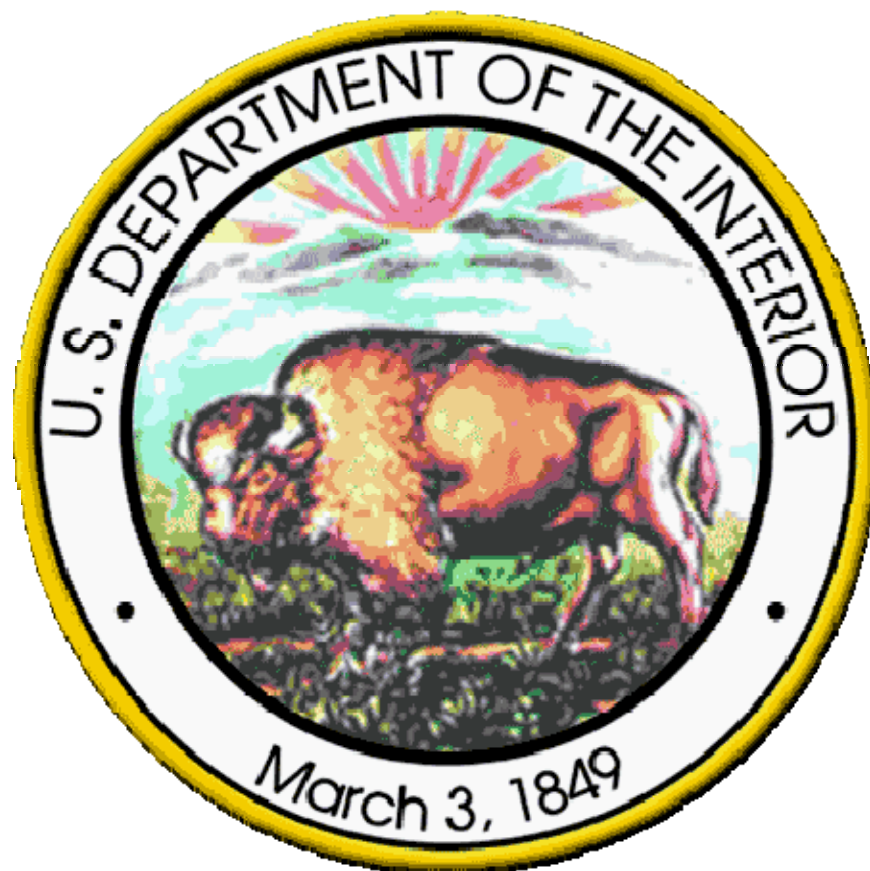


**BUREAU OF OCEAN ENERGY MANAGEMENT,
REGULATION, AND ENFORCEMENT**

**ENVIRONMENTAL STUDIES
PROGRAM**



**STUDIES DEVELOPMENT PLAN
FY 2011-2013**

Offshore Environmental Studies Program

**Fiscal Years 2011-2013
Studies Development Plan
Gulf of Mexico OCS Region**

**U.S. Department of the Interior
Bureau of Ocean Energy Management, Regulation, and Enforcement
Gulf of Mexico OCS Region
New Orleans, LA
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SECTION 1.0 PROGRAMMATIC OVERVIEW

1.1 Introduction to the Region

In managing Outer Continental Shelf (OCS) activity, the 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 and impact mitigation.

The BOEMRE 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 3,574 active platforms (as of 1-22-2010) making significant contributions to the Nation's energy supply.

The BOEMRE 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 BOEMRE 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 the BOEMRE entered into a partnership with the Louisiana State University (LSU) to establish the first Coastal Marine Institute (CMI). This partnership 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 the BOEMRE with 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, the BOEMRE 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 the BOEMRE in the preparation of environmental assessments (EA), 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 gathered since the first workshop was presented.

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 waters are occurring here. These activities include leasing, exploration, development, removal of platforms, and installation of pipelines. The current five-year program (2007-2012) includes 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.

1.3.2 Atlantic Region

The last oil and gas lease sale within the Atlantic Region occurred in 1983. On November 17, 2000, the interests in the last remaining eight natural gas and oil leases active in the Federal waters offshore North Carolina were relinquished. At present, no active OCS oil and gas leases exist in any of the four Atlantic OCS Planning Areas. While more leases were originally issued offshore North Carolina, the primary focus had always been on the 21 leases comprising the Manteo Exploration Unit.

The current 5-year Program (2007-2012) proposed a lease sale offshore Virginia for no earlier than 2011. The BOEMRE has published a Call for Information and Interest/Nominations and Notice of Intent to Prepare an EIS (Call/NOI) for Lease Sale 220 in the Federal Register on November 13, 2008. The area covered by the Call/NOI is about 2.9 million acres offshore Virginia in the Mid-Atlantic Planning Area, and is at least 50 miles offshore. On January 16, 2009, BOEMRE announced the release of the Draft Proposed Program (DPP). The DPP sought public comment on all aspects of the new program for 2010-2015 including energy development and economic and environmental issues in the OCS areas. On February 10, 2009, DOI Secretary Salazar announced that he would extend the comment period on the Draft Proposed Program by 180 days. The DPP under review includes the proposed offshore Virginia lease sale (220), as well as four additional lease sales in the Atlantic Region. Lease sales 230 (2012) and 245 (2015) in the Mid-Atlantic planning area, lease sale 232 (2013) in the North Atlantic planning area, and lease sale 240 (2014) in the South Atlantic planning area. The DPP is still not finalized and no announcements have been made.

The Energy Policy Act of 2005 gave BOEMRE authority for permitting and regulating alternative energy projects and the conversion of existing oil and gas structures for alternative uses on the OCS. On November 6, 2007, the BOEMRE announced in the Federal Register an interim policy for authorization of the installation of offshore data collection and technology testing facilities in Federal waters. The BOEMRE accepted comments and nominations until January 7, 2008 regarding the authorization of OCS activities involving the installation of meteorological or marine data collection facilities to assess alternative energy resources or to test alternative energy technology. Potential alternative energy projects include, but are not limited to: wind energy, wave energy, ocean current energy, solar energy, and hydrogen

production. There is also interest in OCS projects that make alternate use of existing OCS facilities for "energy-related purposes or for other authorized marine-related purposes," such as: offshore aquaculture, research, education, recreation, and support for offshore operations and facilities. The interim policy is in effect until the BOEMRE promulgates final rules.

There is also interest in non-energy OCS resources (sand) for beach renourishment projects. BOEMRE's Marine Minerals Program provides policy direction and guidance for the development of marine mineral resources on the OCS. To date, BOEMRE has conveyed rights to about 30 million cubic yards of OCS sand for 23 coastal restoration projects in 5 states.

Environmental information from the Atlantic will be needed to enable BOEMRE to make permitting decisions and carry out environmental reviews under NEPA for a new program along the Atlantic coast, one that uses new technologies and different expertise now resident in the agency.

BOEMRE is conducting the Atlantic data synthesis study that will provide BOEMRE with updated and synthesized Atlantic OCS information on human and environmental aspects of the region. This data is required for BOEMRE to meet its responsibility of ensuring that all OCS activities are conducted in an environmentally responsible manner. The recent surge in energy prices and alternative energy initiatives may result in future alternative energy leasing activity in the Atlantic Region.

1.4 Identification of Information Needs

With the increase in offshore oil and gas activities in the deepwater GOM and potential energy activities in the Atlantic Regions, environmental and socioeconomic information needs have increased as well. 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 environmental impact statements (EIS's), EA's, mitigations, and other requirements from the NEPA.

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. Presently, the GOMR has focused its energies and efforts in the planning of acquisition of information in deepwaters of the Gulf, both in US and Mexican territories. Continued expansion of industry deepwater development during 2008 and in the near future 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, BOEMRE is conducting the studies of the Loop Current which include the dynamics of the Loop Current in US Waters and its complementary study in Mexican waters. Besides these two studies, the

BOEMRE is nearly ready to award and start the Lagrangian study of the deep circulation. Upon completion of these ongoing studies BOEMRE 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.

1.4.2 Atmospheric Sciences

BOEMRE 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. BOEMRE conducted a calendar year 2008 Gulf-wide emissions inventory study, which estimated emissions for all OCS oil and gas production-related sources in the Gulf of Mexico, including non-platform sources, as well as other non-OCS related emissions. Emissions were calculated for: carbon monoxide (CO), nitrogen oxides (NO_x), sulfur dioxide (SO₂), particulate matter-10 (PM₁₀), PM_{2.5}, and volatile organic compounds (VOC); as well as greenhouse gases- carbon dioxide (CO₂), methane (CH₄), and nitrous oxide (N₂O). This 2008 emissions inventory study, which will be completed in late summer 2010, built upon several past emissions studies, including one for the Breton Sound area and two Gulf-wide studies. Emissions inventories are used in air quality modeling to determine potential impacts of offshore sources to onshore areas.

BOEMRE will soon finalize an air quality study that synthesized and integrated all meteorology, air quality, and emissions inventory data from previous BOEMRE studies and oil/gas and industry related studies accomplished in the Gulf since 1988. The database created from the study will allow analysis of important relationships between the meteorological, air quality, and emissions variables for Gulf coastal areas and the Breton National Wilderness Area.

BOEMRE has also finalized a study to determine if the data collected from the NASA Aura Satellite could improve air quality modeling for potential onshore OCS impacts in areas adjacent to the Gulf of Mexico. The data provides vertical profiles of ozone and its photochemical precursors.

The Study, *Meteorological and Wave Measurements for Improving Meteorological and Air Quality Modeling* has recently been awarded. This study objective is to characterize the atmospheric boundary layer structure and air-sea interaction to improve meteorological and air quality modeling over coastal transition zone, in shallow and deep water areas. This study focuses on the data gaps between 10 m to 100 m above the sea surface and the transition zone between land and ocean.

On March 12, 2008, the Environmental Protection Agency (EPA) significantly strengthened its National Ambient Air Quality Standards (NAAQS) for ground-level ozone. EPA revised

the 8-hour “primary” ozone standard to a level of 75 parts per billion (ppb) and strengthened the “secondary” standard to the same level of 75 ppb. Then in early January, 2010 the EPA proposed another revision to the ozone standard, this time to a lower concentration, 0.060 to 0.070 parts per million (ppm), to provide increased protection for children and other “at risk” populations. Additional Gulf Coast counties/parishes would become non-attainment for ozone, which will likely generate renewed interest in mitigating OCS sources contribution to ozone non-attainment areas. In turn, this will likely require BOEMRE to conduct additional air quality studies to more accurately determine the OCS contribution. Procurement efforts are to fund a 2011 Gulf-wide emissions inventory study to address the strengthened EPA ozone standard are in progress.

1.4.3 Fates and Effects

Accidental releases of SBF fluids occur every year or so. Although laboratory studies of fluids and field studies of cuttings piles indicate the material is biodegraded over a period of several years, we haven’t studied the recovery of the impacted seafloor. The study “Synthetic-based Fluid Spill of Opportunity: Environmental Impact and Recovery” was awarded in November 2006. The cruise occurred in June 2008 but due to critical equipment failure, no samples were collected. Budget and time limitations precluded rescheduling of the cruise that year. The study was terminated and, because spills have become less frequent, not included in the Study Development Plan.

In the mid-1970’s, the first major offshore environmental survey in the GOM was conducted in response to questions about the effects of oil and gas activities on the continental shelf. This study, Mississippi, Alabama, and Florida (MAFLA) examined physical, chemical, and biological parameters along the MAFLA shelf. Portions of the study area were revisited in the late 1980’s for similar analyses as part of Mississippi-Alabama Marine Ecosystem (MAMES). MAFLA and MAMES are just a few examples of BOEMRE studies that collected baseline information or examined the fates and effects of oil and gas activities in the OCS of the GOM; BOEMRE’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 BOEMRE management decisions. It is time for the BOEMRE to revisit the areas examined in past studies to determine typical parameters and possibly compare these measurements to the results of past studies. In addition, new issues have arisen such as ocean acidification and new methodologies and techniques for characterization have been developed. The region should be recharacterized to collect baseline data on important new issues and to employ new technologies. Collecting baseline data for areas where future oil and gas activities may occur should also be considered. However, debate over the objectives and methodology of such a study has resulted in postponement of this study. One example of a debated component of the study is whether to compare relatively ‘pristine’ EGOM locations with previously drilled CGOM 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, we propose a one-day workshop in which BOEMRE will solicit expert advice from a diverse group of scientists on the best ways to utilize past 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.

The relationship between BOEMRE OCS activity and coastal oil spills is regularly questioned. The topic is addressed in a general way in NEPA documents. A better grasp of the percent of crude oil spilled in coastal waters that originated on the OCS and the amount of fuel spilled in support of OCS activities would benefit state and other federal agencies that review or participate in our NEPA activities. The USGS maintains an extensive database on oil spills. Through analysis of this data, BOEMRE could provide a clearer description of the geographical locations of spills and the causes and volumes of spills. This publication would engender a more fact-based discussion of coastal oil spill risk.

1.4.4 Biology

The management needs of the BOEMRE continue to demand information on all aspects of ecology in every habitat of U.S. waters. New and ongoing oil and gas activities touch upon every ocean province from our coastal marshes to the abyss. New emphasis is placed on eastern Gulf of Mexico (EGOM) resources following Congressional requirements to offer leases within 125 miles of the west coast of Florida. New technology ushers 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 outer continental shelf (OCS). So, while BOEMRE needs continue to push into new frontiers where biological information is sparse, outdated information on shelf communities also needs to be renewed. In addition to these GOM needs, new possibilities are opening on the U.S. Atlantic coast. Much work is needed to gather and to update knowledge for Atlantic ecosystems.

The BOEMRE needs to renew its knowledge of GOM habitats periodically to continue to insure that protective measures are adequate and to adapt management practices to changing conditions. A long range systematic 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 BOEMRE protects with stipulations, other shelf habitats, *Sargassum* communities, coastal studies, protected species, invasive species, and climate effects. Information on the 37 topographic features the BOEMRE protects around the GOM should be updated. Seagrass data should be renewed. Live bottoms (low relief) and live bottoms (Pinnacle Trend) will need updating near the end of the long range cycle. Baseline data will be gathered for the first time for the new category, Potentially Sensitive Biological Features (i.e., live bottoms of moderate relief [about 8 ft or higher]). Long-term monitoring at the Flower Garden Banks continues to be a center-piece of BOEMRE responsible management. Renewed interest in oil reserves under deep salt layers near the shelf edge make this region a good starting point for a program of studies to update BOEMRE information on shelf habitats.

Delineation of the long-term effects of oil and gas activities on the outer continental shelf is beneficial to assess the effectiveness of BOEMRE protection of the coastal, marine, and

human environments. The state of benthic communities near oil and gas activities is a robust indicator that the BOEMRE can use to define the effectiveness of their regulations and to apply adaptive management. A workshop to explore a thorough scientific approach to assessing the long-term effects of oil and gas activities would be beneficial to the program.

Pelagic *Sargassum* algae is a valuable essential fish habitat. This remarkable community is vulnerable to contamination from spills because it floats at the surface of the sea. This is particularly relevant to the BOEMRE because the pelagic *Sargassum* ecosystem shares the offshore waters with BOEMRE permitted activities. Recent analyses of satellite imagery suggest that *Sargassum* biomass in the Gulf of Mexico (GOM) is greater than previously estimated and 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.

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. An BOEMRE study by Continental Shelf Associates (1985) mapped seagrass habitat in the Big Bend area as far offshore as 110 km (70 mi). With oil and gas activity moving closer to this sensitive habitat, an updated characterization would be valuable for BOEMRE management.

The BOEMRE has an immediate need for comprehensive information on ecosystems of the Atlantic OCS. The onset of offshore renewable energy activities demands assessments of potential impacts. The BOEMRE has a Mid-Atlantic lease sale scheduled for 2012 and needs to look toward other potential areas of development on the east coast. The Atlantic OCS boasts a profusion of hard bottom habitat ranging from coral reefs in the southern part of the Florida Straits to coral/sponge communities, worm reefs, fishing banks, canyons, coldwater reefs, and deepwater *Oculina* and *Lophelia* communities. The BOEMRE needs to be prepared to assess potential impacts to all these habitats and more. Accurate mapping of seafloor features and archaeological resources is a foundation requirement. Literature search and synthesis of existing information will be combined with new studies to provide a thorough understanding of Atlantic OCS habitats and promote proper ecosystem-based management.

Deep waters continue to be a primary field of industry activity and an imminent need for environmental information. Continued studies will be needed into the future to better understand the ecology of sensitive deep water habitats in both the GOM and Atlantic. 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.

The BOEMRE 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. The BOEMRE 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. The BOEMRE needs information on Atlantic coast seabird populations to evaluate their vulnerability to potential oil and gas impacts.

1.4.5 Protected Species

BOEMRE 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 BOEMRE 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.

The most recently completed study, the Sperm Whale Seismic Study (SWSS), resulted in a large amount of data on the potential impacts of seismic activity on the sperm whale in the GOM. Recommendations for future research from this report directly influence the current studies program and in this case resulted in a follow on study to identify sperm whale prey resources in the GOM (GM-09-05).

1.4.6 Social Sciences and Economics

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, (NRC) 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 Coastal Marine Institute (CMI) (see studies beginning with GM-92-42 at http://www.gomr.boemre.gov/homepg/regulate/environ/ongoing_studies/gom-se.html). 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. Because the CMI annual planning cycle conflicts with the timing of SAC reviews, CMI proposals cannot be provided in this document even though they address a wide range of critical information needs related to such topics as industry strategy, localized socioeconomic effects, infrastructure use, hurricane effects, environmental justice, and assessment methodology.

1.4.7 Other Studies

The Atlantic Ocean has a complex and diverse marine mammal and sea turtle community. Impacts to these species from vessels, fisheries interactions and ocean noise continue to be of concern. There are 5 proposed lease sales in the Atlantic planning areas in the Draft Proposed Program (DPP) for 2010-2015. This is in addition to potential alternative energy and alternative use information needs that may require additional studies in these planning areas.

1.4.8 Archaeological Resources

Archaeological 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. BOEMRE, 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.

BOEMRE has several on-going studies to expand our knowledge of the types of resources that are likely to be encountered on the OCS. One current study focuses on 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. A second study *Archaeological Analysis of Submerged Sites on the Gulf of Mexico Outer Continental Shelf*, procured in 2009, will assist BOEMRE in determining if

targets identified for avoidance are actually associated with archaeological resources and provide information on the extent of debris fields associated with historic shipwreck sites. These data will aid in analyzing the effectiveness of BOEMRE's permit mitigations. BOEMRE 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 by its permitted actions. Another study procured in 2009 will expand our knowledge of what shipwrecks were lost in the Gulf of Mexico by conducting research in a rich, previously untapped, resource - the New Orleans Notarial Archives.

As part of BOEMRE's NHPA responsibilities to understand the full range of impacts from its undertakings, a future need addresses an issue raised by the State of Louisiana, namely the effects of OCS-related traffic on coastal prehistoric sites.

As BOEMRE's mission expands under new legislative mandates into areas in the Atlantic for oil and gas and alternative energy projects, information needs regarding the potential for encountering submerged cultural resources expand as well. One recently awarded study *Inventory and Analysis of Archaeological Site Occurrence on the Atlantic* seeks to establish a baseline of documented sites in the Atlantic Planning Region similar to what currently exists for the Central and Western Gulf. 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 BOEMRE archaeologists are at present joining with our benthic biologists and NOAA/OER to procure 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*. BOEMRE also is joining with NOAA's USS Monitor National Marine Sanctuary to continue the study *Battle of the Atlantic* investigating World War II losses off of North Carolina. The first season of this study won the Dept. of Interior's Cooperative Conservation Award in 2009. Future needs directed at understanding the range of resources off the Atlantic coast include an investigation into primary literature dealing with losses resulting from the coastal slave trade, which is poorly documented in secondary literature and not well understood. The discovery of a slave-ship wreck, however, would have major sociological, historical, and political ramifications and BOEMRE has a need to better understand where these might occur.

1.5 New Starts for FY 2010 and Ongoing Studies

Table 1. Gulf of Mexico Region New Starts for FY 2010 and Ongoing Studies

NEW STARTS				
Program Lead	Planning Area	Start FY	Discipline	Study Title
BOEMRE	GW	10	SS	Ethnic Groups and Enclaves Affected by OCS Activities (GM-08-05)
BOEMRE	GW	10	HE	Investigation of Potentially Sensitive Biological Features Surrounding Shelf-Edge Topographic Banks in the Northern Gulf of Mexico (GM-09-03)
BOEMRE	GW	10	AQ	Year 2011 Gulf-wide Emissions Inventory Study (GM-10-02)
BOEMRE	GW	10	PO	A Lagrangian Approach to Study the Gulf of Mexico's Deep Circulation (GM-10-03)
BOEMRE	GW	10	MM	Association of Sea Turtles with Petroleum Platforms in the Gulf of Mexico (GM-10-04)
BOEMRE	W	10	PO	Current-Topography Interaction and its Influence on Water Quality and Contaminant Transport Over Shelf-Edge Banks (GM-10-05)
BOEMRE	GW	10	PO	Membership in Industry's Climatology and Simulation of Eddies (CASE)/Eddy Joint Industry Project (GM-10-x11)
BOEMRE	M-ATL	10	SS	Battle of the Atlantic Expedition 2009 (AT-10-04)
BOEMRE/ CMI	GW	10	IM	Administration of CMI (GM-09-01-01)
BOEMRE/ CMI	GW	10	HE	New Invasive Species at Platforms (GM-09-01-xx)
BOEMRE/ CMI	GW	10	HE	Biomass and Mass-Balance Isotope Content of Seep Populations on the Upper Slope Gulf of Mexico Determined from Archived Samples (GM-09-01-xx)
BOEMRE/ CMI	GW	10	HE	Gulf SERPENT (GM-09-01-xx)
BOEMRE/ CMI	GW	10	SS	A Prospectus for Historical Social and Economic Analysis of the Oil and Gas Industry for the Gulf of Mexico Region(GM-09-01-xx)

**Note: The procurement of any study is contingent upon availability of funding*

ONGOING STUDIES				
Program Lead	Planning Area	Start FY	Discipline	Study Title
<i>Air Quality</i>				
BOEMRE/ CMI	C & W	07	AQ	Deployment and Operational of Radar Profiler (GM-92-42-138)
BOEMRE	C & W	06	AQ	Deployment of a BOEMRE Radar Wind Profiler to the University of Houston Coastal Research Center in Galveston, Texas (GM-06-x14)
BOEMRE	GW	08	AQ	Meteorological and Wave Measurements for Improving Meteorological and Air Quality Modeling (GM-08-04)
BOEMRE	GW	06	AQ	Synthesis, Integration, and Analysis of Meteorological and Air Quality Data (GM-06-02)
BOEMRE	GW	07	AQ	Year 2008 Gulf-wide Emission Study (GM-07-x11)
<i>Fates & Effects</i>				
BOEMRE/ CMI	C	06	FE	A Study of Long-Term Trends in Environmental Parameters Along the Louisiana/Mississippi Outer Continental Shelf Using Ocean Color Remote Sensing Data (GM-92-42-129)
BOEMRE	GW	10	FE	Characterization and Potential Impacts of Noise Producing Construction and Operation Activities on the OCS (GM-09-11)
BOEMRE/ CMI	C & W	04	FE	Determination of Net Flux of Reactive Volatile Organic Compounds at the Air-Water Interface in the Gulf of Mexico (GM-92-42-116)
BOEMRE/ CMI	C	00	FE	Improving the Predictive Capability of 3D Seismic Surface Amplitude Data for Identifying Chemosynthetic Community Sites (GM-92-42-76)
<i>Habitat and Ecology</i>				
BOEMRE/ CMI	C	03	HE	Assessing Trophic Linkages Between Platforms and Pelagic Fishes Using Ultrasonic Telemetry and Active Acoustics (GM-92-42-105)

BOEMRE/ CMI	C & W	06	HE	Deep-Water Coral Distribution and Abundance on Active Offshore Oil and Gas Platforms and Decommissioned "Rigs-to-Reefs" Platforms (GM-92-42-126)
BOEMRE/ CMI	C & W	04	HE	Determining the Geographic Distribution, Maximum Depth, and Genetic Affinities of Corals on Offshore Platforms, Northern Gulf of Mexico (GM-92-42-117)
BOEMRE/ CMI	C & W	04	HE	Digital Conversion and Selected Analysis of Dive Video From Fifteen Dive Seasons (GM-92-42-118)
BOEMRE/ CMI	GW	08	HE	Digitization and Reanalysis of Northern Gulf of Mexico Continental Slope Study Seafloor Photographs (GM-92-42-140)
BOEMRE	C & W	08	HE	Exploration and Research of Northern Gulf of Mexico Deepwater Natural and Artificial Hard Bottom Habitats with Emphasis on Coral Communities: Reefs, Rigs and Wrecks (GM 08-03)
BOEMRE	C	10	HE	Forcing Functions Governing Salt Transport Processes in OCS Navigation Canals and the Surrounding Wetland Landscape Utilizing Houma Navigation Canal (HNC) as a Surrogate Canal (GM-10-01)
BOEMRE/ CMI	GW	07	HE	Gulf SERPENT: Establishing a Deepwater Plankton Observation System Using Industrial ROVs (GM-92-42-133)
BOEMRE	C & W	05	HE	Investigations of Chemosynthetic Communities on the Lower Continental Slope of the Gulf of Mexico (GM-05-03)
BOEMRE	W	04	HE	Long-Term Monitoring at the East and West Flower Garden Banks, 2004 (GM-04-06)
BOEMRE	C	05	HE	Multi-Component and Multi-Frequency Seismic for Assessment of Fluid-Gas Expulsion Geology and Gas Hydrate Deposits: Gulf of Mexico (GM-05-06)
BOEMRE/ CMI	C	01	HE	Platform Recruited Reef Fish, Phase I: Do Platforms Provide Habitat that Increase the Survival of Juvenile Reef Fishes? (GM-92-42-91)

BOEMRE/ CMI	GW	06	HE	Platform Recruited Reef Fish, Phase II: Do Platforms Provide Habitat that Increases the Survival of Reef Fishes? (GM-92-42-128)
BOEMRE/ CMI	C	04	HE	Ship Shoal: Sand, Shrimp, and Seatrout (GM-92-42-109)
BOEMRE/ CMI	C	03	HE	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 (GM-92-42-104)
BOEMRE	W	09	HE	Long-Term Monitoring at the East and West Flower Garden Banks (2009-2014) (GM-09-02)
<i>Information Management</i>				
BOEMRE/ CMI	GW	09	IM	Coastal Marine Institute 2009-2013 (GM-09-01-01)
BOEMRE	AW	09	IM	EcoSpatial Information Database – U.S. Atlantic Region (GM-08-x13)
BOEMRE	GW	06	IM	Information Transfer Meetings and Other Workshops (GM-04-03)
BOEMRE	C & W	05	IM	Literature Search and Data Synthesis of Biological Information for use in Management Decisions Concerning Decommissioning (GM-04-04)
BOEMRE	ATL & WG	09	IM	Literature Search and Data Synthesis for Marine Mammals and Sea Turtles in the US Atlantic from Maine to the Florida Keys (GM-09-x20)
BOEMRE	N & M- ATL	07	IM	North and Central Atlantic Information Resources: Data Search and Literature Synthesis (GM-07-02)
BOEMRE	S-ATL	09	IM	South Atlantic Information Resources: Data Search and Literature Synthesis (GM-09-x21)
<i>Marine Mammals and Protected Species</i>				
BOEMRE	GW	08	MM	Seismic Survey Mitigation Measures and Marine Mammal Observer Reports (GM-08-02)
BOEMRE	GW	09	MM	Sperm Whale Acoustic Prey Study (SWAPS) (GM-09-05)

BOEMRE	GW	06	MM	Trophic Aspects of Sperm Whales in the Northern Gulf of Mexico Using Stable Isotopes of C and N: Geographical and Inter-Annual Variation (GM-06-x15)
<i>Physical Oceanography</i>				
BOEMRE	W	05	PO	Deepwater Program: Direct Observations of Ocean Currents Over the Western Slope in the Gulf of Mexico (GM-03-01b)
BOEMRE	E	04	PO	Deepwater Program: Survey of Deepwater Currents in the Eastern Gulf of Mexico (GM-04-01)
BOEMRE	E	08	PO	Dynamics of the Loop Current in U.S. Waters (GM-08-01)
BOEMRE/ CMI	GW	06	PO	Effects of Loop Current and Loop Current Eddies - Analysis Using the Real-time BOEM ADCPs from Oil Platforms (GM-92-42-127)
BOEMRE	C & W	07	PO	Integrated Bio-Physical Modeling of the Louisiana-Texas (LATEX) Shelf (GM-07-x14)
BOEMRE	GW	06	PO	Membership in Industry's Climatology and Simulation of Eddies(CASE)/Eddy Joint Industry Project (GM-05-x10)
BOEMRE	GW	06	PO	Modeling Waves and Currents Produced by Hurricanes Katrina and Rita (GM-06-x10)
BOEMRE/ CMI	C	05	PO	New Wave Current Information System (WAVCIS) Ocean Observing Station on Ship Shoal (GM-92-42-119)
BOEMRE	GW	08	PO	Ultra-Deepwater Circulation Processes in the Gulf of Mexico (GM-07-05)
BOEMRE/ CMI	E	04	PO	Variability of Deep Water Mass Properties and the Loop Current in the Eastern Gulf of Mexico (GM-92-42-113)
BOEMRE/ CMI	C & W	02	PO	Wave-Bottom Interaction and Bottom Boundary Layer Dynamics in Evaluating Sand Mining at Sabine Bank for Coastal Restoration, Southwest Louisiana (GM-92-42-94)
BOEMRE	E	09	PO	Current Measurements in the Yucatan-Campeche Area in Support of Loop Current Dynamics Study (GM-09-07)

<i>Social & Economic</i>				
BOEMRE/ CMI	GW	02	SS	A Collaborative Investigation of Baseline and Scenario Information for Environmental Impact Statements (GM 92-42-97)
BOEMRE/ CMI	GW	05	SS	An Assessment of the Opportunities for Alternative Uses of the Hydrocarbon Infrastructure in the Gulf of Mexico (GM-92-42-123)
BOEMRE	C & W	08	SS	Analysis of the Oil Services Contract Industry in the Gulf of Mexico Region (GM-07-09)
BOEMRE	GW	07	SS	Assessing Impacts of OCS Activities on Public Infrastructure, Services, and Population in Coastal Communities Following Hurricanes Rita and Katrina (GM-07-x12)
BOEMRE/ CMI	GW	09	SS	Characteristics and Possible Impacts of the Aging Workforce Transition on the Outer Continental Shelf Oil and Gas Industry in the Gulf of Mexico Region (GM-09-01-02)
BOEMRE/ CMI	GW	09	SS	Developing Indicators to Measure Socioeconomic Impacts of OCS Activities: A Temporal Analysis of Counties within the Gulf of Mexico Region (GM-09-01-03)
BOEMRE/ CMI	GW	06	SS	Diversifying Energy Industry Risk in the Gulf of Mexico (GM-92-42-130)
BOEMRE	N	08	SS	Energy Market and Infrastructure Information for Evaluating Alternative Energy Projects for OCS Atlantic and Pacific Regions (GM-08-x14)
BOEMRE/ CMI	C	03	SS	Environmental Justice: A Comparative Perspective in Louisiana (GM-92-42-106)
BOEMRE/ CMI	GW	05	SS	Factors Affecting Global Petroleum Exploration and Development and Impacts on the Attractiveness and Prospectivity of the U.S. Gulf of Mexico Deepwater (GM-92-42-122)
BOEMRE/ CMI	GW	07	SS	Forecasting Service Vessel and Helicopter Trips Related to OCS Development (GM-92-42-134)
BOEMRE/ CMI	GW	09	SS	Geographic Units for Socioeconomic Impact Analysis in the Gulf of Mexico Region (GM-09-01-04)

BOEMRE	GW	06	SS	Gulf Coast Communities and the Fabrication and Shipbuilding Industry: A Comparative Community Study (GM-06-03)
BOEMRE/ CMI	GW	06	SS	Gulf Coast Subsidence and Wetland Loss: A Synthesis of Recent Research (GM-92-42-131)
BOEMRE	GW	08	SS	History of Gulf of Mexico Offshore Petroleum Industry, Phase III: Deepwater Developments (GM-08-07)
BOEMRE/ CMI	GW	09	SS	Improving Capacity for Institutional Analysis of the Oil and Gas Industry for the Gulf of Mexico Region (GM-09-01-05)
BOEMRE	GW	09	SS	MAG-PLAN Modification: New Gulf of Mexico Data Collection, Testing and Streamlining of OCS Economic Impact Model (GM-08-08)
BOEMRE/ CMI	GW	06	SS	Marginal Production in the Gulf of Mexico and Lost Production from Early Decommissioning – Economic, Environmental, and Regulatory Perspective (GM-92-42-132)
BOEMRE/ CMI	C & W	08	SS	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 (GM-92-42-142)
BOEMRE	M-ATL	09	SS	Oil and Gas Infrastructure in the Mid-Atlantic Region (GM-09-08)
BOEMRE/ CMI	GW	06	SS	Post Hurricane Assessment of OCS-Related Infrastructure and Communities in the Gulf of Mexico Region (GM-92-42-124)
BOEMRE/ CMI	GW	04	SS	Social Capital and Offshore Oil Development in St. Mary Parish (GM-92-42-110)
BOEMRE/ CMI	C & W	07	SS	Socio-Economic Responses to Coastal Land Loss and Hurricanes: Measuring Resilience among Outer Continental Shelf Related Coastal Communities in Louisiana (GM-92-42-137)

BOEMRE/ CMI	C & W	06	SS	Spatial Restructuring and Fiscal Impacts in the Wake of Disaster: The Case of the Oil and Gas Industry Following Hurricanes Katrina and Rita (GM-92-42-125)
BOEMRE	GW	07	SS	State and Local-Level Fiscal Effects of the Offshore Petroleum Industry (GM-07-08)
BOEMRE/ CMI	C & W	07	SS	Structural Shifts and Concentration of Regional Economic Activity Supporting GOM Offshore Oil and Gas Activities (GM-92-42-135)
BOEMRE/ CMI	C & W	08	SS	The Offshore Drilling Industry and Rig Construction Market in the Gulf of Mexico (GM-92-42-141)
BOEMRE/ CMI	C	00	SS	The Relationship of Crime to Oil Development in the Coastal Regions of Louisiana (GM-92-42-80)
BOEMRE/ CMI	GW	07	SS	Understanding Current and Projected Gulf OCS Labor and Port Infrastructure Needs (GM-92-42-139)
<i>Social & Economic (Marine Archaeology)</i>				
BOEMRE	C & W	09	SS	Archaeological Analysis of Submerged Sites on the Gulf of Mexico Outer Continental Shelf (GM-09-04)
BOEMRE	AW	08	SS	Evaluation of Visual Impacts on Historic Properties (GM-08-10)
BOEMRE/ CMI	C & W	07	SS	Examining and Testing Potential Prehistoric Archaeological Features on the Gulf of Mexico, Offshore Continental Shelf (GM-92-42-136)
BOEMRE	C & W	07	SS	Impacts of Recent Hurricane Activity on Historic Shipwrecks in the Gulf of Mexico (GM-06-x17)
BOEMRE	AW	09	SS	Inventory and Analysis of Archaeological Site Occurrence on the Atlantic OCS (GM-09-10)
BOEMRE	GW	08	SS	Investigation for Potential Spanish Shipwrecks in Ultra-Deepwater (GM-08-09)
BOEMRE	C & E	09	SS	Shipwreck Research in the New Orleans Notarial Archives (GM-09-x22)
<i>Other (Research Partnerships)</i>				
BOEMRE Technology Assessment and Research Program (TAR)				
BOEMRE-Louisiana State University, Coastal Marine Institute (CMI)				
USGS/Biological Resources Division (BRD)				

NOAA-National Marine Fisheries Service (NMFS)/National Marine Mammal Laboratory (NMML)			
National Science Foundation (NSF)			
National Aeronautics and Space Administration (NASA)			
Discipline Codes			
AQ = Air Quality	FE = Fates & Effects	HE = Habitat & Ecology	
IM = Information Management	MM = Marine Mammals & Protected Species		
PO = Physical Oceanography	SS = Social Sciences		
Planning Area Codes			
Central = C	Nationwide = N	Mid Atlantic = M-ATL	Atlantic Wide = AW
Eastern = E	North Atlantic = N-ATL		
Gulf Wide = GW	South Atlantic = S-ATL		
Western = W	Straits of Florida = SF		

SECTION 2.0 PROPOSED STUDY PROFILES

2.1 Introduction

The following sections focus on the proposed studies for FY 2010 and FY 2011. Most of the ongoing studies in the GOMR can be found on the web at:

http://www.gomr.boemre.gov/homepg/regulate/environ/ongoing_studies/gom.html

Additional information about recent BOEMRE funded deepwater research, in particular research cruises, can be found at:

<http://www.gomr.boemre.gov/homepg/regulate/environ/deepenv.html>

2.2 Profiles of Studies Proposed for FY 2011 NSL

Table 2. Gulf of Mexico Region Studies Proposed for FY 2011 NSL

Page #	Discipline	Title	Rank
GULF OF MEXICO			
29	HE	Characterization of Potentially Sensitive Biological Features Surrounding Shelf-Edge Topographic Banks in the Northern Gulf of Mexico with Analyses of Impacts and Recovery	1
31	FE	Baseline Coastal Oil Spill Characterization	2
33	SS	Detailed Gulf of Mexico Vessel Trip Data to Support Environmental, Socioeconomic, and Archaeological Impact Analyses of OCS Activity	3
35	SS	Archaeological Impact Analyses of OCS Vessel Activity	4
37	HE	Characterization of Seagrass in Waters of the U.S. Outer Continental Shelf Florida Big Bend Area	5
39	HE	Gulf of Mexico 2011 Monitoring Initiative: Lesser Known Shelf-Edge Banks	6
43	IM	Workshop on Monitoring the Long-term Effects of Offshore Oil and Gas Activities in Gulf of Mexico	7
47	AQ	A Coupled Atmosphere and Ocean Model in the Gulf of Mexico	8
ATLANTIC			
51	SS	Battle of the Atlantic Expedition 2011	1
55	MM	Controlled Seismic Airgun Exposure Experiments with Bottlenose Dolphins and Humpback Whales in Study Areas off of Cape Hatteras	2
57	HE	Comprehensive Ecosystem Characterization of the U.S. Outer Continental Shelf: Pelagic Sargassum Algae Distribution and Movement in the Gulf of Mexico and Atlantic	3
61	IM	Extended Mid-Atlantic Planning Area Information Resources Data Search and Literature Synthesis	4
AQ = Air Quality		FE = Fates & Effects	HE = Habitat & Ecology
IM = Information Management		MM = Marine Mammals & Protected Species	
PO = Physical Oceanography		SS = Social Sciences	

ENVIRONMENTAL STUDIES PROGRAM: Studies Development Plan FY 2011-2013

Region: Gulf of Mexico

Planning Areas: Central, Western

Title: Characterization of Potentially Sensitive Biological Features Surrounding Shelf-Edge Topographic Banks in the Northern Gulf of Mexico with Analyses of Impacts and Recovery

BOEMRE Information Needs to be Addressed: The BOEMRE needs to describe the character of Potentially Sensitive Biological Features (PSBF's) in the shelf-edge region of the northern Gulf of Mexico to establish baseline conditions, enhance identification of sensitive habitats, and ensure adequate protection. Potential impacts and recovery from the Deepwater Horizon spill should be assessed.

Cost Range: (in thousands): \$834*

Period of Performance: FY 2011-2014

Description:

Background: The Bureau of Ocean Energy Management, Regulation, and Enforcement (BOEMRE) Notice To Lessees 2009-G39 describes protection for Potentially Sensitive Biological Features (PSBF's). These are seafloor features in the Gulf of Mexico (GOM) with moderate to high relief (about 8 feet or higher) that provide valuable habitat for benthic species and serve as Essential Fish Habitat. They are not covered by the biological stipulations on Leases. They provide surface area for the growth of sessile invertebrates and attract large numbers of fish. Habitat utilization of these features is expected to vary depending on physical parameters including relief, size, habitat complexity, association with other features (as in trends or systems of features), water quality, turbidity, depth, and temperature.

The BOEMRE has become aware of PSBF's from its large database of bathymetric surveys and from USGS multi-beam surveys. These features are protected from direct physical impacts of oil and gas activities based on bathymetry provided with permit applications. However, the benthic and fish communities of these features are relatively unknown. Of particular concern are multiple features known to exist in the vicinity of protected topographic features along the shelf-edge of the northern GOM. Available seafloor surveys suggest that these PSBF's support high diversity benthic communities similar to the protected banks. Significant areas of these features occur outside the bank No Activity Zones. The BOEMRE needs to investigate these PSBF's to characterize their benthic and fish communities and define their distribution. Bathymetric data alone does not describe the quality and sensitivity of this ecosystem. This information is required to ensure that the BOEMRE properly protects these valuable resources which are a significant component of the wider ecosystem.

The Deepwater Horizon oil spill on April 20, 2010, in block MC252, approximately 50 miles southeast of Venice, Louisiana, released millions of gallons of crude oil in the north-central GOM. The oil release was treated with dispersants both at the sea's surface and subsea (at about 5000 ft of water depth). The dispersed oil weathers, biodegrades, clumps, and eventually sinks to the seafloor. In this manner, the oil could be distributed widely over a large area of the seafloor and could directly affect hard bottom communities.

This study is designed as an adaptive approach to management and may result in revision of BOEMRE No Activity Zone boundaries. The BOEMRE needs to characterize these features across the entire northern GOM. This study will begin that process by examining notable PSBF's known to exist near important topographic features along the shelf-edge. We will also assess the impact and recovery of these ecosystems to possible effects of oil from the Deepwater Horizon spill. Recent USGS work has provided high resolution multi-beam bathymetry around numerous shelf-edge topographic features in the northern GOM. In addition, the Flower Garden Banks National Marine Sanctuary (FGBNMS) has conducted several ROV surveys around a few of the banks. This study will be carried out in cooperation with the Louisiana Universities Marine Consortium (LUMCON), the FGBNMS, and the University of North Carolina Wilmington (UNCW).

Objectives: The objective of this study is to provide the BOEMRE with information needed to evaluate the quality and sensitivity of known PSBF habitats near protected topographic features, relate them to the wider ecosystem, and assess possible oil impacts/recovery.

Methods: This study will characterize both the physical and biological components of PSBF's. The study will incorporate available information for these features and conduct field investigations to gather new information. In addition, sediment and tissue samples will be analyzed for effects from the Deepwater Horizon oil spill. The study will focus on representative areas of PSBF's around protected topographic features along the edge of the GOM continental shelf from the Flower Garden Banks to Jakkula Bank. Sampling sites will be selected to produce a representative description of features in this area. Work already done by the FGBNMS will be incorporated and supplemented to maximize our results. That work includes numerous ROV surveys at several shelf-edge banks. New information will be gathered with additional ROV surveys, water quality instrumentation, and sampling of benthic and fish components (including contaminants analyses). Semi-Permeable Membrane Devices may be deployed at each sampling site if continued deposition of oil is suspected. Other methods may be employed as available and appropriate, including SCUBA, AUV, submersibles, benthic samplers, and camera systems.

Revised Date: June 23, 2010

* Procurement process was near completion in 2010 before deferment to 2011. The proposal, SOW, and budget were prepared, needing only modification to add assessment of Deepwater Horizon oil spill effects. This is an increase of \$129,590 for that assessment. The budget is a firm number with thorough detail backing it. Cooperative Agreement and Interagency Agreement were approved by receiving entities and ready for BOEMRE signature. Procurement possible early in the first quarter of 2011.

ENVIRONMENTAL STUDIES PROGRAM: Studies Development Plan FY 2011-2013

Region: Gulf of Mexico

Planning Area: Eastern

Title: Baseline Coastal Oil Spill Characterization

BOEMRE Information Needs to be Addressed: The relationship between BOEMRE OCS activity and oil spills is a common question and often the public is more concerned about coastal spills due to the direct impacts on sensitive wetlands, tourism, recreation, and fish/shellfish industry. Because there is little to no activity in EGOM coastal waters related to EGOM OCS activity presently, the report will serve as a baseline to which future spill occurrence can be compared. The results of the study will be used by BOEMRE to improve the description of the location, frequency, size, and BOEMRE relationship to coastal oil spills in NEPA documents. Customers who need more detailed or site-specific information about coastal oil spills than is available in a Multi-Sale EIS can refer to this document. These results may assist other agencies in consultations that are necessary to the NEPA process.

Cost Range: (in thousands) \$80-\$160

Period of Performance: 2011-2012

Description:

Background: The USCG maintains records of all reported oil spills to water. BOEMRE uses portions of this data in the NEPA documents to estimate the number and size of coastal oil spills for a specific proposed action. More information is available in this database than has been used by BOEMRE. Because there is not OCS activity in this area presently, the characteristics of coastal oil spills will serve as a baseline to which future rates can be compared. BOEMRE would be better able to respond to questions about coastal oil spills with this study.

Objectives: The objective is to use the extensive oil spill database maintained by the USCG to better characterize coastal oil spills. This information will be used as a baseline to evaluate how and where OCS activity increases coastal oil spill occurrence and in future NEPA documents to improve BOEMRE's coastal oil spill text.

Method: The contractor will become familiar with the USCG data base and its quirks. The job is made more difficult by the fact that every few years the database was altered in some way. They will sort the most useful data for BOEMRE NEPA document needs, for example spills from fishing boats may not be useful. The contractor will need input from USCG and BOEMRE experts.

Spills will be described in greater detail by location, cause of spill, volume of spill, season of spill, and type of spill (crude or refined product), and, if possible the provenance of the crude – OCS or state waters and if refined product - fuel leak or loss of cargo. This more refined use of the USCG data available will provide better understanding of the types of coastal oil spills that occur.

For situations where the data is missing or ambiguous, such as the vessel type or the location, rules shall be developed to determine data that shall be counted or eliminated from the evaluation. Locations where the spill would be more likely to be OCS product, such as a pipeline landfall, may need to be individually addressed.

The data will be analyzed and mapped. The data will be reviewed to look for patterns or events that contribute to spills. Conclusions regarding spill frequency, spill size, spill cause, material spilled, and spill location will be developed and summarized in a report. The extracted data will be stored so that it can be used to make future comparisons.

Revised Date: September 2, 2010

ENVIRONMENTAL STUDIES PROGRAM: Studies Development Plan FY 2011-2013

Region: Gulf of Mexico

Planning Areas: Eastern, Central, and Western

Title: Detailed Gulf of Mexico Vessel Trip Data to Support Environmental, Socioeconomic, and Archaeological Impact Analyses of OCS Activity

BOEMRE Information Needs to be Addressed: The information will be used for Gulf of Mexico Region Environmental Impact Statements as it becomes available, particularly for analyzing and discussing impacts of vessel traffic that supports OCS activities. The data provided will support baseline description, scenario development, and detailed impact analyses of a number of different disciplines, including air quality, water quality, archaeology, and socioeconomics.

Cost Range: (in thousands) \$40-\$50

Period of Performance: FY 2011-2016

Description:

Background: Vessel support constitutes a large and vital segment of OCS-related activities in coastal, near-coastal and offshore waters. The need for vessel support is one of the distinguishing characteristics of the offshore vs. onshore petroleum industry. In the Gulf of Mexico Region (GOMR), the intensity, type, and location of OCS-related vessel traffic is an important component of the “baseline.” This traffic is also one of the important vectors of possible OCS-generated effects to the physical, biological, and socioeconomic environment. For this reason, one of the key parameters forecasted in the scenarios developed for analyzing the effects of offshore oil and gas development is the number of vessel trips that will be required by the different stages of OCS development to support activities. For this reason, as well, the adequacy of vessel traffic data and BOEMRE vessel traffic forecasts is an issue that the State of Louisiana raises strongly and often.

BOEMRE has made numerous efforts to collect information on vessel support from the offshore industry, supply boat companies, and ports. However, these past efforts have met with only limited success due to the way companies, port authorities, and supply efforts are organized and reported.

Objectives: The purpose of this study is to:

- develop a fuller understanding of the magnitude and location of OCS-related vessel traffic in the GOMR and,
- to apply this understanding to refine (a) baseline descriptions of geographic areas and of industry activities, (b) BOEMRE scenarios and modeling, and (c) subject area

assessments that address vessel traffic such as air quality, water quality, historic preservation, and socioeconomics.

Methods: The Federal government requires that virtually all commercial vessels operating in U.S. waters transmit its ship identifier and location through a standard AIS transponder. PortVision is a commercial venture that has set up a system in the GOMR to collect these reports, filter and organize these data, and to make them available to their clientele in real time and as organized reports. AIS transponders provide data on the speed, heading and location of vessels over 65 feet and for many vessels that are smaller. PortVision collects about 40 million vessel locations per day. These data will be filtered and analyzed to provide BOEMRE with information regarding total vessel traffic in the Gulf of Mexico Region by channel and port and the level of activity that is directly related to OCS development.

Revised date: September 2, 2010

ENVIRONMENTAL STUDIES PROGRAM: Studies Development Plan FY 2011-2013

Region: Gulf of Mexico OCS Region
Planning Areas: Eastern, Central, and Western
Title: Archaeological Impact Analyses of OCS Vessel Activity

BOEMRE Information Needs to be Addressed: The information will be used for Gulf of Mexico Region Environmental Impact Statements as it becomes available, particularly for analyzing and discussing impacts of vessel traffic that supports OCS activities. The data provided will support baseline description, scenario development, and detailed archaeological impact analyses. This information is needed immediately to begin to assess the effect of the OCS program on significant cultural resources. Ideally work would begin shortly after the data becomes available and conclude in 2012.

Cost Range: (in thousands) \$100-\$150 **Period of Performance:** FY 2011-2012

Description:

Background: Vessel support constitutes a large and vital segment of OCS-related activities in coastal, near-coastal and offshore waters. The need for vessel support is one of the distinguishing characteristics of the offshore vs. onshore petroleum industry. In the Gulf of Mexico Region (GOMR), the intensity, type, and location of OCS-related vessel traffic is an important component of the “baseline.” This traffic is also one of the important vectors of possible OCS-generated effects to National Register eligible historic properties by contributing to the erosion of channel shorelines. The State of Louisiana has raised this as an issue in the past and BOEMRE, despite numerous efforts to collect information on vessel support from the offshore industry, supply boat companies, and ports has been unable to address the issue adequately. The present study proposes to build upon another study proposed for this cycle, *Detailed Gulf of Mexico Vessel Trip Data to Support Environmental, Socioeconomic, and Archaeological Impact Analyses of OCS Activity* which will analyze data on vessel tracks from Federally required AIS transponders transmitting vessel location and speed in real time.

Objectives: The purpose of this study is to:

- develop a fuller understanding of the routes chosen by OCS-related vessel traffic to reach their offshore destinations,
- to apply this understanding to define a baseline description of the extent to which these routes impinge upon National Register eligible properties in the coastal zone, and

- document the present condition of selected “high-value” sites in comparison to their recorded condition documented in the site files of the Louisiana Division of Archaeology.

Methods: The Federal government requires that virtually all commercial vessel operating in U.S. waters transmit its ship identifier and location through a standard AIS transponder. PortVision is a commercial venture that has set up a system in the GOMR to collect these reports, filter and organize these data, and to make them available to their clientele in real time and as organized reports. AIS transponders provide data on the speed, heading and location of vessels over 65 feet and for many vessels that are smaller. PortVision collects about 40 million vessel locations per day. These data will be filtered and analyzed to provide BOEMRE with information regarding total vessel traffic in the Gulf of Mexico Region by channel and the level of activity that is directly related to OCS development. These data will be overlaid with site location data obtained in GIS format from the Louisiana Division of Archaeology to determine where there are intersections between high OCS-related vessel traffic patterns and the presence of significant historic properties along the channel margins.

These data will then be analyzed with respect to the total universe of vessel traffic from other non-OCS sources to understand the level of effect attributable to OCS sources. Finally, selected sites will be visited and documented in order to develop an understanding of their present condition in comparison to the condition at the time of their discovery as reported in the Site Files of the Louisiana Division of Archaeology.

Revised date: September 2, 2010

ENVIRONMENTAL STUDIES PROGRAM: Studies Development Plan FY 2011–2013

Region: Gulf of Mexico

Planning Area: Eastern

Title: Characterization of Seagrass in Waters of the U.S. Outer Continental Shelf: Florida Big Bend Area

BOEMRE Information Needs to be Addressed: The potential for offering offshore leases within 125 miles of the west coast of Florida prompt the need for BOEMRE 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 BOEMRE 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 2011-2014

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). A study by Continental Shelf Associates (CSA, 1985) mapped seagrass habitat as far offshore as 110 km (70 mi). Another CSA study assessed hurricane damage after hurricanes *Elena* and *Kate* passed through the area in 1985. *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.

With oil and gas activities moving further east, the BOEMRE needs to consider possible effects. Construction activities directly impact the seafloor by placement of structures, laying pipelines, anchoring vessels, and especially by the sweep of chain and wire rope attached to large anchors. All these activities disturb bottom sediments, increasing turbidity. Drilling results in the discharge of cuttings that produce a significant turbidity plume. Pipelines in less than 200 ft of water depth are buried in a trench; an activity that can increase turbidity over a large area.

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 BOEMRE renew its information base for sensitive habitats on the Florida shelf. Seagrasses of the Big Bend area are a valuable resource that the BOEMRE must protect. Knowledge of the status of seagrass is important for the BOEMRE 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: This study quantitatively surveys the distribution of seagrass and algae communities in Federal waters of the Florida Big Bend region.

Methods: The study will employ typical survey methods for quantitative analysis of seagrass 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, video, or still transects. appropriate methods will accomplish the following tasks.

Revised Date: September 2, 2010

ENVIRONMENTAL STUDIES PROGRAM: Studies Development Plan FY 2011–2013

Region: Gulf of Mexico

Planning Area: Western

Title: Gulf of Mexico 2011 Monitoring Initiative: Mapping and Characterizing Lesser Known Shelf-Edge Banks

BOEMRE Information Needs to be Addressed: The BOEMRE needs to renew outdated knowledge of GOM habitats to continue to insure that protective measures are adequate or to adapt their management to changing conditions.

Cost Range: (in thousands) \$925-\$1,175

Period of Performance: FY 2011-2014

Description:

Background: Much of the BOEMRE baseline data for benthic habitats on the continental shelf of the Gulf of Mexico dates back to the 1970's and 80's. The BOEMRE did a good job of surveying and analyzing the array of habitats encountered at that time. The analyses resulted in the classification of hard bottom habitats by the BOEMRE into biological zones and for differing levels of protection. It is important for the BOEMRE to be able to detect anthropogenic impacts from oil and gas activities. This can only be done by comparison with reliable information on the status and health of the sensitive habitats concerned. Many natural and anthropogenic influences could have produced changes in the past 20-30 years. Furthermore, mapping capabilities have greatly improved during the intervening period, allowing much more detailed depictions of the seafloor. The BOEMRE needs to procure new high resolution seafloor depictions and refresh its knowledge of GOM habitats to continue to insure that protective measures are adequate or to adapt their management to changing conditions.

New seafloor bathymetry, sonar, backscatter, and other possible sources of information can reveal previously unknown details of seafloor character. The resolution and accuracy of the geographic data collected in the late 70's and early 80's is not as reliable as modern data. High resolution bathymetry is available for some shelf-edge banks but many of the banks protected by the BOEMRE are still characterized by the old data. New surveys are needed to characterize those banks and to discern small features that are now protected by the BOEMRE between banks. The application of new techniques is needed to solve this issue.

Baseline data for sensitive habitats is essential for defining changes in those habitats over time. Establishing the natural condition allows us to distinguish subsequent anthropogenic effects from natural changes. Few of the habitats that the BOEMRE protects have been revisited since those early investigations. While this 20-30 year time lapse would not be a problem if natural selection and seasonal events were the only impacting influences, this is not truly the case. Anthropogenic effects permeate the natural environment to the point that it is difficult to distinguish between natural changes and those prompted by man's activities.

Besides the direct effects of such things as shipping traffic and fishing pressure, there are more subtle influences on outer continental shelf habitats such as urban development, urban and agricultural runoff, the introduction of invasive species, the effects of global warming, and sea-level rise. As a result of these many influences, sensitive habitats on the continental shelf may change more rapidly than would result from strictly natural conditions. Therefore, baseline data must be updated periodically to maintain a current understanding of the conditions of sensitive habitats. Without periodic inspection, it will be more difficult or impossible to determine the cause of changes to sensitive benthic communities. If this is the case, then the validity of BOEMRE protective measures could be called into question. The BOEMRE needs to periodically verify the condition of sensitive shelf habitats.

New knowledge, equipment, and techniques can be used to update baseline data. The body of knowledge and understanding of the function of natural communities has grown considerably in the past 30 years. Better equipment has been developed to produce more reliable and consistent measures of the environment. Measures and analyses can be made that were not available years ago. Methods have improved considerably for the collection of field sampling and their analyses. All of this works together to allow a better characterization of the topography and ecology of seafloor habitats.

The BOEMRE needs to institute a comprehensive program of periodic monitoring for sensitive habitats on the continental shelf of the Gulf of Mexico (GOM). The long-range program would systematically survey the GOM to update our knowledge of habitat conditions using the latest information and technology. The task is a large one and would need to be approached in phases. This first phase, the “2011 Monitoring Initiative”, would start the process with an examination of lesser known topographic features near the shelf edge. Future phases would focus on varying habitats and conditions across the GOM.

Numerous banks near the outer edge of the GOM continental shelf were surveyed in the late ‘70’s or early ‘80’s and have not been visited by BOEMRE since that time. Diaphus, Ewing, Sweet, Elvers, Bouma, Rezak, Sidner, Parker, and Applebaum Banks are among shelf-edge banks for which we have little or no recent knowledge. Reef fish surveys conducted by the NMFS SEAMAP program using baited drop cameras will provide some information about the occurrence of reef fish at some of these banks. The SEAMAP data will be considered in analyses for this study.

Our knowledge of seafloor characteristics and the condition of the ecosystems on these banks will be updated by surveys conducted in this study. The goal will be to update our knowledge of shelf-edge banks and surrounding areas to enhance our ability to identify anthropogenic impacts potentially caused by oil and gas activities. These investigations will characterize the ecosystems using modern techniques and place them in relation to regional knowledge to support BOEMRE decision-making. It will also provide BOEMRE the information needed to insure that protective measures are adequate and enable adaptive management as needed.

Objectives: The objectives of this study are to:

- provide highly accurate depictions of seafloor physiography in areas surrounding named topographic features;
- initiate a systematic program of periodic monitoring across the GOM;
- provide updated ecological data and analyses for the lesser known shelf-edge banks; and
- relate the results of these investigations to the regional knowledge base for BOEMRE decision-making

Methods: The project will use the best available methods to conduct surveys of numerous shelf-edge bank habitats for which updated information is needed. Areas of focus will include known topographic features and their surrounds. The efforts will be coordinated with recent efforts of the Flower Garden Banks National Marine Sanctuary and the NMFS SEAMAP program to prevent redundant efforts. Scientists will select lesser known shelf-edge banks having little or no recent information available as targets for investigation.

The study will begin with collection of seafloor remote sensing data. High resolution seafloor bathymetry and reflectance will be primary. Other methods may be used as appropriate. There are several entities capable of performing the required work.. A partnership with the USGS, NOAA, or a university may be appropriate. This work will support the remainder of the study.

Investigations will be performed using a variety of methods such as video and still imagery collected with ROV's and drop cameras. Results will be analyzed through a variety of descriptive, univariate, multivariate, and geospatial methods. Samples may be taken as needed for substrate, benthic fauna and flora, and water quality assessments. The project will benefit by partnering with the FGBNMS to assist in species identification, as their office has built a considerable expertise with the regional fauna and flora.

Deliverables will include quarterly reports, a final report, data files, GIS files, metadata files, and imagery. Community composition data will be formatted to display the results through the geospatial interface of the new BOEMRE *EcoSpatial Information Database* (ESID, pronounced "ee-sid"). In addition, any specimens appropriate for archiving, such as new records for the area, will be archived with the Smithsonian National Museum of Natural History.

Data will be incorporated into a Geographic Information System to depict seafloor topography, habitat zones, and community composition. Seafloor topography will be processed to display at high resolution with ample detail. Community composition data will be linked to the GIS to both display the results and to provide access to the data through the geospatial interface. The geospatially linked data will be used to define habitat zones based on community composition.

Revised Date: September 2, 2010

ENVIRONMENTAL STUDIES PROGRAM: Studies Development Plan FY 2011-2013

Region: Gulf of Mexico

Planning Areas: All

Title: Workshop on Monitoring the Long-term Effects of Offshore Oil and Gas Activities in Gulf of Mexico

BOEMRE Information Needs to be Addressed: BOEMRE has sponsored an extensive amount of studies on the Gulf of Mexico (GOM). Baseline studies in the 1970's evolved into focused ecosystem studies and monitoring studies. These studies provide a solid basis for the management of potential impacts from offshore oil and gas activities. In accordance with the Outer Continental Shelf Lands Act (OSCLA) and BOEMRE's mission, BOEMRE should periodically revisit the results of these studies compared to new research in order to monitor any cumulative effects of offshore oil and gas activity on the GOM. Thus, BOEMRE needs to determine the most efficient and effective way to use both past studies and propose future studies with this goal in mind. The sum of both past and current, as well as future studies forms a strong environmental monitoring framework that guides BOEMRE management decisions. BOEMRE must also consider if any new baseline data needs to be collected (e.g., sites in the Eastern Planning Area). BOEMRE should solicit expert advice from a diverse group of scientists on the best ways to utilize past 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.

Cost Range: (in thousands) \$175 -\$225

Period of Performance: FY 2011

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. The cumulative effect of this activity on the environment should be assessed periodically in accordance with OCSLA and BOEMRE'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 development of protective measures and identification of vulnerable ecosystem components. Thus, years of BOEMRE 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. BOEMRE reports from the ESP can be searched at:

<https://www.gomr.boemre.gov/homepg/espis/espismaster.asp?appid=1> and are listed by year and study number at:

http://www.gomr.boemre.gov/homepg/regulate/environ/techsumm/rec_pubs.html.

Included among these reports are bibliographies of relevant literature such as “Effects of Oil and Gas Development: A Current Awareness Bibliography 2000-2004” (BOEMRE #: 2005-019, 2005).

Additionally, BOEMRE 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. BOEMRE does not operate research facilities and therefore always seeks out qualified scientists through a selective and competitive process to conduct this research. This process begins with a request for proposals. However, before BOEMRE develops a request for proposals, it is necessary to determine how to build upon this monitoring framework by determining the key components of an effective new research study that makes the most of past studies.

Objectives: The purpose of this proposal is to hold a multi-disciplinary workshop where a diverse group of scientific experts guide BOEMRE on the direction that a future research project examining the long-term effects from the oil and gas industry in federal waters of the GOM should take. Before BOEMRE develops a request for proposals, it is necessary to determine (1) the best way to utilize available data from previous studies, (2) what previous studies are most valuable for baseline or incremental data, (3) what offshore sites should be (re)examined, (4) if and what new techniques or instrumentation should be used to collect new data or analyze previously collected data, (5) what new data should be collected, (6) if any new baseline data should be collected from sites where oil and gas activity has not yet taken place, (7) how to extract any possible effects of OCS oil and gas activity from other anthropogenic environmental effects including state oil and gas activities and from natural environmental influences (e.g., oil seeps, river or atmospheric inputs, etc...).

Methods: This study will conduct a one and one-half or two day workshop with participation by academic, private sector, and government scientists with specialties including, but not limited to, toxicology, biology, chemical oceanography, (bio) geochemistry, environmental chemistry, environmental mineralogy, and sedimentology among many other possible specialties. The workshop will give the participants the opportunity to:

1. Learn about BOEMRE’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” 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 compliment BOEMRE’s interests,
4. Determine what sites should be (re)visited including possible sampling schemes
5. Advise BOEMRE 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, X 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).
7. Consider if new baseline data is needed for any areas (e.g., the Eastern Planning Area)
8. 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, etc.
9. Establish a method to separate natural environmental effects from man made effects.
10. Form possible collaborations to compete in the future call for proposals.

The proposed budget will cover the cost for event planning and execution, facilities and needed equipment rental, and preparation of the workshop recommendations.

Revised Date: September 2, 2010

ENVIRONMENTAL STUDIES PROGRAM: Studies Development Plan FY 2011-2013

Region: Gulf of Mexico

Planning Area: Central

Title: A Coupled Atmosphere and Ocean Model for Air Quality and Other BOEMRE Applications in the Gulf of Mexico

BOEMRE Information Needs to be Addressed: The National Center for Atmospheric Research (NCAR) has developed a new and advanced meteorological model (The Weather Research and Forecasting Model (WRF)) to replace the MM5 meteorological model. Therefore, BOEMRE needs to make a transition from MM5 model to an improved WRF model for air quality and other BOEMRE applications, for example, alternative energy, oil spill, and climate change. Interactions between the atmosphere and the ocean are very important in the climate change. Specifically, BOEMRE needs to make use of more current and accurate meteorological models for use in modeling air emissions from OCS sources. The meteorological models that are being implemented nationwide need to be adapted to simulate the marine boundary layer to more realistically simulate atmospheric conditions needed for air quality modeling in the Gulf of Mexico. There is also the need to incorporate two-way interaction between ocean and atmosphere to take into account changing oceanographic features in the Gulf that would affect the marine boundary layer and hence atmospheric dispersion. The techniques or information would be used to enhance modeling capabilities to address the revised ozone standard, potential air quality impacts on PSD Class I areas, and regional haze.

BOEMRE should work with NCAR and NOAA and WRF working committee to develop the module that includes characteristics of coastal meteorology, take into account the air-sea interaction and the transition layer of land and sea, evaluate the mixing height to be used in air quality modeling, and focus on WRF-VAR for data assimilation. BOEMRE should also work with the WRF committee to include one or two way coupling in one of the modules. BOEMRE should also further explore other ongoing efforts to generate a coupled atmosphere and ocean model that interfaces with the WRF or MM5 model. There are a number of organizations already working on the coupled atmosphere and ocean model, to name a few, such as Navy, NCAR, and NOAA etc.

BOEMRE should work with federal agencies and research facilities on the development or implementation of the new and advanced Weather Research and Forecasting Model (WRF) and a coupled WRF and ocean model. Through this study BOEMRE would contribute funding to

these ongoing efforts to support the development of a combined atmosphere and ocean model system suitable for GOM needs. The availability of an integrated atmosphere-ocean model would improve BOEMRE's ability to assess the impact of offshore operations on air quality in view of the EPA proposed new and more stringent ozone standard.

Cost Range: (in thousands) \$1,800-\$2,000 **Period of Performance:** FY 2011-2013

Description:

Background: The advanced meteorological model will be used to drive the air quality model. To obtain the better and more accurate estimates of air concentration resulting from the releases of air emissions from OCS sources and to assess the impact of air concentration, BOEMRE needs to make use of more current meteorological models. The coupling between air and sea allows for feedback from the influences of the upper ocean to the atmospheric circulation. The coupled atmosphere-ocean model eliminates the need for the model to externally specify fluxes across the interface of the ocean surface, i.e., the model will internally calculate these fluxes. The BOEMRE has funded a number of relevant studies including meteorological and oceanographic modeling studies, observational studies, and a study of the atmospheric boundary layer study (ABL) in the GOM. Currently, BOEMRE also has an ongoing study for wind-wave measurements in the Gulf of Mexico. The new information of air-sea interaction obtained in this study will be integrated into the WRF model. The results obtained from these studies will be used to develop the atmosphere – ocean model. This coupled model will be used in BOEMRE applications such as air quality, oil spill, oil and gas platform design, alternative energy, and extreme weather forecast in real time.

Objectives: The objectives of this study are:

- to integrate one atmospheric model and one ocean model into an atmosphere – ocean model system,
- to obtain a better understanding of the feedback mechanism of the upper ocean and the impact of sea surface temperature on the atmospheric circulation, and
- to improve the accuracy and parameterization of various physical processes of the model and to produce a better working integrated atmosphere and ocean model.

Methods: This study will develop a single integrated atmospheric and oceanic model system utilizing existing meteorological and oceanic models. The WRF or MM5 model will be used for the meteorological model and the ocean model will be selected later. The information available through the atmospheric boundary layer (ABL) study and other relevant observational studies will be used to evaluate model sensitivity and the mixing height, to test hypotheses, and to verify the model.

This study mainly concerns with adapting the existing atmosphere and ocean models for use in the air quality applications in the Gulf of Mexico region. BOEM will consider a three phase approach as follows:

Phase I: Modify WRF model tailored to BOEMRE's needs by incorporating marine boundary formulations consistent with latest theory and over water observations.

Phase II: Leverage the works already developed by a number of research institutes and develop a working atmosphere and ocean model.

Phase III: Develop an improved atmosphere and ocean model for air quality application.

BOEMRE will work cooperatively with other federal and institutional partners including but not limited to USGS, and Woods Hole Oceanographic Institution to develop and achieve the coupled atmosphere – ocean model that can be applied to meet the needs of BOEMRE, especially to meet the requirement of the EPA proposed new and more stringent ozone standard.

Revised Date: September 2, 2010

ENVIRONMENTAL STUDIES PROGRAM: Studies Development Plan FY 2011-2013

Region: Gulf of Mexico

Planning Area: Mid-Atlantic

Title: Battle of the Atlantic Expedition 2011

BOEMRE Information Needs to be Addressed: The North Carolina coastline has long been referred to as the Graveyard of the Atlantic; more than 1,000 ships have been reported to have wrecked in this area dating back as far as the early 16th century. During World War II this area served as one of the great battlefields of the German U-boat assault on North America, with over 125 vessel casualties. As interest in renewable energy sources and coastal restoration projects off North Carolina increases offshore development in this area will increase as well. As these operations move into the waters along the Atlantic coast, BOEMRE faces new challenges in fulfilling its role as an environmental steward. Not the least of these challenges comes as a result of our responsibility to consider impacts from permitted activities on significant archaeological resources on the seabed. Therefore, a current assessment of World War II vessel losses will be crucial for mitigating adverse affects to these resources as 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.

Cost Range: (in thousands): \$100

Period of Performance: FY 2011-2012

Description:

Background: Perhaps the longest military campaign of World War II, the Battle of the Atlantic was waged from the waters off England to the east coast of the United States and into the Gulf of Mexico. From its beginnings in 1939 through the end of the war with Germany hundreds of vessels were lost. Many of these vessels have been relocated on the seafloor. Some in shallow water allowing for exploration and visits from the recreational diving community; others in depths too great for diving, but well within reach of remotely operated vehicles (ROVs). These sites are recognized as non-renewable cultural, historical, and archaeological resources. Given the violent nature of these vessel losses, many are also war graves.

For the last three years the BOEMRE has partnered with NOAA's Monitor National Marine Sanctuary (MNMS), as well as other federal and state agencies, academic institutions, and local organizations to document and assess the archaeological significance of World War II shipwreck casualties from the German U-boat offensive off the North Carolina coast.

In July 2008, BOEMRE participated in the first effort of a cooperative expedition, led by Monitor NMS, to begin documenting the remains of vessels lost off the North Carolina coast during World War II (<http://sanctuaries.noaa.gov/missions/battleoftheatlantic/>). In addition to Monitor NMS, participants in Phase I included NOAA's Maritime Heritage Program, the National Park Service Submerged Resources Center, BOEMRE, the University of North Carolina Coastal Studies Institute, and the East Carolina University Maritime Heritage Program.

In August 2009, a second expedition was conducted, which built on partnerships established during the 2008 Battle of the Atlantic Expedition. The primary focus of the 2009 expedition was scientific documentation of the converted British military trawler H.M.T. *Bedfordshire*, sunk by U-558. In addition to in-depth documentation of this vessel, a one-week remote sensing survey was completed which successfully relocated the remains of the U.S. Navy trawler YP-389, sunk by U-701. With the assistance of two local dive shops, part of the team also returned to the three German U-boats that were investigated during the 2008 expedition in order to carry out corrosion potential studies, which will provide an assessment of the structural integrity of each of these vessels.

In 2010, BOEMRE entered into a five-year inter-agency cooperative agreement with MNMS to locate and document WWII vessel casualties, assess their significance under the National Register of Historic Places, and provide educational outreach to the public in order to deter the collection of artifacts from these sites by relic hunters. The cooperative agreement between BOEMRE and MNMS provided funding for the 2010 expedition, and was set up to allow for additional funds to be provided for each of the five years of the agreement. The 2010 expedition, which recently completed, focused on merchant vessel casualties in water depths ranging from 80 to 230 feet below sea level. Vessels documented during the 2010 expedition included *Empire Gem*, *City of Atlanta*, *E.M. Clark*, and *Kashina*. Since the German and British governments still claim ownership of many of these vessels, coordination with these governments has been an important part of this project. Consultations with the British and Germany Embassies were conducted to ensure that proper protocols were followed in completing these investigations. By documenting the current status of each of these vessels, baseline data was acquired which can be used for long-term monitoring of the sites.

The NOAA Monitor National Marine Sanctuary (MNMS) is committed to a multi-year investigation of vessel losses from the Battle of the Atlantic. BOEMRE's continued participation and partial funding of this project will increase our role in the overall direction and scope of this project. It will also help to fulfill our responsibilities under Section 106 of the National Historic Preservation Act and Executive Order 11593 by providing vital information on the current condition of these wrecks in order to determine potential adverse affects from BOEMRE-permitted activities.

Objectives: The 2011 expedition will continue investigation of Allied losses in the Graveyard of the Atlantic including US and British naval vessels, as well as US Merchant Marine ships.

Many of these wrecks have undergone illegal salvage, especially those at depths shallower than 130 feet. The deeper Allied shipwrecks are in a much better state of preservation due to the challenges of technical diving and working in strong currents. These shipwrecks lie in a near exact state from when they sank, and as such, truly reflect the battlefield that raged above and below during WWII.

Investigations carried out off North Carolina will be combined with the efforts BOEMRE has already completed on WWII casualties in the Gulf of Mexico, which serves as the foundation for this project. The objectives of this project are to collect detailed documentation of these vessels. Fieldwork will include remote sensing surveys, site mapping, photo-mosaics, video/photo documentation, corrosion potential studies, and an evaluation of the artificial reef effect at each of the sites. Results from this project will include a cumulative report on fieldwork and historical significance; a joint Battle of the Atlantic nomination with BOEMRE on the U-166 and Gulf of Mexico WWII merchant vessel losses to the National Register of Historic Places; and outreach products, including a Battle of the Atlantic web site, posters, and educational materials. Additionally, this project will strengthen existing federal and state partnerships, as well as create new ones.

Methods: The objectives of the study will be obtained through investigating up to six historic shipwrecks during the 2011 field season. These sites will be selected by BOEMRE and NOAA archaeologists. Testing will be performed by marine archaeologists applying a variety of techniques including remote sensing, diving, and ROV inspection. The investigations will likely consist of extensive remote sensing, photographic documentation and mapping of exposed features.

Revised Date: September 2, 2010

ENVIRONMENTAL STUDIES PROGRAM: Studies Development Plan FY 2011-2013

Region: Gulf of Mexico

Planning Area: Mid-Atlantic

Title: Controlled Seismic Airgun Exposure Experiments with Bottlenose Dolphins and Humpback Whales in Study Areas off of Cape Hatteras

BOEMRE Information Needs to be Addressed: The potential for renewable energy development, and oil and gas exploration, in the U.S. Atlantic Ocean will require biological impact analysis for a suite of industry activities. Seismic airgun arrays may be used for a variety of purposes, including exploration for petroleum reserves, reservoir monitoring, and site selection for wind towers and other structures. Acoustic disturbance has been identified as an impact to marine mammals and other marine life, but the level of impact and biological significance for most species is unclear. Conducting tagging, biopsy sampling, and controlled exposure experiments on two species of interest, the depleted coastal bottlenose dolphin (representing toothed whales) and the endangered humpback whale (representing baleen whales), will provide severely needed data for impact analysis and other regulatory mandates.

Cost Range: (in thousands) \$2,500-\$3,000 **Period of Performance:** FY 2010 - 2012

Description:

Background: The Atlantic Ocean has a complex and diverse marine mammal community. Under the Endangered Species Act (ESA) and the Marine Mammal Protection Act (MMPA), these species are given particular legal status. The potential impacts of seismic activities are subject to thorough review by the National Marine Fisheries Service, Fish and Wildlife Service and Marine Mammal Commission. Oil and gas exploration and acquisition, sand and gravel procurement, and wind turbine assignment and other alternative energy projects include seismic operations. Any potential impacts that BOEMRE-regulated activities may have on these marine mammal populations are significant program concerns. Given these concerns and the information needs to address them, we propose a study to conduct controlled exposure experiments on marine mammals in mid-Atlantic waters off of Cape Hatteras, NC. Two species, the coastal bottlenose dolphin and the humpback whale, will be targeted. These two species have been chosen to represent both toothed and baleen whales, and also the coastal and offshore waters in the study area.

The western north Atlantic coastal bottlenose dolphin stocks have been designated as depleted under the Marine Mammal Protection Act (MMPA). These stocks were severely affected by a high mortality event in 1987-88.

The humpback whale is listed as endangered under the Endangered Species Act (ESA). Humpback whales conduct seasonal migrations from waters off New England to the

Caribbean in the fall and return in the spring. The offshore waters in the proposed study area comprise a portion of the migratory corridor for humpback whales.

Objectives: This proposed study will focus on gathering data on the ambient acoustic environment of inshore and offshore study areas, and behavioral modifications of bottlenose dolphins and humpback whales in response to seismic airgun operations, including testing the efficacy of ramp-up procedures. Acoustic output of the airgun array may be varied in order to simulate the sound levels of different applications of seismic data to industry operations, and mammal responses to those varying levels of acoustic disturbance will be monitored. Biopsy samples taken from animals at the time of tagging will permit genetic analysis of the individual animals, and contaminant analyses will give baseline levels and health assessments for the targeted species.

Methods: This study will be conducted in an offshore and a near shore study in the vicinity of Cape Hatteras, NC. Bottlenose dolphins and humpback whales will be tagged in a timely fashion that will allow post-tagging/pre-exposure, during exposure, and post-exposure behavioral data. Biopsy samples will also be taken.

A dedicated vessel, either provided by the seismic industry (ship of opportunity) or a scientific research vessel (e.g. NSF's the *Langseth*), with a seismic airgun array will run tracklines designed to expose the tagged mammals to various levels of seismic acoustic disturbance. Visual and acoustic monitoring of the tagged animals will be conducted during the seismic runs from an independent vessel. The visual and acoustic monitoring will continue for a period of time following exposure. These data will be combined with data retrieved from the tags to determine a suite of information including surface intervals, dive duration, dive depth, feeding frequency, group dynamics, and social structure. Pre-exposure, during exposure, and post-exposure parameters will be compared.

Tags will be equipped with receivers capable of determining the level of received sound at the animal. Tags will also be capable of giving GPS locations of animals. This will give ambient noise levels at the tagged animals prior to, and following, the exposures, as well as acoustic exposure levels at various distances from the acoustic source. Since several controlled exposure experiments will be conducted on each of the two species, a wide range of environmental conditions, including depth, temperature and salinity, will be represented in the received sound level determinations.

Revised Date: September 2, 2010

ENVIRONMENTAL STUDIES PROGRAM: Studies Development Plan FY 2011-2013

Region: Gulf of Mexico

Planning Area: Mid-Atlantic, South Atlantic

Title: Comprehensive Ecosystem Characterization of the U.S. Outer Continental Shelf: Pelagic *Sargassum* Algae Distribution and Movement in the Gulf of Mexico and Atlantic

BOEMRE Information Needs to be Addressed: The BOEMRE needs to characterize the occurrence and movement of pelagic *Sargassum* algae in the Gulf of Mexico and western Atlantic to support assessment of oil spill risks and mitigation of potential impacts to this vulnerable habitat.

Cost Range: (in thousands) \$500-\$625

Period of Performance: FY 2011-2013

Description:

Background: Pelagic *Sargassum* algae comprises a unique ecosystem that merits thorough consideration in BOEMRE's 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 astonishing endemic species. 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 remarkable *Sargassum* community is vulnerable to contamination from spills because it floats at the surface of the sea. This is particularly relevant to the BOEMRE 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 Gulf of Mexico (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.

This study is proposed as an initial effort to develop a more comprehensive program approach to studies management. The goal is a wholistic management approach that develops each

study to maximize its research contribution to support ecosystem-based management of marine resources on the U.S. Outer Continental Shelf (OCS) across all the relevant scientific disciplines. This approach will maximize the use of studies resources by broadening the approach to a more cooperative endeavor with consideration of all aspects of the ecosystems of the region. During the development phase, this study will seek to combine efforts and resources across disciplines with other BOEMRE scientists and with outside entities. In particular, work on juvenile sea turtle associations, fish associations, and water current patterns will be entertained. This may involve sharing not only ship time but also certain other resources such as water quality analyses and personnel (e.g., data coordination and statistical expertise). It could require researchers to conduct sampling for the direct benefit of a separate study in lieu of direct involvement of personnel from those other studies.

Ideally, the comprehensive ecosystem characterization program will employ multi-disciplinary teams to characterize relevant aspects of sensitive OCS ecosystems. Future studies can be designed to target multiple aspects of the environment for a particular geographic area. Disciplines that utilize similar approaches to field work will cooperate in their efforts to share resources in general and ship time in particular. This will result, not only in cost savings, but will produce integrated analyses to synthesize information into a more comprehensive understanding of the ecosystem.

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. The project will also solicit coordination with other BOEMRE scientists and scientists from other institutions with overlapping interests. In particular, partnerships will be sought with scientists studying sea turtle associations with *Sargassum*, utilization of *Sargassum* by fish, and water current studies. Opportunistic sampling may be employed for measures such as sampling for contaminants, water quality measurement, plankton sampling, and other programs of opportunity. 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. Estimate the standing biomass of *Sargassum* based on results.
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 BOEMRE'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: September 2, 2010

ENVIRONMENTAL STUDIES PROGRAM: Studies Development Plan FY 2011-2013

Region: Atlantic

Planning Area: Mid-Atlantic

Title: Extended Mid-Atlantic Planning Area Information Resources: Data Search and Literature Synthesis

BOEMRE Information Needs to be Addressed: The BOEMRE will need updated and synthesized Mid-Atlantic OCS information on human and environmental aspects of the region, in order to meet its responsibility of ensuring that all OCS activities are conducted in an environmentally responsible manner. The recent surge in energy prices and offshore energy initiatives may result in future leasing activity in the Central Atlantic Region.

Cost Range: (in thousands) \$150-\$300

Period of Performance: FY 2010-2011

Description:

Background: The central United States (US) Atlantic seaboard between Cape Hatteras, North Carolina and North Myrtle Beach, South Carolina has not been developed for potential energy reserves. It has unique physical oceanography, physiography, and zoogeography; several valuable fisheries; and characteristic weather patterns. It harbors a suite of protected coastal and offshore marine organisms including sea turtles, bats, birds, fishes, and marine mammals, many of which are considered endangered or threatened.

The last synthesis of physical oceanographic information for the US Atlantic OCS was conducted for BOEMRE in 1981. The meandering and shoreward penetration of the Gulf Stream generates a complex flow patterns around the shelf break region. Other than hurricanes, numerous Northeasters with strong winds and high waves visit the region during fall and winter seasons. In addition, the BOEMRE sand and gravel program has collected nearshore information during the 1990's and beyond, which could be incorporated into the synthesis. Given the date of the review and the certain advance in knowledge since then (including several large field programs funded by NSF, NOAA, NASA, NAVO and ONR), a synthesis of knowledge is highly recommended, especially given our limited familiarity with this area. The Navy should be a considerable source for their assessments along the Atlantic coast.

Although BOEMRE has conducted an extensive amount of social science research in the Gulf of Mexico Region, much of this information is not applicable to the Mid-Atlantic coastal region. The Mid-Atlantic coastal area is characterized by many barrier islands and areas highly dependent on recreation or protected Federal or state parks and reserves. Many communities in the region have very limited or no history of offshore energy production. 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 energy development.

In the Atlantic Region, the Environmental Studies Program (ESP) has been limited to prelease descriptive and process-type investigations in recent years since there has been no production in that area. The recent surge in energy prices and offshore energy initiatives may result in future leasing activity in the Atlantic Region.

Based on current expressions of industry interests, BOEMRE expects that offshore energy projects and activities in the foreseeable future will begin to focus on portions of the BOEMRE OCS Atlantic. These are “frontier areas” with no ongoing energy operations. The energy industry is rapidly evolving in the face of changing energy markets, technologies, and governmental policies. Planning for this future cannot be based on past experience alone.

Objectives: The objectives of the study are:

- to develop comprehensive information on the human and environmental aspects of the region, and
- to update the understanding of the ecological communities, the dominant oceanographic and other processes that drive the shelf and deep-sea ecosystems, and the potential sensitivities of the area.

Methods: The data search and synthesis will be a comprehensive search and integration of existing environmental and socioeconomic information for the region. The relative contributions of physical oceanographic processes to cross-shelf transport will be evaluated, as will the contributions of buoyancy and meteorological forcing to seawater transport. Period of performance is expected to be 12 months, with a deliverable report after 9 months.

Revised Date: September 2, 2010

2.3 Profiles of Studies Proposed for FY 2012 NSL

Table 3. Gulf of Mexico Region Studies Proposed for FY 2012 NSL

Page #	Discipline	Title
65	AQ	Deploying NOAA-NDBC Buoys for the Air Quality Program
69	AQ	Enhancing the Capability of a New Meteorological Model for Air Quality and Other
71	AQ	Meteorological and Wave Measurements for Improving Meteorological and Air Quality Modeling - A Deep Water Site
73	AQ	NEPA Air Quality Modeling Study
75	FE	Environmental Monitoring of Oil and Gas Development Sites on the Florida Outer Continental Shelf
77	HE	Artificial Reef Effects of Oil and Gas Pipelines on the Outer Continental Shelf of the Gulf of Mexico
79	HE	Gulf of Mexico Monitoring Program (2011) South Texas Banks
81	HE	Long-term Effects of Oil and Gas Activities on the Florida Shelf
85	MM	Movement of Reefed Platforms in the Gulf of Mexico due to Tropical Storms
87	PO	Synthesis of Recent Oceanographic Observations in Deep Waters of the Gulf of Mexico
89	SS	Support for Socioeconomic Impact Assessments of Offshore Energy Development in the Gulf of Mexico Region
MARINE ARCHAEOLOGY		
93	SS	Archival Investigation for Potential Slave Shipwrecks on the Outer Continental Shelf, Atlantic and Gulf of Mexico Regions
97	SS	Investigation of a Possible 18th Century Wooden Shipwreck off the Chandeleur Islands
AQ = Air Quality FE = Fates & Effects HE = Habitat & Ecology IM = Information Management MM = Marine Mammals & Protected Species PO = Physical Oceanography SS = Social Sciences		

ENVIRONMENTAL STUDIES PROGRAM: Studies Development Plan FY 2011-2013

Region: Gulf of Mexico

Planning Area: Gulf-wide

Title: Deploying a NOAA/NDBC Buoy for the Air Quality Program

BOEMRE Information Needs to be Addressed: The BOEMRE's funded buoy 42040 operated under the NOAA, National Data Buoy Center (NDBC) for air quality applications has been discontinued; this buoy is located in MOBILE SOUTH 64 nm South of Dauphin Island, AL (29.18 N 88.21 W ((29°11'3" N 88°12'48" W). As a result, there is a new data gap in the eastern part of the Central Gulf of Mexico, in addition to the significant existing data gaps offshore Louisiana. These data are needed for air quality modeling, air quality review, and the environmental impact analysis, and for NEPA document. This meteorological information is urgently needed in view of the stringent ozone, particulates, and other pollutants regulations newly proposed by EPA; many counties in Louisiana and Coast States have become ozone nonattainment area. There are two purposes for the use of this buoy. Initially, this buoy will be used in conjunction with the extended period of time for the wind-wave measurements at ongoing shallow water site or at a proposed deep water site. However, the ultimate goal of this buoy is to place a buoy at about the same general location as the existing Buoy 42040 once the wind-wave measurement study is completed. This buoy also can be used to support many other applications: the ongoing data collection program for air emissions, the alternative energy program, and the real time prediction of severe weather. This meteorological information is crucial in characterizing the atmospheric structure in the surface layer. In this study, an inter-agency agreement with NOAA is proposed to deploy an enhanced system for wind-wave measurements. Furthermore, the theory of the flux transfer at the air-sea interface at light winds at present is still controversial; the high levels of air concentration often occur at the situation of light winds. The proposed study will clarify some of these issues.

This inter-agency agreement (IA) will fund a buoy for three-years in partnership with the NOAA, National Data Buoy Center (NDBC), and place a new buoy at a shallow water site or at a deep water site. Meteorological and wave measurements are needed to improve meteorological and air quality modeling and to derive dispersion parameters for use in air quality model and assessment. These field measurements obtained with the new and enhanced buoy will improve the accuracy of meteorological and air quality models and benefit air

quality assessments to be used in environmental impact statements. The data will be used to improve air quality modeling used to predict and assess 8 hour ozone, visibility, and haze in NEPA documents. Additionally, an IA with NDBC will allow BOEMRE to fund additional buoys if and when needed in the near future.

Cost Range: (in thousands) \$384-\$576

Period of Performance: FY 2012-2014

Description:

Background: The Atmospheric Boundary Layer (ABL) data has been collected and analyzed in several previous BOEMRE studies (2002-028 and 2004-060). Recommendations to further advance the scientific understanding of the ABL in the central and western GOM were offered. Wind and wave data collected in this interagency agreement with the NOAA NDBC will be combined with data collected in the ongoing study of the Meteorological and Wave Measurements for Improving Meteorological and Air Quality Modeling (NSL GM-08-04) to address some of the recommendations raised in the previous BOEMRE studies of the atmospheric boundary layer. If the buoy is not located in the vicinity of the existing measurement site and the two programs may not overlap in time. This buoy can be used for many other applications: a. To use this buoy at a deep water site, b. To place this buoy at the general location of as the discontinued buoy 42040, c. Alternative energy program, and d. Ongoing other BOEMRE's ocean measurement studies.

In previous BOEMRE studies, the simultaneous measurements of wind and wave in the lower level of the atmospheric boundary layer offshore were not available and there were data gaps between sea surface and 200 m. The purpose of the deployment of a new and enhanced buoy is to collect atmospheric turbulence and the wind-wave data in the atmospheric surface layer and the subsurface water temperature. The detailed description of work is provided in the "Statement of Work" (the interagency agreement previously proposed by NDBC; April, 2008).

Buoy can also be used to collect actual turbulence data and the information on the sea state, the data can be used in COARE algorithm or to verify the CORE algorithm. To name a few, the capability of this buoy also includes the measurements of wind gust, wave height and period, sea surface temperature, subsurface temperature, and ocean current profile. Ultimately, meteorological and wave measurements will be used to characterize the atmospheric boundary structure and air-sea interaction (flux parameterization) and to test theories (e.g., COARE algorithm, flux calculations) such that this information can be used to improve the application of meteorological and air quality models in the offshore environment and the coastal area.

Objectives: This study has three objectives:

- to collect wind-wave data at a buoy for three years,
- to focus the collection of data to close the data gaps in the atmospheric surface layer and oceanic subsurface data,

- to collect data that can be used to characterize the atmospheric surface layer structure and air-sea interaction to improve meteorological and air quality modeling over coastal transition zone, shallow water and deep water areas, and
- to have in place an interagency agreement with NDBC to allow for rapid buoy deployment if a need arises in the near future.

Methods: The approach is to deploy one or two buoys to collect wind-wave data. The NDBC buoy will be funded to collect measurements of meteorological and oceanography data for three years. A new buoy will be assembled, tested, and then placed at a shallow water site or a deep water site. The buoy will record and transmit wind measurements at 3 and 5 meters from the sea surface and air temperature at 4 and 2 meters from the sea surface. Subsurface temperatures will be collected at three depths within the 12 meter water column. Wave characteristics will also be measured.

Revised Date: September 2, 2010

ENVIRONMENTAL STUDIES PROGRAM: Studies Development Plan FY 2011-2013

Region: Gulf of Mexico

Planning Area: Gulf-wide

Title: Enhancing the Capability of a New Meteorological Model for Air Quality and Other

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

Period of Performance: 2012 -2014

BOEMRE Information Needs to be Addressed: The National Center for Atmospheric Research (NCAR) has been developing a new and advanced meteorological model (The Weather Research and Forecasting Model (WRF)) to replace the existing MM5 meteorological model. The MM5 meteorological model has been widely used in the meteorological and air quality applications. However, the MM5 model has become obsolete and has been replaced by WRF model. BOEMRE has ongoing studies for wind-wave measurements and air emissions in the Gulf of Mexico. The new information of air-sea interaction obtained in this study will be integrated into the WRF model. The WRF model needs to be further improved. As yet, the WRF model has not tailored to the specific needs and requirements of BOEMRE; to treat the realistic meteorological phenomena and air dispersion characteristics over the ocean in the Gulf of Mexico. BOEMRE also needs to use the WRF model for air quality and other BOEMRE applications such as alternative energy and climate change. WRF model is the only tool that can be used for assessing the impact of air quality on the environment.

Description:

Background: Recently, the BOEMRE has funded a number of studies including air quality and meteorological modeling and the atmospheric boundary layer study (ABL) in the Gulf of Mexico, including an ongoing study for wind-wave measurements. The information and results obtained from these studies can be used to improve the WRF meteorological model for air quality application and other applications such as oil spill, oil and gas platform design, alternative energy, and hurricane forecast etc. The accuracy of the concentration estimates obtained from the air quality model is also dependent on the accuracy of the meteorological model output; this information is needed in the environmental impact statement.

Objectives: The objectives of this study are to improve the capability of the WRF model for air quality applications over the ocean in the Gulf of Mexico and to leverage the state-of-science and up-to date modeling information developed by the scientific community, and to produce a better working WRF model for the application to OCS. This information is also needed for obtaining the better concentration estimates obtained from an air quality model for environmental impact assessment and other BOEMRE's applications.

Methods: This study will utilize the information and results obtained from the atmospheric boundary layer study and other BOEMRE'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 for the model. The WRF model will be used for this study. The BOEMRE-funded observational data will be used for model sensitivity study and verification.

BOEMRE will work with NCAR and NOAA and WRF working committee to develop the module, especially the air-sea interaction module, and focus on WRF-VAR for data assimilation.

Revised Date: September 2, 2010

ENVIRONMENTAL STUDIES PROGRAM: Studies Development Plan FY 2011-2013

Region: Gulf of Mexico

Planning Area: Gulf-wide

Title: Meteorological and Wave Measurements for Improving Meteorological and Air Quality Modeling: A Deep Water Site

BOEMRE Information Needs to be Addressed: Meteorological and wave measurements are needed to improve meteorological and air quality modeling and to derive dispersion parameters for use in air quality model and assessment. These field measurements will improve the accuracy of meteorological and air quality models and benefit air quality assessments to be used in environmental impact statements. The data will be used to improve air quality modeling used to predict and assess 8 hour ozone, visibility, and haze in NEPA documents. This study is also in responses to the stringent ozone regulations newly proposed by EPA and to supporting the ongoing air emissions study.

Cost Range: (in thousands) \$500-\$1,000

Period of Performance: FY 2012-2014

Description:

Background: Meteorological and wave measurements will be used to characterize the atmospheric boundary structure and air-sea interaction (flux parameterization) and to test theories (e.g., COARE algorithm, flux calculations) such that this information can be used to improve the application of meteorological and air quality models in the offshore environment and the coastal area. The BOEMRE has conducted several meteorological studies in the GOM; however, these wind measurements need further updating for offshore meteorological and air quality assessments.

This study is to focus on the deep water site; the characteristics of the atmosphere boundary layer and oceanic boundary layer at a deep water site are different than those at a shallow water site. The ongoing wind and wave measurements are being conducted for the atmospheric boundary layer between 10 m – 200 m at a shallow water site. Wind information above 200 m height is also important since the mixing height, an important parameter, is usually above 200 m in the Gulf of Mexico. The current funding for an ongoing study does not include the deep water site and furthermore, there are no wind measurements in the levels below oil platform (Buoy) and above 200 m in the atmospheric boundary layer (Profiler). Simultaneous measurements of wind-wave at a shallow site and a deep water site are important for meteorological and air quality modeling, a tool for assessing the impact of air quality on the environment.

In previous BOEMRE studies, the simultaneous measurements of wind and wave in the lower level of the atmospheric boundary layer offshore were not available and there were data gaps

between sea surface and 100 m. The information gathered from previous studies will help set up a more comprehensive field measurement system to collect more accurate wind and wave data. The proposed study will take advantage of existing boundary layer studies and provide updated data, science and information for improving the accuracy of meteorological and air quality modeling. Therefore, it is proposed to install a meteorological measurement system offshore to obtain information for atmospheric boundary layer study.

Objectives: The objectives of this study are to characterize the atmospheric boundary layer structure and air-sea interaction for improving meteorological and air quality modeling over coastal transition zone, shallow water and deep water areas. Furthermore, this study is to focus on the data gaps between sea surface and 2,000 m above the sea surface at a deep water site and the transition zone between land and ocean (the ongoing study program).

Methods: Conduct field observations and data collection. Plan and install a new wind measurement system using wind profilers, sodar, buoys, ADCP, and meteorological wind measurement sensors mounted on an offshore platform.

Revised Date: September 2, 2010

ENVIRONMENTAL STUDIES PROGRAM: Studies Development Plan FY 2011-2013

Region: Gulf of Mexico
Planning Area: Gulf-wide
Title: NEPA Air Quality Modeling Study

BOEMRE Information Needs to be Addressed: The information gathered will be used as part of the air quality assessment section of the multi-sale EIS. This proposed study will provide information regarding future impacts from newly proposed and more restrictive EPA air quality standards. The information will provide a more accurate assessment of OCS oil and gas emissions sources impacts to all Gulf coast states onshore air quality.

Cost Range: (in thousands) \$600-\$800 **Period of Performance:** FY 2012-2015

Description:

Background: BOEMRE is the air quality regulatory authority for oil and gas operations in the central and western Gulf of Mexico. Air quality assessment, specifically potential onshore ozone impacts due to oil and gas operations in Federal waters, is part of BOEMRE's regulatory responsibility. Recently, the EPA has proposed several new, more restrictive, air quality standards for criteria air pollutants, including sulfur dioxide, nitrogen oxide and ozone. In light of the new standards, BOEMRE needs to conduct studies to assess, current and future, potential stationary and mobile OCS sources' air quality impacts to Gulf coastal states non-attainment areas, including Florida. This information is required to inform the NEPA process with OCS air quality impacts estimates out to 40 years. This information would also be useful in BOEMRE strategic partnering initiatives with Gulf coast states regarding regulatory modeling and the OCS contribution to the non-attainment areas within their respective states.

Objectives: The specific objective of this study is to develop estimates of Gulf of Mexico states' onshore OCS air quality impacts based on the new, more restrictive, EPA standards for criteria pollutants.

Methods: Using the proposed new EPA standards and the best estimates for oil and gas development in the western, central and eastern Gulf of Mexico region, create modeling scenarios, employing either CAMx, UAM-V or CMAQ air quality model to assess onshore OCS air quality impacts. These scenarios will be used to estimate the OCS contribution to ozone levels in the Gulf States' non-attainment areas.

Revised Date: September 2, 2010

ENVIRONMENTAL STUDIES PROGRAM: Studies Development Plan FY 2011-2013

Region: Gulf of Mexico

Planning Areas: Central and Eastern

Title: Environmental Monitoring of Oil and Gas Development Sites on the Florida Outer Continental Shelf

BOEMRE Information Needs to be Addressed: The state of benthic communities near oil and gas activities is a robust indicator that the BOEMRE can use to define the effectiveness of their regulations and to apply adaptive management.

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

Period of Performance: FY 2012-2015

Description:

Background: Regulations enacted by the BOEMRE are designed to mitigate the environmental effects of oil and gas activity (O&G) on the U.S. Outer Continental Shelf (OCS). The BOEMRE expressly seeks to eliminate negative impacts where possible and to otherwise limit the impacts to temporary and negligible effects on ubiquitous soft bottoms.

Potential impacts range in severity from the effects of temporarily increased turbidity to possible blowouts with high turbidity and the release of hydrocarbons. Bottom impacts from placement of structures can kill benthic fauna and restrict recovery for as long as the structure remains in place. Anchor impacts are common. The sweep of anchor lines during conventional pipelay operations can cover wide areas of the seafloor.

The health of organisms exposed to impacts has long been used as indicators of the effects of impacting actions. The state of benthic communities near O&G activities can serve as a robust indicator of the effects of O&G activities on the environment. Studies of contaminants can measure direct impacts but do not define the manifestations of those impacts. A thorough assessment of the benthic communities surrounding O&G activities can reveal possible indirect or secondary effects through measures such as species diversity, species composition, and reproductive condition. Local communities around O&G activities can be compared with communities in similar habitats that are distant from O&G activities to determine their degree of impairment.

The OCS of Florida is an area where communities can be found that are distant from any O&G activities. Similar Communities that are near O&G activities are found on the Mississippi/Alabama/Florida (MAFLA) OCS. The study examines various sites and types of impacts to cover the range of environmental effects produced by O&G activities. It will compare community composition and function to assess the effects of O&G activities. The study will analyze reproductive health and other pertinent indicators of health and competitive success.

Periodic monitoring of the effects of O&G activities provides feedback to the BOEMRE to insure protection of the marine, coastal, and human environment. Measures of community health and success will serve as clear indicators of the effectiveness of BOEMRE regulations and support adaptive management practices.

Objectives: This study will evaluate the condition of benthic communities surrounding oil and gas activities to detect impacts. The study will accomplish this objective through the following goals.

- assess the condition of benthic communities near a variety of ongoing O&G activities;
- assess the condition of benthic communities near a variety of past O&G activities;
- assess the condition of benthic communities in similar habitats that are distant from O&G activities; and
- evaluate the effects of O&G activities.

Methods: Sites will be selected on the OCS with a priority for Florida but may extend as far west as Mississippi. Selections for sites of present and past O&G activity will consider comparability with reference sites distant from O&G activities. Historic sampling will be considered in site selection. Any available historic data for selected sites will be included in the evaluation as feasible. Sites will be targeted to include O&G activities of various types, including placement of wells, platforms, smaller structures, pipelines on the seafloor, pipeline burial, and others. In particular, representative areas of the Gulf Stream pipeline will be examined. This pipeline will serve to represent the east/west gradient seen across the eastern Gulf of Mexico. One site in Main Pass block 255 is of particular interest, since a past study (MMS 93-0021) examined effects of wells drilled in close proximity to a Pinnacle Trend reef feature.

Sampling at each site will include an array of measures to assess the condition of major components of the local ecosystem. Sampling design will consider temporal fluctuations and other potential confounding influences. Community composition will be measured through quantitative surveys of the benthic infauna, epifauna, and fish communities, as appropriate. In addition, the health of each community will be assessed through measures such as reproductive state, incidence of disease, mass, etc. Basically, the study will seek to answer the questions, “What is there?” and “What is its condition?”.

Revised Date: September 2, 2010

ENVIRONMENTAL STUDIES PROGRAM: Studies Development Plan FY 2011-2013

Region: Gulf of Mexico

Planning Areas: Central and Western

Title: Artificial Reef Effects of Oil and Gas Pipelines on the Outer Continental Shelf of the Gulf of Mexico

BOEMRE Information Needs to be Addressed: The BOEMRE 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 invasive species. Pipelines could be considered corridors for migration.

Cost Range: (in thousands) \$750-\$800

Period of Performance: FY 2012-2014

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. Associated pipelines will also be decommissioned but will be abandoned in place. While concerns are raised over loss of artificial substrate provided by platforms, the artificial substrate provided by pipelines remains unassessed. 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. There are currently about 33,000 miles of pipelines in the GOM.

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 invasive 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 migration 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 detrimental invasive species. Growing concern over invasive species suggests that future attention on the role of oil and gas structures as vectors will intensify.

The BOEMRE 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 invertebrate and fish communities associated with oil and gas pipelines on the OCS, compare the communities with those of natural habitats, identify and quantify native and invasive species, and assess the corridor effect of pipelines.

Methods: Representative pipelines will be selected for examination across the Central and Western Planning Areas 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. Investigations will be made via random and targeted sampling.

1. Characterize the cover, distribution, and abundance of species associated with pipelines across the GOM. Collect video and/or photo transects randomly and selectively using remotely operated vehicles (ROV).
2. Investigate the possibility of using industry pipeline inspection videos to supplement collected imagery.
3. Collect specimens using ROV's to identify uncommon species.
4. Evaluate the possible corridor effect of pipelines across the GOM. Assess the nature of possible connections provided by pipelines, particularly the question of whether pipelines provide east/west corridors or primarily north/south corridors.
5. Address the relationships between pipeline communities and surrounding communities such as soft bottoms and natural reef complexes. Give particular attention to pipelines adjacent to natural reefs and the potential corridor extension of the natural reef community along the pipeline.
6. Classify the distribution of species associated with pipelines based on regional differences and differences correlated with physical factors such as depth, latitude, longitude, distance from shore, substrate, turbidity, etc.

Revised Date: September 2, 2010

ENVIRONMENTAL STUDIES PROGRAM: Studies Development Plan FY 2011–2013

Region: Gulf of Mexico

Planning Area: Western

Title: Gulf of Mexico Monitoring Program (2012): South Texas Banks

BOEMRE Information Need(s) to be Addressed: The BOEMRE needs to renew its knowledge of GOM habitats periodically to continue to insure that protective measures are adequate or to adapt their management to changing conditions.

Cost Range: (in thousands) \$700-\$850

Period of Performance: FY 2012-2015

Description:

Background: The BOEMRE needs to institute a comprehensive program of periodic monitoring for sensitive habitats on the continental shelf of the Gulf of Mexico (GOM). Much of the BOEMRE baseline data for benthic habitats on the continental shelf dates back to the 1970's and 80's. The BOEMRE did a good job of surveying and analyzing the array of habitats encountered at that time. The analyses resulted in the classification of hard bottom habitats by the BOEMRE into biological zones and for differing levels of protection. It is important for the BOEMRE to be able to detect anthropogenic impacts from oil and gas activities. This can only be done by comparison with reliable information on the status and health of the sensitive habitats concerned. Many natural and anthropogenic influences could have produced changes in the past 20-30 years. The BOEMRE needs to renew its knowledge of GOM habitats periodically to continue to insure that protective measures are adequate or to adapt their management to changing conditions.

New work has shown that the South Texas Banks are poorly understood ([MMS 2009 ITM Proceedings](#)). Limited study of the area in the past did not characterize the reef communities across seasonal variations. Water quality in the region varies significantly with season. cursory surveys have revealed numerous unreported species present on the banks.

The 2012 Monitoring Initiative will update BOEMRE's knowledge of the bathymetry and ecology of the South Texas Banks. The mapping work will be relatively small, since several of the South Texas Banks have recently been surveyed with high resolution multibeam mapping techniques. This project will complete the surveys for several banks not covered.

Deliverables will include high resolution GIS layers for the bathymetry. Ecological investigations will encompass seasonal changes for the region and will assess all the major trophic levels of the reef communities from algae to fish. The data will be analyzed and formatted for incorporation into the BOEMRE *EcoSpatial Information Database*. The study will provide information for revision of BOEMRE GIS layers depicting protection zones

around the South Texas Banks. It will also provide BOEMRE the information needed to insure that protective measures are adequate and enable adaptive management as needed.

Objectives: The Gulf of Mexico Monitoring Program (2012): South Texas Banks will collect physiographic and ecologic information for South Texas Banks to produce an updated synthesis characterizing the nature of the system in support of BOEMRE protective management.

- This study will update information on the South Texas Banks for BOEMRE's systematic program of periodic monitoring across the GOM.
- This study will complete the high resolution mapping of the South Texas Banks.
- This study will provide updated ecological investigations of the South Texas Banks.
- This study will provide data and spatial layers on the South Texas Banks for incorporation into the BOEMRE *EcoSpatial Information Database*.

Methods: This study will collate existing information, conduct bathymetric surveys, and conduct ecological surveys to update BOEM's state of knowledge. Seafloor remote sensing surveys will be conducted using the best methods available to characterize the topography of seafloor features in the region of the South Texas Banks. Researchers in south Texas have been collecting survey data in the area. Existing high resolution surveys will be incorporated into the process and remaining areas will be surveyed. At this time, the following South Texas Banks remain to be surveyed but may be completed before this study begins: Big and Small Dunn Bar Banks, Baker Bank, South Baker Bank, Hospital Bank, and Mysterious Bank. Other banks or hard bottoms in the area may also be targeted, as needed.

Representative ecological surveys and sampling of the South Texas Banks will be conducted across the region. Efforts will encompass seasonal variations that occur in the region. Sampling will target major groups at all trophic levels of the reef communities, in particular, algae, sponges, corals, echinoderms, crustaceans, fish, etc. Surveys will utilize a variety of methods including but not limited to video/still transects, diver surveys, ROV surveys, drop cameras, grab sampling, etc. The sampling design will target selected sites at several banks across the region for one year of seasonal sampling. Continuous records of water quality measures such as salinity, turbidity, and PAR will be essential. Satellite images should be examined to detect patterns of influence from onshore surface water drainage. Results will be analyzed through a variety of descriptive, univariate, multivariate, and geospatial methods. All data, including bathymetric and ecologic data will be incorporated into the BOEMRE EcoSpatial Information Database. Seafloor topography will be processed to display at high resolution with ample detail. Community composition data will be linked to the GIS to both display the results and to provide access to the data through the geospatial interface.

Revised Date: September 2, 2010

ENVIRONMENTAL STUDIES PROGRAM: Studies Development Plan FY 2011-2013

Region: Gulf of Mexico

Planning Areas: Central and Eastern

Title: Long-term Effects of Oil and Gas Activities on the Florida Shelf

BOEMRE Information Needs to be Addressed: Delineation of the long-term effects of oil and gas activities on the outer continental shelf is necessary to assess the effectiveness of BOEMRE regulations and promote adaptive management practices. This information is needed to ensure that BOEMRE regulations continue to effectively protect the coastal, marine, and human environments.

Cost Range: (in thousands) \$2,500-\$3,000 **Period of Performance:** FY 2012-2015

Description:

Background: The oil and gas industry has been operating in the Gulf of Mexico (GOM) since the 1940s and has expanded over about two thirds of the continental shelf. The cumulative effect of this activity on the environment should be assessed periodically to evaluate safe practices for protecting ecosystems. Since oil and gas activity covers a broad area with about 3800 offshore structures, it is necessary to select a representative subset for study. The study area should have a substantial history of oil and gas activity; it should be comparable to a similar reference area with no oil and gas activity; it should be an area previously studied to allow detection of change; and it should also be as free as possible of confounding effects, such as the influence of the Mississippi River plume and recurring hypoxic conditions. This study will focus on the Mississippi/Alabama/Florida (MAFLA) shelf area to meet all these requirements. The purpose of this study is to produce a current assessment of the cumulative long-term impacts of oil and gas activity in the MAFLA shelf area, compare them to relatively undeveloped areas off the west Florida shelf, and relate that to the wider region of the Gulf of Mexico continental shelf.

The only substantially sized portion of the northern Gulf of Mexico that can provide reference sites with no history of oil and gas activity is in the eastern Gulf. The Mississippi Delta region is not directly comparable to the Florida shelf due to differences in sediment type and sedimentation. However, the area between the delta and the west coast of Florida is very similar in sediments, water quality, and other physical conditions. The MAFLA shelf has a long history of oil and gas activities and has experienced increased activity over the last 30+ years. This lengthy history of oil and gas activity makes the area a suitable representative of the potential for long-term cumulative impacts. The oil and gas activity of the Mississippi/Alabama shelf is comparable to that offshore of Louisiana and Texas while the shelf area itself is comparable to the adjacent portions of the eastern Gulf near the west coast of Florida. In addition, there are a few sites off the Florida panhandle with historic oil and gas activity that can also be compared to areas further east.

The identification of long term effects related to oil and gas activity is sometimes masked by other ongoing natural variations in the environment. Impacts from oil and gas activities may not be discernable from other influences or even background conditions. Fewer confounding effects are present on the MAFLA shelf than are found further west. The influence of the Mississippi and Atchafalaya Rivers to the west is a major obstacle to identifying anthropogenic effects. The effects of turbidity, siltation, salinity shifts, and nutrient loads from rivers are similar to potential anthropogenic stressors such as oil and gas activities.

Rivers can even deliver contaminants with effects similar to those of potential contaminants from oil and gas activities. The annual summer hypoxic zone in the central and western Gulf suppresses community diversity and limits the occurrence of long-lived benthic organisms. While the Mississippi River plume has some influence to the east and other rivers are also present to the east, the effects are much less than those to the west. The Mississippi plume is mostly carried to the west by water currents. Rivers to the east are much smaller and carry a much lower sediment load resulting in less turbidity. As a result, sedimentation is lower and the seafloor has less fine silt and clay, producing less turbidity from resuspension by storms. While confounding effects will not be absent on the MAFLA shelf, they will be much less than to the west and more comparable to the eastern Gulf near Florida.

Previous studies have examined sediments, organisms, and water in this area of the northeastern Gulf of Mexico. Baseline measurements along the MAFLA shelf were made during extensive studies in the mid-1970s. The general findings were that the shelf area was relatively pristine with some influence from the Mississippi River discharge. Part of this area was revisited in the late 1980s during the Mississippi/Alabama Marine Ecosystem Study (MAMES). Portions of this historic data may or may not be useful for comparison to new data collected. Advances in instrumentation and methodology combined with poor recovery or quality control and assurance documentation for historic data may limit our ability to compare some historic data with new data. Alternatively, for those data where historical detection limits were too high to quantify contaminants, statistical methods are now available that may be used to generate default contaminant concentration estimates to substitute for nondetectable results. These studies will certainly allow some historical comparison to supplement the reference sites and increase our ability to define change in the ecosystem. The MAFLA region is perhaps the most ideal location available in the Gulf for the determination of impacts from oil and gas activities and evaluation of those effects. The history of oil and gas activities, availability of a comparable reference study area, comparatively lower confounding influences, and historic studies make the MAFLA a prime location for an assessment of potential long-term cumulative impacts to ecosystems of the continental shelf of the Gulf of Mexico.

Objectives: The objective of this study is to evaluate the long-term effects of oil and gas activity in the Gulf of Mexico. The study will accomplish this objective through the following goals.

- compare data from areas where oil and gas activities have occurred for decades with areas of no activity;
- compare the results to historical studies;

- determine, to the extent possible, whether there are long term measurable changes in potential indicators of contamination, including biological indicators, and if these changes can be attributed to oil and gas activities; and
- extrapolate the impacts of oil and gas activities from the MAFLA shelf to the remainder of the Gulf of Mexico continental shelf with consideration for regional conditions.

Methods: Sampling will target offshore sites located along the MAFLA shelf area. The sampling design will include both areas with a high probability of impact and areas to be used as a reference of minimal impact from oil and gas activities. The study will collect, analyze, and compare sediment, biological, and possibly water samples from the MAFLA shelf using appropriate techniques to evaluate impacts. Transect sampling across potential contaminant gradients will be an integral part of the design. The sampling design will consider temporal fluctuations and other potential confounding influences and their extent, possibly classifying sampling sites by regional conditions. Historic sampling will be considered in site selection. Example parameters to be analyzed include but are not limited to trace metals, sediment dating, petroleum hydrocarbons, and benthic and fish components. Sampling could include sediments, biota, and the water column. Data from other studies conducted in the area will be used for sample design and comparison, where appropriate. An evaluation of the effects of the Mississippi River plume, differences in sediments and sedimentation, and other potential confounding influences will be included in the analysis.

Revised Date: September 2, 2010

ENVIRONMENTAL STUDIES PROGRAM: Studies Development Plan FY 2011-2013

Region: Gulf of Mexico
Planning Area: Central
Title: Movement of Reefed Platforms in the Gulf of Mexico due to Tropical Storms

BOEMRE Information Needs to be Addressed: This information is highly relevant to federal, regional and state agencies as almost 4,000 structures are found in OCS waters and a little over 300 retired structures have been sited as artificial reefs to date with the goal of creating more productive permanent habitats. Many more structures will be decommissioned in coming years, with the option to join the Rigs to Reef program. This study will provide an understanding of the predictability and potential movement of reefed platforms and other materials, which may assist BOEMRE scientists and engineers in designing and implementing mitigations placed on artificial reef proposals, such as distances from active oil and gas pipelines.

Cost Range: (in thousands) \$250-\$350 **Period of Performance:** FY 2012-2013

Description:

Background: Artificial reefs can be created out of materials such as ships, reef balls, and decommissioned oil and gas platforms. The placement of these materials is important when creating artificial reefs. They need to be placed not only where marine organisms will use the new habitat, but also where they can be properly managed and where other natural resources such as oil and gas reserves, fishing and trawling grounds, and natural reefs are still accessible and protected.

In several cases artificial reefs, such as ships, have moved along the seafloor during storms. After several intense hurricane seasons, the MV Hercules Tugboat has moved about 481 feet from its original placement since it was reefed in 2002 in the State of Louisiana Ship Shoals 230 artificial reef site. Understanding a structure's potential for movement during storms plays an important role when determining reef site design, placement and mitigations for the reefing process. If a structure has the potential to move it will be important to place it at safe distances from active pipelines or other infrastructure, and further actions may be required to stabilize certain materials subject to movement during storm events. Information about the structure type, distance in relation to recent storm paths, and direction and distance of movement will contribute to the overall understanding of potential movements of artificial reefs during storms in the Gulf of Mexico. This information may be used for future regulatory processes in the Rigs to Reefs program.

Objectives: Sonar and mesotech surveys will be used to estimate movement of artificial reefs and structure makeup throughout the Gulf. Data from this study will be compared to previously documented movements of reefed structures as well as other artificial reefs (i.e. ships). The combined data will provide a better understanding of what movement is occurring and what measures are needed to stabilize certain structures in the future. The objectives for this study are:

- to determine whether movement of artificial reefs has occurred,
- to what degree has the movement occurred,
- where and how has movement occurred,
- to determine what size, shape, and/or type of material is more likely to move in a storm event.

Methods: An effort will be made to choose artificial reef sites that have pre-storm sonar survey data, and that were in the path of recent GOM hurricanes such as Lili, Ivan, Katrina, Rita, Gustav, and Ike. Side scan and sector scan sonar surveys will be conducted to assess the condition and movement of the reefed material. Sonar data and imaging of the structures' pre-storm condition will be used to for comparison. A comparison will be conducted between structures which have moved to those that have not moved which maintain similar parameters (i.e., water depth, sediment type, storm paths, size and stability of reefed material).

Revised Date: September 2, 2010

ENVIRONMENTAL STUDIES PROGRAM: Studies Development Plan FY 2011-2013

Region: Gulf of Mexico

Planning Area: Gulf-wide

Title: Synthesis of Recent Oceanographic Observations in Deep Waters of the Gulf of Mexico

BOEMRE Information Needs to be Addressed: The results of this study will provide new climatologies of currents in the deep GOM that could improve design of future field programs and structures in the GOM. These climatologies and updated database will help to validate and evaluate results of numerical models applied to the deep waters of the Gulf and will be used by BOEMRE and Industry to prepare for and avoid high currents, make better biological assessments for our regulatory documents, and suggest new direction of oceanographic research.

Cost Range: (in thousands) \$975-\$1,200

Period of Performance: FY 2012-2015

Description:

Background: Following the high-priority recommendation of the first deepwater workshop in 1998, the BOEMRE designed and completed the first comprehensive synthesis of historical deepwater oceanographic data in the GOM, i.e., BOEMRE report No. 98-0022. This first summary identifies a glaring lack of data on currents in the entire GOM. Since that report, the BOEMRE has been systematically collecting current and hydrographic data to describe the circulation of the deep Gulf and introducing new technologies to our oceanographic tool-kit. We have learned much over the course of these studies, but no grand synthesis has been done. By the time of proposed award, BOEMRE will have at its disposal data from US and Mexican waters covering over a decade of new observations which will make it ripe for an updated synthesis.

Objectives: This study will consist of gathering, analyses and synthesis of deep hydrographic and current data in the GOM, including Mexican waters. The objectives of this study are:

- to build on our previous data synthesis of oceanographic data to produced updated climatologies and summaries of oceanographic parameters (T, S, density, currents, etc.) in the GOM;
- to update and expand our database of hydrographic and current data for the GOM; and
- To suggest new research directions and identify gaps in data and knowledge.

Methods: This study will gather new oceanographic observations to update the existing oceanographic database. The updated database will be subjected to analyses to produce the desire climatologies, and identify the data and knowledge gaps.

Revised Date: September 2, 2010

ENVIRONMENTAL STUDIES PROGRAM: Studies Development Plan FY 2011–2013

Region: Gulf of Mexico

Planning Area: Gulf-wide

Title: Support for Socioeconomic Impact Assessments of Offshore Energy Development in the Gulf of Mexico Region

BOEMRE Information Needs to be Addressed: This effort will provide timely and focused information and analysis in support of GOM EIS', EA's, and other decision documents. Over the last two decades, the GOMR offshore oil and gas industry has been changing rapidly, often in unanticipated directions, in the face of equally rapid changes in international business climate, business practices, industry reorganizations, mergers and outsourcing, advances in technology and control systems, and expanding deepwater development in the GOM and worldwide. As a consequence, the onshore social and economic impacts of offshore energy development are also changing, intensifying the concerns of coastal states. The importance of this cooperative agreement to BOEM is that it provides reliable support for timely and substantive responses to rapidly changing facts "on the ground" and to the public concerns that they engender.

Cost Range: (in thousands) \$750-\$850

Period of Performance: FY 2012-2016

Description:

Background: One aim of BOEMRE's CMI program is to encourage the development of regional expertise on environmental and socioeconomic issues raised as a result of the OCS leasing program. Cooperative interactions among GOMR and Louisiana Center for Energy Studies (LSU CES) staff have achieved this goal. Over the years, these interactions have nurtured, within the Center, an increasing expertise on the operations and economics of the varied sectors of the offshore petroleum industry, and on their function as vectors for socioeconomic impacts. This expertise focuses on the industry (e.g., its organization, economics, operations), changes within the industry (e.g., in development strategies, labor demand, geographic distribution), and direct effects of the industry and its changes (e.g., employment, traffic, landfill use).

Over the years, the GOMR Environmental Assessment Section has come to rely on this expertise, which has proven to be resourceful in identifying emerging issues (within the industry and for the states) and in providing relevant information and thorough analyses in the short turnarounds often necessary in the context of a complex and rapidly changing industry. The cooperative relationship between BOEMRE and the LSU CES has proven invaluable to the Bureau particularly when new questions arise that must be quickly addressed during the

assessment process. This study will continue this relationship and thus the Bureau's timely access to critical insights, information and analyses.

Objectives: The purpose of this study is to provide information and analyses that:

- help BOEMRE identify, early on, organizational and operational changes within the offshore industry that are significant to the assessment of its economic and socioeconomic effects;
- support thorough and accurate economic and socioeconomic assessments of the industry's effects in the face of ever changing baseline conditions;
- allow timely and considered responses to rapidly arising public and state concerns regarding the onshore impacts of the OCS leasing program; and
- allow the Bureau to refine its analyses of economic and socioeconomic effects at the level of counties/parishes and BOEMRE-defined Economic Impact Areas.

This study will allow BOEMRE staff to work collaboratively with LSU experts to perform short-term, highly focused efforts as issues critical to impact assessments arise as well as longer-term projects. The identification of specific tasks to be addressed and resources to be allocated will be done as needed, and as a cooperative effort between the Bureau and the LSU CES staff. Tasks will address the following topical areas:

Industry dynamics - the identification and evaluation of changes occurring within the industry that affect its long- and short-term planning, operations, labor demand, distribution, and/or activity levels and the identification and evaluation of their economic and socioeconomic consequences.

Industry sector operations and dynamics - the description of the characteristics and operations of specific industry sectors (e.g., geotechnical services), the identification and evaluation of changes occurring within the specific sectors, and the identification and evaluation of their economic and socioeconomic consequences (e.g., technologies, capitalization, purchases, labor demands, and geographic distribution).

State- and local-level operations and dynamics - the identification and evaluation of the social and economic consequences to communities, counties/parishes, county/parish aggregations; or states of the operations of (or changes in the operations of) the industry or specific sectors of the industry at the community, county/parish, or state level.

Methods: For each task, research design will be developed as a cooperative effort between the Bureau and the LSU CES staff. Methods may include, but are not limited to, literature reviews, data collection from publicly available sources, targeted interviews with industry officials, workshops, and statistical and econometric analyses. Tasks will not employ any method that would require OMB clearance under the Paperwork Reduction Act. Work products may include literature reviews, data from focused collection efforts; written analyses, short (2-5 page) focus papers, and study reports. Selected final products may be jointly authored by BOEMRE and LSU CES staff.

Revised Date: September 2, 2010

ENVIRONMENTAL STUDIES PROGRAM: Studies Development Plan FY 2011-2013

Region: Atlantic, Gulf of Mexico

Planning Areas: North, Mid, and South Atlantic; Western, Central and Eastern GOMR

Title: Archival Investigation for Potential Slave Shipwrecks on the Outer Continental Shelf, Atlantic and Gulf of Mexico Regions

BOEMRE Information Needs to be Addressed: The National Historic Preservation Act requires BOEMRE to consider the effects of its permitted activities on significant archaeological resources. BOEMRE meets this obligation by requiring high-resolution surveys in those leases currently held by operators. However, with the potential opening of new lease areas in the GOMR and renewable energy development in the Atlantic region, there is little information available pertaining to the potential for discovery of shipwrecks associated with the American slave trade. The purpose of the present study is to determine the likelihood and frequency of vessels lost at sea that participated in the American slave trade and may lie on the OCS with the potential to be impacted by BOEMRE permitted actions. No field investigations of sites will be conducted.

Cost Range: (in thousands) \$350-\$400

Period of Performance: FY 2012-2014

Description:

Background: The transportation of African slaves to North America began around the mid-1500s and continued through the American Civil War. For more than 300 years, approximately half a million Africans were shipped to slave markets along the Atlantic and Gulf coasts. By 1820, the United States government outlawed the importation of slaves, although smuggling, which flourished in the mid-1800s, continued for another half-century. While it is documented that hundreds of slave ship voyages brought slaves to North America, it is unknown how many other voyages carrying smuggled slaves occurred (Figure 1). Adding to the number of trans-Atlantic voyages, perhaps thousands more voyages participated in the coastwise trade, moving slaves from American ports along the eastern seaboard to southern ports such as New Orleans.

Historians of the African slave trade have conducted ample research concerning the African diaspora, the Middle Passage, and the cultural traditions that enslaved Africans brought to America. The aspect of the slave trade that has received little study is the frequency of vessel losses. It is unknown how many of the vessels carrying slaves to and throughout North American ports were lost at sea and are now potentially located on the OCS. Additionally, there is little information available to assist BOEMRE with identifying shipwreck sites as potentially involved with the slave trade and therefore eligible for the National Register of Historic Places.

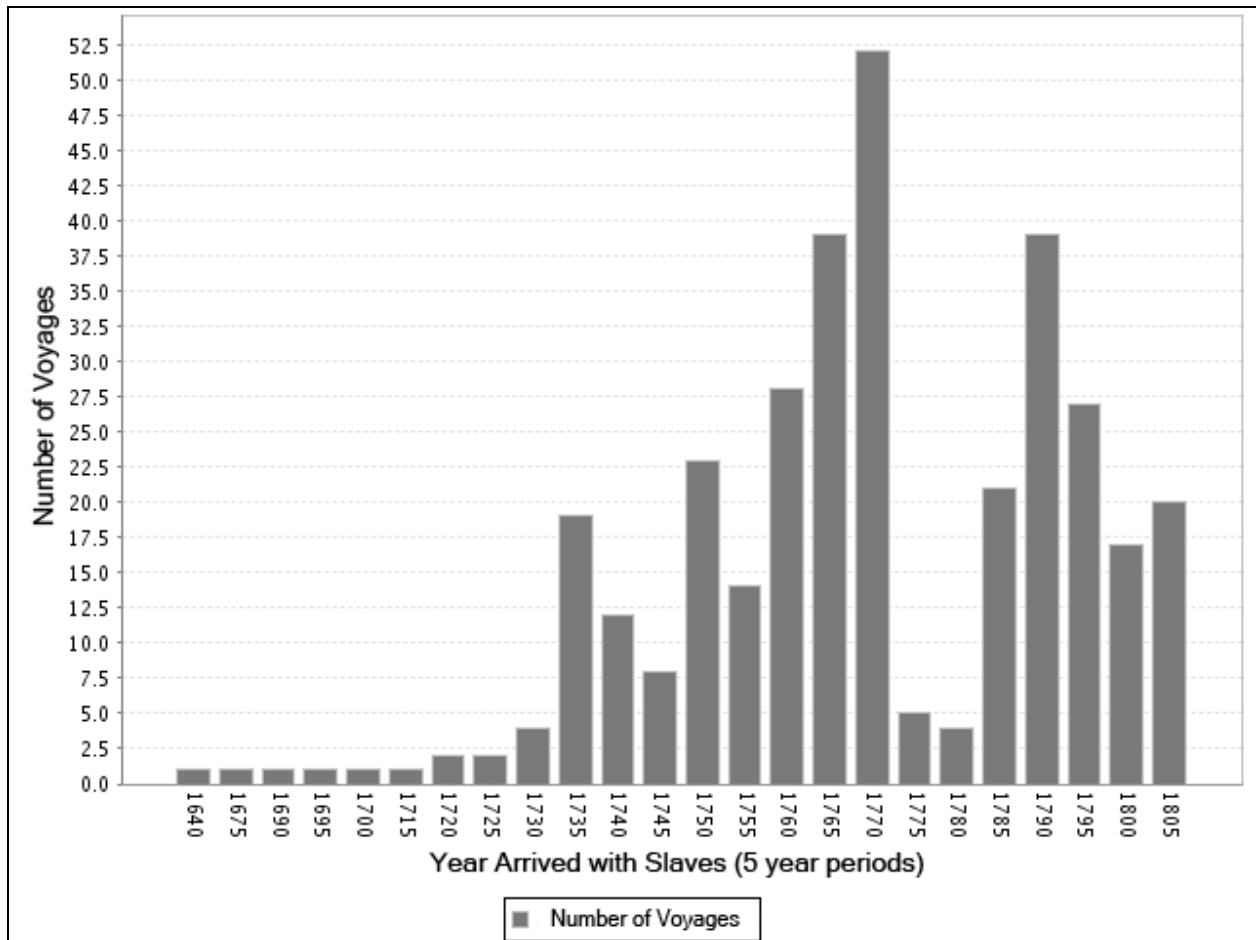


Figure 2. Number of documented slave voyages from Africa to North America between 1640 and 1805 (source: Trans-Atlantic Slave Trade Database, available online at <http://www.slavevoyages.org/tast/index.faces>).

Few examples of slave ships (or former slave ships) have been found in the archaeological record. Shipwreck sites such as the British slave ship *Henrietta Marie*, lost in 1700 off Key West, Florida, offer some clues as to how these significant archaeological sites might appear on the seafloor. Though this ship was not carrying human cargo at the time of her demise, iron shackles of various sizes were discovered along with the ship’s bell to provide a positive identification for the vessel. This site, along with only a handful of others discovered worldwide, represents an important type of cultural resource that may be especially difficult to identify through industry high-resolution surveys on the OCS. Shipwrecks in varying degrees of degradation or burial may not initially appear as potential archaeological sites based on survey data alone. Sites such as shipwrecked slave vessels, of a unique and culturally sensitive nature, are in danger of disturbance or destruction from industry development of offshore renewable energy sources and increased oil and gas extraction from the OCS. The study will access archival records to compile a database of shipwrecks associated with the trans-Atlantic and coastwise slave trades that may lie on the Atlantic or GOM OCS and elucidate the diagnostic features of a ship and its accoutrements that may be used to identify sites as potentially associated with the slave trade.

Objectives: Use primary historic documents and the Trans-Atlantic Slave Trade Database to understand the size and scope of the maritime slave trade as well as develop a strategy for identifying and recognizing such sites on the Atlantic and GOM OCS.

Methods: The study should strictly focus on an analysis of primary sources at American, French, and British records housed in the National Archives, Washington DC, French National Archives, and British National Archives. Sources include insurance records, customs records, and slave manifests as well as a compiled database of slave ship voyages to determine frequency of loss and potential of loss in the Atlantic and GOMR planning areas. No field investigations of confirmed shipwrecks or potential shipwrecks will be conducted.

Revised Date: September 2, 2010

ENVIRONMENTAL STUDIES PROGRAM: Studies Development Plan FY 2011–2013

Region: Gulf of Mexico

Planning Area: Central

Title: Investigation of a Possible 18th Century Wooden Shipwreck off the Chandeleur Islands

BOEMRE Information Needs to be Addressed: This study will provide information on potential archaeological resources/wooden shipwrecks by examining the remains of an 18th century archaeological site off the Chandeleur Islands. Information obtained will assist the BOEMRE Social Sciences Unit to determine the distribution of wooden shipwrecks in high energy environments. It will also provide baseline information on the size of expected debris fields associated with wooden shipwreck sites. This information will be used to develop avoidance criteria for managing wooden shipwreck sites in high energy environs on the OCS. This study will help fulfill BOEMRE requirements under Section 106 of the National Historic Preservation Act.

Cost Range: (in thousands) \$175-\$275

Period of Performance: FY 2012-2014

Description:

Background: In 1988-89, BOEMRE funded a study to examine a ballast pile located just offshore of the northern portion of the Chandeleur chain of islands in Louisiana State waters (Garrison, et. al. 1989). The outcome of this particular study focused on the use of remote sensing equipment and its effectiveness on the Outer Continental Shelf (OCS). The study also provided limited information on the artifacts and ballast of this archaeological site as well as the sites' surrounding environment. A recent re-examination of the report, data, and artifacts suggests the conclusion that this is a localized collection of ballast and artifacts may, in reality, be part of a larger distribution and scattering of the remains of an 18th century wooden shipwreck. In addition, the deposition of a wooden shipwreck within a local barrier island environment may have caused the vessel remains to spread out horizontally across the seafloor, thereby expanding the overall size of the site through time and as a result of natural and, possibly, cultural processes. This phenomenon is different to that of metal-hulled and fiberglass shipwrecks observed the GOMR. The proposed study seeks to re-examine the site in order to delineate the site's overall size and understand how a wooden shipwreck behaves in a dynamic environment. Specifically, the proposed study will provide an analog for understanding other high energy environments on the OCS such as Ship Shoal, Chandeleur, and East and West Cameron Areas where many wooden shipwreck remains are likely buried. The overall knowledge gained from this study will allow the BOEMRE to make determinations as to the expected size and distribution of wooden shipwreck sites as well as management decisions with regard to industry's impacts to cultural resources in these high energy environments. These determinations of expected size and distribution of wooden

shipwreck remains may also make it possible to relax archaeological survey requirements in some areas, resulting in significant savings in survey costs to the oil and gas industry and best management strategies by BOEMRE.

Objectives: The objectives of the study are to ground-truth, positively identify, and assess the size and distribution of a possible 18th century wooden shipwreck in a high energy environment.

Methods: The objectives of the study will be achieved through an investigation of the physical remains of the wooden shipwreck. Extensive remote sensing of the site using magnetometer, side-scan sonar, and sub-bottom profiler will be followed by diver investigations of promising targets. Diver investigations will include diver visual inspections, mapping, and limited dredging and probing of the site. Test units will be excavated in areas determined from both the remote sensing data as well as diver visual surveys. The project will likely consist of extensive photographic documentation and mapping of the overall site. Limited artifact collection for identification purposes is expected and all artifacts collected during the investigation are to receive conservation and curation in conjunction with State of Louisiana protocols. This project would compliment similar efforts in the GOM OCS Region such as the recently completed *National Register of Historic Places of submerged sites on the Gulf of Mexico Outer Continental Shelf* (Enright, et. al. 2006). The results of this study pointed out a lack of wooden shipwrecks identified on the OCS in shallow water making them difficult to manage and protect. The proposed study will aid in assessing remote sensing targets that appear likely to be related to an archaeological site and provide a baseline in which the BOEMRE can provide the best management strategies for these resources.

Revised Date: September 2, 2010

SECTION 3.0 TOPICAL AREAS FOR FY 2012 AND BEYOND

The GOMR is expecting a continuation of offshore oil and gas activities at its current pace. 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 oil and gas 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.

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 the BOEMRE 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, the BOEMRE 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 BOEMRE studies. One current study is investigating 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 planned study in deep water off Virginia, combine archaeological investigation of deepwater wrecks with biological characterization of the organisms that have colonized them. 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. New 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 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 studies program is continuously addressing the information needs in this constantly evolving area and will develop new studies as the need arises.

3.3 Gas Hydrates

BOEMRE is following the development of gas hydrates and will propose appropriate studies once it is determined where and how hydrates will be recovered from the OCS.

3.4 Decommissioning

Over the next decade, it is expected that a large number of the 3,851 structures in the GOM will be removed. These structures have supplied a hard surface for organisms to flourish, creating an artificial ecosystem and affecting the distribution of species. Historically, the Gulf States have requested and been granted permits to reef about 10 percent of the oil and gas structures decommissioned each year. Over the last decade, structure removals have begun to outpace new structure emplacements. Will the Gulf States continue to request about 10 percent of the decommissioned oil and gas platforms for artificial reef material? 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 Renewable Energy

On August 8, 2005, President Bush signed into law the Energy Policy Act of 2005 (EPAAct). EPAAct amended the Outer Continental Shelf (OCS) Lands Act to grant the Secretary of the U.S. Department of the Interior discretionary authority to issue leases, easements, or rights-of-way (ROW) 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. EPAAct requires the Secretary to share with nearby coastal States a portion of the revenues received by the Federal Government from authorized renewable energy and alternate use projects on certain areas of the OCS. EPAAct also included a requirement that the Secretary develop any necessary regulations to implement the new authority.

On March 20, 2006, the Secretary delegated to the BOEMRE the new authority that was conferred by the EPAAct. Under this authority, BOEMRE becomes the lead Federal agency of permitting and regulatory oversight of the Cape Wind and Long Island Offshore Wind Park Projects, and any other projects already submitted to the U.S. Army Corps of Engineers. On

November 6, 2007, the BOEMRE announced in the Federal Register an interim policy for authorization of the installation of offshore data collection and technology testing facilities in Federal waters. The BOEMRE accepted comments and nominations until January 7, 2008 regarding the authorization of OCS activities involving the installation of meteorological or marine data collection facilities to assess renewable energy resources (e.g., wind, wave, and ocean current) or to test renewable energy technology. The interim policy is in effect until the BOEMRE promulgates final rules. In light of this new responsibility, BOEMRE has begun collecting the data and information necessary to analyze the impacts of these new types of projects on natural and cultural resources. Several studies are being developed and will examine future renewable energy planning scenarios and infrastructure.

The BOEMRE published the final rule: Renewable Energy and Alternative Uses of Existing Facilities on the OCS (REAU). The rule was published in the Federal Register on April 29, 2009 (74 FR 81, pp. 19638-19871) establishing a program to grant leases, easements, and ROWs for renewable energy project activities on the OCS, as well as certain previously unauthorized activities that involve the alternate use of existing facilities located on the OCS; and establishing the methods for sharing revenues generated by this program with nearby coastal States. The REAU regulations ensure the orderly, safe, and environmentally responsible development of renewable energy sources on the OCS. The program embraces a "cradle-to-grave" approach.

On April 9, 2009, the Department and the Federal Energy Regulatory Commission (FERC) cleared the way for the publication of the REAU regulations by signing an agreement that clarifies each agency's jurisdictional responsibilities for leasing and licensing renewable energy projects on the OCS. Under the agreement, the BOEMRE has exclusive jurisdiction with regard to the production, transportation, or transmission of energy from non-hydrokinetic renewable energy projects, including wind and solar. FERC has exclusive jurisdiction to issue licenses for the construction and operation of hydrokinetic projects, including wave and current, but applicants will be required to first obtain a lease through the BOEMRE.

The program is administered by the Office of Offshore Alternative Energy Programs (OAEP) within the Offshore Energy and Minerals Management office (OEMM). This new activity in the marine environment requires an assessment of the potential environmental impacts to resources on the OCS. Some present studies at BOEMRE are Comparative Study of Offshore Wind Turbine Generators (OWTG) Standards; Determining Night Time Distribution of Long-Tailed Ducks Using Radio Telemetry; Effects of Pile Driving Sounds on Auditory and Non-Auditory Tissues of Fish; North and Central Atlantic Information Resources: Data Search and Literature Synthesis; South Atlantic Information Resources: Data Search And Literature Synthesis; Update of Summary of Knowledge: Selected Areas of the Pacific Coast; Compendium of Avian Information and Comprehensive GIS Geodatabase; Energy Market and Infrastructure Information for Evaluating Alternative Energy Projects for OCS Atlantic and Pacific Regions; Evaluation of Visual Impacts on Historic Properties; Meteorological and Wave Measurements for Improving Meteorological and Air Quality Modeling; Characterization and Potential Impacts of Noise Producing Construction and Operation Activities on the OCS; EcoSpatial Information Database – U.S. Atlantic Region; and Potential

for Interactions between Endangered and Candidate Bird Species with Wind Facility Operations on the Atlantic OCS. Possible future studies at BOEMRE are Controlled Seismic Airgun Exposure Experiments with Bottlenose Dolphins and Humpback Whales in Study Areas off of Cape Hatteras; Extended Mid-Atlantic Planning Area Information Resources: Data Search and Literature Synthesis; and High Resolution Bathymetry of Seafloor Biological and Archaeological Features of the Mid-Atlantic Outer Continental Shelf.

A completed study through the Environmental Studies Program (ESP), required by the Outer Continental Shelf Lands Act, as amended in 1978 (OCSLAA), is a Worldwide Synthesis and Analysis of Existing Information Regarding Environmental Effects of Alternative Energy on the Outer Continental Shelf Report (OCS Report MMS 2007-038). The BOEMRE will continue to meet information needs as they arise and exceed expectations for the Renewable Energy Program.

3.6 Physical Oceanography

Should renewed oil and gas interest in the Atlantic Region develop in the future, additional BOEMRE oceanographic studies are highly recommended. Only a few past BOEMRE 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 BOEMRE oceanographic studies would be used by BOEMRE 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. A new study to be completed in the very near future, *Literature Synthesis for North and Central Atlantic*, will provide a review of state of knowledge that will help guide any future studies planning and EIS's in this Region.

3.7 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 2010-2011 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 BOEMRE 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, 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. BOEMRE 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. An updated industry infrastructure factbook is in process; future versions may include selected industry sectors. Service ports are vectors for many industry

impacts but have proven particularly difficult to address. Currently, BOEMRE is engaged in limited efforts to address this issue, and plans an annual purchase of GOM vessel movement data beginning in 2010.

BOEMRE 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 BOEMRE 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

Currently, the GOMR is reexamining questions of geographic focus. The onshore analysis area consists of the 132 counties/parishes included in Labor Market Areas (LMA) that fall in whole or part within the coastal zones of Texas, Louisiana, Mississippi, and Alabama or the Florida Panhandle. The BOEMRE aggregates these into 13 Economic Impact Areas. Substantial CMI efforts are being directed toward refining these aggregations to better reflect onshore industry distributions and activities and, hence to provide stronger support to BOEMRE economic modeling and SIA. Results of these efforts will 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. Also, SIA emphasizes rural issues but many of these will be metropolitan, hence a methodology for identifying OCS-related effects in metropolitan areas may be needed.

Topical Focus

Links between OCS industry dynamics, the baseline industry distributions and activities, and socioeconomic effects are apparent in the fabrication industry’s growing use of foreign blue-collar labor. An ongoing study addresses this high-profile issue may need updating or expansion if local and national conditions change. Not all scoping issues can be anticipated, but the Gulf is developing research-based “whitepapers” on many that can, particularly those related to infrastructure and development scenarios.

“Whitepapers” permit more detailed and data-rich considerations of issues than are appropriate for an EIS, and the approach will be extended to other social and economic issues. The Gulf will also continue to pursue its systematic reexamination of standard and OCS-specific SIA topics (see, NRC 1992). BOEMRE has concluded studies of crime and work scheduling. Current studies address Louisiana fiscal systems, coastal recreation and tourism, and land loss, and BOEMRE is considering additional efforts in these areas and in others. These broader studies may identify more focused needs, such as the assessment of local-level fiscal impacts on education or health systems. 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 comparative

study will be needed to identify, for at that local level, which SIA do or do not occur, and under what conditions.

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Offshore Environmental Studies Program

**Addendum 2010
Studies Development Plan
Gulf of Mexico OCS Region**

**U.S. Department of the Interior
Bureau of Ocean Energy Management, Regulation, and Enforcement
Gulf of Mexico OCS Region
New Orleans, LA
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SECTION 1.0 ADDENDUM OVERVIEW

A blowout, explosion, and fire occurred on April 20, 2010 aboard the Transocean-owned *Deepwater Horizon* Mobile Offshore Drilling Unit (MODU) during cementing of the wellhead located at a depth of 5,000 feet and operated by the British Petroleum Corporation. The *Deepwater Horizon* rig sank on April 22, 2010 causing damage to the well riser and a massive oil spill which has spewed 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 have 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. Meanwhile, two relief wells are being drilled to intercept the well at a depth of several thousand feet below the mudline to stop the flow of oil to the surface. 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 *Deepwater Horizon* incident is poised to become the largest and most devastating oil spill in American history whose environmental and social impacts may exceed those of all previous spills in U.S. waters.

This addendum to the FY 2011-2013 Studies Development Plan for the Gulf of Mexico Region (GOMR) includes four profiles for new studies related to the oil spill within the disciplines of air quality, physical oceanography, and social sciences and marine archaeology (see Table 2). Table 1 represents an integrated table of profiles which includes the four oil spill-related studies as well as five proposed studies that can be found in the original FY 2011-2013 Studies Development Plan for the GOMR (includes the top four ranked studies for the GOM and top one ranked study for the Atlantic region). Table 1 presents an overall ranking of these nine proposed study profiles. Additionally, we have developed new study profiles that may be considered for funding under the Louisiana Coastal Marine Institute (CMI) program which provides matching BOEMRE (formerly MMS) and LSU funds for research by LSU scientists. Please see Table 3 for studies proposed for funding through the CMI program at the end of this document.

ENVIRONMENTAL STUDIES PROGRAM: Studies Development Plan FY 2011-2013

Region: Gulf of Mexico

Planning Areas: Central and Eastern

Title: Hindcasting of the Deepwater Horizon Oil Spill using an Ocean Circulation Model

BOEMRE Information Needs to be Addressed: This study will develop an ocean hydrodynamic model which accurately hindcasts ocean currents and oil movement and fates during the Deepwater Horizon oil spill.

Cost Range: (in thousands) \$800-\$1,000

Period of Performance: FY 2011-2015

Description:

Background: Oil from the Deepwater Horizon incident has demonstrated large-scale and complex impacts on marine waters in the northern Gulf of Mexico. The spilled oil currently covers tens of thousands of square kilometers of surface waters and is diversely composed of oil slick, a thinner oil sheen, and emulsified oil. As well, the heavy use of dispersants has resulted in a less buoyant oil/dispersant mixture, which has resulted in the formation of several sub-surface layers and the likely settling of oil in deepwater sediments. The distribution and fate of oil entering the marine environment depends on a variety of factors, including properties of the oil, environmental conditions (e.g., winds, waves, and currents), and weathering processes.

An essential first step in hindcasting the Deepwater Horizon oil spill is development of an ocean circulation model which can accurately hindcast currents and spill trajectories at the vertical resolution appropriate to the Horizon event. The Horizon spill occurred in deep waters (~1,500 m) and several sub-surface layers of dispersed oil have been observed in the water column. Whereas traditional 3D oil spill models accommodate only a few vertical layers (~5), ocean circulation models incorporate the many vertical layers (>30) which are necessary for reproducing currents in a deep water column. Results from ocean circulation modeling are an important contributor to BOEMRE's Oil Spill Risk Analysis (OSRA) work, and likewise, will be an important step towards hindcasting the movement and fate of oil from the Deepwater Horizon spill.

Objectives: The purpose of this 4-year study is to develop a hindcast model which as accurately as possible predicts the actual spill, by incorporating the various physical and chemical elements unique to the Horizon spill. This study will produce a hindcast of the circulation regime during the Deepwater Horizon event, as well as an understanding of oil spill motion and fates.

Methods: The objectives of this study will be met through development and application of an ocean hydrodynamic model for a time period relevant to understanding oil fate from the Horizon event. An essential component of the study will be to gather the various physical and chemical datasets needed to build and validate the model, including measurements of wind and current velocity time series, remote sensing products (SSH, SST, and ocean color), actual

oil trajectory and fate data, vertical field profiles and measurement of subsurface layers, etc. Aspects of the physical environment (spill occurrence in deepwaters) and methods for fighting the spill (heavy use of chemical dispersants) are very unique to the Horizon incident. A full physical model will be developed and validated for the Deepwater Horizon spill time period and affected region. Oil motion will then be simulated as a passive tracer in the model as a means of diagnosing flow pathways and timescales. As well, the transport and dispersion of oil as a buoyant tracer (with variable buoyancy) will be used to simulate oil-dispersant behavior. An important component of this study will be intercomparison of model results with actual oil movement and fates in the field.

Revised Date: September 2, 2010

ENVIRONMENTAL STUDIES PROGRAM: Studies Development Plan FY 2011-2013

Region: Gulf of Mexico
Planning Area: Gulf-wide
Title: Effects of Oil & Gas Exploration on Estuarine Bottlenose Dolphin Stocks

BOEMRE Information Needs to be Addressed: The exploration and development of oil and gas resources in the Gulf of Mexico, as well as potential renewable energy and alternate use projects, will require BOEMRE to produce information for a variety of NEPA documents as well as ESA and MMPA compliance. As a result of the Deepwater Horizon (DWH) spill incident, coastal systems (bays, sounds, and estuaries) and the species that inhabit them are likely to be adversely affected. There are approximately 33 individual stocks of coastal bottlenose dolphins (*Tursiops truncatus*) (NMFS, 2009) in the Gulf of Mexico. There is a need for BOEM to gather data on dolphin stocks within the impacted areas for oil spill impact assessment as well as for future regulatory documents.

Cost Range: (in thousands) \$600-\$900

Period of Performance: FY 2011-2013

Description:

Background: The Gulf of Mexico has a diverse marine mammal community. All marine mammal species are protected under the Marine Mammal Protection Act (MMPA) and stocks are assessed to monitor population trends, human-caused mortality, and productivity rates. The potential impacts of oil and gas activities are subject to thorough reviews by the National Marine Fisheries Service, Fish and Wildlife Service and Marine Mammal Commission. Coastal bottlenose dolphin stocks are recognized as communities that exist as functioning units of the ecosystem and under the MMPA must be maintained as such. The stable patterns of residency observed within these coastal dolphin communities suggest that long periods would be required to repopulate the home range of a community were it eradicated or severely depleted. The potential impacts from the DWH incident could result in depletion of some coastal bottlenose stocks. An effective management strategy for these stocks would be the protection of the long-term resident communities, with their multi-generational geographic, genetic, demographic and social stability. These localized units would be at greatest risk from geographically-localized impacts (e.g. oil spills).

Objectives: The objectives of the proposed study contain several items, including:

- a current description of selected impacted stocks and associated parameters (mortality, abundance, etc.),
- incorporation of DWH incident stranding information for coastal dolphins, and
- field sampling of selected populations (e.g. Barataria Bay-B61) to determine abundance estimates and biopsy sampling to investigate potential polycyclic aromatic hydrocarbons (PAH) levels through either direct exposure or bioaccumulation to oil.

Complete characterization of many of these basic stocks would benefit from additional photo-identification, telemetry and genetic research.

Methods: This proposed study is expected to provide information for the Gulf of Mexico that is necessary for the development of NEPA documents, biological assessments/evaluations for ESA biological opinions, and BOEMRE protected resources monitoring and mitigation measures. Field surveys and biopsy sampling will be done in cooperation with NMFS.

Revised Date: September 2, 2010

ENVIRONMENTAL STUDIES PROGRAM: Studies Development Plan FY 2011-2013

Region: Gulf of Mexico

Planning Area: Gulf-wide and Atlantic-Wide

Title: Long-term Monitoring Effects of Oil Spill on Pelagic *Sargassum*, Distribution and Movement in the Gulf of Mexico and Atlantic

BOEMRE Information Needs to be Addressed: The Bureau of Ocean Energy Management, Regulation and Enforcement needs to characterize the occurrence and movement of pelagic *Sargassum* algae in the Gulf of Mexico and assess the impacts from the Deepwater Horizon oil spill to this vulnerable habitat.

Cost Range: (in thousands) \$650-\$750

Period of Performance: FY 2011-2013

Description:

Background: This program pursues an ecosystem-based approach to gather information to support responsible management of marine resources on the Outer Continental Shelf (OCS). A series of cooperative studies will share resources to collect information and combine field work for cost-effective research. The program will employ a multi-disciplinary team to characterize relevant aspects of sensitive OCS ecosystems. Each study will be designed to target multiple aspects of the environment for a particular geographic area. Disciplines that utilize similar approaches to field work will cooperate in their efforts to share resources in general and ship time in particular. This will result, not only in cost savings, but will produce integrated analyses to synthesize information into a more comprehensive understanding of the ecosystem. Such a cooperative effort could share not only ship time but also certain other resources such as water quality analyses and personnel (e.g., data coordination and statistical expertise).

Pelagic *Sargassum* algae comprises a unique ecosystem that merits thorough consideration in BOEMRE's 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 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 astonishing endemic species. 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 vulnerable to contamination from spills because it floats at the surface of the sea. This is particularly relevant to the BOEMRE 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. The satellite observations reveal that

Sargassum biomass in the Gulf of Mexico (GOM) is greater than previously estimated and 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.

Objectives: This study will characterize the occurrence and movement of pelagic *Sargassum* algae in the Gulf of Mexico and assess the impacts from the Deepwater Horizon oil spill to this natural resource.

Methods: A variety of methods will be employed to characterize the occurrence and movement of pelagic *Sargassum* algae. The project will also solicit coordination of field work with scientists from other institutions with overlapping interests. In particular, partnerships will be sought with scientists studying the impacts and long-term effects of the DWHR oil spill in the GOM. Opportunistic sampling may be employed for measures such as sampling for contaminants, water quality measurement, plankton sampling, benthic sampling (dead/sunken mats), and other programs of opportunity. The project will use appropriate methods to accomplish the following tasks.

1. Use satellite imagery and overflight maps from current spill monitoring to identify the abundance and distribution of *Sargassum* before, during and after the DWHR oil spill.
2. Utilize other observations of distribution, abundance, and ecological factors from other groups monitoring the spill and its impacts to the GOM.
3. Conduct active field sampling of *Sargassum*;
 - affected during spill
 - down-current of spill
 - in spill area after spill
 - dead and sunken mats
4. Analysis of field sampling should include;
 - contaminants on/in *Sargassum*,
 - on/in flora and fauna associated with *Sargassum* mats
 - flora and faunal health, diversity and abundance
5. Estimate the standing biomass of *Sargassum* based on results.
6. Cooperate with other researchers having overlapping interests to maximize resources and promote additional research. This cooperation shall include supporting and requesting opportunistic sampling for/from other programs as appropriate, especially for collection of sunken, dead *Sargassum* mats.
7. Integrate study results into BOEMRE's new *Eco Spatial 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: September 2, 2010

ENVIRONMENTAL STUDIES PROGRAM: Studies Development Plan FY 2011-2013

Region: Gulf of Mexico

Planning Area: Central

Title: Impacts to Shipwrecks and Prehistoric Sites Located as a result of Dredging Activities Associated with the Deepwater Horizon Oil Spill

BOEMRE Information Needs to be Addressed: The BOEMRE is required under Section 106 of the National Historic Preservation Act to take into consideration the effects of its permitted actions on significant historic properties. Proposed dredging activities along the Louisiana coastline in an effort to stave off oil entering into the fragile wetlands has the potential to adversely impact and possibly destroy unidentified cultural resources that may be significant under any or all four criteria of the National Register of Historic Places. Dredging of the sand sources to construct this emergency berm will occur in high-energy, shallow-water environments where shipwrecks and prehistoric landforms containing archaeological sites are likely to occur. This study will provide BOEMRE with baseline information on the location, preservation, site size, and the size of debris fields associated with shipwrecks discovered as a result of the dredging activities and berm construction.

Information obtained will assist BOEMRE with complying with its Section 106 responsibilities under the NHPA by providing data about sites encountered and possibly impacted during these proposed activities. These data will also provide BOEMRE information about what appropriate mitigation measures for these sites as well as the level of damage (if any) has resulted to the resource.

Cost Range: (in thousands) \$2,400-\$3,600 **Period of Performance:** FY 2011-2013

Description:

Background: The State of Louisiana has been approved to construct a large sand berm to protect fragile wetlands from the impacts of the Deepwater Horizon oil spill. In order to construct this berm, the State will dredge from sand sources on the OCS as well as state waters and deposit these sediments in an effort to create a six foot high berm. Unfortunately, there will not be time dedicated to conduct an extensive remote sensing survey of the borrow areas or of the berm construction in an effort to identify historic shipwrecks as well as prehistoric landforms containing potential archaeological sites. Additionally, current conditions will not permit archaeologists to conduct diver investigations to assess the age, cultural affiliation, or nationality of shipwrecks or the presence of prehistoric sites prior to the removal of sediments. In an effort to understand what impacts have occurred to shipwrecks and archaeological sites found as a result of the sediment removal process, this study will provide BOEMRE with baseline information on the location, preservation, and the size of

debris fields associated with shipwrecks as well as the location, preservation, and size of prehistoric sites discovered as a result of the dredging activities and berm construction. Information obtained will assist BOEMRE with complying with its Section 106 responsibilities under the NHPA by providing data about sites encountered and possibly impacted during these proposed activities. These data will also provide BOEMRE information about appropriate mitigation measures for these sites as well as the level of damage (if any) that has occurred.

Objectives: The objectives of the study are to identify and ground-truth all shipwrecks and archaeological sites encountered during the sediment removal process/berm construction. The study will then focus attention at each site individually, positively identifying and assessing the size, distribution, and characteristic of the shipwreck remains and archaeological sites. Data recovered from the sites will be used to fulfill the Section 106 process by determining if each site is eligible for inclusion on the National Register of Historic Places as well as providing information to the general public about Louisiana's maritime heritage and archaeological resources.

Methods: The objectives of the study will be achieved through an investigation of the physical remains of each shipwreck site and archaeological site identified as a result of the dredging activities associated with the construction of the berm. Extensive remote sensing of each site will be conducted using magnetometer, side-scan sonar, sub-bottom profiler, and sector scanning sonar devices in order to assess the condition and location of each site. This will be followed by diver visual investigations of each site if conditions are safe. Diver investigations will include diver visual inspections, mapping, and potentially additional hand dredging and probing in order to determine the size and distribution of prehistoric sites and the age, cultural affiliation, and nationality of each shipwreck. Test units will be excavated in areas determined from both the remote sensing data as well as visual surveys (should diving conditions allow) as a means to identify intact areas of the site or if these are secondary deposits made as a result of the larger berm dredging activities. The project will also conduct extensive photographic documentation and mapping of each site. Coring of each prehistoric site will occur along with detailed geotechnical/geochemical analysis of each core including: grain-size analysis, point-count analysis, and palynological analysis. Additionally, there will need to be some limited radiometric dating (C14, Pb210, and possibly Cs137) of strata or the organic materials contained within the cores will provide a more complete picture of the relative age of different layers in the dredge borrow area as well as identify depositional dynamics which might have bearing on the sub-surface archeology in the region. 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 analysis such as wood analysis will be conducted to provide further information about these sites. The study will provide an extensive archaeological assessment of each site including site maps, site descriptions, 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 the sites

located during the dredging of the borrow material. The end product of this study will be two fold; first, it will provide information on the types of impacts that could be expected from the removal of sand and gravel from borrow areas on the OCS, and, second, provide 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 Louisiana's rich maritime heritage.

Revised Date: September 2, 2010

ENVIRONMENTAL STUDIES PROGRAM: Studies Development Plan FY 2011-2013

Region: Gulf of Mexico

Planning Area: Eastern

Title: Sperm Whales in the Eastern Gulf (SWEG)

BOEMRE Information Needs to be Addressed: Recent mandates to offer offshore leases within 125 miles of the west coast of Florida prompt the need for BOEMRE to investigate and better understand protected resources. The Draft Proposed Program 2010-2015 has 3 scheduled lease sales in the Eastern Planning Area (Sale 225, 226, and 234). This increased level of activity has the potential to impact protected species and warrants further studies.

Cost Range: (in thousands) \$1,500-\$1,800 **Period of Performance:** FY 2011-2013

Description:

Background: As an endangered species, Sperm whales (*Physeter macrocephalus*) are protected by both the Endangered Species Act and the Marine Mammal Protection Act. In 2008, BOEMRE published the Sperm Whale Seismic Study (SWSS) Synthesis Report (OCS Study MMS 2008-006). This research was conducted in the northern GOM and provided information on sperm whale population structure, genetics, movements, and response of whales to anthropogenic industry activities. However, there are limitations to this study. The SWSS study area was primarily focused in the region between Mississippi Canyon and De Soto Canyon, although one cruise was conducted in the northwest Gulf. This region has extensive human activity in the form of marine transportation, recreational activities, commercial and recreational fishing, oil and gas activities, and other anthropogenic disturbances. Thus the sperm whale population that was most studied during SWSS already may have been habituated to anthropogenic sounds, including those from seismic airgun arrays. SWSS data, therefore, can not be considered truly baseline in the sense of defining normal behavior of unexposed animals. Nevertheless, the SWSS results for the sperm whale population in this main study area do reflect a "normal" behavior in the presence of human activity for a discrete population of particular interest because its range coincides so closely with current and planned oil and gas exploration. Limited observations in SWSS from areas outside the SWSS focus study area mean that results found by SWSS may not include variations, if any, in behaviors associated with other geographic regions in the Gulf, particularly sperm whale populations found off the south west coast of Florida, in the Dry Tortugas region.

Objectives: This proposed study will focus on obtaining data about populations of sperm whales from less anthropogenically "impacted" areas. Specifically, the research will focus on areas with little to no oil and gas activities. Populations in the Dry Tortugas region have not been exposed to intensive seismic surveys or oil and gas industrial activities and a study

similar to SWSS in this region may provide information useful for comparison with the SWSS results.

This study will also provide true baseline information about a species prior to any industry activities and will provide valuable insights into potential effects of industry activities on a naive population.

Methods: This study will focus on an area with little to no industry activity, offshore southwestern Florida. Data collected in this study will be similar to those data collected in SWSS and will include a detailed characterization of sperm whales in terms of sex and age distribution, genetic profiles, habitat use, and seasonal movement patterns. Research vessels and remote sensing devices will also obtain ambient noise measurements and physical oceanographic data to allow a detailed habitat characterization – mapping of both physical oceanographic features and ambient underwater noise levels will be correlated to sightings of sperm whales and other cetaceans observed.

A subset of whales will be tagged using either S-tags (long-term movements) or d-tags (shorter-term movements) to document seasonal movements, habitat use, foraging strategies and potential mixing with West Atlantic populations.

Revised Date: September 2, 2010

ENVIRONMENTAL STUDIES PROGRAM: Studies Development Plan FY 2011-2013

Region: Gulf of Mexico OCS Region

Planning Area: Gulf-wide

Title: Effects of Gulf of Mexico OCS Leasing Program and the Gulf of Mexico Oil Spill on Recreation, Tourism, and Fisheries

BOEMRE Information Needs to be Addressed: Impacts of the Gulf of Mexico oil spill to recreation and tourism and fisheries are critical issues that must be addresses as fully as possible in future impact assessments. This study will insure that the most current and updated information is available to support BOEMRE environmental assessments and other decision making. This study will also support the identification or “scoping” of issues most salient to GOMR stakeholders, a process also important to environmental assessment. In support of BOEMRE environmental assessments, it will then analyze issues identified as important based on this scoping.

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

Period of Performance: FY 2011-2014

Description:

Background: Impacts to the recreation and tourism and fishing industries from the Gulf of Mexico oil spill have been of a particular concern of Gulf Coast residents, beach and ocean users, researchers, and coastal States which BOEMRE must address thoroughly, both in the short and long-term. Most immediately, many of the more pressing concerns are difficult to address because they are “indirect”—that is, they arise from processes other than from actual fouling of the immediate environment—yet they are substantial and their effects move through many sectors of the economy. Indirect effects on businesses and local economies have occurred in coastal areas far from physical manifestations of spill effects and, even, far from the coasts. The information which is available on the airways and in print is often confusing, contradictory, fragmentary, and/or contentious. Reliable information sources are many, varied and evolving. While various Federal agencies and Federal/State institutions are assuming the yeoman tasks of data acquisition and analysis, some of these data are publically available and some may be tied up in litigation and the NERDAM process and unavailable for public dissemination for many years.

Systematic, reliable, and current information is important to the assessment of the socioeconomic impacts of the Gulf of Mexico oil spill. However, in the current context, assembling and maintaining information on the effects of recreation and tourism and fisheries is a continuous and substantial task. BOEMRE seeks to address this problem through the development of a regularly updated synthesis of salient information as it becomes available for public dissemination.

This is the shorter-term issue raised by the oil spill. In the longer-term, the BOEMRE must address the fact that the Gulf of Mexico oil spill has raised stakeholder concerns in general about consequences of OCS leasing program to recreation and tourism and the fisheries industries. This study will develop a detailed baseline description of these industries and activities in the Gulf Region that includes information on geographic distributions, trends, and the socioeconomic contributions made by these industries to Gulf Region states and locals. It will identify the various factors related to normal OCS operations and accidental events (such as oil spills) and provide analyses and tools in support of BOEMRE assessments of these factors.

Objectives: The overall goal of this study is to support BOEMRE socioeconomic assessment. In the shorter term, this study will provide timely and reliable information on the consequences of the Gulf of Mexico oil spill to commercial, recreational and sports fishing and fisheries.

In the longer term, this still will:

- develop a baseline description of the tourism and recreation industry in the GOMR. This will include a description of its various economic sectors (e.g., retail and restaurant establishments, accommodation and equipment rentals, service enterprises, etc.), its various participant groups (e.g., locals, vacation and business visitors, seasonal residents, retirees, etc.) and activities (e.g., boating, diving, gambling, hotels, recreational fishing, cultural, historical, and recreational attractions, etc.),
- to the extent possible, describe the composition, size and distribution of the various economic sectors and activities of the GOMR tourism and recreation industry at the county/parish level,
- to the extent possible, describe the composition, size and distribution of the various economic sectors, participants, and activities of the GOMR tourism and recreation industry BOEMRE-defined impact areas and coastal areas,
- identify the various direct and indirect impacting factors that may be generated by the OCS petroleum leasing program and the possible effects of each factor to the industry's various sectors and activities. Identify key factors for further analysis, and.
- develop analytical tools for assessing the impacts of key impacting factors at the level of BOEMRE-defined impact areas and coastal areas.

Methods: The methodology will consist of a literature review, data collection from public sources, discussions with key industry representatives, and analysis and synthesis of the collected data and information. Working with BOEMRE and other involved agencies and institutions, this study will first define a set of relevant information/data categories and sources. The study will also develop a standardized format for monthly update reports. This

study will synthesize new information/data from these sources as they become available. The study will also conduct regular searches of websites and other possible sources to collect salient information concerning effects of the oil spill and synthesize these findings, and will develop contacts with researchers on projects sponsored by NOAA, BOEMRE and other agencies to collect and incorporate new information that can be made available. This study will evaluate the effects of normal operations (e.g., ship traffic, air traffic, onshore industrial activities) and accidental events (e.g., oil spills) on recreation and tourism and fisheries.

Revised Date: September 2, 2010

ENVIRONMENTAL STUDIES PROGRAM: Studies Development Plan FY 2011-2013

Region: Gulf of Mexico OCS Region

Planning Area: Gulf-wide

Title: MAG-PLAN Post-Gulf of Mexico Oil Spill Modifications

BOEMRE Information Needs to be Addressed: Modification of MAG-PLAN is part of broader BOEMRE efforts to understand the local and regional consequences of the program as industry activities expand or contract and will support planning, decision making and environmental assessments related to the management of mineral resources on the OCS. The oil spill cleanup and mitigation industry is an important sector of overall OCS-related activity and should be incorporated into economic/demographic projections.

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

Period of Performance: FY 2011-2012

Description:

Background: BOEMRE maintains an OCS Economic Impact Model (EIM) called MAG-PLAN to provide a consistent bureau-wide approach to estimating employment, personal income, and similar economic impacts from OCS activities. MAG-PLAN is a Microsoft Access-based, 2-stage model that uses OCS-specific “cost functions” to estimate the industry expenditures required (by industry sector and onshore incidence of spending) to complete a given activity, such as drilling an exploration well or operating a production facility. The second stage uses general economic multipliers from the commercial economic modeling system IMPLAN to forecast employment, personal income, and other variables resulting from the initial industry expenditures. Obtaining data at the appropriate level of detail for the different activity functions has proven to be difficult since no publically or commercially available data source contains all of the data needed for the model.

An ongoing BOEMRE effort aims to update and strengthen the current MAG-PLAN model by: (1) testing and improving functionality of the model; (2) incorporating, for selected industry sectors, additional information on offshore expenditure patterns and their onshore allocations; (3) creating new activity functions for FPSO systems, subsea tiebacks/well completions and seismic exploration; and, (4) improving onshore distributions at the county/parish level. This proposal amends an ongoing effort to update and strengthen MAG-PLAN in light of the Gulf of Mexico oil spill by addressing OCS-related activities involving the oil spill cleanup and remediation. For future environmental assessments, the MAG-PLAN model may be used to account for employment and expenditures due to small, medium and large spills that contact, or do not contact, land.

Objectives: The objective of this MAG-PLAN Modification is to develop a new activity function for oil spill clean up and mitigation that includes expenditure patterns and their onshore allocations.

Methods: This effort will develop a new industry activity function built on the detailed descriptions of the oil spill clean up and mitigation industry developed by the “OCS-Related Infrastructure study” (Proposal 4, above) as well as on data on the Gulf of Mexico oil spill and smaller oil spills. Specifically, this effort will create the new activity function based on expenditure data gleaned from a thorough investigation of all public and commercially available data sources, as well as any additional sources identified. It will integrate this function into the MAG-PLAN model. It will be designed to provide onshore distribution outputs at the county/parish level using the most current sector allocation codes.

Revised Date: September 2, 2010

ENVIRONMENTAL STUDIES PROGRAM: Studies Development Plan FY 2011-2013

Region: Gulf of Mexico OCS Region

Planning Area: Gulf-wide

Title: Socioeconomic Analysis of the Gulf of Mexico Oil Spill on GOMR Families and Communities

BOEMRE Information Needs to be Addressed: The socioeconomic impacts of the Gulf of Mexico oil spill have already begun, and the indirect consequences, particularly, will continue for many years and will be far-reaching. For individuals and households, impacts are expected to include changes in livelihood strategies (both due to loss of options such as fishing, operating tourism-related enterprises, and working on rigs that have left the Gulf as well as due to new options such as participating in the cleanup efforts), relocation (into and out of specific communities or the area), changes in hurricane preparation, changes in environmental awareness and the relationship to the coast, and reemergence of post-Katrina effects and post-traumatic stress-type symptoms. For communities, the incident and its aftermath will affect local businesses, real estate, local tax bases, hurricane and disaster planning, population demographics and dynamics (including relationships between locals and those from outside), and education and social service providers.

A detailed, accurate picture of these short- and long-term, direct and indirect socioeconomic consequences is important to BOEMRE environmental assessments, and is extremely difficult to draw. Difficulties arise because of causal complexities, geographic variability, and the emotionally fraught atmosphere in which information gathering must occur. This effort will address these challenges with an experienced staff, a mixed methods approach, and community-based participatory research model.

Cost Range: (in thousands) \$500-\$740

Period of Performance: FY 2011-2013

Description:

Background: The socioeconomic impacts of the Gulf of Mexico oil spill have already begun, and the indirect consequences, particularly, will continue for many years and will be far-reaching. Neither the full range nor extent of the impacts is yet known.

This study will use the significant findings of and data collected during prior BOEMRE studies in the Gulf of Mexico as baseline for identifying and assessing the socioeconomic impacts of the Gulf of Mexico oil spill. It will focus on impacts at three levels: the individual, household, and community. Because the spill is differentially affecting Gulf Coast

communities, with some expected to receive large volumes of oil and others not, it is expected that the impacts will also be uneven. To date, in areas where significant amounts of oil are found in the water and onshore, impacts have included closure of fisheries and wildlife refuges, contamination of drinking water supplies, and large-scale and long-term cleanup operations. However, even in areas where no oil is present, policy decisions such as fisheries closures and moratoria on leasing and drilling have already affected those working in the offshore petroleum industry.

For individuals and households, impacts are expected to include changes in livelihood strategies (both due to loss of options such as fishing, operating tourism-related enterprises, and working on rigs that have left the Gulf as well as due to new options such as participating in the cleanup efforts), relocation (into and out of specific communities or the area), changes in hurricane preparation, changes in environmental awareness and the relationship to the coast, and reemergence of post-Katrina effects and post-traumatic stress-type symptoms. For communities, the incident and its aftermath will affect local businesses, real estate, local tax bases, hurricane and disaster planning, population demographics and dynamics (including relationships between locals and those from outside), and education and social service providers. The socioeconomic impacts of the Gulf of Mexico oil spill have already begun, and the indirect consequences, particularly, will continue for many years and will be far-reaching. Neither the full range nor extent of the impacts are yet known, and those affected by this ongoing event are already showing an unwillingness and inability to talk about those impacts due to uncertainty, distrust, anger, and fear that saying anything will affect potential future job or compensation opportunities. To address these challenges, a mixed methods approach is necessary, conducted in partnership with affected populations using a community-based participatory research model.

Objectives: The overall objective is to provide a detailed, accurate picture of the short- and long-term, direct and indirect socioeconomic consequences of the Gulf of Mexico oil spill to the Gulf Coast. Such questions will be addressed as: What are the differential impacts of this incident based on region, community, and household? What factors such as livelihood and occupational opportunities, infrastructure, economic diversity, and connections to the industry (both material and ideal) influence the nature and scope of the impacts? How does the release and response to it affect those who still work in this industry – across sectors? What are the effects to communities of financial compensation to some individuals/groups over a long period of time? How do these impacts reverberate through the communities, and what aspects of household and community vulnerabilities and resilience exacerbate or mitigate their effects?

Methods: This effort will build on data, methods and findings of a number of earlier BOEMRE research efforts. The 1998 study, Economic and Social Consequences of the Oil Spill in Lake Barre, Louisiana, provides information about a much smaller spill; that spill is still remembered by people who were living and working in the area at the time. The 2002 report, Social and Economic Impacts of Ocs Activities on Individuals and Families, provides a baseline for understanding differences in offshore oil's effects on various Gulf of Mexico Region (GOMR) subareas; importantly, it relates this variation to differences in the spectrum

of local industry sectors and their articulation to offshore oil and provides in-depth case studies of Morgan City and New Iberia, LA. The 2002 report, Socioeconomic Baseline and Projections of the Impact of an OCS Onshore Base for Selected Florida Panhandle Communities, provides background information on the Florida panhandle. The 2004 report, Labor Migration and the Deepwater Oil Industry, provides information on immigrant labor and shows how the specific processes through which this labor is recruited affect the way it is integrated into the host community. The 2008 report, Benefits and Burdens of Ocs Activities on States, Labor Market Areas, Coastal Counties, and Selected Communities, summarizes local-level socioeconomic impacts in communities across the Gulf. subareas. The 2008 History of the Offshore Oil and Gas Industry in Southern Louisiana shows the importance of local ties to the offshore industry, hence in defining its presence and effects; it includes case studies in the Louisiana communities of south Lafourche Parish, Houma and south Terrebonne Parish, and Morgan City, along with more than 400 transcribed interviews that provide much-needed pre-spill perspectives on the industry and will help explain local responses to this incident.

This study specifically builds on the research design and information from the soon-to-be completed Gulf Coast Communities & the Fabrication & Shipbuilding Industry: A Comparative Community Study. This earlier effort was conducted after the 2005 hurricanes and provides extensive historical, demographic, and ethnographic data on eight study communities: Mobile, AL, Bayou la Batre and south Mobile County, AL, southeastern MS, south Lafourche and Terrebonne, LA, Morgan City, LA, the Golden Triangle, TX, the Central Coastal Bend, TX, and Brownsville and Port Isabel, TX. This earlier effort will provide the baseline for the new study, an extensive, data-rich and analytically detailed comparative basis for identifying the consequences of the oil spill as well as their regional variation. This study will also benefit from data that have been collected further inland in Lafayette Parish, LA and Lauderdale and Clarke counties, MS as part of the ongoing study, History of the Gulf of Mexico Offshore Oil and Gas Industry During the Deepwater Era; the perspectives and experiences of people living a bit farther inland and tied to the offshore petroleum industry by employment, will be important.

Besides the synthesis of material from earlier studies and the collection and analysis of contemporary data and information sources, this study will place experienced fieldworkers in four coastal areas, from west to east: (1) St. Mary, Iberia, and Vermillion parishes, LA; (2) Lafourche and Terrebonne parishes (and Grand Isle), LA; (3) Jackson, Harrison, and Hancock counties, MS; and (4) Mobile and Baldwin counties, AL and Escambia County, FL. Each fieldworker will organize a team of community researchers who will help identify key local organizations and individuals to participate in the study, gather data, meet regularly to discuss what is being learned and adjust the study's direction as needed, and provide information about the study to others in their community. Each fieldworker will be focus his/her efforts on the coastal communities but will be responsible for occasional trips further inland to capture the difference between those living on the coast and directly affected by the spill and those who are affected by the paychecks, tax revenues, and other benefits of the offshore industry.

Revised Date: September 2, 2010

ENVIRONMENTAL STUDIES PROGRAM: Studies Development Plan FY 2011-2013

Region: Gulf of Mexico

Planning Area: Central

Title: A Comparative Analysis of the Effects of the Deepwater Horizon Spill on the Biota Inhabiting Six World War II Shipwrecks and Shipwrecks Spanning the 19th Century in the Gulf of Mexico

BOEMRE Information Needs to be Addressed: This study will support EIS's and decision-making by providing documentation and analysis of a major oil spill's effects on deepwater artificial reefs and associated biota. General questions to be addressed include how oil, the dispersed oil, and the dispersant used to manage the overall oil spill interact and are integrated within the seafloor and these micro-habitats. This study will also address the long term impacts that the hydrocarbons and chemicals released into the water column will have on the biota and the seafloor surrounding each of the test sites. In addition, the study will address the archaeological degradation of metal and wooden hulled shipwreck sites, the impacts that hydrocarbons and other chemicals have on site formation processes, and current state of each site compared to the earlier 2004 study.

Cost Range: (in thousands) \$1,600-\$2,400 **Period of Performance:** FY 2011-2013

Description:

Background: As amply demonstrated in the award winning 2004 study entitled *Archaeological and Biological Analysis of World War II Shipwrecks in the Gulf of Mexico*, these archaeological sites serve as an ideal random sample because they are dispersed throughout the study area and have a diverse array of organisms 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 any 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 as to each site's structural integrity and current state of preservation in order to understand the individual formation processes occurring at each site. Additional, bio-chemical analysis was conducted in order to identify what microorganisms were present at each site and to determine if they were accelerating the decay of these mid-20th century shipwrecks. This critical analysis was a key to understanding the formation processes occurring at each site and for determining if any of these sites' hulls would eventually become compromised and potentially release product and other hazardous material that these vessels were carrying at the time of their sinking.

Most of these sites have not been visited since the conclusion of this pilot study and the study did not include wooden shipwreck sites.

Objectives: The efforts of this follow-up study will be to complete a detailed comparative analysis of data collected during the 2004 study and the current physical and environmental condition of each site and its associated biota. In addition, the study will also focus on a detailed analysis of the environmental, biological and archaeological conditions of several wooden shipwreck sites that have been previously investigated and are located in the area of the oil spill. These data will be compared to data collected during previous site investigations and will serve to inform BOEMRE of the rate of changes occurring at these sites. They will also serve to address questions related to the rate of degradation occurring at these sites and identify whether these changes are a result of the level of hydrocarbons and dispersant chemicals at the location of each site.

Methods: Methods employed for this study will include a re-assessment and comparison of the local environment at each site, the physical and biological modification of sediments in the immediate area of the site, further sampling of the fauna attached to hard substrate for taxonomic purposes as well as levels of toxins in sample organisms, additional analysis of new video imagery collected at each site, and sampling of any fouling communities, motile fish, and invertebrate species association with the sites. Follow up archaeological assessments and site plans will be completed and analyzed to indicate whether there have been changes to these sites since the 2004 pilot study. Additional bio-battery coupons will be placed at each study site for chemical analysis and wood samples will be collected from each wooden shipwreck sites. The end product of this study will include a report detailing the comparison and analysis with the earlier data collected from 2004 study, detailed maps of each site along with changes identified at each site, and a public outreach component including but not limited to posters and booklets detailing the history of the project and lessons learned from this oil spill event.

Revised Date: September 2, 2010

ENVIRONMENTAL STUDIES PROGRAM: Studies Development Plan FY 2011-2013

Region: Gulf of Mexico

Planning Area: Gulf-wide

Title: Air Quality Impacts Assessment of the Deepwater Horizon Oil Spill

BOEMRE Information Needs to be Addressed: To support the NEPA process when preparing Environmental Impact Statements and Assessments regarding future oil spills and for onshore emissions impacts analysis of the Deepwater Horizon oil spill.

Cost Range: (in thousands) \$700-\$900

Period of Performance: FY 2011-2013

Description:

Background: On April 20, 2010, the Deepwater Horizon rig at Mississippi Canyon 252 in the Gulf of Mexico (GOM) had a major explosion resulting in a fire and ultimately sinking of the rig. Response to this incident has led to a major increase in vessel activity, including the Coast Guard, skimming activities, boom deployment, ROV support operations, two relief well drilling operations, a recovery rig to flare the gas from the riser and store the oil/water mixture, subsea dispersants vessels, pile driving vessels to secure the booms, sand dredging vessels, and additional recovery vessels. Reports range that approximately 1,500-3,000 vessels are responding to this incident. There is also an increase in helicopter trips offshore, aircraft trips for images, aircraft trips for dispersants, and aerial surveys of coastal marshes and beaches for assessments. In addition, flaring of gas is occurring on the recovery rig, along with controlled burning of the oil on the surface, and of course, the burning of the rig itself before it sank. Vapors are also evaporating from the oil slick. Lastly, this incident has led to increased motor vehicle traffic to the incident command centers on the coast, plus vehicular travel to survey marshes and shores. This increase in activity will lead to increases in air emissions in the GOM.

Objectives: To determine air quality impacts caused by this spill to onshore coastal areas and if the emissions associated with the oil spill contribute to adjacent Gulf coastal areas ozone non-attainment issues. The specific purpose of this study is to perform an air quality impacts assessment for the whole spill period for the GOM from Texas to Florida using Deepwater Horizon oil spill detailed air emissions daily inventories to assess the impacts to ozone levels in onshore areas.

Methods: The contractor will collect and calculate daily emissions data from all sources on the OCS related to the Deepwater Horizon Oil Spill. See background section for a listing of some of the sources that should be included. Additional sources might need to be added as oil spill clean-up effort continues. The contractor will quality control and assure all emissions data. The contractor will generate an emissions inventory that complies with current USEPA current formats by combining the spill related emissions with current Gulf-wide emissions and emissions from adjacent Gulf States to produce an air quality model-ready emissions

inventory. The contractor will process meteorological data for several specific ozone episodes during the whole oil spill period for the GOM domain including the states of Texas, Louisiana, Mississippi, Alabama, and Florida and adjacent areas, as required. Using an approved USEPA air quality photochemical model, the contractor will model the episodes using nested fine grid runs to determine the impacts of the Deepwater Horizon specific oil spill emissions, looking at impacts to: adjacent platforms, onshore coastal Texas to Florida, plus the cities of Houston, TX; Baton Rouge, LA; New Orleans, LA; Gulfport, MS; Mobile, AL; Pensacola, FL; and Panama City, FL. The contractor will quality control and assure the model, using approved modeling performance evaluation tools and methods, and by including specific monitor data available related to the Deepwater Horizon oil spill from USEPA, Center for Toxicology and Environmental Health, L.L.C. (CTEH), NOAA, etc. for the coastline and specific offshore meteorological data. The contractor will describe and analyze all the monitoring programs that were conducted specific to the DWH oil spill. Deliverables include emissions inventories, impacts modeling results/analyses, plus interim and final reports.

Revised Date: September 2, 2010

ENVIRONMENTAL STUDIES PROGRAM: Studies Development Plan FY 2011–2013

Region: Gulf of Mexico
Planning Area: Central
Title: Documenting Impacts of the Deepwater Horizon Oil Spill on Coastal Avian Communities

BOEMRE Information Needs to be Addressed: The BOEMRE is a steward of the coastal environment which includes coastal bird resources (including the endangered piping plover). The BOEMRE is mandated to determine the status of oiled and unoled vulnerable coastal bird populations including those on barrier islands and beach headlands. Understanding coastal intertidal wetland bird communities and ecosystems is vital to their management and assessment of long-term damage from oil spills and other cumulative impacts.

Cost Range: (in thousands) \$95-\$105 **Period of Performance:** FY 2011-2012

Description

Background: The Deepwater Horizon oil spill off the Louisiana coast is unprecedented. The negative impacts to coastal bird communities along the southeastern Louisiana coast are becoming increasingly evident: reports of oiled birds, dead, dying, or observed with differing degrees of oiling on plumage are a daily occurrence. Oil has thus far made landfall at different sites in differing degrees, some as isolated events, and others more extensive and severe. Remediation activities are in place in many areas, including booming, removal of oil by hand and heavy equipment, etc.

Prior to the oil spill, planning efforts were underway to conduct the second ground survey of nesting birds ever conducted along the entire Louisiana coast in the spring of 2010. Focal nesting species included Wilson's and Snowy Plover, American Oystercatcher, Least, Gull-billed, Caspian, Royal, and Sandwich Terns, Brown Pelican, and Black Skimmer. Data were also collected on Reddish Egret, Red Knot, and Piping Plover. Numerous individuals representing different agencies/organizations participated in the planning of the 2010 survey including the Barataria-Terrebonne National Estuary Program (BTNEP), Coastal Bird Conservation Program, Louisiana State University, National Audubon Society, and biologists with the Louisiana Department of Wildlife and Fisheries and U.S. Fish and Wildlife Service. The results of this survey can be compared to, and will build upon data collected during a similar survey in 2005 funded by BTNEP; BTNEP participated in, as well as provided all logistical coordination for this survey, and published the final report entitled "Zdravkovic M. and R. DeMay. 2006. Status of Select Beach-nesting Birds in Coastal Louisiana 2005: breeding abundance, habitat use, and distribution. Barataria-Terrebonne National Estuary Program, Thibodaux, LA. Report # 33."

The 2010 survey began in early May, shortly after the Deepwater Horizon accident occurred. In order to stay in front of potential impacts associated with the oil spill, the schedule was modified and initial efforts included surveying those areas most at risk: islands from Grand Isle eastward to Sandy Point and then westward into Terrebonne Bay. Since then, surveys have also been completed in the Biloxi Marsh area from Lake Borgne to the islands south of the Mississippi River Gulf Outlet and from Rainey Refuge westward to the Texas State line. Data for oiled birds including dead and dying birds and birds encountered during the surveys was also collected.

Whereas 2005 and 2010 surveys covered the entire Louisiana coast, this proposal seeks to cover only select locations within the Barataria-Terrebonne Basins.

Objectives: The primary objectives of this project are to:

- estimate avian numbers associated with the barrier island/headland beach habitats,
- document dead, dying, and oiled birds versus un-oiled birds,
- conduct these surveys over time to track trends in oiled versus un-oiled birds, and
- to develop a final report that presents the findings of the project.

A matrix would be developed/used to document oil on plumage and to assess behavior of individual oiled birds. There are now at least two protocols that exist in terms of data collection; either one could be used.

Data would be collected and documented on paper and digitally as a Microsoft Excel form. A Final Report would be developed that incorporates the data collected.

Methods: The project team will select specific beaches both on barrier islands and headland areas of the Barataria-Terrebonne area (essentially the area between the Mississippi and Atchafalaya Rivers) for which some baseline pre-spill data exists. Ground surveys of select beaches (both mainland beaches and barrier island beaches) within the Barataria-Terrebonne region will allow adequate regular coverage of the same areas. These select sites will be routinely surveyed for the project duration. The initial selection of sites will, in part, be determined by those areas impacted by oil events (intermittent contamination) or unaffected, and include those with and without oil spill emergency preparation (booms, dikes, etc). While a comparison of oiled beaches versus un-oiled beaches would be desirable, this will be beyond the control of the contractors as changes in weather, currents, etc. could cause previously un-oiled areas to become impacted by oil. Ground surveys allow needed scrutiny to detect smaller amounts of oil on a bird's plumage as well as in the environment.

These surveys would use trained /qualified observers who walk select beaches including dunes and overwash fans. All birds observed would be recorded: those exhibiting no signs of oil contamination, those with oil, and those impaired by oil, or dead. This will allow

determination of percent occurrence of oiled birds at different sites as well as information on motility (or presumed mortality) at those sites. Based on experience from previous censuses, up to four two-person teams will be deployed for coverage of beach and adjacent habitats.

Revised Date: September 2, 2010

ENVIRONMENTAL STUDIES PROGRAM: Studies Development Plan FY 2011–2013

Region: Gulf of Mexico

Planning Areas: Central and Eastern

Title: Recovery, Restoration, and Remediation following the Deepwater Horizon Oil Spill: Potential Contamination and Recovery of Live Bottom Habitats on the West Florida Shelf and South Florida Reefs

BOEMRE Information Needs to be Addressed: The BOEMRE needs to examine live bottom and coral habitats and communities in the oil spill region of influence to assess recovery from potential impacts.

Cost Range: (in thousands) \$1,200-\$1,470 **Period of Performance:** FY 2011-2016

Description:

Background: The Deepwater Horizon oil spill in block MC252, approximately 50 miles southeast of Venice, Louisiana, released millions of gallons of crude oil in the north-central Gulf of Mexico. The oil release was initially treated with dispersants at the surface but subsequently received application of dispersant subsea, at the source of the spill, in about 5000 ft of water depth. A number of mechanisms operate in the weathering process as spilled oil ages. Some of these mechanisms can result in deposition of the oil on the seafloor. Movement of spilled oil in the ocean is controlled by wind and water currents. These forces can push oil toward shore and can distribute it widely across the ocean. In the Gulf of Mexico, the Loop Current enters from the south beside the Yucatan peninsula, doubles back on itself in the northeastern GOM and flows south and east through the Straits of Florida, next to the Dry Tortugas and the Florida Keys. This major current and others may carry spilled oil from the Deepwater Horizon blowout to the vicinity of sensitive live bottom habitats on the West Florida Shelf and to the reef systems of south Florida.

Oil treated with dispersants is broken into micron-sized droplets that mix with the water. These droplets are not clumped together but are distributed in the water, allowing them to diffuse farther through the water as time passes. This happens to oil, both on the sea surface and subsea. With the oil separated into tiny droplets, the oil's surface area is increased, allowing faster weathering and biodegradation. More bacteria can act upon the oil and, over time, flocculation or clumping with organic particles can occur. As the oil flocculates, it becomes heavier and begins to sink toward the seafloor. In this manner, the oil could be distributed widely over a large area of the seafloor, possibly including live bottoms.

This study will evaluate the possible contamination and recovery of live bottoms and coral reef habitats and communities on the West Florida Shelf and off south Florida. The West Florida Shelf is composed of karst geology having large areas of flat limestone substrate. Much of the substrate is covered by sand with a profusion of scattered exposed live bottom areas. In some places the sand is periodically shifted by currents and storms, covering hard substrate and resulting in communities of gorgonians attached to solid substrate but

protruding up through the sand. Inshore areas have live bottoms including seagrass/algae beds mixed with patches of hard bottom. Wherever hard bottom is exposed, it supports sponges, gorgonians, and other associated organisms and fish. The study will be coordinated under the umbrella of a larger multi-disciplinary effort for the area. Partnerships will be sought with coastal institutions in the affected area. Lab analyses may be combined with other spill study efforts.

Objective: This study will evaluate the possible contamination and recovery of live bottoms and coral reef habitats and communities on the West Florida Shelf and off south Florida.

Methods: The study will monitor live bottoms on the West Florida Shelf and south Florida reef tract in the region of influence (ROI) of the Deepwater Horizon spill. Samples of sediments, seagrass, algae, invertebrates, and fish will be analyzed for contaminants. Surveys will be conducted to compare community condition with historic data, including measures such as community composition, diversity, evenness, distribution, abundance, biomass, reproductive state, disease, etc. The sampling sites may be in a grid pattern of transects but other options will be considered. Analyses of water currents and detection of oil movements will be important factors in site selection. Appropriate sampling techniques will be employed, including the use of grabs, traps, divers, video, and still imaging.

Revised Date: September 2, 2010

ENVIRONMENTAL STUDIES PROGRAM: Studies Development Plan FY 2011–2013

Region: Gulf of Mexico

Planning Area: Eastern

Title: Recovery, Restoration, and Remediation following the Deepwater Horizon Oil Spill: Florida Big Bend Seagrass Community Characterization and Recovery

BOEMRE Information Needs to be Addressed: Seagrasses in the Big Bend extend into water >25 m (82 ft) deep and up to 110 km (70 mi) offshore. The BOEMRE needs to update information about the status of seagrass in the region and to examine the effects and recovery following the Deepwater Horizon spill.

Cost Range: (in thousands) \$600-\$900

Period of Performance: FY 2011-2016

Description:

Background: The Deepwater Horizon oil spill in block MC252, approximately 50 miles southeast of Venice, Louisiana, released millions of gallons of crude oil in the north-central Gulf of Mexico. The oil release was initially treated with dispersants at the surface but subsequently received application of dispersant subsea, at the source of the spill, in about 5000 ft of water depth. A number of mechanisms operate in the weathering process as the spilled oil ages. Some of these mechanisms can result in deposition of the oil on the seafloor. The dispersed oil forms micron-sized droplets that no longer resist mixing with water. These droplets are not clumped together but are distributed in the water, allowing them to diffuse farther through the water as time passes. With the oil separated into tiny droplets, the oil's surface area is increased, allowing faster weathering and biodegradation. More bacteria can act upon the oil and, over time, flocculation or clumping with organic particles can occur. As the oil flocculates, it becomes heavier and begins to sink toward the seafloor. In this manner, the oil could be distributed widely over a large area of the seafloor.

The Big Bend region is considered relatively undisturbed with high water quality. General decline of seagrasses in the Big Bend region has been attributed to increases of both coastal development and accompanying turbidity and contaminants. It is important to document the condition of seagrasses in the Big Bend region as soon as possible to detect any possible effects of contamination by oil and dispersants from the Deepwater Horizon spill.

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. A study by Continental Shelf Associates (1985) mapped seagrass habitat as far offshore as 110 km (70 mi). Both *Halophila 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; previous studies identified species distributions but did not measure quantities or density of grassbeds. At the onset of the Deepwater Horizon spill, a study was already planned to update BOEMRE's knowledge of seagrass in the Big Bend area. New directives and incentives are in place for oil and gas exploration ≥ 125 miles (200 km) from the Florida coast. Based on these pressures and the Deepwater Horizon incident, the BOEMRE should renew its information base for sensitive habitats on the Florida shelf and assess effects and recovery related to the spill. Seagrasses of the Big Bend area are a valuable resource that the BOEMRE must protect. Knowledge of the status of seagrass is important for the BOEMRE 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, algal species, fauna, and contaminants. 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 should be conducted in coordination with another study (GM-08-x13) that is gathering existing data into a GIS interface.

Objective: This study quantitatively surveys the distribution of seagrass communities in Federal waters of the Florida Big Bend region and assesses the effects and recovery from spill effects.

Methods: The study will employ typical survey methods for quantitative analysis of seagrass 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, video, 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. Characterize associated faunal communities (species composition, distribution, abundance, diversity, etc).
6. Sample vegetation and fauna for detection of contaminants potentially related to the Deepwater Horizon oil spill.
7. 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.

Revised Date: September 2, 2010

ENVIRONMENTAL STUDIES PROGRAM: Studies Development Plan FY 2011-2013

Region: Gulf of Mexico

Planning Areas: Central and Eastern

Title: Determining Long-Term Impacts on Phytoplankton Communities during Recovery from the Deepwater Horizon Oil Spill

BOEMRE Information Needs to be Addressed: The results of the study will provide a long-term analysis of changes in phytoplankton assemblages to provide information on ecosystem recovery from the oil spill in the northern Gulf of Mexico.

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

Period of Performance: FY 2011-2015

Description:

Background: In oceanic and coastal waters, the greatest amount of biological production is by the smallest organisms, plankton, which in turn pass large amounts of energy to higher trophic levels. Hence, when plankton are affected by an oil spill, the effects can have impacts all the way up the food chain. Under normal (non-spill) conditions, primary producers in the Gulf of Mexico are composed of a rich variety of algal groups, including for example, cyanobacteria, diatoms, dinoflagellates, and prymnesiophytes. The region of the Mississippi River outflow, which is near the Deepwater Horizon site, has the highest measured rates of primary production in the Gulf of Mexico.

The Deepwater Horizon oil spill may result in a variety of long-term impacts on phytoplankton communities in the northern Gulf. Water quality is currently being impacted by the crude oil and oil/dispersant plumes across vast regions of open ocean waters and coastal waters of northern Gulf States. Research from previous oil spills has demonstrated that the prolonged presence of oil can affect phytoplankton abundance and species diversity. Exposure to oil can have direct toxicity effects on algae by inhibiting growth and photosynthesis through changes in the light field, nutrient availability and uptake, and maximum specific growth rates. Previous research demonstrated that a significant effect could be the stimulation of some species by aromatic compounds of low molecular weight, resulting in the alteration of natural phytoplankton community structure and its trophic relationships. In a mixed culture, competitive exclusion would operate and cause species best adapted to the polluted condition to dominate.

As well, exposure to oil can affect phytoplankton communities, by first impacting the zooplankton and filter feeder communities that consume algae. In one study, researchers showed that zooplankton were virtually eliminated by the presence of oil, which resulted in altered algal species composition and increased phytoplankton biomass. As well, in coastal waters, filter feeders such as bivalve mollusks (clams, mussels and oysters) and polychaete worms filter out and consume huge amounts of phytoplankton, such that oil toxicity impacts on filter feeders would likely be reflected in phytoplankton communities. Finally, although

some research has been performed, more information is needed on the impacts of oil-dispersant mixtures on phytoplankton, especially the specific effects of oil and dispersants from the Deepwater Horizon spill.

Objectives: This study will evaluate the long-term impacts of oil and dispersants on phytoplankton communities in Gulf coastal and oceanic waters that were impacted by the Deepwater Horizon spill. The purpose of this 4-year study is to analyze temporal changes in algal concentrations and species composition in the water column, as well as the environmental forcing factors, through the use of new measurements and historical datasets.

Methods: The objectives of this study will be met through the use of new field measurements, ocean color satellite data, and comparison to previous historical datasets. A variety of measurements will be collected to assess the status of the phytoplankton community, including cell size and concentrations, pigment concentrations, species composition, growth rates and primary production. Such measurements can be made using various standard optical and biogeochemical protocols, either in the laboratory or in the field depending on the specific measurement. As well, time-series of satellite ocean color measurements (such as from SeaWiFS and MODIS) will be analyzed to give a broader spatial and temporal perspective of algal changes. These satellite measurements will likely be ground-truthed with some of the measurements collected in the field during the course of this study. Factors forcing variability in phytoplankton communities will also be measured and analyzed, including hydrocarbon levels, temperature, nutrient and light availability, and grazing pressure. There is a large historical dataset of phytoplankton and auxiliary measurements from the northern Gulf of Mexico that will be compiled and utilized as a baseline for comparison against which recovery of phytoplankton assemblages will be assessed.

Revised Date: September 2, 2010

ENVIRONMENTAL STUDIES PROGRAM: ANNUAL STUDY PLAN FY 2011-2013

Region: Gulf of Mexico OCS Region

Planning Area: Gulf-wide

Title: Assessing an Oxygen Budget for the Gulf of Mexico after the Deepwater Horizon Incident

BOEMRE Information Needs to be Addressed: A better understanding of the oxygen budget for the Gulf of Mexico needs to be determined, especially at depths of about 1,200 m where dispersed oil plumes have been reported, in order to understand what happened when oil, natural gas, and dispersant were released in deep waters. This understanding is critical to evaluating the use of dispersants in deep waters.

Cost Range (in thousands): \$ 850 to \$1,000 **Period of Performance:** 2011-2014

Description:

Background: The Deepwater Horizon incident is the first such incident in deep water and the first time that dispersants have been injected near the sea floor for remediation purposes. The use of dispersants in addition to the unplanned release of oil and natural gas, both carbon sources, into the deep water environment lead to concerns as to whether dissolved oxygen levels in the Gulf of Mexico would drop drastically as a result of microbial degradation. Thus, EPA required monitoring protocols for the use of subsea dispersants. Initial dissolved oxygen data has shown that dissolved oxygen levels appear to remain in the normal range, above levels of immediate concern, despite the use of dispersants (NOAA, 2010a, http://www.noaanews.noaa.gov/stories2010/20100623_brooks.html, EPA, 2010, <http://www.epa.gov/bpspill/dispersants-bp.html>; JAG, 2010). Though not severe, drops in dissolved oxygen have sometimes been seen at or below 1,000 meters; however, there is concern that these drops are a result of oxygen probes being effected by oil in the water (NOAA, 2010b, http://noaanews.noaa.gov/stories2010/20100722_jag.html). Further measurements continue to be released as a result of government monitoring (e.g., the EPA and NOAA) and various research efforts. However, as of this date, it is still not clear what actually happened when oil, gas, and dispersants were released into the deep waters of the Gulf of Mexico. In 2005, the Minerals Management Survey released a report "Understanding the Processes that Maintain the Oxygen Levels in the Deep Gulf of Mexico" MMS 2005-032.

Though the study gleaned much information on the oxygen budget for the Gulf of Mexico, 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 Gulf-wide processes would be useful for studies of pollutant transports at depth." Thus, there is a need to both reassess and build on what is known about oxygen variability in deep waters of the Gulf of Mexico in light of the impacts the Deepwater Horizon incident may have had on oxygen consumption. A better understanding of the

oxygen budget for the Gulf of Mexico needs to be determined, especially at depths of about 1,200 m where dispersed oil plumes have been reported, in order to understand what happened when oil, natural gas, and dispersant were released in deep waters.

Objectives: The goal of this study is to re-evaluate an oxygen budget for the Gulf of Mexico post-Deepwater Horizon and compare that budget to what was known about oxygen variability in deep waters before the event. Special focus should be given to depths of about 1,200 m. Essentially, the study should attempt to reconstruct what happened when oil, natural gas, and dispersant were released into the deep waters in terms of dissolved oxygen levels. This understanding is critical to evaluating the use of dispersants in deep waters.

Method: This study will involve a combination literature and data searches, synthesis, mining, and interpretation as well as numerical modeling. Data from government agencies, contractors, and peer reviewed literature should all be considered. Quality control standards and metadata of used data should be well described. Winkler titration methods are preferred to data collected from oxygen probes. In fact, a side note of this study may be a review of the quality of dissolved oxygen data from these two methods. Additionally, results should be compared to pre-Deepwater Horizon data such as the past BOEMRE report “Understanding the Processes that Maintain the Oxygen Levels in the Deep Gulf of Mexico” MMS 2005-032 and Rivas et al., (2005) whenever possible. Researchers should be mindful of the oxygen minimum zone in the Gulf of Mexico when interpreting their results.

Revised Date: September 2, 2010

ENVIRONMENTAL STUDIES PROGRAM: Studies Development Plan FY 2011-2013

Region: Gulf of Mexico

Planning Area: Central

Title: Oil/Dispersed Oil-Sediment Interactions in Deep Water Environments

BOEMRE Information Needs to be Addressed: Increased knowledge of oil-sediment interactions, especially those in deepwater environments and in the presence of a dispersant.

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

Period of Performance: FY 2011-2013

Description:

Background: The Deepwater Horizon incident is the first such incident in deep water and the first time that dispersants have been injected near the sea floor 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. Ongoing studies are investigating the existence and persistence of dispersed oil plumes in the Gulf of Mexico, but little attention has focused on how the oil has interacted with sediments. Oil in the Sea (National Research Council, 2003) notes that “Much more needs to be learned about how petroleum interacts with marine sediment...” (page 4) and “Much more needs to be learned about oil-sediment interaction...” (page 59). Both physical and chemical processes are of interest including oil-suspended mineral particle (SPM) interactions, oil- mineral aggregate formation (OMA), aggregation/dispersion, absorption/partitioning, sedimentation, and/or transport.

Objectives: The objective of this study is to determine the interactions of oil and dispersed oil with sediment particles in a deepwater environment and to explore sedimentation of the oil.

Methods: The approach to this study is open, but principal investigators should clearly demonstrate that methods are appropriate and likely to be successful. Innovative approaches and cutting-edge technology are encouraged. Lab, tank (Ohmsett), and/or field components are all welcomed in this study. This study should mimic the conditions found during the Deepwater Horizon incident to the greatest extent possible (temperature, pressure, dissolved oxygen, salinity, oil, and dispersant). Field components should be aware of natural seeps in the area.

Revised Date: September 2, 2010

ENVIRONMENTAL STUDIES PROGRAM: Studies Development Plan FY 2011-2013

Region: Gulf of Mexico

Planning Area: Central

Title: Natural Seep Inputs and Their Relation to the Hydrocarbon Inventory of the Gulf of Mexico

BOEMRE Information Needs to be Addressed: This study will result in information BOEMRE needs for both EIS development as well as for better understanding the Deepwater Horizon incident.

Cost Range: (in thousands) \$750-\$1,250 **Period of Performance:** FY 2011-2014

Description:

Background: To assess the affected environment in BOEMRE's Environmental Impact Statements as well as to fully consider the deepwater horizon incident, the background hydrocarbons in the Gulf of Mexico (GOM) from the numerous natural seeps (and resulting slicks) need to be fully evaluated. Though literature is available on this subject, more information is needed. Items to consider are determining an updated volume of oil and natural gas that seeps into the GOM, the seepage rate of the oil and natural gas into the GOM, how seepage varies with time/season, background concentrations of oil and gas in the GOM considering the presence of seeps, and the fate of the oil and gas from seepage. This study may also consider comparing the amount of hydrocarbons introduced into the GOM from natural seeps to: (1) the estimated amount of hydrocarbons introduced into the GOM by runoff, (2) hydrocarbons introduced from oil and gas activities in State waters, (3) estimation of hydrocarbons introduced by oil and gas activities in Federal waters, and (4) other anthropogenic hydrocarbon inputs such as those from the shipping industry.

Objectives: The objective of this study is to better evaluate natural seeps in the GOM in terms of volume, seep rate, variation over time, resulting background hydrocarbon concentrations, and the ultimate fate of seeped oil and natural gas. Comparisons to estimations of the amount of hydrocarbons introduced to the GOM by runoff, State oil and gas activities, federal oil and gas activities, and other anthropogenic inputs are also pertinent depending on the approach and final cost of the study.

Methods: The methodology to approach this study is open and can include any combination of the following: remote sensing techniques, further analysis of existing seismic data, chemical techniques, and a literature synthesis. GIS efforts may also be incorporated into this study. All techniques should be established in the literature and fully described in the final products. Since methane is the primary constituent of natural gas, the study may focus on methane instead of natural gas as a whole. Preference will be given to studies using updated techniques such as those considering any method improvements gleaned as a result of deepwater horizon research efforts.

Revised Date: September 2, 2010

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Offshore Environmental Studies Program

**Fiscal Years 2011-2013
Studies Development Plan
Atlantic OCS Region**

**U.S. Department of the Interior
Bureau of Ocean Energy Management, Regulation, and Enforcement
Atlantic OCS Region
Herndon, VA
2010**

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SECTION 1.0 PROGRAMMATIC OVERVIEW

1.1 Introduction to the Program

On December 10th, 2009 Secretary of the Interior Ken Salazar announced that the Bureau of Ocean Energy Management, Regulation, and Enforcement (BOEMRE) would establish a new regional office in 2010 to support renewable energy development on the Outer Continental Shelf (OCS) off the Atlantic seaboard. 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. Given the extent and magnitude of the expected activity in the mid and north coast areas, the Atlantic Regional Office will provide all Atlantic states with an easily accessible point of contact that is familiar with the state and local governments and sensitive to the issues and efforts underway in the region. The Atlantic OCS Region will be responsible for evaluating leases, rights-of-way (ROWs) and rights-of-use easements for renewable energy activities in an effective, efficient and consistent manner while being responsive to the States, developers and other stakeholders. The new office will implement and manage 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.

The regulatory framework for renewable energy activities was published in April 2009. The Region will issue leases, easements and ROWs for orderly, safe, and environmentally responsible renewable energy development activities and alternate uses of existing facilities on the OCS. To better facilitate this endeavor, the Atlantic Region is establishing inter-governmental task forces to coordinate and collaborate with states concerning renewable energy commercial development activities along the Atlantic coast. These efforts will enable BOEMRE 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 March 2010 Task Force meetings will have been held in ten (10) Atlantic states. These Task Force meetings also allow stakeholders to preview draft RFI's and provide information or research to BOEMRE that may provide guidance during the decision making process.

BOEMRE is also coordinating with other Federal agencies responsible for permitting or authorizing portions of offshore renewable energy projects, such as the National Marine Fisheries Service, Environmental Protection Agency, and Fish and Wildlife Service. Part of these efforts includes identifying information needs from these agencies for integration into the BOEMRE Environmental Studies Program.

Companies have approached BOEMRE with wind, current energy and subsea power cable project proposals and several states initiated efforts to accommodate offshore renewable energy development.

1.2 Map of Planning Area

Figure 1. Atlantic OCS Region Planning Area

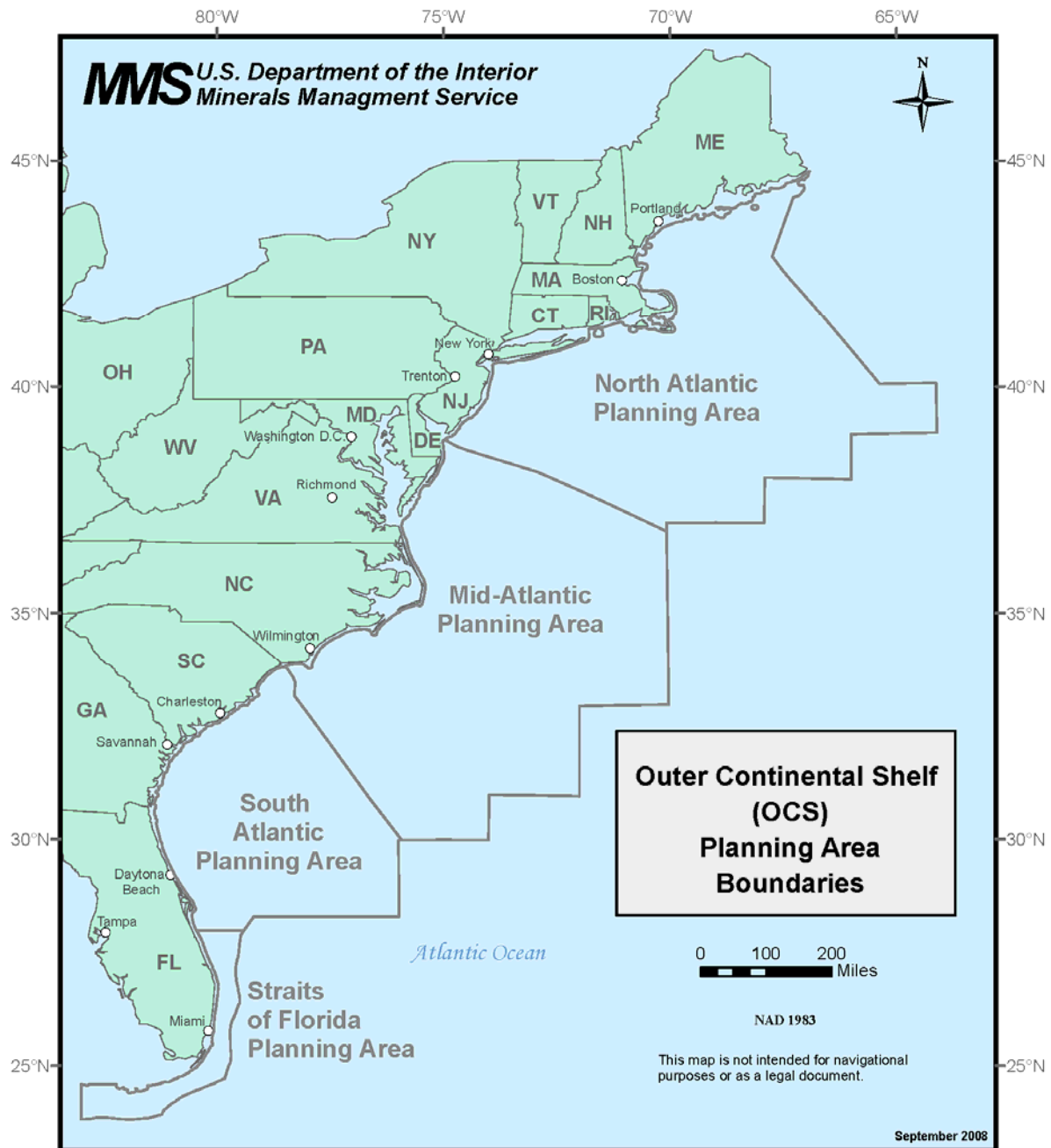
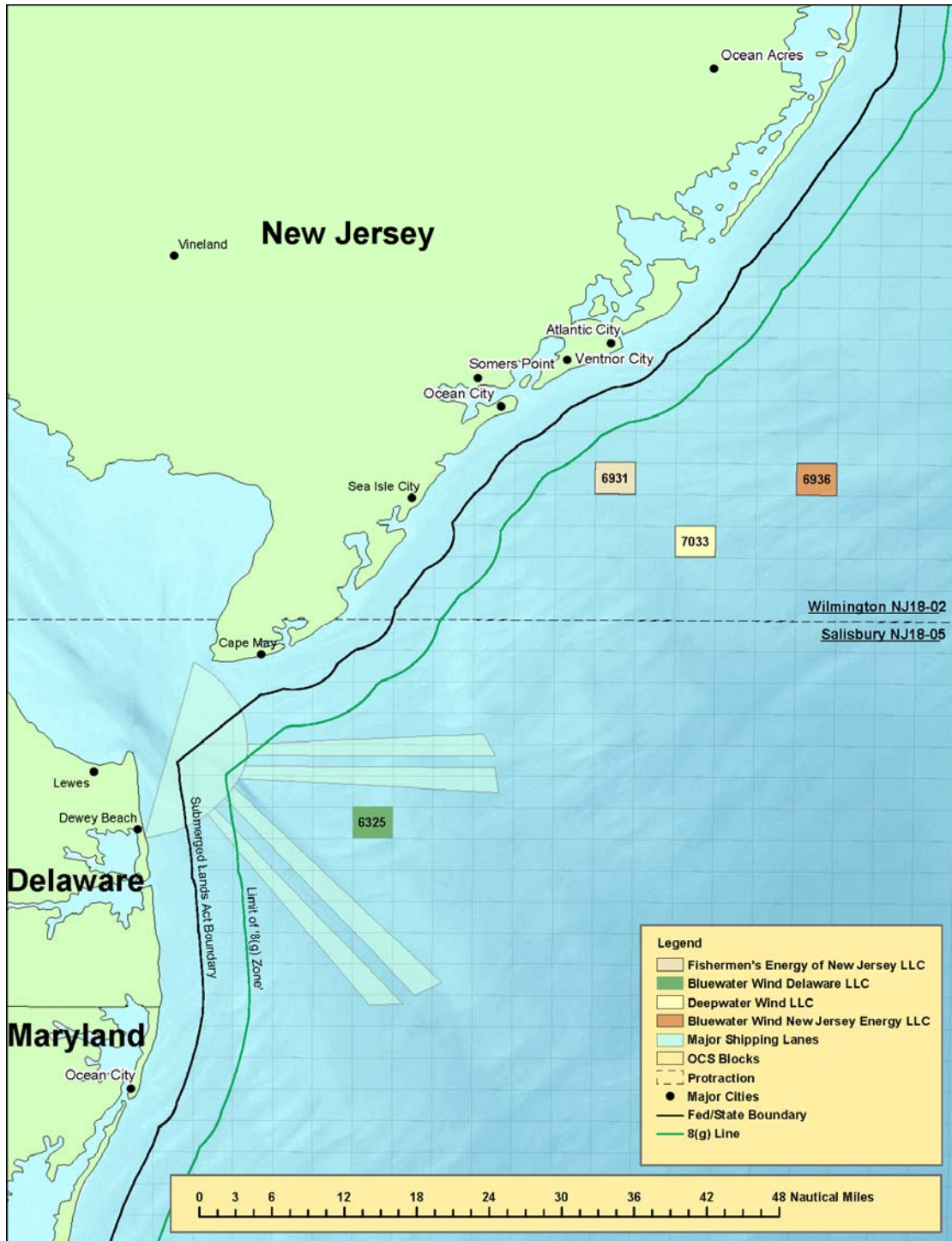


Figure 2. Map of Interim Policy Leases



1.3 Projected OCS Activities

In recent months four Interim Policy leases were signed. Three are located off New Jersey and one is off Delaware. As a requirement of these IP leases a project plan is to be submitted which provides details on fabrication methods, engineering specification, inspections, archeological resources and safety systems for BOEMRE review. It is anticipated that these leases will result in meteorological towers being installed in the spring/summer 2010.

The expectation is that in the next few years, while commercial applications for offshore wind facilities are undergoing permitting and environmental review, offshore activities will focus on evaluation of wind resources using meteorological towers, and technology testing. The focus in the short term for the BOEMRE Environmental Studies Program (ESP) as well as industry will be on collecting information for supporting renewable energy leasing decisions such as basic characterization of the environment where these activities may occur. Some studies will also focus on foundational information needs, such as creating a database of historical properties that may be affected by offshore wind energy development. In the long-term, the potential studies will take advantage of the opportunity to study these technologies during the first stages of development. The information needs will not be site specific but rather focus on a general understanding applicable to a variety of impact producing elements.

Task force meetings have been held in several states. These meetings have resulted in a collaborative effort between state and federal agencies to identify potential areas for lease. BOEMRE will prepare Request for Interest (RFI) documents for publication with input for the task forces and hopes to publish RFI's to the states of Delaware, Rhode Island, Massachusetts, New Jersey, New York, Virginia and Maryland in 2010.

Cape Wind Associates, LLC (Cape Wind) has proposed to construct and operate a commercial-scale wind energy facility offshore Massachusetts, in Nantucket Sound. BOEMRE published the Cape Wind draft Environmental Impact Statement (DEIS) on January 18, 2008 and the final EIS (FEIS) on January 21, 2009. Once regulatory obligations are complete, the BOEMRE will issue a record of decision on the project.

1.4 Identification of Information Needs

The following sections provide a basic discussion of the existing understanding of information needs in the key areas of oceanography, airborne resources, aquatic biology, and social science. This discussion is not meant to be all encompassing but rather provides an initial attempt to define the key areas of information need for BOEMRE as the development of renewable energy projects on the OCS begins.

1.4.1 Oceanography

Development of offshore ocean renewable energy involves the placing of new types of structures in the ocean. The interactions between these structures and the ocean environment,

(i.e., wind, currents, waves, etc.) are yet to be fully understood. While there are engineering concerns with the impacts of the environment on these new technologies, also of interest is the potential alteration of ocean processes, both local and regional, by these technologies. The technologies are designed to harvest the energy from the earth's surface with the underlying premise that the amount used is undetectable, however, as more devices are emplaced, there may be an additive effect. As the new technologies evolve, so must our understanding of how these technologies may impact the overall energetics of the ocean environment.

Wind technologies are the most advanced with the most viable design involving the placement of a monopile, with a diameter of 4 to 5 meters, into the seafloor. To be commercially viable, a large number of these devices must be placed in a relatively small area. Presently, one existing wind facility in Denmark has 80 monopiles, but plans are being made to expand this to 160. Oceanographic processes affected by these devices include wind, waves and currents, and sediment transport both in the near field and far field. In the near field, the wind is affected by the disturbance of the rotors which can create vortices and eddies. The far field effects are only speculative. The monopiles also interact with the local current and wave regime and may create small alterations in flow, again possibly creating eddies or altering wave patterns. Alteration of waves and currents can also lead to changes in the sediment transport in the area. In the near field, scour can occur around the monopiles, while in the far field, alterations in the longshore transport of sediment may occur. The existing wave regime at proposed sites may determine whether a site can be developed. Because the wind turbines will require regular maintenance, the wave environment must be such that service vessels can reach the turbines.

It is anticipated that the first wind facilities will utilize monopole structures. Although the alteration of the environment, including artificial reef formation, associated with installation of lattice work structures has been extensively studied by BOEMRE for oil and gas structures, the installation of tens to hundreds of these monopole placed in relatively close proximity may provide a different type of interaction.

The height of the monopole structures can exceed 300 feet. Lighting will be required to meet Federal Aviation Administration requirements while minimizing impacts to birds, sea turtles, fish and other marine species as well as the human element. Evaluation of various potential lighting schemes is needed to determine which configuration best meets the needs with the least impacts for offshore facilities.

Ocean current technologies involve an underwater turbine that extracts the energy from the current. The turbine is attached to the seafloor by either tethering or a foundation structure. These technologies are still in the testing phase and the final design is unknown. A large number of devices may be placed in a relatively small area and the additive effects of extracting energy from an ocean current are unknown. Scour around the base of these devices is a major concern, since they would be placed in a high energy current regime.

1.4.2 Airborne Resources

In the United States there are more than 200 species of birds that regularly use or travel over the waters of the Federal OCS, therefore, any proposed wind project would potentially impact an avian resource involving a subset of these species. Because of the impracticability to study such vast number of species at once it is useful to divide birds into different groups or guilds that have similar behaviors while recognizing that these terms are overlapping and their usage varies.

- Seaducks (e.g., eiders, scoters, long-tailed duck)
- Seabirds (e.g., pelagic species such as gannets, petrels, shearwaters)
- Waterbirds (e.g., loons, grebes, cormorants, alcids, gannet, gulls)
- Passerines (e.g., thrushes, warblers, sparrows)
- Raptors (e.g., eagles, hawks, falcons, owls)
- Shorebirds (e.g., piping plovers, red knots, willits, least terns, godwits, curlews)

The evaluation of the impact of a wind project on avian resources requires information about avian resources pre- and post-construction. Potential impacts to birds from offshore wind development involve two major factors: direct collision with wind turbine generators (WTG) or behavioral changes due to the presence of WTGs. Effects of WTGs may include: avoidance of the specific area, barriers to movement (migration, feeding flights), increased energy expenditure, and attraction (feeding and resting sites).

To assess those effects, there is currently a lack of information in key areas. First is knowledge of avian resource (endangered and non-endangered) distribution, movements, and behavior in the specific regions of likely offshore wind energy development. There are currently large gaps in data on the general distribution and abundance, flight patterns (during good weather, nocturnal and inclement weather), and behavior during migration, wintering, foraging, and staging for most avian species that utilize the offshore environment. The second is an understanding of the mechanisms underlying the attraction or avoidance of avian resources to offshore wind facilities.

The current understanding of potential impacts of offshore wind projects on birds is based on the knowledge of the geographic distribution and behavior of certain species, past studies of onshore wind farms, and on environmental studies conducted at existing offshore wind farms overseas.

Avoidance behavior has been documented with seaducks at offshore wind projects in Denmark and Sweden. This occurs when a population of birds that normally would have flown over the preconstruction project area now flies around the developed wind project. The avoidance is triggered by a visual (and possibly auditory) response to the turbines. The significance of such impacts depends on the energetic consequences of the additional flight necessary to circumnavigate wind projects.

Avoidance behavior has also been documented for a variety of waterbird species at European offshore wind projects. This occurs when a population of birds that normally would have fed in the preconstruction project area does not do so after the project is built. The significance of such impacts depends on whether birds can find suitable alternative feeding grounds. Depending on the significance of the impacts from individual projects, accrued impacts from multiple projects have the potential to be significant.

Attraction behavior has been documented for a variety of waterbird species in Europe. The attraction is caused by new food sources (e.g., fish, invertebrates) inhabiting the wind farm area that did not inhabit the area before construction. This new food source is likely generated from increased productivity created by the hard substrate of WTGs in the water column. The attraction also may be caused by perching opportunities offered by the service access platforms of the turbines or other platforms associated with the wind project. The benefit of the new food resource and perching sites potentially increases risk of collision with turbines.

Attraction behavior has also been documented with certain types of artificial lighting that may be used for aviation or navigation obstruction lighting on turbines. It has also been documented with permanent lighting on oil platforms and boats (Michel et al., 2007). In this case, the attraction behavior very likely is caused by a disruption in the physiological senses birds use for navigation at night (Michel et al., 2007). The ensuing disorientation may cause birds to fly in the vicinity of the artificial light for extended periods of time. This results in unproductive energy expenditure and increased risk of collision with wind turbine structures.

The potential magnitude and significance of these impacts may vary greatly between wind project sites. Any specific wind project may have most of the guild groups mentioned above plus specific subgroups or species that raise regional attention. In some areas, endangered species such as the piping plover and roseate tern are a concern.

Interactions between migratory bat species and offshore wind turbines are also unknown. Existing information is based on anecdotal reports of bats observed offshore. Basic information about whether and which bats may be at risk must first be gathered prior to determining whether additional studies are needed.

1.4.3 Aquatic Biology

To help determine areas where information is needed to make environmentally sound decisions about future alternative energy development, BOEMRE contracted for a literature synthesis (Michel et al., 2007). Many of the issues cut across resources such as benthic resources, fishery resources, marine mammals, and sea turtles. The effects of sediment suspension and redistribution and smothering are a concern for benthic organisms in addition to habitat addition, loss, and alteration. Fish and motile benthic organisms may be affected by loss of habitat, noise during construction and operation and attraction to and avoidance of facilities by predators and prey. Marine mammals and turtles may be impacted by habitat loss, noise during construction, collisions with vessels or entanglement in cable moorings. Other factors that could result in impacts to marine life include effects of sound, lights, electromagnetic fields, and contaminants. The siting of these facilities is critical to

minimizing the impacts and requires an understanding of the locations of sensitive biological habitats through mapping. Evaluations of these potential impacts will be needed in development areas, both regionally and on a site-specific basis.

As new facilities are constructed and decommissioned, sediments in the area will be disturbed by activities such as vessel anchoring, pile driving, cable trenching, and facility removal procedures. A change in the grain size in the immediate vicinity of the activity as the fine components of the sediment are winnowed away can have an effect on the benthic species assemblage utilizing the area after the activity ceases. A change in the benthic community can affect higher trophic levels due to changes in the prey composition. The suspension of sediment in the water column temporarily alters light availability which can affect primary productivity and the ability of mobile species to find prey and avoid predators. As the sediments settle back to the bottom, benthic species can be smothered.

The introduction of new hard substrate where facilities are placed causes both the loss and addition of habitat. The existing soft sediment substrate is replaced by hard substrate in the form of piles and scour protection for wind facilities, and housings and anchors for wave and current facilities. As mentioned above, the placement of such facilities can alter the existing habitat where grain sizes are changed. The facilities will provide habitat for different communities of pelagic organisms by creating vertical structure in the water column and by making hard substrate available for the attachment of benthic organisms. Waves and currents within an array of structures may be altered, potentially making the area more or less suitable depending on individual species preferences. Addition of structure in an area where none existed previously creates an artificial reef effect. This can also provide stepping stones for the expansion of species ranges, both native and invasive.

Large structures placed in the water have been shown to attract fish. Where the prey is concentrated, predators also will follow. Conversely, an array of structures may be avoided by some species due to noise, electromagnetic fields or the physical obstruction. Where these species are of commercial or recreational value, the fisheries industry may be affected. When species are attracted to the structure of the array, they may be afforded some protection from fishing pressure due to their proximity to the facility if boats cannot reach them.

Anywhere vessels travel or facilities are placed, there is the risk of animals colliding with them or becoming entangled in anchor lines or cables. Collision and entanglement are of particular concern for threatened and endangered species of marine mammals and sea turtles.

The construction, operation and decommissioning of offshore renewable projects will introduce sound into the marine environment (e.g., pile driving and vessel noise). Marine mammals and other marine life (e.g., sea turtles, fish) rely on sound to communicate, find mates, navigate, detect predators, and to gain information about their environment critical to survival and reproductive success. Current information suggests that anthropogenic noise (human-induced sound), in certain situations, can affect marine mammals, fish and sea turtles. Some of these impacts may be immediately detectable (i.e., injury, observed avoidance of an area) while others may be more subtle or difficult to detect (i.e., masking important intraspecies communication, deterring animals from preferred breeding or foraging habitat,

interrupting important behavior such as nursing and caring for young). Further, sound perception and sensitivities vary by species, and even individuals within a species. The ultimate question is to discover at what point does anthropogenic noise interfere with the animals' functions (behavioral and physiological) such that it becomes disruptive to important biological processes (i.e., breeding, feeding, reproductive success) and possibly biologically significant. Further research is key to answering this challenging question.

Platforms that are brightly lighted at night have been shown to attract fish that are normally diurnally active because the lights enable them to continue hunting even at night. The effect of electromagnetic fields on sensitive benthic and fish species, especially elasmobranchs, is incompletely understood. These fields could attract or deter animals. They could also affect a species' ability to locate prey, avoid predation or navigate. The reintroduction of contaminants into the water column during disturbance of the sediments is possible. Contaminants may also be introduced to the environment through spills or antifouling coatings. Careful consideration of these potential impacts is necessary in advance of development. A complete picture of benthic habitats, the distributions and abundances of key species, and species use of habitats is important for making siting plans. Understanding habitat value, rarity and connectivity is essential to making environmentally sound choices for facility placement.

A complete picture of benthic habitats, the distributions and abundances of key species, and species use of habitats is important for making siting plans as well as determining methods and timing for construction. Understanding habitat value, rarity and connectivity is essential to making environmentally sound choices for facility placement. Detailed assessments of species abundances are a critical component of proper evaluation and mitigation of impacts of activities. It is necessary to have information on the seasonal and inter-annual variability in distribution at smaller spatial scales to estimate potential for mortality or other impacts on protected species due to localized activities.

1.4.4 Social Science

Alternative Energy on the OCS is an emerging industry in the U.S. In order to fully comprehend the effects this industry may have on social and economic institutions the first step for BOEMRE was to embark on a studies that capture these unique aspects of OCS alternative energy development.

Considering there has yet to be any OCS alternative energy development in the U.S. it is important to understand the baseline in which the industry will operate. That is, the energy market itself, capacity and the infrastructure needed are important to understand. How energy is produced and sold is a complex phenomenon. This, along with aspects of supply and demand in terms of geographic locations and type of energy used, is an important starting point in determining energy need. Critical to this market is the potential for the costs of energy to change with the introduction of new OCS alternative energy projects, perhaps with an initial rise in price followed by a drop after several years.

While developing the basis of understanding with respect to energy infrastructure and markets, the effects of these actions on society and economy must be examined. In order to do this BOEMRE proposed a social and economic literature synthesis and workshop to aid in the development of a social science studies strategy for alternative energy.

Currently and to aid in the siting of technology testing and data gathering devices (see section 1.3 Projected OCS Activities), there is a need to better document space-use on the OCS. Alternative energy on the OCS has the potential to conflict with other OCS uses. These uses may include oil and gas, sand and gravel, sea navigation, marine protected areas, recreational and commercial fishing, recreational boating, tourism, etc. The various space-uses should be documented, geospatially, in order for BOEMRE to minimize conflicts and incorporate mitigation when decisions are made to develop areas of the OCS with multiple uses.

Following the workshop and the space-use study a social science research strategy will emerge. Nevertheless, there are some key issues which have become apparent throughout the development of the alternative energy program. The draft environmental impact statement and public hearings for the Cape Wind Energy project revealed that commercial fishing is a critical area that must be investigated thoroughly prior to any type of siting. Currently many of the shallow shoals that provide fish resources are also areas where wind developers are interested in placing wind parks. These areas also have potential to be recreational areas where boaters and recreational fisherman frequent. Therefore studies are needed that assess the impact from OCS alternative energy activities with respect to commercial fishing and recreation. This information will undoubtedly be needed for planning purposes and decision-making.

Alternative energy in the U.S. has many supporters but also many opponents. Indeed, Cluck (1998) maintains that environmental attitudes in the U.S. have been institutionalized across regions and demographic groups. Until recently with the work of (Krueger, 2007) it was somewhat unclear how this institutionalization manifested itself. Krueger (2007) found that in Delaware, people are willing to pay more for electricity each month in order to bring OCS wind power to the state. Attitudes for OCS wind development are incredibly supportive and show a commitment and desire on the part of residents to move towards renewable energy as a source for electrical generation as opposed to the status quo of the current energy mix. Indeed, this research shows that people in Delaware care where their energy comes from. Studies such as this allow the Federal government to work with states in order to obtain a clear picture of how residents see the future of energy development. This allows states and communities to be proactive in their decision-making process.

1.5 New Starts for FY 2010 and Ongoing Studies

Table 1 lists new studies planned to start in FY 2010 and ongoing studies, categorized by discipline. Profiles for these studies can be found at:

<http://www.boemre.gov/eppd/sciences/esp/RenewableEnergyResearch.htm>

Table 1. Atlantic OCS Region New Starts for FY 2010 and Ongoing Studies

Program Lead	Planning Area	Start FY	Discipline	Study Title
NEW STARTS				
BOEMRE	ATL	10	HE	Acoustic Monitoring of Temporal and Spatial Abundance of Birds Near Structures on the OCS of the Atlantic and Gulf of Mexico
BOEMRE	ATL	10	HE	Pilot Study of Aerial High-Definition Video Surveys for Seabirds, Marine Mammals, and Sea Turtles on the Atlantic OCS
BOEMRE	ATL	10	FE	Characterization & Potential Impacts of Noise Producing Construction & Operation Activities on the Outer Continental Shelf (OCS)
BOEMRE/ NMFS/USN	ATL	10	MM	Atlantic Marine Assessment Program for Protected Species (AMAPPS)
<i>*Note: The procurement of any study is contingent upon availability of funding</i>				
ONGOING STUDIES				
<i>Social Sciences</i>				
BOEMRE	ALT	08	SS	Evaluation of Visual Impacts in Historic Properties
BOEMRE	ATL	07	SS	North and Central Atlantic Information Resources: Data Search and Literature Synthesis
BOEMRE	ATL	09	SS	Inventory and Analysis of Archaeological Site Occurrence on the Atlantic OCS
BOEMRE	ATL	09	SS	OCS Renewable Energy and Space-Use Conflicts and Related Mitigation
BOEMRE	ATL/PAC	08	SS	Energy Market and Infrastructure Information for Evaluating Renewable Energy Projects for OCS Atlantic and Pacific Regions

<i>Fates & Effects</i>				
BOEMRE	ATL	09	FE	Effects of EMF from Transmission Line on Elasmobranches and Other Marine Species
<i>Information Management</i>				
BOEMRE	ATL	08	IM	Compendium of Avian Information and Comprehensive GIS Geodatabase
<i>Marine Mammals and Protected Species</i>				
BOEMRE	ATL	08	MM	Potential for Interactions between Endangered and Candidate Bird Species with Wind Facility Operations on the Atlantic OCS
<i>Habitat & Ecology</i>				
BOEMRE	ATL	09	HE	Determining Night Time Distribution of Long-Tailed Ducks Using Radio Telemetry
<i>Physical Oceanography</i>				
BOEMRE			PO	
<i>Other (Research Partnerships)</i>				
BOEMRE Technology Assessment and Research Program (TAR)				
National Marine Fisheries Service (NFMS)				
U.S. Navy (USN)				
Discipline Codes AQ = Air Quality FE = Fates & Effects HE = Habitat & Ecology IM = Information Management MM = Marine Mammals and Protected Species PO = Physical Oceanography SS = Social Sciences SE = Social & Economic				
Planning Area Codes Atlantic = ATL (Headquarters Managed) Pacific = PAC				

SECTION 2.0 PROPOSED STUDY PROFILES

2.1 Introduction

The following sections focus on the proposed studies for FY 2011 and FY 2012.

2.2 Profiles of Studies Proposed for FY 2011 NSL

Table 2. Atlantic OCS Region Studies Proposed for the FY 2011 NSL

Page #	Discipline	Title	Rank
15	FE	Evaluation of Lighting Schemes for Offshore Wind Facilities and Impacts to Local Environments	1
17	FE	Potential Artificial Reef Effects of Offshore Wind Facilities	2
19	AQ	Synthesis, Analysis, and Integration of Air Quality and Meteorological Data for the Atlantic Region	3
AQ = Air Quality FE = Fates & Effects HE = Habitat & Ecology IM = Information Management MM = Marine Mammals and Protected Species PO = Physical Oceanography SS = Social Sciences			

ENVIRONMENTAL STUDIES PROGRAM: Studies Development Plan FY 2011-2013

Region: Atlantic

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

Title: Evaluation of Lighting Schemes for Offshore Wind Facilities and Impacts to Local Environments

BOEMRE Information Need(s) to be Addressed: The lighting of offshore wind facilities will determine the level of impact to the surroundings as well as provide for the safety of other users of the area.

Cost Range: (in thousands) \$175-\$225

Period of Performance: FY 2011-2012

Description:

Background: The selection of lighting for offshore wind facilities will require the balancing of several requirements. The lighting will need to meet Federal Aviation Administration requirements while minimizing impacts to birds and onshore development. Various lighting schemes for onshore wind facilities and communication towers have been evaluated for their interaction with birds, as well as impacts to nearby housing developments or historic properties. The impacts involve the intensity of the light, the color, how the light is directed, and the rate of blinking. The best scheme for offshore facilities may differ because of the configuration and size of the wind towers and for their potential to interfere with established flight patterns. Also, because of their height, these lights may be visible from shore and impact coastal communities and historic properties.

Lighting near the sea surface will need to meet Coast Guard requirements as well as minimize effects on sea turtles, fish, and other marine species. The configuration of the facility, the location of shipping lanes, and the type of vessels allowed within the facility will be important for determining the type of lighting. Lights may attract turtles, fish, and possibly marine mammals.

Objectives: This study will evaluate the potential lighting schemes for offshore wind facilities, describe air traffic and vessel traffic usage along the East Coast and how that will affect lighting options, and the impacts of these lighting options on marine and coastal species and the human environment.

Methods: The methodology will consist of a literature review, data collection from public sources, discussions with FAA and US Coast Guard representatives, and analysis and synthesis of the collected data and information.

Revised Date: January 22, 2008

ENVIRONMENTAL STUDIES PROGRAM: Studies Development Plan FY 2011-2013

Region: Atlantic

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

Title: Potential Artificial Reef Effects of Offshore Wind Facilities

BOEMRE Information Need(s) to be Addressed: The installation of offshore wind facilities will lead to the creation of artificial reefs. The base of each monopile will include scour protection that could be created from a number of materials, resulting in a range of impacts. Information about the alteration of the environment is needed for BOEMRE approval of different scour prevention materials. Stakeholders have raised concerns about the potential impacts of this altered ecosystem to local marine species and commercial fishing.

Cost Range: (in thousands) \$175-\$225

Period of Performance: FY 2011-2012

Description:

Background: Wind facilities will involve the installation of tens to hundreds of structures in a relatively small area leading to the creation of artificial reefs. Each monopile may require the use of scour pads or some other material to reduce sediment transport around the base. These materials will also increase available hard substrate and further the creation of an artificial reef system. The BOEMRE has extensively studied the alteration of the environment by the placement of oil and gas structures on the OCS. The interaction of oil and gas structures is very different, providing a lattice work of surface area. Monopiles will consist of a single cylinder with a diameter of approximately 5 meters. However, tens to hundreds of these will be placed in relatively close proximity providing a different type of interaction. Scour protection will also add a different type of substrate to the local environment.

The first wind facilities are expected to be placed along the Atlantic coast in relatively shallow water (~20 meters). This study will build on information gathered from the compilation of information about benthic habitats and examine the potential impacts from placing these structures in the existing mix of hard and soft substrate. Available information on the effects of similar marine structures and materials is to be included. Artificial reef effects of concern include alteration of the benthic environment, attraction of fish species, attraction of prey for marine mammals and sea turtles, creation of a protective environment that attracts sea turtles, and potential range expansion of both native and invasive species. The study will also summarize the different types of scour protection currently available and the potential impacts to the environment as well as performing a literature search of information and studies of the effects that have been seen on existing turbines in Europe and other locations.

Objectives: This study will evaluate the potential artificial reef effects from the development of offshore wind facilities along the Atlantic Coast. The study will also summarize and evaluate various scour protection materials and their potential to affect the benthic environment.

Methods: The methodology will consist of a literature review, calculations of potential areas of effect, gathering information from key scientists, and analysis and synthesis of the collected data and information.

Revised Date: March 30, 2010

ENVIRONMENTAL STUDIES PROGRAM: Studies Development Plan FY 2011–2013

Region: Atlantic

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

Title: Synthesis, Analysis, and Integration of Air Quality and Meteorological Data for the Atlantic Region

BOEMRE Information Need(s) to be Addressed: The Atlantic region is lacking readily available data for the purposes of analysis and modeling.

Cost Range: (in thousands) \$450

Period of Performance: FY 2011-2015

Description:

Background: Federal and private organizations have collections of meteorological, air quality and emissions data for the Atlantic Region. These data can be used to support various air quality related data analysis and modeling activities. A data synthesis study can assemble all available data from a variety of resources into a single dataset so that an integrated analysis of the data can be conducted. This study is to be similar to GOMR studies; 2009-055, 2009-056, 2009-057 and 2009-058.

Objectives: The objective of this analysis is to prepare an integrated dataset that can be used to provide the basis for an improved understanding of the relationships between meteorology, air quality and emissions in the Atlantic region; and to support future regulatory data and modeling analyses related to ozone, fine particulate matter and regional haze. The data synthesis study should also include some basic analyses of the data to ensure the integrity and usability of the dataset, and to provide new information about meteorological and air quality conditions in the Atlantic region.

Methods: This data synthesis should incorporate pre-existing data and study results, as well as new. For example, data from the U.S. Environmental Protection Agency (EPA) Air Quality System (AQS), the National Weather Service (NWS) and the National Data Buoy Center (NDBC) can be included. The deliverable should be an interactive database tool that has query capabilities in order to retrieve specific subsets of the data based on criteria such as date range, location and parameter type.

Revised Date: June 21, 2010

2.3 Profiles of Studies Proposed for FY 2012 NSL

Table 3. Atlantic OCS Region Studies proposed for FY 2012 NSL

Page #	Discipline	Title
23	IM	Information Synthesis on the Potential for Bat Interactions with Offshore Wind Facilities
25	FE	Survey and Evaluation of Potential Environmental Effects from Anti-fouling Paints, Lubricants, Hydraulic Fluids and other Chemical Products Potentially used at Offshore Facilities
27	SS	The Economic Impact of OCS Wind Development on Commercial Fishing
29	SS	Recreation and Tourism in the Atlantic Region

ENVIRONMENTAL STUDIES PROGRAM: Studies Development Plan FY 2010-2012

Region: Atlantic

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

Title: Information Synthesis on the Potential for Bat Interactions with Offshore Wind Facilities

BOEMRE Information Need(s) to be Addressed: The potential for impacts to bats from offshore wind development was identified as an area of concern by stakeholders. Basic information as to whether any bat species are at risk is unavailable at this time. The information may be needed for environmental reviews of proposed wind facilities.

Cost Range: (in thousands) \$75-\$125

Period of Performance: FY 2012-2013

Description:

Background: Of the 45 species of bats found in the continental United States, six are federally-listed as endangered under the Endangered Species Act (<http://endangered.fws.gov/bats/bats.htm>). Further, many bats are at risk due to the spread of the devastating disease, white-nose syndrome.

A workshop on renewable energy environmental information needs identified the use of the OCS by migratory bats as an area of concern (Michel and Burkhard, 2007). In a couple of instances, land-based wind facilities were sited in areas of bat migration, resulting in mortality of some of the bats. Not surprisingly, there is concern that in some locations bats may be at risk from offshore wind facilities. Although bats have been observed foraging for insects around onshore and offshore wind turbines, bats generally migrate offshore at low altitudes at <10 m above the ocean surface (Ahlén et al. 2009). Thus, the risks to bats offshore may not be identical to the risks on land. Currently, no comprehensive summary exists for the characterization of the use of coastal and offshore areas by bats.

Objectives: The objective of the study is to collate information about bats and their potential occurrence on the OCS.

Methods: This study will synthesize existing information about bat species that occur along coastal areas, summarize bat sightings, and identify species and behaviors of bats. This information will be used to help assess risks to bats from potential offshore wind energy facilities. The deliverables will consist of a literature review (national and international); data collection from public sources; discussions with key scientists; and analysis and synthesis of the collected data and information into a GIS relational database and final report.

Revised Date: March 23, 2010

ENVIRONMENTAL STUDIES PROGRAM: Studies Development Plan FY 2010-2012

Region: Headquarters

Planning Area(s): All

Title: Survey and Evaluation of Potential Environmental Effects from Anti-fouling Paints, Lubricants, Hydraulic Fluids and other Chemical Products Potentially used at Offshore Facilities

BOEMRE Information Need(s) to be Addressed: Offshore renewable energy facilities will require the use of anti-fouling paints, lubricants, and hydraulic fluids among other chemicals. These chemicals will come into contact with the marine environment either directly or through small spills. The impacts will depend on the composition of the paint, lubricant, or fluid used. BOEMRE needs information about these chemicals to develop appropriate mitigation measures.

Cost Range: (in thousands) \$100-\$150

Period of Performance: FY 2012-2013

Description:

Background: The installation of commercial facilities for the generation of electricity through renewable energy will require the use of tens to hundreds of devices. Each of these devices will be painted with anti-fouling paints and will use lubricants and hydraulic fluids. Some paints and fluids have the potential to cause greater or lesser impact to the environment depending on the composition. Stakeholders have expressed their concern about the types of chemicals that may be used (Michel and Burkhard, 2007). In the past, antifouling paints have included chemicals such as tributyltin and copper, which can have detrimental impacts to the environment. Other types of chemicals or products that may be used include blasting agents for surface preparation and coatings used above the waterline. The potential impacts to the environment will depend on the frequency with which the chemicals are replaced or reapplied and a description of the application process. The BOEMRE will need to evaluate the potential environmental impacts from the use of these chemicals and must ensure that appropriate chemical handling procedures and spill response are used.

Objectives: The study will compile information about the various types of anti-fouling paint, lubricants, hydraulic fluids, and other chemicals or products available and identify, where possible, the potential environmental impacts from the use of these chemicals. The study will also evaluate spill response capabilities for the potential types of spills.

Methods: The methodology will consist of a literature review, data collection from public sources, discussions with key industry representatives, and analysis and synthesis of the collected data and information.

Revised Date: March 12, 2009

ENVIRONMENTAL STUDIES PROGRAM: Studies Development Plan FY 2011-2013

Region: Atlantic

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

Title: The Economic Impact of OCS Wind Development on Commercial Fishing

BOEMRE Information Need(s) to be Addressed: Concerns have surfaced on the potential impacts that OCS wind development may have on commercial fishing. These impacts are not currently well understood. Results of the study will be used in BOEMRE Atlantic Region environmental assessments.

Cost Range: (in thousands) \$500-\$750 **Period of Performance:** FY 2012-2013

Description

Background: The Atlantic OCS Region extends from the Canadian border to the tip of Florida. The diversity of fish resources is large and the manner of fishing varied. In New England and the northern mid-Atlantic offshore banks and major inshore marshes and estuaries are important habitats and fishing areas. In the southern mid-Atlantic and eastern Florida open water and reefs are important for fish resources and fishing. Fishing along the Atlantic seaboard supports direct and indirect food sales, industrial processing, and provides valuable recreational experiences. In 2008, commercial fishery landings in the Atlantic Region totaled approximately 1.4 billion pounds with a value of over \$1.43 billion. (NOAA, 2008) A number of offshore areas have been declared Habitat Areas of Special Concern under EFH and major inshore bays, estuaries, and seagrass beds are under various programs of protection and management. The information concerning all aspects of fish resources and fishing on the Atlantic seaboard is broad.

The BOEMRE is considering renewable energy development from southern New England to southern Florida. Key challenges relative to Atlantic Region fisheries are to minimize space-use conflicts, estimate artificial reef effects, avoid habitat alteration, reduce noise from pile driving, and moderate effects from electromagnetic fields, if any. For the Atlantic Region, the most noteworthy gap related to fisheries is that regarding potential space-use conflicts for commercial fishing, especially for the mid-Atlantic Region. The concern relates to the potential economic loss to fisheries. Alternately, offshore wind facilities could be de facto protected areas and possibly beneficial to fisheries.

It is important to note that this study will focus on commercial fishing effects in particular, as opposed to space-use conflicts in general (social, cultural, other economic, etc.), which are being examined under the 2009 study “AE: OCS Renewable Energy and Space-Use Conflicts and Related Mitigation”.

Objective: The objective of this study is to assess the potential economic burdens or benefits to commercial fishing along the Atlantic coast.

Methods: Information about major fishing grounds along the Atlantic coast will be collected in a form compatible with georeferencing. Interface will be established between these fisheries and the locations where industry interest on the OCS has occurred and been documented. Estimates will then be made as to the potential economic loss to these specific areas. Additionally, the literature on marine protected areas will be investigated for insights on commercial fishers.

Revised Date: March 23, 2009

ENVIRONMENTAL STUDIES PROGRAM: Studies Development Plan FY 2011-2013

Region: Atlantic

Planning Areas: North, South, and Mid-Atlantic

Title: The Impact of OCS Wind Development on Recreation and Tourism in the Atlantic Region

BOEMRE Information Needs to be Addressed: Concerns have surfaced on the potential impacts that OCS wind development may have on recreation and tourism. Information on how these effects manifest themselves should be better understood in order for better decisions to be made with respect to specific locations and the economic impacts that may occur. Results of the study would be applied to all BOEMRE Atlantic Region environmental assessments.

Cost Range: (in thousands) \$275-\$300

Period of Performance: FY 2011-2012

Description:

Background: Possible OCS-related impacts on tourism and recreation - from such impacting factors as oil spills, noise, use conflicts, alteration of viewsapes - are commonly major stakeholder concerns. In coastal areas of the United States, recreation and tourism account for large portions of the local economy. Indeed, for many coastal areas, they are the base on which the economy rests. These economic sectors are also often perceived to be an integral part of a coastal way of life.

One important step in the assessment of possible OCS-related impacts on tourism and recreation is to develop consistent and inclusive measures of economic activity and employment that is generated by those sectors of the local economy. A related step is to develop consistent and inclusive measures of the subsets of those sectors that are built on environmental amenities that might be affected by OCS activities. BOEMRE assessments address substantial coastal and near-coastal areas of affected states. These areas have large tourism and recreation industries, but not all of these activities are at risk. Beach use, ocean boating and fishing, coastal bird watching might be affected by an oil spill, for example, but visiting New Orleans or using an inland state park would not be.

Objectives: The objectives of the study are to:

- synthesize the literature about recreation and tourism in coastal counties near areas being considered for OCS activities, and
- develop for these counties estimates of economic activity and employment from recreation and tourism activities from OCS activities or accidents.

Methods: BOEMRE has developed a methodology for estimating county-level economic activity and employment generated by recreation and tourism sectors of the economy, and for estimating the portion of those that are built on environmental amenities that might be

affected by OCS-related activities. This study will apply that method to Atlantic and near Atlantic coastal counties and develop procedures to streamline the acquisition and analysis of data used.

Revised Date: August 31, 2010

SECTION 3.0 TOPICAL AREAS FOR FISCAL YEAR 2011 AND BEYOND

Topical areas for future studies of environmental concerns for alternative energy development include continued collection of baseline data in frontier areas; monitoring of projects during construction and operation; future environmental concerns for specific technologies; and cross-cutting issues that apply to any development on the OCS. Topical areas also include overarching themes such as global climate change and the benefits of OCS energy development. Questions arise such as: Will development of renewable energy make a difference in global climate change by decreasing greenhouse gases? Skeptics suggest that it would take many years to reverse the trends. However others suggest that these steps towards renewable ocean energy are critical for the US to take. These issues will be explored using scientific information from around the world.

3.1 Baseline Data

Of critical importance is the collection of baseline data prior to development. Baseline information for key species such as fish, birds, marine mammals, invertebrates among other biological resources are important to obtain in areas of new development. Initial studies were identified earlier in this plan that focus on the initial areas of interest, but as development expands, new areas will require syntheses of existing data as well as the collection of new information. Indeed, many scientists suggest a minimum of two years of data is necessary. Baseline information will be used to better understand ecosystem dynamics and evaluate the alteration in habitat as a result of alternative energy development. Scientists must also identify coastal threatened and endangered species of plants, insects and sea-grass. In addition, baseline data of human uses of the ocean is important to collect. This involves data on fishing, navigation, subsistence and general recreational uses.

3.2 Monitoring

Since offshore alternative energy has not yet been developed, a great opportunity is available to monitor the interactions between the technology and the environment as the technology is being developed, deployed, and operated. An overall theme is to develop standardized monitoring protocols. This includes protocols for monitoring fish, turtles, marine mammals, birds, benthos, etc. How do you measure the impact of facilities on these resources? What levels of impacts are significant? If impacts are significant, how are they mitigated? Questions arise as to the best monitoring technologies to use in order to assess the interaction of technology with the environment. Many scientific monitoring technologies are currently under development, many with promising results.

Certain species are of particular concern because of their designations as threatened or endangered such as the North Atlantic right whale, piping plover, and roseate tern along the Atlantic Coast. Monitoring of these species and potential impacting factors during construction such as pile driving and vessel traffic will need to be conducted.

Monitoring of facilities for attraction of sea turtles by lights and food sources post-construction is also important. Project displacement of recreators, living resources and

habitats should be conducted. Monitoring devices can also be placed near structures during pilot stages in order to evaluate interactions with the ecology. The interactions with the ecology is not only important within the project footprint but along the shoreline. Therefore, shoreline morphology monitoring should take place.

3.3 Wind 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 US 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 as well as spacing for the entire wind park 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, consideration must be given to economic impacts in terms of a reduction in property values of coastal residents. While studies have shown that onshore wind facilities do not have a negative effect, this has yet to be analyzed for offshore wind facilities in the United States because of their absence.

European studies have shown adverse impacts from noise generated from the construction phase of development (i.e. pile driving). Impacts are species specific and proper mitigation should be developed to minimize these impacts.

Scour effects and stability of shoals where development occurs could impact several species. It is important to establish acceptable limits to modification of the environment by physical processes so as to have minimal impact on the ecology.

Additional technologies will need to be developed and improved in order to better monitor bird strikes. Avian impacts are one of the most important wind development issues. Not only are additional technologies important but improved predictive models are also necessary to better estimate bird interactions with wind turbines.

The cumulative effects from multiple projects along the coast are a concern. How closely should facilities be spaced? What level of habitat alteration can be absorbed by the coastal ecosystem? What will be the acceptance of communities to multiple facilities including aesthetics and recreational impacts?

3.4 Ocean Current Technology Issues

While it is expected that development of ocean current facilities will not occur in the near future, some design testing is planned. The design will probably incorporate a turbine design similar to technologies being tested to extract energy from tides. 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.

3.5 Cross-Cutting Issues

Alternative energy in the U.S. has many supporters but also many opponents and cuts across geographic regions, demographic groups and income levels. Indeed, Cluck (1998) maintains that environmental attitudes in the U.S. have been institutionalized across regions and demographic groups. Until recently with the work of (Krueger, 2007) it was somewhat unclear how this institutionalization manifested itself. Krueger (2007) found that in Delaware, people are willing to pay more for electricity each month in order to bring OCS wind power to the state. Attitudes for OCS wind development are incredibly supportive and show a commitment and desire on the part of residents to move towards renewable energy as a source for electrical generation as opposed to the status quo of the current energy mix. Indeed, this research shows that people in Delaware care where their energy comes from. Studies such as this allow the Federal government to work with states in order to obtain a clear picture of how residents see the future of energy development. This allows states and communities to be proactive in their decision-making process.

Another cross-cutting issue is global climate change and the benefits of OCS alternative energy development on the environment and human communities. Many questions arise when considering the effects of alternative 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 US to take. A thorough cost/benefit analysis of these projects is needed.

A worldwide analysis of manufacturing of OCS alternative energy technologies is needed to trace the most likely manufacturing aspects of commercial and non-commercial OCS alternative energy proposals. Manufacturing of wind turbines as well as other types of wave and current technologies are limited within the world. Indeed, the US could become a leader in manufacturing for offshore alternative energy, but first it is important to understand the current state of manufacturing before determining the possibilities. The location of manufacturing is important for the economics of Nations (Denmark) and States (Oregon). An analysis of the worldwide manufacturing OCS alternative energy technologies allows countries to predict the economic benefits in terms of employment and income.

Eventually, decommissioning impacts will need to be considered including the methods of removal and potential effects of leaving structures in place.

Other cross-cutting considerations include interactions with offshore mariculture; risks from natural disasters such as hurricanes, earthquakes, and tsunamis; determining the need for exclusion zones around facilities; evaluating the reliability of equipment; and homeland security.

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Offshore Environmental Studies Program

**Fiscal Years 2011-2013
Studies Development Plan
Pacific OCS Region**

**U.S. Department of the Interior
Bureau of Ocean Energy Management, Regulation, and Enforcement
Pacific OCS Region
Camarillo, CA
2010**

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SECTION 1.0 PROGRAMMATIC OVERVIEW

1.1 Introduction to the Region

The Environmental Studies Program in the Pacific Outer Continental Shelf (OCS) Region started in 1974. The Program has evolved with changes in the geographic areas of concern and study, in the emphasis of disciplines highlighted for research, and the change in the status of the Region from a frontier to a mature oil and gas producing area (prelease to postlease emphasis), and, finally, with the implementation of the Energy Policy Act of 2005 and the responsibility for the OCS renewable energy program.

Existing production and development activities on 43 producing oil and gas leases offshore southern California will continue. Annual production from these leases is currently about 63,000 bbls of oil per day and 130 MMCF of natural gas per day. It is expected that production from the majority of these facilities will continue for many years. The projected OCS activities section of this report discusses the activities anticipated on producing leases.

The need for information to regulate future renewable energy projects that may be proposed and implemented in the Pacific OCS Region is reflected in this plan. These energy projects will require studying areas outside southern California as interest and resource potential for wind and wave energy facilities exist all along the Pacific Coast. For example, the Federal Energy Regulatory Commission has issued several permits for pilot projects within State waters of Washington, Oregon, and California. Hydrokinetic wave energy conversion devices are being tested offshore Oregon.

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. New uses previously proposed for oil and gas platforms have included marine aquaculture and Liquefied Natural Gas (LNG) facilities. When needed, new or updated environmental studies will support BOEMRE decisions with regard to non-traditional uses of offshore facilities. The plan complements and reinforces the Environmental Studies National Strategic Plan.

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. It includes Hawaii, only in regards to the earliest planning for possible environmental studies related to renewable energy projects that may occur in that area. This plan focuses on the Southern California Planning Area and areas to the north and into Washington State that might experience renewable energy projects.

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

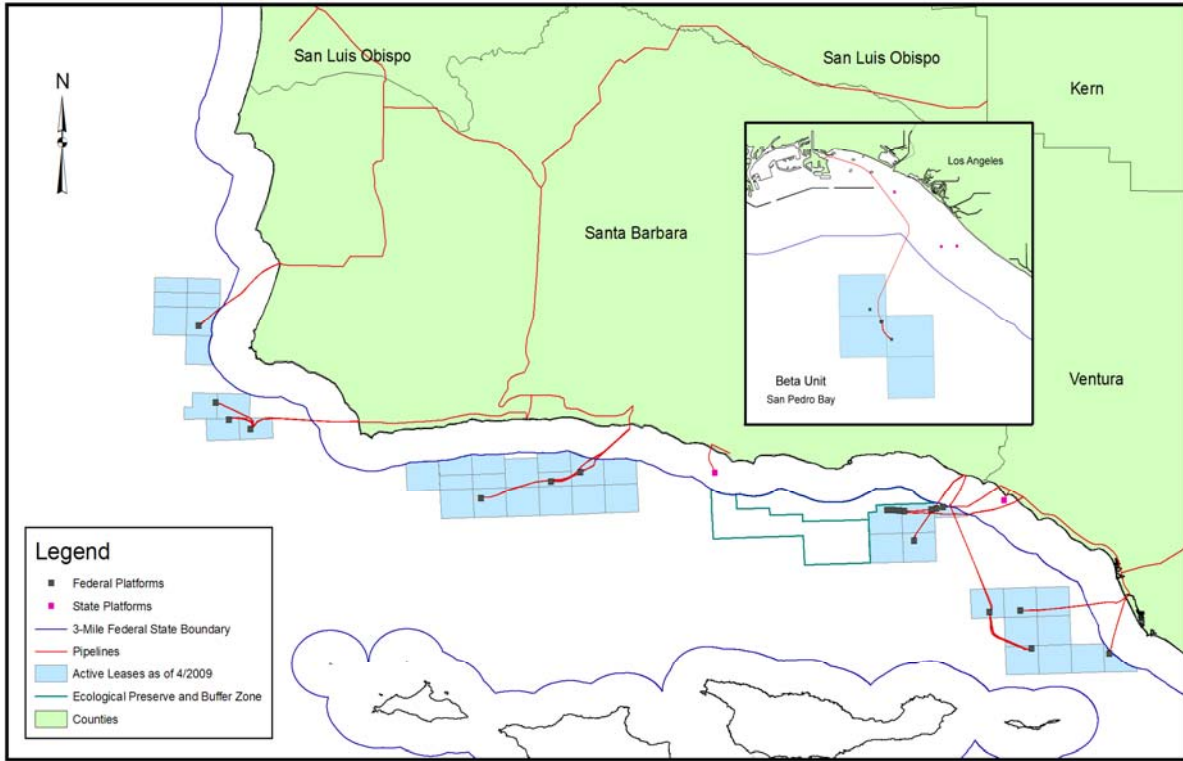
- The study provides significant new or additional information beyond what is already known.
- The identified study is within the time frames of the Offshore Program.
- The information provides insight into significant processes critical for understanding both natural and anthropogenic changes.
- The issue can be studied within science's present abilities or understanding of experimental methods to acquire the information.

The level of future OCS oil and gas activities and the introduction of renewable energy projects offshore the Pacific Coast 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 Bureau of Ocean Energy Management, Regulation, and Enforcement and Pacific OCS Region home pages at www.boemre.gov for additional information.

1.2 Maps of the Pacific OCS Region

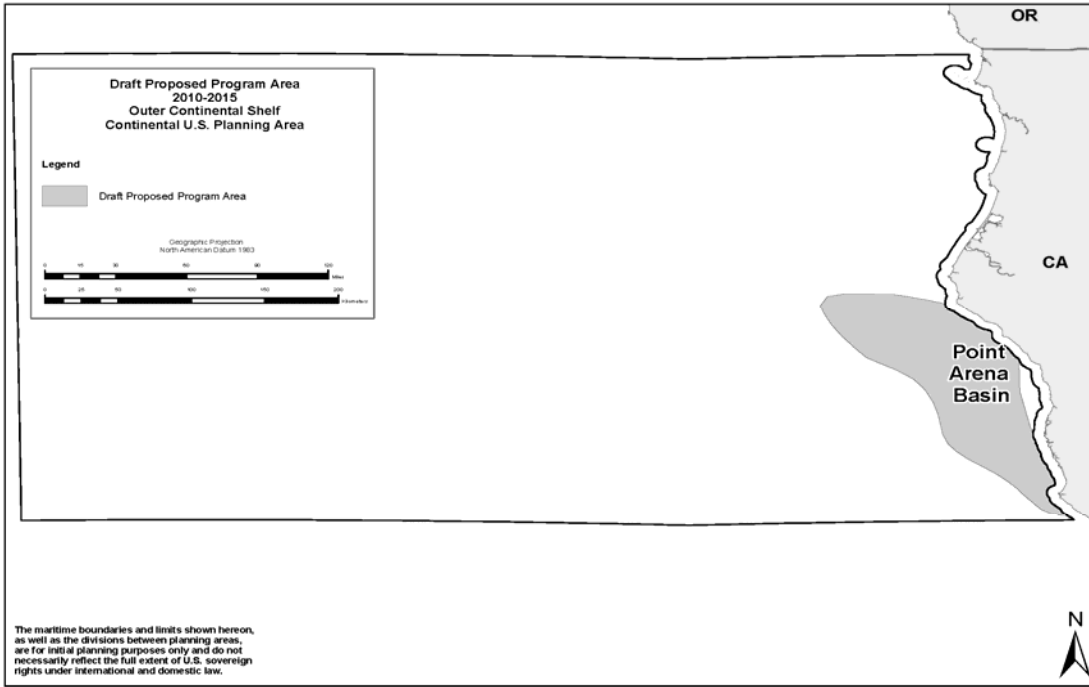
Figure 1. Active Leases in Southern California



Pacific OCS Region Leases and Facilities

Figure 2. Northern and Southern California Oil and Gas Planning Areas

Northern California Planning Area



Southern California Planning Area

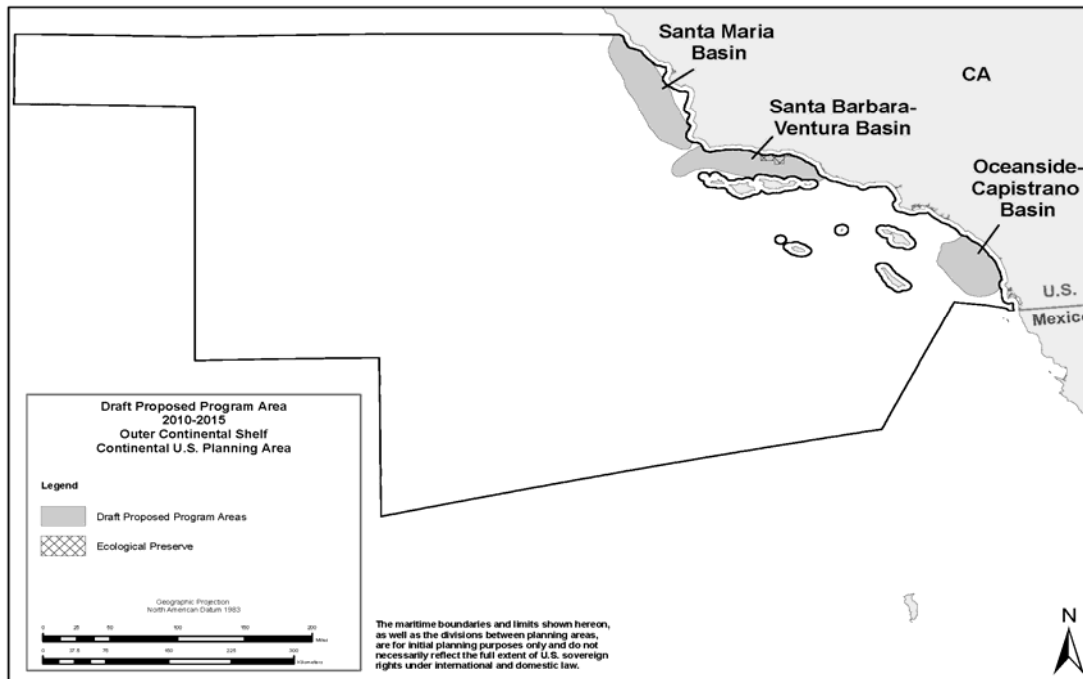


Figure 3. Resource Potential for Renewable Energy from Wave Power

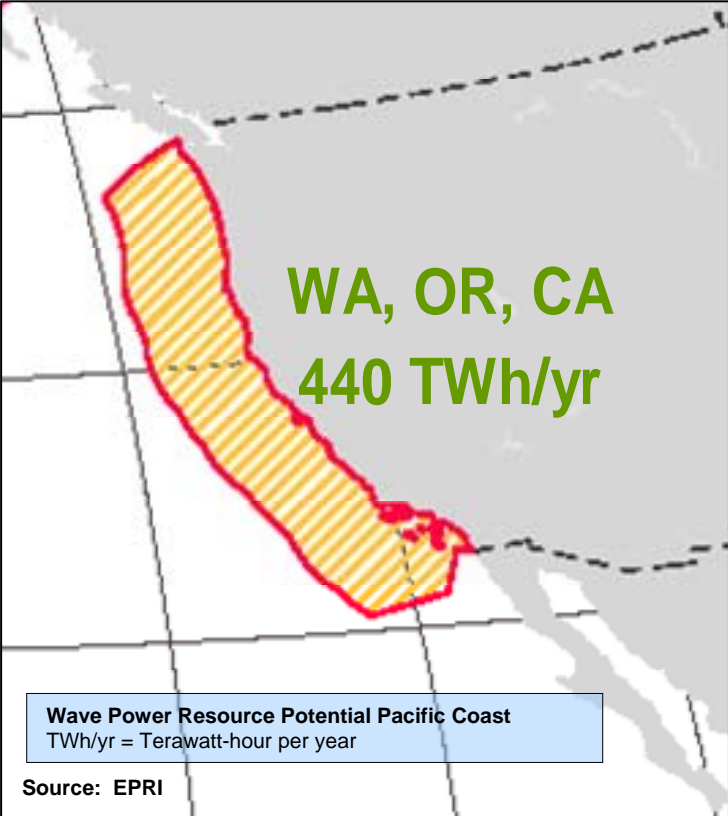


Figure 4. Resource Potential for Renewable Energy from Wind Power



1.3 Projected OCS Activities

The BOEMRE Environmental Studies Program supports BOEMRE 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.

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. It remains to be determined what oil and gas lease sales may be proposed for the Pacific OCS Region in the near or distant future. The Draft Proposed Program for a continued 5-Year Plan, 2010-2015 for oil and gas leasing, was published in the Federal Register in January 2009 and included geographically limited lease sales for Southern California and Northern California Planning Areas. The Secretary of the Interior extended the comment period until late September 2009.

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 approximately 63,000 barrels of oil and 130 MMCF of natural gas per day. This rate could be sustained into the next decade, as Federal lessees continue to focus on the recovery of 300-400 million barrels of oil in proved reserves. Studies identified in this regional plan highlight information gaps and are geared to allow BOEMRE to conduct analyses that support 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.

Studies are needed to address and monitor the environment adjacent to the existing facilities. For example, information from environmental studies was used in the assessment of the environmental effects of power cable repairs in FY 2009 and FY 2010 within the Santa Ynez Unit in Santa Barbara Channel. Platforms in the Santa Ynez Unit are electrically powered from onshore sources via a cable, and BOEMRE used recent data from environmental studies in preparing an Environmental Assessment for that postlease activity. In addition, the BOEMRE recently produced a complex Environmental Assessment that involved formal consultation with the U.S. Fish and Wildlife Service and the National Marine Fisheries Service for a revised Development and Production Plan to produce an oil reservoir from an adjacent State lease. Environmental Studies information was crucial to completion of these National Environmental Policy Act documents.

Renewable Energy Activities and Alternate Use of OCS Facilities

The BOEMRE was delegated the 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 wind and wave 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.

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 FY 20011-2013 fall into the following categories:

Supporting potential renewable energy and existing oil and gas leasing, exploration, and production activities:

Social Science

With increasing interest in renewable energy resource development, particularly in areas outside the area currently developed for oil and gas, additional information needs will have to be addressed. This information is also expected to support decisions on oil and gas, should Pacific OCS Planning Areas be included on a future 5-Year oil and gas leasing program. An inventory and analysis of submerged cultural resources will be needed for environmental assessment and mitigation of potential adverse affects to these resources. The study “Inventory and Analysis of Archaeological Site Occurrence on the Pacific OCS” will address the issue. 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

The study “DOI Partnership: Distinguishing between Human and Natural Causes of Changes in Kelp Forests Using Long-term Data from DOI Monitoring Programs” will allow BOEMRE to better analyze ecosystem-level changes in the environment. Successful integration of biologic, geologic, and oceanographic information will allow prediction of regional consequences from events occurring within a limited spatial scale. Such predictive capability is important in OCS permitting, mitigation, and decommissioning decisions related to offshore oil and gas and renewable energy activities.

Concerns about the effects of electromagnetic fields of power cables that will be associated with new renewable energy projects on the Pacific Coast will be addressed in the study “Renewable Energy *in situ* Power Cable Observations” as well as the ongoing effort to analyze existing literature on the topic. Actual field measurements in the new study will allow BOEMRE to make decisions with regard to siting and possible mitigation of power cable effects.

The southern sea otter, *Enhydra lutris nereis*, is exceptionally vulnerable to oil spills and may interact with offshore manmade facilities (foraging, haul-out, sheltering). This species is listed as threatened under the Endangered Species Act. In the past 5 years, the southern sea otter population has significantly expanded its range down the coast of California into areas of existing oil and gas production and potential renewable energy production. The BOEMRE needs to understand where and how southern sea otters are using habitat near manmade structures in order to calculate risks to otters in environmental analysis of OCS activities. The study “Southern Sea Otter Range Expansion and Habitat Use and Interaction with Manmade Structures” will provide BOEMRE with this information. Observations of otters in the vicinity of natural oil seeps, coupled with ongoing research by U.S. Geological Survey (USGS) and funded by BOEMRE (fingerprinting seep oils), would also inform BOEMRE of the possible source of oil on any otters that should become oiled. The BOEMRE has previously funded extensive sea otter studies in the region and will seek partnership opportunities for this study with the U.S. Fish and Wildlife Service (USFWS) as well as USGS.

Information Management

The “West Coast Marine Renewable Energy Planning Guidebook” will provide a critical step in planning renewable energy projects offshore California, Oregon, and Washington. This effort is closely tied to the West Coast Governors’ Agreement on Ocean Health and will be needed by BOEMRE, the States, and others in order to rationally plan for projects and avoid or minimize user conflicts. This study builds upon several ongoing efforts including a multiple-use study being conducted by BOEMRE headquarters.

1.5 New Starts for FY 2010 and Ongoing Studies

Table 1. Pacific OCS Region New Starts for FY 2010 and Ongoing Studies

Program Lead	Planning Area	Start FY	Discipline	Study Title
NEW STARTS				
BOEMRE	SC	10	HE	Regional Importance of Manmade Structures as Rockfish Nurseries
BOEMRE	NC/CC/SC	10	HE	BOEMRE MARINE–Multiagency Rocky Intertidal Network
BOEMRE	SC	10	HE	Completion of Fish Assemblage Surveys around Manmade Structures and Natural Reefs off California
BOEMRE	SC	10	HE	Habitat Mapping in the Santa Barbara Channel
BOEMRE	NC/O/WA	10	MM	Marine Mammal and Seabird Surveys of Potential Renewable Energy Sites Offshore Northern California, Oregon, and Washington
BOEMRE	O/WA	10	HE	Survey of Benthic Communities near Potential Renewable Energy sites Offshore Oregon and Washington
BOEMRE/ BAA/NOPP	All	10	SS	Renewable Energy Visual Impacts
<i>*Note: The procurement of any study is contingent upon availability of funding</i>				
ONGOING STUDIES				
<i>Fates & Effects</i>				
BOEMRE	All	09	FE	Effects of EMF from Transmission Lines on Elasmobranchs and Other Marine Species
BOEMRE	SC	06	FE	Investigation of PCB and PAH Contaminants in Samples of Platform Resident Fish
BOEMRE	SC	05	FE	Volume and Chemistry of Natural Seeps in the Santa Barbara Channel
<i>Habitat and Ecology</i>				
BOEMRE	SC	09	HE	MINT – BOEMRE Intertidal Team
BOEMRE	SC	07	HE	Continuation of Fish Assemblages Associated with Platforms and Natural Reefs in Areas Where Data are Non-existent or Limited
BOEMRE	SC	08	HE	Spatial and Seasonal Variation in Biomass and Size Distribution of Juvenile Fishes

				Associated with a Petroleum Platform
Information Management				
Marine Mammals and Protected Species				
BOEMRE	SC	07	MM	Shorebird Survey of Ventura County
BOEMRE/ BRD	CC/SC	07	MM	Comprehensive Relational Database and Web Page for Seabirds, Marine Mammals, Fish, Fisheries and Human Uses off Southern California
Physical Oceanography				
BOEMRE	SC	08	PO	Relationship of Inner Shelf Currents to Large Scale Dynamics
Social Sciences & Economics				
Multidisciplinary				
BOEMRE	SC	07		Environmental Mitigation Monitoring
Other (Research Partnerships)				
BOEMRE Technology Assessment and Research Program (TAR)				
Cooperative Ecosystem Studies Unit; Oregon State University (OSU)				
National Oceanographic Partnership Program (NOPP); e.g., Protocols for Baseline Studies and Monitoring for Ocean Renewable Energy and Renewable Energy Visual Evaluations.				
Federal Interagency Agreements: e.g., U.S. Geological Survey/ Biological Resources Division, Columbia Environmental Research Center, Western Fisheries Research Center, Menlo Park Coastal and Marine Geology Center				
Discipline Codes				
AQ = Air Quality FE = Fates & Effects HE = Habitat & Ecology				
IM = Information Management MM = Marine Mammals and Protected Species				
PO = Physical Oceanography SS = Social Sciences				
Planning Area Codes				
Southern California = SC Central California = CC				
Northern California = NC Oregon = O				
Washington = WA				
All = NC/CC/SC/O/WA/Hawaii				
http://www.boemre.gov/eppd/sciences/esp/profiles/pacific.htm				

SECTION 2.0 PROPOSED STUDY PROFILES

2.1 Introduction

Study Descriptions of Ongoing Studies may be found on the web at <http://www.boemre.gov/eppd/sciences/esp/profiles/pacific.htm> and a list of significant completed studies by the Pacific OCS Region may be found at <http://www.boemre.gov/omm/pacific/enviro/studies-accomplishments-2009.htm>.

2.2 Profiles of Studies Proposed for FY 2011 NSL

Table 2. Pacific OCS Region Studies Proposed for FY 2011 NSL

Page #	Discipline	Title	Rank
13	SS	Inventory and Analysis of Archaeological Site Occurrence on the Pacific OCS	1
15	HE	DOI Partnership: Distinguishing Between Human and Natural Causes of Changes in Nearshore Ecosystems Using Long-term Data from DOI Monitoring Programs	2
17	HE	Renewable Energy <i>in situ</i> Power Cable Observation	3
19	MM	Southern Sea Otter Range Expansion and Habitat Use and Interaction with Manmade Structures	4
21	IM	West Coast Marine Renewable Energy Planning Guidebook	5
AQ = Air Quality HE = Habitat and Ecology IM = Information Management SS = Social Science FE = Fates and Effects MM = Marine Mammals and Protected Species PO = Physical Oceanography			

ENVIRONMENTAL STUDIES PROGRAM: Studies Development Plan FY 2011–2013

Region: Pacific Region

Planning Area(s): Washington/Oregon/All California

Title: Inventory and Analysis of Archaeological Site Occurrence on the Pacific OCS

BOEMRE Information Need(s) to be Addressed: Development of energy and mineral resources offshore the Pacific States is expected to continue, whether as a result of the opportunity for development of renewable energy resources created by the Energy Policy Act of 2005, the possible inclusion of areas off California on a 5-Year Oil and Natural Gas Leasing Program, or proposals by developers for development of strategic minerals. Therefore, an inventory and analysis of submerged cultural resources will be crucial for environmental assessment and mitigation of potential adverse affects to these resources. The study “Inventory and Analysis of Archaeological Site Occurrence on the Pacific OCS” will address the issue. 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.

Cost Range: (in thousands) \$325-\$375 **Period of Performance:** FY 2011-2013

Description:

Background: BOEMRE collected baseline data offshore Oregon, Washington, and California in the 1980's. A study completed in 1987 (Pierson et al.) evaluated potential submerged archaeological resources from Morro Bay, CA, southward. A 1990 study (Espy Houston and Associates) addressed potential submerged archaeological resources from Morro Bay, CA, through southern Washington. The work was at an appropriate scale and was well done, but the data require updating with information from the past 20 years. Since that time, there have been a number of significant archaeological discoveries off the Pacific states. As a result, there is a critical need to update the baseline studies, develop a digital database of known and reported submerged cultural resources along the Pacific OCS, and identify areas where inundated prehistoric sites might be located. A similar effort was completed in the Gulf of Mexico Region in 2003, (Pearson et al.) and was recently contracted for the Atlantic OCS.

Objectives: While remote sensing surveys will be required of permittees in their area of effect, an inventory of potential archaeological resources developed by the proposed study will help guide decisionmakers in developing appropriate mitigation strategies for targets located by remote sensing. In addition, the development of an effective survey strategy is dependant upon knowing the nature of these resources and where they most likely may be located.

The objectives of this study are to develop an inventory of known, reported, and potential archaeological sites for the Pacific OCS similar to what has been developed for the Gulf of Mexico Region. The proposed study will develop an inventory of historic shipwrecks, emphasizing the use of primary sources; assess areas of the Pacific OCS for prehistoric site potential and develop a model for where prehistoric sites might be expected; and recommend appropriate survey methodology in order to detect and avoid impacts to such resources. Emphasis should be placed along a 12-mile corridor that parallels the present-day coastline, running roughly from 3 to 15 miles offshore. However, the database and survey strategy should incorporate the entire West Coast.

Methods: Using the previous two Pacific Region studies as a baseline, the proposed study will synthesize data collected over the past 20 years to develop an inventory of historic shipwrecks emphasizing the use of original sources; assess areas of the OCS for prehistoric site potential by evaluating current theories on prehistoric settlement patterns, paleo-shorelines, sea level rise, and regional geology; and synthesize this information to recommend an appropriate survey methodology in order to detect and avoid impacts to archaeological resources. The database should be developed using the same format as the current GOMR shipwreck database and should link to a Geographic Information System (GIS) compatible to the existing BOEMRE GIS.

Revised Date: September 1, 2010

ENVIRONMENTAL STUDIES PROGRAM: Studies Development Plan FY 2011–2013

Region: Pacific OCS Region

Planning Area: Southern California

Title: DOI Partnership: Distinguishing Between Human and Natural Causes of Changes in Kelp Forests Using Long-term Data from DOI Monitoring Programs

BOEMRE Information Need(s) to be Addressed: Monitoring and predicting the potential impacts of OCS oil and gas and renewable energy production on nearshore ecosystems requires an ability to distinguish between changes caused by natural processes and those caused by human activities. This is often hampered by the lack of long-term data to describe natural variation. In southern California, two Department of the Interior monitoring programs that focus on kelp forest communities have the potential to provide considerable insight into the patterns and causes of change in kelp forest ecosystems. Analysis of these datasets (which span 25+ years) will enable scientists and managers to evaluate possible impacts from offshore oil and gas and renewable energy activities and develop options to mitigate these impacts. This is especially important to BOEMRE in light of global climate change and the need to understand the cumulative impacts of multiple projects on the OCS.

Cost Range: (in thousands) \$200-\$250

Period of Performance: FY 2011-2013

Description:

Background: Due to the inherent connectivity of the marine environment, a number of activities related to outer continental shelf (OCS) oil and gas and renewable energy production can adversely affect nearshore habitats. These activities may include: (1) alteration of habitat through the installation, maintenance, and/or removal of platforms, pipelines, cables, and other structures; (2) release of contaminants into the marine environment by oil spills and discharges; (3) decreased water quality via sediment disturbance during anchoring, dredging, etc.; and (4) onshore activities that result in erosion or spillage into the nearshore environment.

The BOEMRE requires information about the sensitivity and resilience of biological habitats to disturbance to perform environmental analyses. Understanding the natural dynamics of nearshore ecosystems requires comprehensive long-term data that span a wide range of environmental conditions in areas potentially impacted by OCS energy activities. Such data exist for kelp forest communities located in the Southern California Bight that are monitored regularly by two Department of the Interior Bureaus (USGS and National Park Service). A lack of funding and staff for analyses has caused these data to be under-utilized.

Giant kelp forests have been designated Habitat Areas of Particular Concern (a subset of Essential Fish Habitat) for groundfish by the Pacific Fishery Management Council and as

environmentally sensitive habitats by the State of California. Attributing change in kelp forest systems to human activities, however, can be difficult because kelp forests undergo large and abrupt fluctuations in size and species composition in response to a variety of predictable (e.g., seasonal) and unpredictable (e.g., disease, large waves) natural events. Longer-term studies that encompass the wide range of environmental conditions experienced by kelp forests are uncommon and those that exist have tended to focus on a single species or guild,

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

Methods: Long-term data on the kelp forest communities of San Nicolas Island and the Channel Islands National Park will be combined and analyzed to determine: (1) the influence of short and long-term climate oscillations on the abundance, species composition, and trophic structure of kelp forest communities; (2) resilience of the community to varying levels of disturbance; and (3) the periodicity (and, if possible, causes) in shifts of community state. Anticipated products for the proposed work include peer-reviewed scientific publications and compiled data and metadata archived in an accessible format that facilitates future syntheses and environmental analyses required under the National Environmental Policy Act. Funds will support the analysis of existing data collected by the USGS and National Park Service (NPS). The USGS has been collecting data on the abundance of macroalgae, benthic invertebrates and fishes at six kelp forest sites around San Nicolas Island since 1980. The NPS has been collecting similar data at 16 sites within the Channel Islands National Park since 1982. These two databases are very compatible in terms of their content, time period, and methods of data collection. The general approach will be to conduct detailed comparative time series analyses. Importantly, both data sets encompass two of the largest El Niño events ever recorded (1982-83 and 1997-98). Moreover, differences in environmental conditions among islands and among sites within islands (owing to different current regimes and exposures) provide a wide range of environmental conditions over which natural changes in kelp forest communities can be assessed.

Revised date: March 24, 2010

ENVIRONMENTAL STUDIES PROGRAM: Studies Development Plan FY 2011–2013

Region(s): Pacific

Planning Area(s): All

Title: Renewable Energy *in situ* Power Cable Observation

BOEMRE Information Need(s) to be Addressed: The BOEMRE requires information concerning the level of impacts of electromagnetic field (EMF) on some marine species. Submarine transmission cables that power offshore oil platforms in the Pacific Region provide an opportunity to assess potential behavior and reaction of electromagnetic sensitive species to industry activities. The information will be applicable to all renewable energy power cable EMF considerations and will determine effectiveness of the commonly proposed mitigation of cable burial.

Cost Range: (in thousands) \$700-\$850

Period of Performance: FY 2011-2014

Description:

Background: Renewable energy technologies, for the foreseeable future, will be focused on the generation of electricity. In all cases, we expect the individual devices will be interconnected with power cables to transmit the electricity to a platform or gathering site, and a single cable will connect the entire facility to shore. The power cable will transmit either alternating current or direct current. If the cable uses alternating current, it will generate both electric and magnetic fields. Proper shielding can block electric fields but not magnetic fields, which, in turn, can induce secondary electric fields. One of the potential impacts from energized power cables may be the local attraction or repulsion of electrosensitive species to the EMF.

Submarine transmission cables that power offshore oil platforms in the Pacific Region provide a unique opportunity to assess potential behavior and reaction of electromagnetic sensitive species to industry activities. Knowledge gained from this study will be directly applicable to renewable energy projects in any OCS planning area. In the Pacific Region, there are two identical power cables, several miles long, located in the same corridor on the seafloor within the Santa Ynez Unit offshore Southern California Planning Area. Both of these cables use the industry standards of the power cables that will be used for connecting devices (35 KV) within renewable energy installations. These cables were emplaced concurrently by the manufacturer. One cable is unenergized and disconnected from the grid, and one cable is energized. The energized power cable will be compared to the unenergized cable to determine potential impacts from electromagnetic fields while controlling for habitat contributed by the cable structure.

We will compare species densities among cable treatments to determine attraction/repulsion of electrosensitive species to energized and unenergized power cables. Data from the on-going EMF Synthesis Study NSL-PC-08-08 will determine the sampling width for the present cable biological survey transects. Data from the on-going Completion of Fish Assemblage Survey

NSL PC-10-03 study will be used for habitat assemblage comparisons. Contemporaneously with the biological surveys, we will measure EMF emissions along both cables.

Objectives: The objectives of this study are to determine: 1) the strength, spatial extent, and variability of EMF's along both energized and unenergized cables; 2) whether electrosensitive species respond (attraction/repulsion) to the EMF's of an *in situ* power transmission cable; 3) differences among fish communities associated with cable habitat and fish communities in natural habitats obtained from other BOEMRE-funded studies; and 4) the effectiveness of the commonly proposed mitigation of cable burial.

Methods: The evaluation would initially involve multiple cable surveys and EMF measurement, followed by a comparison of species at both cables to determine potential impacts from electromagnetic fields while controlling for habitat contributed by the cable structure.

- 1) Conduct fish surveys using the *Delta* submersible, a 4.6 m, 2-person vessel, operated by Delta Oceanographics of Oxnard, California along cable transects about two meters from the substrata. Conduct transects along both cables and in proximate habitat near the cables;
- 2) During all transects document (a) species; (b) estimated total length; (c) its distance and position relative to the cables and proximate habitat;
- 3) Measure EMF's using existing equipment;
- 4) Determine electrosensitive species response (attraction/repulsion) to the EMF's of an energized and unenergized, *in situ*, power transmission cable; and,
- 5) Using data from 4, analyze effectiveness of the commonly proposed mitigation of cable burial.

Revised Date: March 24, 2010

ENVIRONMENTAL STUDIES PROGRAM: Studies Development Plan FY 2011–2013

Region: Pacific OCS Region

Planning Area: Southern California

Title: Southern Sea Otter Range Expansion and Habitat Use and Interaction with Manmade Structures

BOEMRE Information Need(s) to be Addressed: The southern sea otter, *Enhydra lutris nereis*, is exceptionally vulnerable to oil spills and may interact with offshore manmade facilities (foraging, haul-out, sheltering). This species is listed as threatened under the Endangered Species Act. In the past 5 years, the southern sea otter population has significantly expanded its range down the coast of California into areas of existing oil and gas production and potential renewable energy production. The BOEMRE needs to understand where and how southern sea otters are using habitat near manmade structures in order to calculate risks to otters in environmental analysis of OCS activities. Observations of otters in the vicinity of natural oil seeps, coupled with ongoing research being done by USGS and funded by BOEMRE (fingerprinting seep oils) would inform BOEMRE of the possible source of oil on any otters that potentially become oiled.

Cost Range: (in thousands) \$300-\$400

Period of Performance: FY 2011-2014

Description:

Background: The southern sea otter was listed as threatened primarily because of its small population size and the risk of oil spills. Since listing, the southern sea otter population has gradually increased its size and range. Approximately 2,800 sea otters now inhabit the coastline from Half Moon Bay to Santa Barbara. Within the past 5 years, about 100 sea otters have been routinely observed in the Point Conception area, adjacent to active oil and gas facilities, natural oil and gas seeps, and areas of potential renewable energy production. Very little is known about their daily activity patterns and habitat use in this area. Information gained from this study, coupled with ongoing research being done by USGS and funded by BOEMRE, such as ongoing studies that fingerprint seep oils, would inform BOEMRE of the possible source of oil on any otters that potentially become oiled. The BOEMRE has previously funded extensive sea otter studies in the region and will seek partnership opportunities for this study with the USFWS as well as USGS. The study will allow for a comparative analysis between the southern California area and other areas of the Pacific coast where data have been collected or are in the process of being collected.

Objectives: Research objectives include 1) identification of important sea otter resting and foraging areas adjacent to man-made structures; 2) delineation of movement patterns along the southern California coast; and, 3) assessment of sea otter distribution and behavior in the vicinity

of man-made structures and natural oil and gas seep areas (e.g., Coal Oil Point, Santa Barbara County).

Methods: Up to 20 sea otters per year will be captured on the southern California coast over a 2-year period. Each animal will be implanted with a VHF radio tag and a time-depth recorder using well established techniques developed by the USFWS and the USGS. Geospatial tags may be considered and used if they are developed and approved for use in sea otters by the time this study is initiated. Geospatial data of sea otter and existing data of known seep locations would be examined for potential contact.

Tagged animals will be tracked for a 2-year period from land and air on a weekly basis with periodic intensive survey periods designed to determine daily movement and activity patterns in relationship to oil and gas facilities and naturally occurring oil seeps. In the third year of the project, some of the tagged sea otters will be recaptured to recover their time-depth-recorders for more detailed analysis of their activity patterns.

Revised date: March 24, 2010

ENVIRONMENTAL STUDIES PROGRAM: Studies Development Plan FY 2011–2013

Region: Pacific

Planning Areas: Washington/Oregon/All California

Title: West Coast Marine Renewable Energy Planning Guidebook

BOEMRE Information Need(s) to be Addressed: The potential for marine renewable energy is being investigated by the West Coast Governors’ Agreement on Ocean Health Renewable Energy Action Coordination Team. Since both new technologies and areas not previously developed (frontier areas) are involved, available geo-spatial data, data gaps, and priority data needs need to be identified. Additionally, BOEMRE and other Federal, State and tribal representatives would work closely with the contractor for this study to recommend planning criteria and considerations for potential marine renewable energy projects.

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

Period of Performance: FY 2011-2013

Description:

Background: The Governors of California, Oregon and Washington announced the West Coast Governors’ Agreement on Ocean Health on September 18, 2006. The Agreement launched a new, proactive regional collaboration to protect and manage the ocean and coastal resources along the entire west coast, as called for in the recommendations of the U.S. Commission on Ocean Policy and the Pew Oceans Commission. One element of the action plan developed under the Agreement concerns new, environmentally sustainable energy production. While offshore renewable energy could provide new, reliable sources of energy for the West Coast, the feasibility and environmental impacts of these technologies is not yet fully understood. The west coast states have agreed to collaborate with the BOEMRE, Department of Energy, Federal Energy Regulatory Commission, National Oceanographic and Atmospheric Administration, tribes, and other agencies to evaluate the potential benefits and impacts of renewable ocean energy projects off California, Oregon, and Washington, as well as to develop the long-term regulatory structure for removal or expansion of activities. The collaboration has taken the form of multiple working groups, known as Action Coordination Teams, that are working together to develop recommendations on how to best implement the actions described in the Agreement. One of the key tasks identified by the Renewable Energy Action Coordination Team is to develop the “West Coast Marine Renewable Energy Planning Guidebook.”

Objectives: This guidebook would identify currently available, public geospatial data, data gaps and priority data needs for marine and coastal resources on the west coast. Additionally, BOEMRE and other Federal, State, and tribal representatives would identify recommended planning criteria, decision-making tools, and considerations for potential marine renewable energy projects as part of this proposed study.

The BOEMRE and the Department of Energy have contractors currently assessing some of these issues on the West Coast and their products may be easily incorporated into this working report. Additionally, this study could leverage any funds that are secured by the Renewable Energy Action Coordination Team to complete this project. All data sources and literature reviews would be reviewed under this contract including the Pacific Region's Summary of Knowledge.

Methods: This working report would combine governance, data context, technology, and energy infrastructure key components at the regional level. The report will link this information to multipurpose maps that support decision-making on a site specific and regional scale (e.g., linking data layers to BOEMRE/NOAA Multipurpose Marine Cadastre). The report will also denote, where possible, critical habitats and human uses. The contractor will review the State and Federal siting guidelines and policies, analyze gaps, and suggest solutions.

Revised date: March 24, 2010

2.3 Profiles of Studies Proposed for FY 2012 NSL

Table 3. Pacific OCS Region Studies Proposed for FY 2012 NSL

Page #	Discipline	Title
25	MM	Characterizing and Quantifying Sea Lion and Seal Use of Offshore Oil and Gas Platforms in California
27	HE	Influence of Pacific Offshore Platforms on Marine Fish Ecology

ENVIRONMENTAL STUDIES PROGRAM: Studies Development Plan 2012–2014

Region: Pacific OCS Region

Planning Area: Southern California

Title: Characterizing and Quantifying Sea Lion and Seal Use of Offshore Oil and Gas Platforms in California

BOEMRE Information Need(s) to be Addressed: Ultimately, offshore oil and gas platforms in California will be removed. California sea lions, *Zalophus californianus*, and, to a lesser extent, Pacific harbor seals, *Phoca vitulina*, use these platforms as resting and foraging areas. Both species are protected by the Marine Mammal Protection Act (MMPA). The BOEMRE needs to characterize and quantify the use of these areas by sea lions and seals for environmental review and permitting requirements associated with decommissioning of facilities. This study will also contribute to our understanding of sea lion and seal interactions with other offshore structures including renewable energy facilities being considered for the Pacific coast.

Cost Range: (in thousands) \$150-\$250 **Period of Performance:** FY 2012-2014

Description:

Background: Hundreds of sea lions and seals routinely use offshore oil and gas production facilities in California for resting and foraging. Removal of platforms will displace these animals but, perhaps more importantly, decommissioning activities could result in their injury or death. Characterizing and quantifying sea lion and seal use of offshore platforms is a critical component of our analyses and consultations required under the National Environmental Policy Act (NEPA) and the MMPA.

Objectives: We expect to characterize sea lion and seal use of the platforms, including the number of animals present, seasonal use patterns, and age and gender animals in the immediate vicinity of platforms. This information will be used to satisfy information requirements for NEPA and MMPA and identify use patterns that may minimize disturbance or injury of sea lions and seals during decommissioning activities.

Methods: This study will count sea lions and seals using all 23 Pacific OCS oil and gas platforms under a variety of conditions (differing weather states, day versus night, etc.) and seasons. Activity trends would also be documented.

Sea lions resting on platform decks and buoys are relatively easy to count. Monthly observations conducted by boat and/or from the platforms will be made over a 2-year period. Swimming sea lions will also be counted when they are on the surface.

Surveys documenting daily activity patterns of sea lions will be developed in consultation between the BOEMRE, the National Marine Fisheries Service, Offshore Operators, and prospective researchers and may involve tagging or development of photo ID catalogs of individual animals.

Harbor seal use of platforms will be more difficult to document as this species typically does not haul-out on offshore structures and may sleep for extended periods of time under the platform. Observations may be limited to occasional sightings on the surface or opportunistic observations by SCUBA divers.

Survey methods will be developed, refined, and documented for future assessment of sea lion and seal activity associated with platform decommissioning activities.

Revised date: March 24, 2010

ENVIRONMENTAL STUDIES PROGRAM: Studies Development Plan 2012–2014

Region: Pacific OCS Region

Planning Area: Southern California

Title: Influence of Pacific Offshore Platforms on Marine Fish Ecology

BOEMRE Information Need(s) to be Addressed: The fate of spent offshore platforms off California continues to be a subject of considerable debate and 15 years of scientific surveys funded by BOEMRE. 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 BOEMRE needs to have the resulting BOEMRE OCS reports, USGS, and peer-reviewed 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) \$200-\$250

Period of Performance: FY 2012-2014

Description:

Background: Since 1995, USGS, BOEMRE, 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, BOEMRE is the only Federal or State agency that has funded research at the offshore platforms. The BOEMRE needs to have the resulting BOEMRE OCS reports, various USGS reports, and peer-reviewed material compiled into a single, professionally published reference to support environmental reviews associated with decommissioning and for public outreach purposes. The goal is to publish a book on the subject of the influence of Pacific offshore platforms on marine fish ecology that has been accomplished through and funded by DOI agencies. A similar effort in the Gulf of Mexico resulted in American Fisheries Society publication “Fisheries Reefs and Offshore Development,” which addressed the influence of Gulf of Mexico platforms on marine fish in 2003, <http://www.afsbooks.org/x54036xm>.

Objectives: Collect and compile the reports and peer-reviewed literature into a single reference book.

Methods: Methods include forming an editorial review board, collecting and compiling the peer-reviewed paper and BOEMRE and USGS reports, as appropriate, and choosing and working with a publisher such as the California University Press or the American Fisheries Society.

Revised date: March 24, 2010

SECTION 3.0 TOPICAL AREAS for FISCAL YEAR 2013

Renewable Energy and Alternate Use

Each of the Pacific Coast States has adopted renewable portfolio standards, and the OCS may 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, and Washington; identify suitable areas and conditions; and examine regional environmental effects. These include marine mammal and seabird bird 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.

State of the Rocky Shoreline Report

The BOEMRE has been monitoring the rocky coastline adjacent to OCS oil and gas activities since 1991 and participating in the study of a larger network of sites across the Pacific Coast for many years (the Multi-agency Rocky Intertidal Network, MARINe). The BOEMRE has also been leading a sub-committee of MARINe for the past 2 years, tasked with identifying bioindices, or measurements that can be used predictably to determine relative health of a given rocky intertidal site. It is anticipated that once these bioindices are developed, BOEMRE could look at a subset of the larger dataset and develop a ranking of sites that would inform managers about the health of the rocky intertidal communities specifically in the Santa Barbara Channel. This effort would serve to identify potential data gaps and other issues that hinder our ability to assign a “grade” to a site. BOEMRE could use this information to evaluate the cumulative impact from offshore activities on the shoreline and to assess impacts from new activities or accidental oil spills.

Including the Channel Islands in Shorebird/Seabird Surveys

The Pacific OCS Region 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 BOEMRE to assess real or potential effects of adjacent 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 BOEMRE in this effort.

Acquisition of Archival Aerial Kelp Survey Data for Southern California

Kelp plays an important ecological role in structuring nearshore invertebrate and fish communities along southern California. Low altitude, aerial surveys of the kelp beds along the California coast were done by BOEMRE and BLM during the late 1970's and by the State since then. Data from the 1990's and 2000-2008 have been collected and archived by the State of California and private entities. These data are valuable for BOEMRE in assessing the effects of climate change near oil and gas operations and in analyzing the potential effects of placing renewable energy power cables through or around kelp forests and fish and intertidal communities. This future effort will expand upon the FY 2011 DOI Partnership study by incorporating aerial data sets.

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Offshore Environmental Studies Program

**Fiscal Years 2011-2013
Studies Development Plan
Alaska OCS Region**

**U.S. Department of the Interior
Bureau of Ocean Energy Management, Regulation, and Enforcement
Alaska OCS Region
Anchorage, AK
2010**

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SECTION 1.0 PROGRAMMATIC OVERVIEW

1.1 Introduction to the Region

1.1.1 Background

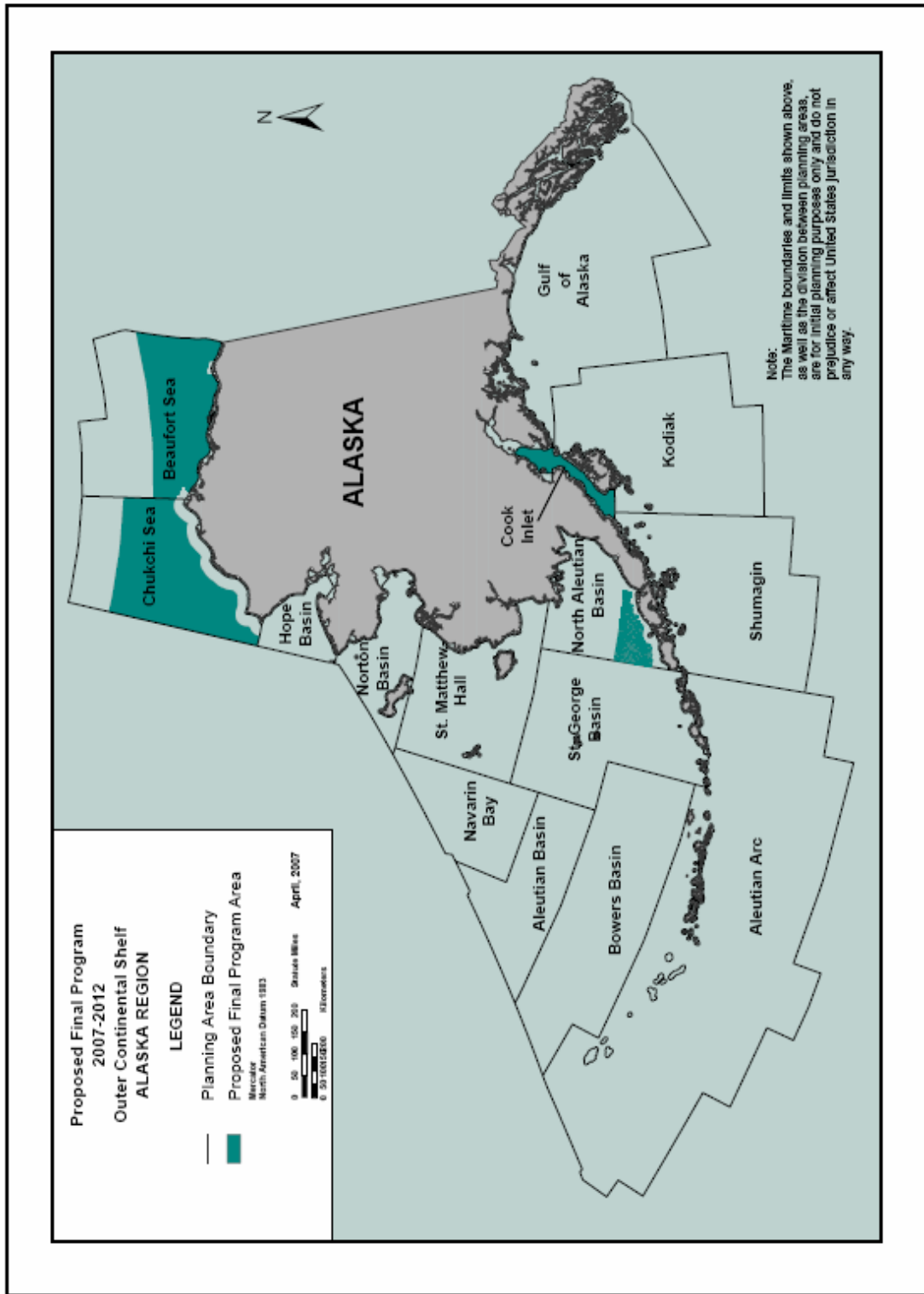
The Bureau of Ocean Energy Management, Regulation, and Enforcement (BOEMRE) Environmental Studies Program was established and funded by the United States Congress to support the offshore oil and gas leasing program of the U.S. Department of the Interior (USDOI) in pursuit of national energy policies. Administered originally in 1973 by the Bureau of Land Management, then by the BOEMRE since 1982, the consistent mandate of the Environmental Studies Program (ESP) 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 BOEMRE mission is to expedite mineral resource exploration and development at fair market value in an environmentally safe and responsible manner. 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 decisionmaking 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 Environmental Studies Program (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 BOEMRE Environmental Analysis Sections when they prepare and/or review Environmental Impact Statements (EISs), Environmental Assessments (EAs), Exploration Permits, and Development and Production Plans.

Since the ESP began, the USDOI and the BOEMRE have funded nationally more than \$850 million for environmental studies through fiscal year (FY) 2009. More than \$340 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 400 different study reports. The ESP manages ongoing study projects in Alaska (currently about 50) in disciplines such as physical oceanography, fates and effects of pollutants, protected and

Figure 1. Final Program 2007-2012 OCS Alaska Region



endangered species, wildlife biology, and the social sciences. Completed study reports are posted on our website at <http://www.boemre.gov/alaska/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-lease decision making. These studies included biological surveys of marine species, basic oceanography and meteorology, and geologic and sea ice phenomena. As a broader base of information was established, it became possible to focus on more topical studies in smaller areas to answer specific questions and fill identified information needs. In addition, generic studies were initiated to examine the potential effects of oil spills on biological resources and different oil development scenarios were modeled to determine the most likely routes of transport and dispersion of oil that might affect the marine environment. The use of computer modeling techniques has been implemented to aid in the assessment of potential oil spill and other pollutant risks to the environment and to key species such as fur seals, sea otters and endangered whales. Modeling has also been used in the ecosystem studies, especially where extrapolation to other areas provided valid analysis.

As study efforts collected and analyzed more disciplinary data, the importance of taking an integrated, interdisciplinary look at complete ecosystems in sensitive areas became apparent. During this time, the offshore leasing program was maturing. As a number of sales were held and exploration activities began, post-lease studies to monitor some of the possible effects of oil and gas activities on the environment and resources of these areas were initiated.

As studies information has been amassed, improved focus has required greater integration of various scientific disciplines. The BOEMRE 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 the BOEMRE and other Federal and State agencies collect more pertinent information, the BOEMRE 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 BOEMRE decision needs. Of course, additional research coordination with groups external to BOEMRE occurs continuously through a variety of institutional mechanisms, as discussed in the following section.

1.1.2 Scientific Studies Are Conducted in Partnership

The Alaska ESP, 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 BOEMRE, 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 Alaska ESP is conducted on a collaborative basis with an extensive range of bilateral and multilateral partnerships. The Alaska ESP coordinates routinely on major projects with numerous federal entities, including: National Oceanographic Partnership Program (NOPP); National Oceanic and Atmospheric Administration (NOAA) and the National Marine Fisheries Service (NMFS) Alaska Fisheries Science Center; NOAA's National Marine Mammal Laboratory (NMML); USGS-Alaska Science Center; U.S. Fish and Wildlife Service (USFWS); 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, 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 BOEMRE Alaska Region to study coastal topics associated with the development of natural gas, oil and minerals in Alaska's OCS. Under this arrangement, BOEMRE taps the scientific expertise of regional and local experts through UAF/UAA to collect and disseminate environmental information about resource issues of mutual interest. Through the CMI, the BOEMRE stimulates important studies in a cost-saving one-to-one match structure. In its first 16 years of operation, the CMI match has come from more than 50 different organizations and has leveraged over \$15 million of BOEMRE funds into \$30 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. In 2008, the cooperative agreement was extended until April 2013. Under the current 5-year agreement with the CMI, the BOEMRE has committed \$500,000 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 serving a separate biogeographic region. The goal of the CESU network is to improve the scientific base for managing federal lands by providing resource managers with high quality scientific research, technical assistance and education through their working partnerships. The Alaska Region participates in two CESUs. The Pacific Northwest CESU encompasses a region extending

across Washington, Oregon, Northern California, Western Idaho and Southeast Alaska, and is hosted by the University of Washington. The Northwest Alaska CESU comprises western (including the Aleutian Islands), north-central (the Interior), and northern (Subarctic and Arctic) Alaska, and is hosted by the University of Alaska, with the University of New Hampshire and the Alaska SeaLife Center as partners.

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 Alaska ESP 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 BOEMRE. 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 Oceans Act of 2000 called for establishment of a Commission on Ocean Policy to establish findings and develop recommendations for a coordinated and comprehensive national ocean policy. The Commission's final report to the President and Congress included specific recommendations for the ESP, such as prioritizing long-term environmental research and monitoring to better understand cumulative, low-level, and chronic impacts of OCS oil and gas activities on the natural and human environments (USCOP, 2004).

Another key source of input derives from discussion and advice generated through the OCS Scientific Committee, an external advisory 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 BOEMRE collaboration and coordination.

Significantly, the BOEMRE ESP also systematically seeks out and includes the knowledge of coastal community residents in planning. For example, the Alaska Annual Studies Plan is distributed for review each year to approximately 250 organizations, including Federal, State and local governments; Native, environmental, industrial, and international organizations. Comments received from stakeholders are influential in designing and managing the Program on an annual basis.

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 proximate to the North Aleutian Basin are likewise concerned about the potential effects of OCS activities on commercial fishing, marine subsistence resources and migratory waterfowl that use coastal lagoons. 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 BOEMRE field-oriented studies, researchers typically coordinate directly with local communities to discuss their plans, seek advice and assure that interested individuals learn about the project and its results. The BOEMRE 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 Issues To Be Addressed

The *Alaska Studies Development Plan FY 2011-2013* complements and reinforces the goals of the Environmental Studies Program. The ESP is guided by several broad themes, which include the following:

- Monitoring Marine Environments
- Conducting Oil-Spill Fates and Effects Research
- Minimizing Seismic and Acoustic Impacts
- Understanding Social and Economic Impacts
- Maintaining Efficient and Effective Information Management

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 Alaska ESP 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 decisionmakers. Currently the Alaska ESP has primary focus on upcoming developments, possible lease sales, exploration activities and existing leases in the Beaufort Sea, Chukchi Sea and North Aleutian Basin 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 Alaska ESP?

Similarly, current offshore oil and gas-related issues in the North Aleutian Basin Planning Area include, but are not limited to:

- What refinements are there to our knowledge of major oceanographic and meteorological processes in the North Aleutian Basin and how do they influence the human, marine and coastal environment?
- What long-term change in anthropogenic hydrocarbon compounds has occurred in water and sediment?
- How do we improve our model predictions of the fate of potential oil spills?
- What long term changes related to past or future activities have occurred in marine food webs, especially regarding key fish, seabirds and sensitive marine mammals?
- What are the effects of offshore oil and gas exploration and development on important socioeconomic activities such as commercial and sport fishing or existing community infrastructures?
- What are current subsistence harvest patterns 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 conducting studies related to the Alaska ESP?

1.2 Projected OCS Activities

The BOEMRE ESP funds studies that have strong applicability to pending pre- and post-lease decisions under the current (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 methodology,
- Feasibility of the proposed project, and
- Availability of needed information from other sources.

1.2.1 Pre-lease Considerations

This *Alaska Studies Development Plan FY 2011-2013* reflects consideration of the proposed lease sales in the *Final Outer Continental Shelf Oil and Gas Leasing Program 2007-2012* (USDOJ, MMS, 2007). 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.

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). The last of these sales was held in April 2007. Other lease sales in that *Program* were postponed or were cancelled due to a lack of industry interest. The BOEMRE issued the *Final Outer Continental Shelf Oil and Gas Leasing Program 2007-2012* in April 2007. The first lease sale under this *Program* was held in February 2008 in the Chukchi Sea Planning Area. The *Final Program* also proposes the following lease sales: two in the Beaufort Sea (2010 and 2011); two more sales in the Chukchi Sea (2010 and 2012) (see Figure 3); one in the North Aleutian Basin (2011) subject to restrictions (see Figure 4); and one in Cook Inlet (2011) as a special interest sale (see Figure 5). The Cook Inlet special interest sale would be held only if industry shows interest in response to a request for nominations and comment.

Preparation of the 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.

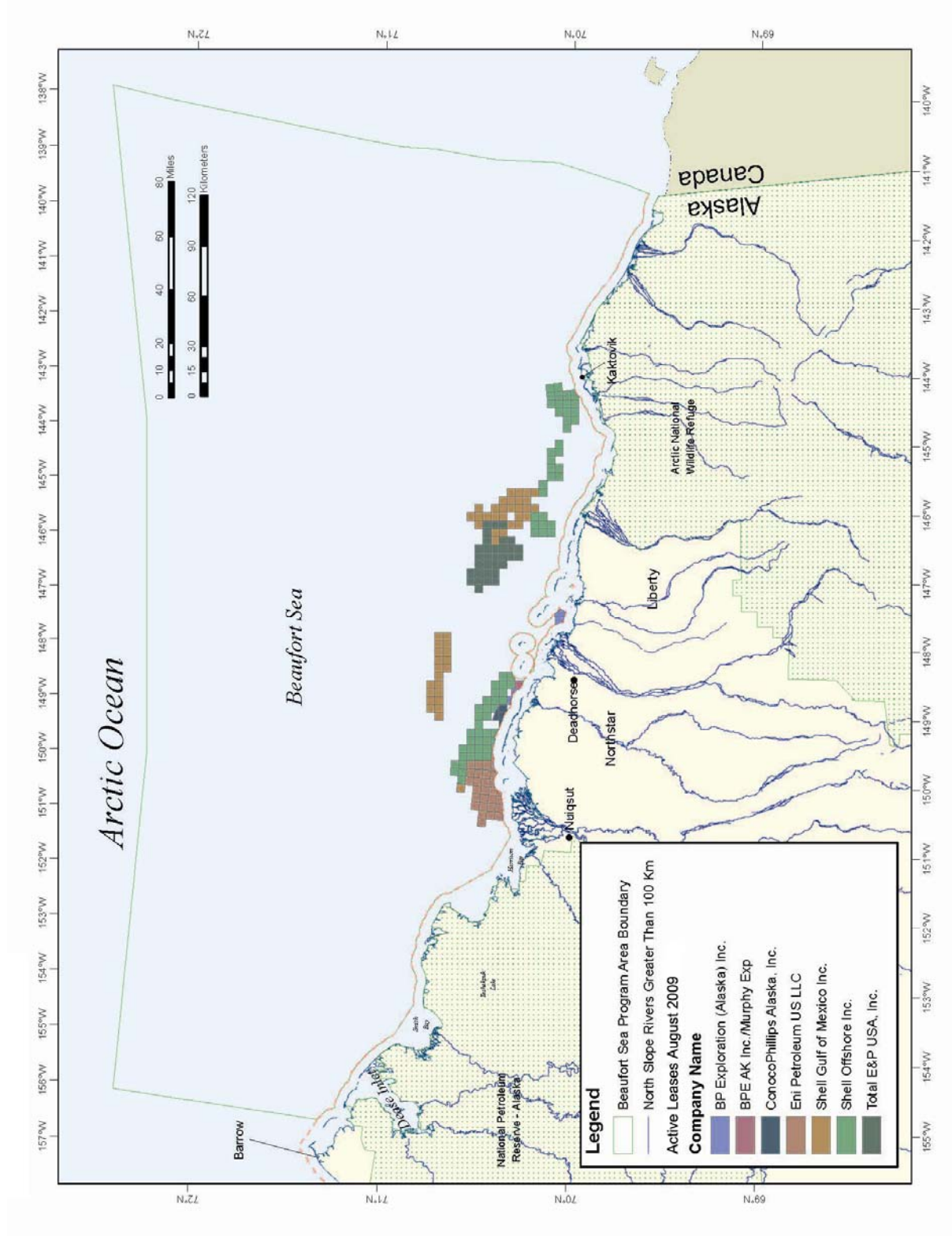
1.2.2 Post-lease Considerations

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 BOEMRE 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 accounted for in 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)

Figure 2. Beaufort Sea Oil and Gas Leasing Activity



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 August, 2009, there are more than 180 active leases in the Beaufort federal offshore area.

The British Petroleum Exploration Alaska (BPXA) Northstar development project (see Figure 6) is located about 10 miles north of Prudhoe Bay. This is the first development project to have production from the Alaska OCS. While the Northstar Island is in State waters, six to seven wells will be drilled into the Federal OCS. The project was approved by the U.S. Army Corps of Engineers in May 1999 and by the BOEMRE in September 1999. Construction started in the winter of 2000 and production began the last day of October 2001. The cumulative production for the Northstar State-Federal Unit through October 2009 totals 140 million barrels of oil from estimated recoverable reserves of 158 million barrels. Annual production peaked at 25 million barrels in 2004.

Another BPXA project is the Liberty Unit in Foggy Island Bay, located about 6 miles east of the State Endicott Project. In January 2008, BOEMRE approved BPXA's *DEVELOPMENT PROJECT: Development and Production Plan* for the Liberty Project (BPXA, 2007). This plan uses ultra-extended-reach drilling from the existing Endicott Satellite Drilling Island (SDI). BPXA believes that this plan will require relatively few wells (up to six), resulting in a smaller environmental footprint and fewer impacts than a previously proposed offshore development.

Lease Sale 193 in February 2008 resulted in 487 leases being issued in the Chukchi Sea Planning Area. The only other active leases are in the Cook Inlet/Shelikof Strait 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 or Gulf of Alaska Subregions (see Figure 1).

Figure 3. Chukchi Sea Oil and Gas Leasing Activity

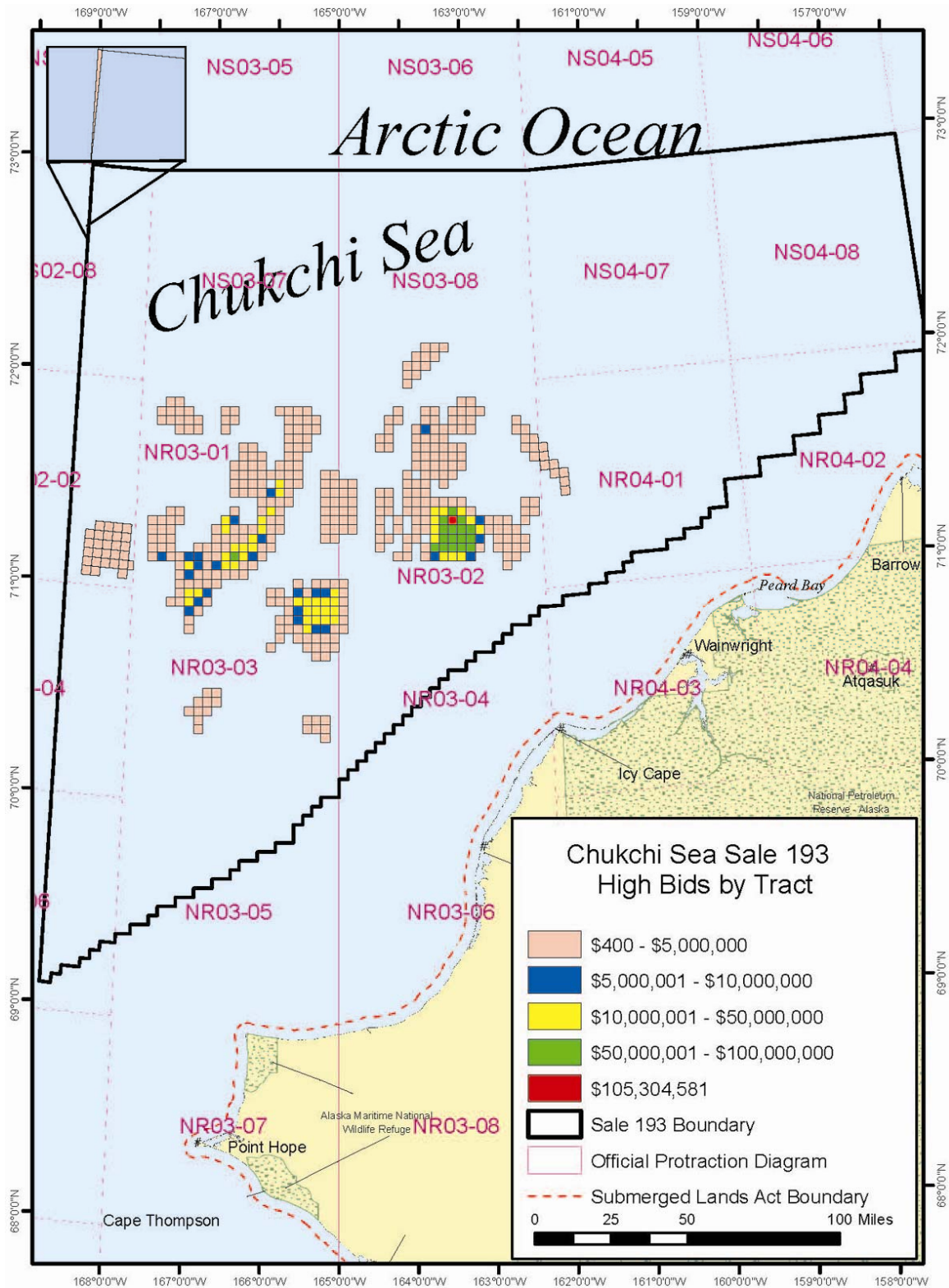


Figure 4. North Aleutian Basin Planning Area

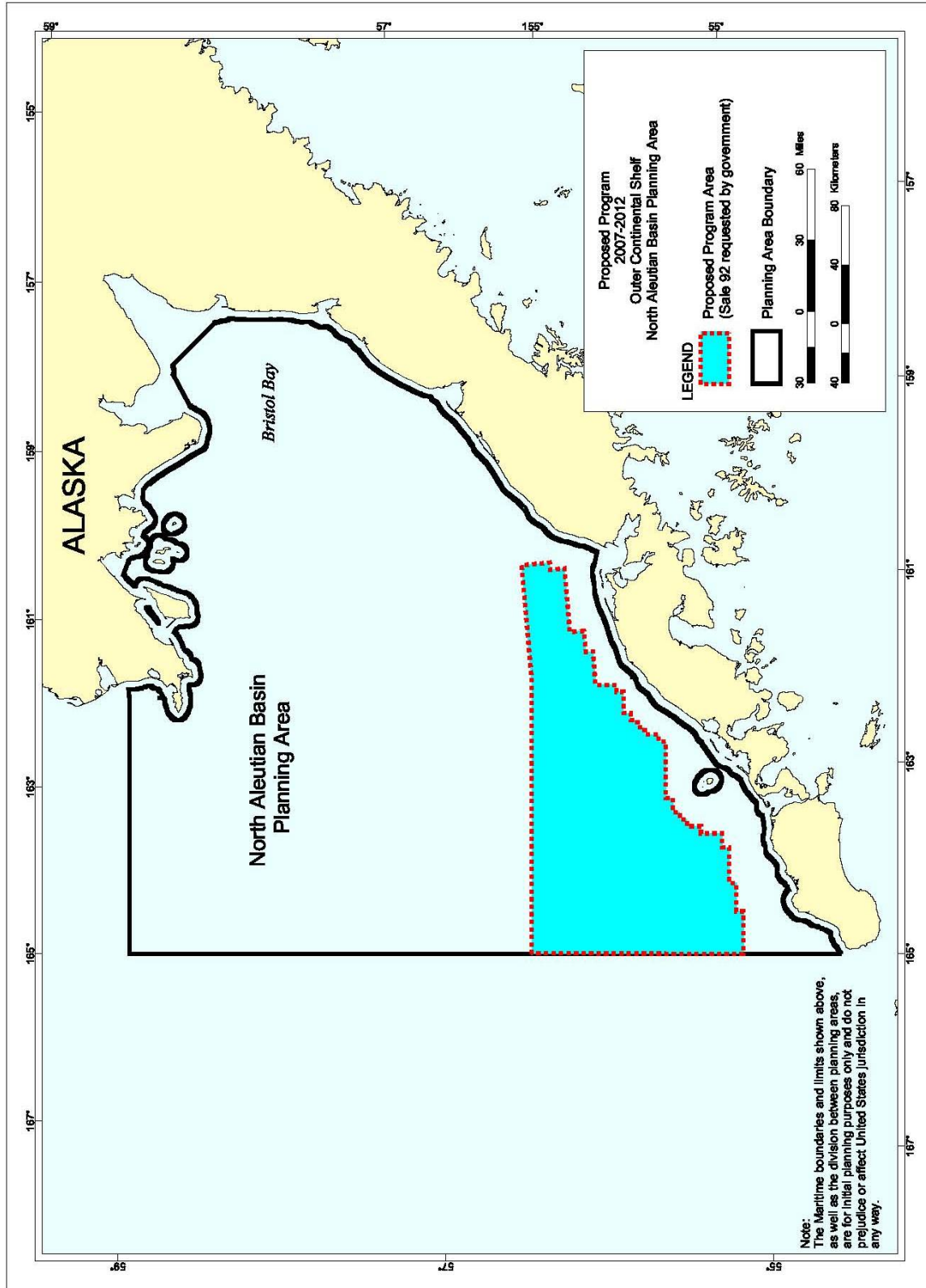


Figure 5. Cook Inlet Oil and Gas Leasing Activity

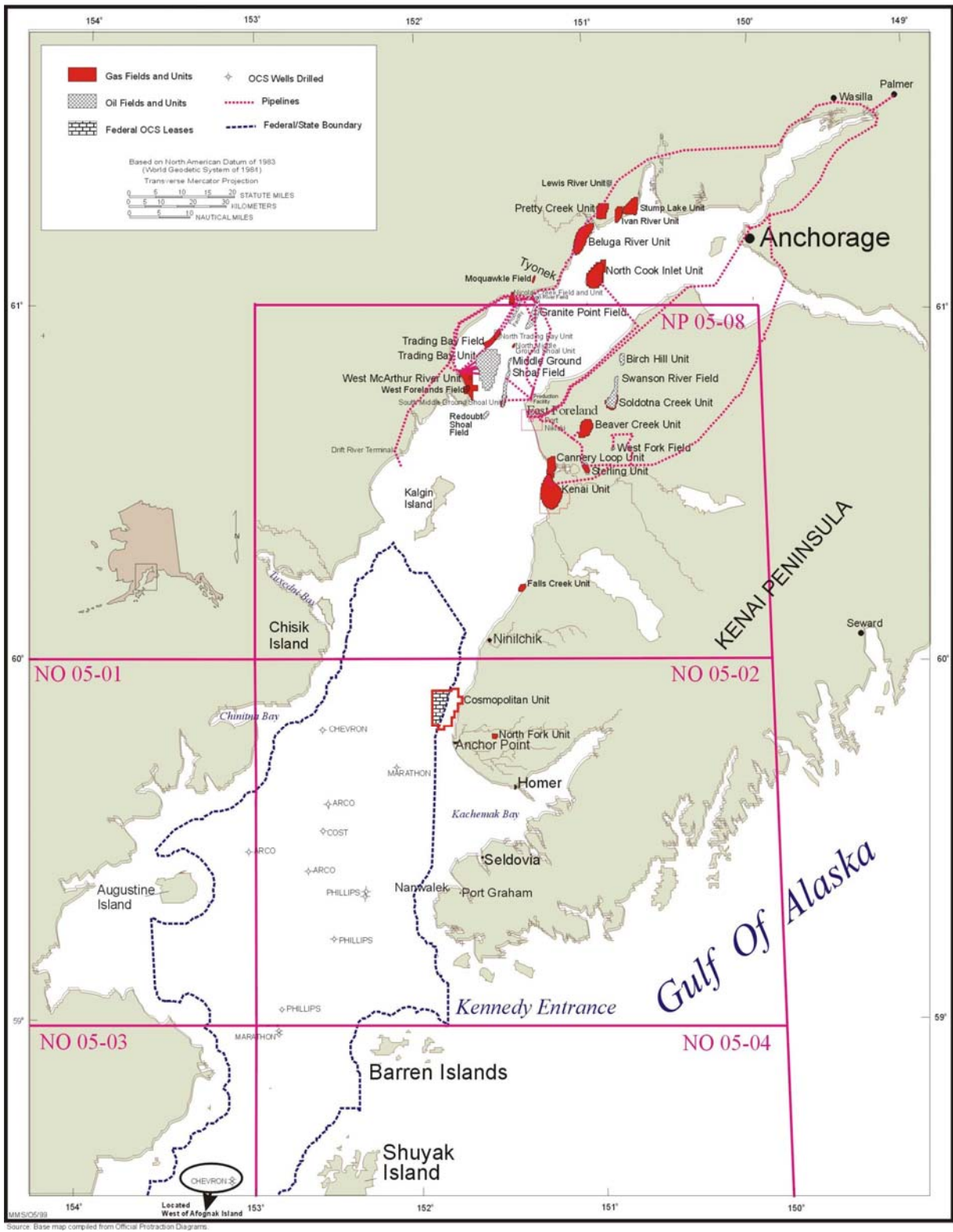
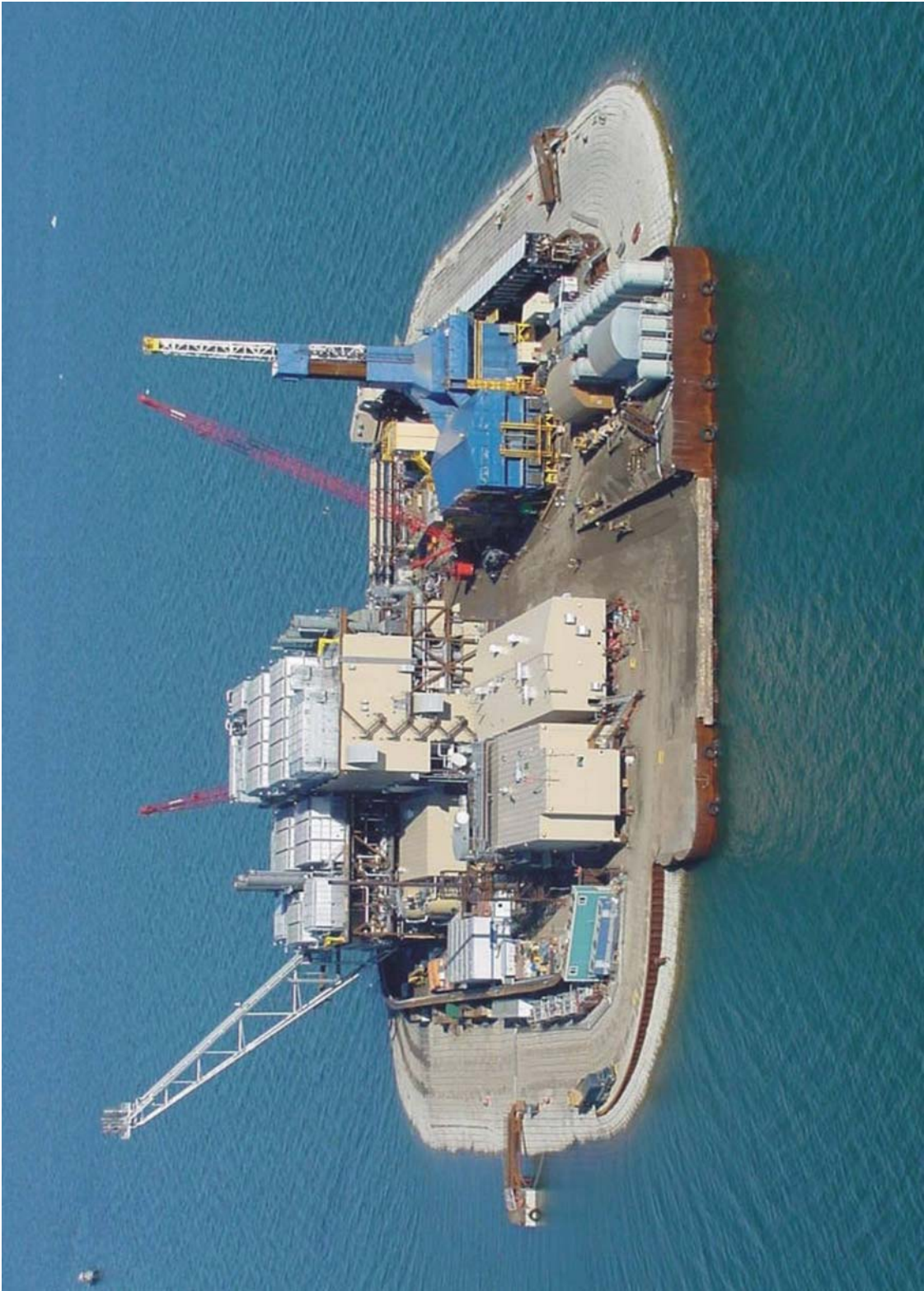


Figure 6. Northstar Island August 2000



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 Alaska ESP distributes the *Alaska Annual Studies Plan* to more than 250 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 Information Transfer Meetings (ITMs) and other meetings. For example, the Alaska OCS Region has conducted eleven ITMs. The eleventh ITM was convened in October 2008 in Anchorage, Alaska. It was held in conjunction with the U.S. and Canada Northern Oil and Gas Research Forum that was sponsored by a number of organizations and government agencies, including the BOEMRE. The BOEMRE, along with numerous organizations and agencies, also sponsors the Alaska Marine Science Symposium held in Anchorage, Alaska each year. In addition, BOEMRE has sponsored a number of workshops and conferences over the years with topics that include: the use of 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 BOEMRE mission.

In preparation for possible oil and gas exploration in the Chukchi Sea (see Figure 3), the BOEMRE 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 BOEMRE 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, presented to and discussed by the workshop participants, and submitted to BOEMRE for prioritization for inclusion in the COMIDA field effort. The workshop report was published in April 2007 (MMS 2007-002 – USDOJ, MMS, Alaska OCS Region, 2007c) and has become a useful planning tool that continues to influence our study priorities.

The BOEMRE also conducted a four day North Aleutian Basin (NAB) planning workshop from November 28-December 1, 2006, in Anchorage, AK. The 113 meeting participants represented a broad mix of research scientists, public agency managers, and stakeholders from local government, commercial fishing, subsistence organizations, tribal organizations and environmental organizations, including regional institutions such as: the Aleutians East Borough, Bristol Bay Borough, Lake and Peninsula Borough, Bristol Bay Native Association, Aleutian Pribilof Islands Association, Friends of Bristol Bay, and the Bering Sea Fishermen's

Association. Plenary speakers and meeting participants emphasized the critical importance of resources in the NAB including human subsistence resources, commercial fisheries and internationally important bird and marine mammal populations and habitats.

Meeting participants broke into five working groups: 1) oceanography, ecosystems, and fate and effects of oil spills; 2) socioeconomics and subsistence; 3) fish and fisheries; 4) birds; and 5) marine mammals. The objectives of each working group were: to review the status of existing information; to identify information needs to support future environmental assessment activities in the Basin; to prioritize those information needs; and to develop proposed study profiles to fill high priority information needs. In total, the agency received 35 study profiles on the various topics discussed. The workshop report was published in June 2007 (MMS OCS Study Number 2007-031 – USDO, MMS, Alaska OCS Region, 2007b). The report has become a useful planning tool that continues to influence our study priorities in the Bering Sea.

1.3.1 Beaufort Sea General Information Needs

Long-Range Monitoring of Interdependent Physical, Biological and Social Processes

Both offshore and onshore oil and gas development and production activities are increasing 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.

A number of studies have been developed to address these issues. The "Arctic Nearshore Impact Monitoring in Development Area" (ANIMIDA), a seven-year program started in 1999, provided baseline data and monitoring results for chemical contamination, turbidity, and subsistence whaling in the vicinity of Northstar and Liberty development sites. The continuation of ANIMIDA (cANIMIDA) has gathered long term monitoring data to provide a basis of continuity and consistency in evaluation of potential effects from site-specific, recently initiated development and upcoming production in the Beaufort Sea OCS. The objectives of cANIMIDA include:

- Hydrocarbon and metal characterization of sediments, bivalves and amphipods in the study area
- Annual assessment of subsistence whaling near Cross Island
- Identification of sources, concentrations, and dispersion pathways for suspended sediment

- Monitoring the Boulder Patch
- Characterization of anthropogenic contaminants in upper trophic biota
- Partitioning of potential contaminants between dissolved and particulate phases

The final study reports from cANIMIDA are available on our website of completed study reports, or will be shortly. Several of these studies are planned to extend beyond the cANIMIDA project. “Continuation of Impact Assessment for Cross Island Whaling Activities” is underway. Sediments, pollutants, or disturbance associated with oil and gas-industry activities could negatively affect this unique environment. The study “ANIMIDA III: Contaminants, Sources, and Bioaccumulation” is proposed for FY 2011, and comprises 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 for summer 2010.

Other keystone oceanographic studies for the Beaufort Sea Planning Area include:

Beaufort Sea Nearshore Currents: The final report for this recently study completed in collaboration with UAF analyzes six years of current meter and water property data collected year-round (1999 – 2007) from the landfast ice zone of the nearshore Alaskan Beaufort Sea (MMS 2009-035 – Weingartner et al., 2009). The time-series data improves our understanding of current circulation under ice and in open water.

Surface Circulation Radar Mapping: Currents play a critical role in the transport and fate of spilled oil. In collaboration with UAF, BOEMRE initiated a study to use HF radar to collect near-real time surface current measurements in the Beaufort Sea and lower Cook Inlet and produce a geospatial database of the measurements.

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, BOEMRE initiated a study that 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 and Chukchi Seas.

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.

The BOEMRE also funds research in collaboration with other federal agencies through the National Oceanographic Partnership Program. Research in the Beaufort Sea conducted through NOPP, includes:

- Circulation, Cross-Shelf Exchange, Sea Ice, and Marine Mammal Habitats on the Alaskan Beaufort Sea Shelf
- Toward a predictive model of Arctic coastal retreat in a warming climate, Beaufort Sea, Alaska
- Episodic Upwelling of Zooplankton within a Bowhead Whale Feeding Area near Barrow, AK
- Comprehensive Modeling Approach Towards Understanding and Prediction of the Alaskan Coastal System Response to Changes in an Ice diminished Arctic

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. Related to these concerns, additional information is needed regarding currents that might carry oil under ice. Up-to-date information on ocean currents and sea ice is necessary to fully address these concerns. Concern has also been raised over increasing spillage from corroded pipelines on the North Slope. Updated spill data for the Alaska North Slope and Canadian Beaufort Sea coastal areas is needed to estimate oil spill occurrence rates. Information on the fate (weathering) of oil spills is being obtained through participation with a joint industry consortium (Oil in Ice JIP [Joint Industry Project]) doing field experiments on cleanup, behavior, and weathering of oil in broken ice.

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. 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. Noise from industrial activity is a central concern. Additionally, Iñupiat whale hunters and the scientific community have raised concerns about potential cumulative impacts on bowhead whales. 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, beluga whales, spectacled eiders and other endangered species are an ongoing concern of environmental groups, Federal agencies and others. North Slope villages are also concerned about potential disturbance of ringed seals,

waterfowl and other subsistence-wildlife species by oil industry activities such as helicopter overflights.

These concerns are addressed in part by ongoing studies such as:

Monitoring the Distribution of Arctic Whales: The BOEMRE 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. In partnership with the NMML, the Bowhead Whale Aerial Survey Project (BWASP) extends a long-term database of the distribution, relative abundance, habitat, and behaviors (especially feeding) of endangered bowhead whales through the bowhead-migration corridor across the Alaskan Beaufort Sea.

Bowhead Whale Feeding Variability: In collaboration with NMFS, WHOI, ADF&G, and the AEWG, BOEMRE combines targeted oceanographic sampling with biological sampling and satellite tracking of individual whales (involving Alaska Native whalers and traditional knowledge) to expand scientific understanding of whale behavior and to improve predictions about where and when aggregations of feeding whales are likely to occur.

The study “Bowhead Whale Feeding Variability in the Western Alaskan Beaufort Sea” was extended for two additional field seasons in FY 2010. When recommending added field seasons for this study, the NMFS cited the importance of continued data collection for the purpose of informing management decisions. The North Slope Borough has also urged the BOEMRE to continue ongoing, long-term studies such as this.

Population and Sources of Recruitment in Polar Bears: In collaboration with the University of Alberta, Canada, the BOEMRE launched a study to provide data necessary for interpretation of the population structure of polar bears in North America and how they make use of land, nearshore, and OCS habitats at various life stages.

Demography and Behavior of Polar Bears: In partnership with the USGS Alaska Science Center and USFWS Marine Mammals Management, BOEMRE will collect data (beginning in 2009) 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.

Fish

Relatively little is known of fishes in the Beaufort and Chukchi Seas, although they fill an essential role in the Arctic ecosystem by consuming small prey and themselves providing a food resource for larger fishes, birds, marine mammals, and people. 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. It is important to assess the distribution and abundance of fishes in these areas to distinguish between anthropogenic and natural effects.

Beaufort Sea Marine Fisheries Monitoring: In collaboration with the NMFS Alaska Fisheries Science Center, 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.

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.

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 Iñupiat 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. 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. Current, relevant studies that address these concerns include:

Subsistence Mapping of North Slope Villages: This study compiles current information on subsistence activities and use of resources for Nuiqsut, Kaktovik, Barrow, and Wainwright and develops a Geographic Information System (GIS) to map and analyze changes in and potential interactions between subsistence activities and oil industry activities.

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 Kaktovik, Wainwright and Venetie.

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

Aggregate Effects Research and Environmental Mitigation Monitoring of Oil Operations in the Vicinity of Nuiqsut: This 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.

1.3.2 Chukchi Sea General Information Needs

Native cultural activities that rely on subsistence, particularly on marine resources, predominate in these regions. The fundamental issues in the Chukchi Sea are very similar to the Beaufort Sea (see Section 1.3.1) although many species that regularly occur within the Chukchi Sea do not typically occur within the Beaufort Sea. One major difference is that BOEMRE placed less emphasis on studying the Chukchi Sea than the Beaufort Sea beginning in the mid-1990s in recognition of leasing priorities. Knowledge of the spatial and temporal variability of leads, polynyas and landfast ice is dated. This information is important for determining the fate of spilled oil in this region and the impacts on biota associated with these systems. The status of many animal populations may also have changed since the earlier studies were conducted. Climate change may have triggered many spatial and temporal changes in the distribution of a variety of species.

Since 2007, BOEMRE has developed a new suite of studies in the Chukchi Sea, leveraging more than \$30 million (through FY2009, with another \$10 million planned for FY10) 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. Some selected highlights of the new research projects underway are excerpted below:

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, BOEMRE initiated a study that 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.

Surface Current Circulation Mapping: In collaboration with UAF, ocean current circulation fields are being mapped and analyzed along the northeastern coast of the 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 and examines the effects of climate state on ice characteristics.

Ecosystem Observations in the Chukchi Sea: The oceanographic component of a new passive acoustic monitoring study 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, photosynthetic radiation, ice thickness, ocean circulation, and zooplankton abundance (volume). The study partners BOEMRE with NOAA-Pacific Marine Environmental Lab and the Alaska Fisheries Science Center, National Marine Mammal Laboratory.

Chukchi Sea Offshore Monitoring in Drilling Area: Chemistry and Benthos: This study establishes a baseline for benthic biomass, species composition, and oil industry anthropogenic chemicals to detect changes as a result of future oil and gas activities. It initiates past and future time-trend analyses for benthic populations and anthropogenic chemicals and seeks to distinguish among changes due to development, climate, and food web structure.

Protected Species and Fish

Distribution and Relative Abundance of Marine Mammals: Aerial Surveys: In collaboration with the National Marine Fisheries Service (NMFS), BOEMRE collects aerial survey data on seasonal distribution, relative abundance, and habitat use of marine mammals in the Chukchi Sea. Observations from June to October 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.

Passive Acoustic Detection and Monitoring of Endangered Whales in the Arctic: A collaboration between NMFS and BOEMRE documents (beginning in 2010) 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.

Demography and Behavior of Polar Bears: In partnership with the USGS Alaska Science Center and USFWS Marine Mammals Management, BOEMRE will collect data (beginning in 2010) 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): Collaboration between BOEMRE and USGS- Biological Resources Division (BRD) provides updated information on marine bird distribution, species composition, molting, staging and timing of use in the vicinity of Peard Bay, Ledyard Bay, and Kasegaluk Lagoon of the eastern Chukchi nearshore environment.

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.

Current and Historic Distribution and Ecology of Demersal Fishes: In partnership with CMI, this study provides information on fish presence, abundance, distribution, geographic range, species assemblages, and habitat diversity that is needed to evaluate and mitigate the effects of offshore development. The project assembles data into a searchable database and analyzes water mass characteristics that define demersal fish habitat.

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

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.

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 the BOEMRE to assess whether OCS activities in the Chukchi Sea will result in changes to offshore subsistence hunting practices.

Traditional Knowledge Regarding Bowhead Whales in the Chukchi Sea: In collaboration with CMI, this study systematically gathers traditional knowledge about bowhead movements, distribution, and long-term changes in size composition and abundance from Native hunters in Wainwright to supplement earlier projects in Barrow and Kaktovik.

Economic Impact Modeling: This study upgrades and refines BOEMRE procedures for estimating the onshore economic effects of OCS-related activities by updating and enhancing the current version of a modeling program known as MAG-PLAN. The model provides a tool to estimate employment, personal income, and OCS-specific “cost functions” to estimate the industry expenditures required to complete a given activity, such as drilling an exploration well or operating a production facility.

1.3.3 North Aleutian Basin General Information Needs

The *North Aleutian Basin Information Status and Research Planning Meeting* in 2006 evaluated study concepts needed for describing the existing environment and forming a basis for assessing potential environmental effects or needed monitoring in the North Aleutian Basin Program Area (see Figure 5). Attendees concluded that critical information needs include:

- High-resolution data to improve existing models of circulation and physical oceanography
- Characterization of existing resources and their status in the Basin
- Distributions of resources in the Basin; life history and seasonal use patterns
- Population trends of important species
- Effects of seismic activities on ecological resources

The BOEMRE contracted with scientific staff at Argonne National Laboratory also to conduct a literature search of relevant scientific publications over the last ten years (1996 to 2006), leading to the production of a literature synthesis report (MMS 2007-066 – USDOl, MMS, Alaska OCS Region, 2007a).

Studies underway in the North Aleutian Basin include:

Modeling of Circulation in the North Aleutian Basin: The BOEMRE contracted with Rutgers University, in association with the University of Alaska-Fairbanks, to modify an existing ice-ocean circulation model to the specific oceanographic conditions in Alaska's Bristol Bay. This study will aid in determining environmentally sound actions that will need to be taken to protect the region.

Biogeochemical Assessment of the North Aleutian Basin Ecosystem: Current Status and Vulnerability to Climate Change: In collaboration with the Coastal Marine Institute at UAF, this cooperative study measures ecosystem productivity in the North Aleutian Basin 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 pCO₂.

Distribution, Abundance, and Habitat Use of North Pacific Right Whales: The North Pacific right whale is a federally designated endangered species. In collaboration with the National Marine Fisheries Service, this multimillion dollar study uses aerial and ship-based surveys, tagging of whales and acoustic methodologies to gather data on the ecology and behavior of right whales in the NAB.

Juvenile and Maturing Salmon Use of the North Aleutian Basin Lease Area: In partnership with the NOAA/NMFS Alaska Fisheries Science Center's Auke Bay Laboratories, this study involves surveys of seasonal fish use and habitat assessment with surface trawls in waters at least 20 meters deep in May and July to assess late winter and early summer fish characteristics.

Spatial and Temporal Mapping of Nearshore Juvenile Fish and Larval Crab: This study, in collaboration with the NOAA Earth System Research Laboratory, maps the location and timing of larval nurseries, juvenile rearing, and crab settling areas through aerial digital imaging and Light Detection and Ranging (LiDAR).

Subsistence Study for North Aleutian Basin: In collaboration with Idaho State University, this study gathers current household and community data to identify predominant patterns of subsistence activities. The results of this study will serve as community baselines to monitor and mitigate any significant future changes in subsistence activities over time, including trends in harvest and distribution networks.

Social and Economic Assessment of Major Oil Spill Litigation Settlement for the Alaska OCS Region: This study, initiated in 2003, gathered social and subsistence data relevant to the region. In particular, the study developed a case study specifically focused on the spill event

of the *Selendang Ayu* along the Aleutian Chain and the implications of that event for nearby coastal communities. The final report is forthcoming.

The ESP continues to work and coordinate with the Aleutians East Borough, the North Pacific Research Board, and other interested stakeholders to develop new study proposals in the Bering Sea. Additional studies proposed to start in FY 2010 include monitoring of near-shore benthic biota habitat, social research on regional socio-economic indicators, and biological studies of Steller sea lions, humpback whales and fin whales. Progress on all of these proposals will remain subject to availability of funds.

1.3.4 Renewable Energy General Information Needs

Section 388 of the Energy Policy Act of 2005 amended the OCSLA to give discretionary authority to BOEMRE 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 the BOEMRE 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.

Renewable energy resources, such as solar, wind, tidal and geothermal power, are gaining credence as a viable means to offset a portion of the nation's dependence upon fossil fuels and reduce pollution emissions, as well as a means to reduce large international trade deficits, to improve national security, and to stimulate new prospects for economic expansion. Alternative renewable energy supplies convey great promise for the future, but they must be imagined within the context of existing and developing socio-economic and political relations, with a watchful eye upon the potential environmental, social and cultural consequences of a significant technological transformation.

The study "Renewable Energy Potential in Coastal Alaska" has been proposed for FY 2012. It has been advertised as a Broad-Agency Agreement RFP (request for proposals) under the auspices of the National Oceanographic Partnership Program and the President's Interagency Committee on Ocean Science and Resource Management Integration. The objectives of this study are to: 1) establish firm intellectual understanding over the range of options, processes, economic feasibility, and potential management strategies that are relevant to development prospects for renewable energy sources on the OCS of Alaska and 2) systematically collect a variety of technical and socioeconomic data to produce a resource inventory database about the realistic prospects and related social impacts of specific alternative energy development scenarios for the Alaska region.

1.4 New Starts for FY 2010 and Ongoing Studies

Table 1 lists new studies planned to start in FY 2010 and ongoing studies, categorized by discipline. Profiles for these studies can be found at:

http://alaska.boemre.gov/ess/ongoing_studies/ongoing_studies/Ongoing%20Studies.pdf

Table 1. Alaska OCS Region New Starts for FY 2010 and Ongoing Studies

Program Lead	Planning Area	Discipline	Start FY	Study Title
NEW STARTS				
BOEMRE	CH / BS	PO	10	Adaptation of Arctic Circulation Model
BOEMRE/ NMML	CH / BS	MM	09	COMIDA: Passive Acoustic Detection and Monitoring of Endangered Whales in the Arctic (Award Pending)
BOEMRE/ PMEL	CH / BS	PO	09	COMIDA: Ecosystem Observations in the Chukchi Sea: Biophysical Moorings and Climate Modeling (Award Pending)
BOEMRE/ NMML/ Canada DFO	CH / BS	MM	10	Bowhead Whale Feeding Variability in the Western Alaskan Beaufort Sea: Satellite Tracking of Bowhead Whales (Extension)
BOEMRE/ NMML	CH / BS	MM	10	Bowhead Whale Feeding Variability in the Western Alaskan Beaufort Sea: Oceanography and Feeding (Extension)
BOEMRE	AK	IM	10	Management, Logistics, and Warehouse Storage of Oceanographic Equipment
BOEMRE	CH	MM	10	COMIDA: Distribution and Relative Abundance of Marine Mammals: Aerial Surveys (Extension)
BOEMRE/ NMFS	BS	HE	10	Beaufort Sea Marine Fish Monitoring Survey in the Central Beaufort Sea
BOEMRE	AK	PO	10	Evaluation of the Use of Hindcast Model Data for OSRA in a Period of Rapidly Changing Conditions (Workshop)
BOEMRE/ NMFS / AEB	NAB	HE	10	North Aleutian Basin Monitoring in Drilling Area (NABMIDA): Nearshore Benthic Biota Habitat Baseline & Community Based Long-Term Monitoring
BOEMRE	CH / BS	HE	10	Joint Funding Opportunities in Existing Marine Fish Studies
BOEMRE/ FWS	CH / NAB	HE	10	Seabird Distribution and Abundance in the Offshore Environment
BOEMRE	NAB	SS	10	North Aleutian Basin Socio-economic Indicators
BOEMRE/ TBD	NAB	MM	10	Seasonal Habitat Use by Endangered Steller Sea Lions of the North Aleutian Basin Sale Area
BOEMRE/ TBD	NAB	MM	10	Occurrence and Distribution of Endangered Humpback and Fin Whales in the NAB Area
BOEMRE	AK	IM	10	Alaska State-Wide Oceans Research and Studies

				Project Browser Covering the Alaska Offshore and Coastal Areas
<i>*Note: The procurement of any study is contingent upon availability of funding</i>				
ONGOING STUDIES				
Physical Oceanography				
BOEMRE/ NOPP	AK	PO	07	Comprehensive Modeling Approach Towards Understanding and Prediction of the Alaskan Coastal System Response to Changes in an Ice Diminished Arctic
BOEMRE	BS	PO	06	Feasibility and Study Design for Boundary Oceanography of the Beaufort Sea
BOEMRE/ CMI	BS	PO	06	Idealized Process Model Studies of Circulation in the Landfast Ice Zone of the Alaskan Beaufort Sea.
BOEMRE/ UAF	BS	PO	06	Support of the Collection of Meteorological Data on the North Slope and Beaufort Sea, Alaska
BOEMRE/ NOPP	BS	PO	07	Circulation, Cross-Shelf Exchange, Sea Ice, & Marine Mammal Habitats on the AK Beaufort Sea Shelf
BOEMRE/ NOPP	BS + other	PO	04	Surface Circulation Radar Mapping in Alaskan Coastal Waters: Field Study Beaufort Sea and Cook Inlet
BOEMRE/ CMI	CH	PO	09	Mapping and Characterization of Recurring Polynyas and Landfast Ice in the Chukchi Sea
BOEMRE/ CMI	CH	PO	09	Surface Current Circulation High Frequency (HF) Radar Mapping in the Chukchi Sea
BOEMRE	CH / BS	PO	06	Beaufort/Chukchi Seas Mesoscale Meteorology Modeling Study Phase II
BOEMRE	NAB	PO	07	Modeling of Circulation in the North Aleutian Basin
Fates & Effects				
BOEMRE/ CMI	BS	FE	05	Assessment of the Direction and Rate of Alongshore Transport of Sand and Gravel In Petroleum Development Region of the North Slope of Alaska
BOEMRE/ CMI	BS	FE	06	Synthesis of Time Interval changes in Trace Metals & Hydrocarbons in Nearshore Sediments of the AK Beaufort Sea: A Statistical Analysis
BOEMRE/ NOPP	BS	FE	07	Toward a Predictive Model of Arctic Coastal Retreat in a Warming Climate, Beaufort Sea, Alaska
BOEMRE	CH	FE	08	COMIDA: Chemistry and Benthos (CAB)
BOEMRE	CH / BS	FE	05	Updates to the Fault Tree Approach to Oil Spill Occurrence Estimators for the Beaufort and Chukchi Sea

Habitat and Ecology				
BOEMRE	NAB	HE	09	Juvenile and Maturing Salmon Use of the North Aleutian Basin Lease Area
BOEMRE/ NOAA	NAB	HE	09	Spatial and Temporal Mapping of Nearshore Juvenile Fish & Settling Crab in the North Aleutian Basin
BOEMRE/ BRD	BS	HE	06	Testing Molecular & Otolith Tools to Investigate Population-of-Origin & Mitigation in Arctic Cisco Found in Colville River, Alaska
BOEMRE/ CMI	BS	HE	08	Recovery in a High Arctic Kelp Community
BOEMRE/ NMFS	BS	HE	07	Beaufort Sea Marine Fish Monitoring: Pilot Survey and Test of Hypotheses
BOEMRE/ CMI	BS	HE	04	Evaluating a Potential Relict Arctic Invertebrate and Algal Community on the West Side of Cook Inlet
BOEMRE/ CMI	CH	HE	07	Current & Historic Distribution & Ecology of Demersal Fishes in the Chukchi Sea Planning Area
BOEMRE/ CMI	CH	HE	09	Trophic Links: Forage Fish, Their Prey, and Ice Seals in the Northeast Chukchi Sea
BOEMRE/ BRD	CH / BS	HE	09	Arctic Fish Ecology Catalogue
BOEMRE/ NOPP	CH / BS	HE	07	Upwelling of Zooplankton within a Bowhead Whale Feeding Area Near Barrow, AK
BOEMRE/ CMI	CH / BS	HE	09	Population Connectivity and Larval Dispersal in Bering, Chukchi, & Beaufort Sea Snow Crab Populations: Estimating Spatial Scales of Disturbance Impacts
BOEMRE/ CMI	NAB	HE	08	Biogeochemical Assessment of the North Aleutian Basin Ecosystem: Current Status & Vulnerability to Climate Change
Marine Mammals and Protected Species				
BOEMRE/ BRD	CH / BS	MM	09	Demography and Behavior of Polar Bears Summering on Shore in Alaska
BOEMRE/ CMI	BS	MM	04	Premigratory Movements and Physiology of Shorebirds Staging on Beaufort Littoral Zone
BOEMRE/ Canada	BS + other	MM	05	Assessing Reproduction and Body Condition of the Ringed Seal Near Sachs Harbour, Northwest Territory, Canada, through a Harvest-based Sampling Program
BOEMRE	CH	MM	08	COMIDA: Distribution and Relative Abundance of Marine Mammals: Aerial Survey
BOEMRE/ BRD	CH	MM	07	Monitoring Marine Birds of Concern in the Eastern Chukchi Nearshore Area (Loons)
BOEMRE/ NMML	CH	MM	07	Pinniped Movements and Foraging: Bearded Seals

BOEMRE/ TBD	CH	MM	09	Pinniped Movements and Foraging: Walrus Habitat Use in the Potential Drilling Area (Chukchi)
BOEMRE/ NMML/ Canada DFO	CH / BS	MM	05	Bowhead Feeding Variability in the Western AK Beaufort Sea: Satellite Tracking of Bowhead Whales
BOEMRE/ NMML	CH / BS	MM	05	Bowhead Feeding Variability in the Western AK Beaufort Sea: Oceanography and Feeding
BOEMRE/ NMML	CH / BS	MM	07	Monitoring the Distribution of Arctic Whales
BOEMRE/ Canada	CH / BS	MM	05	Population and Sources of Recruitment in Polar Bears
BOEMRE/ BRD	CH / BS	MM	09	Migration and Habitat Use by Threatened Spectacled Eiders in the Eastern Chukchi Near and Offshore Environment
BOEMRE/ NMML	NAB	MM	07	Distribution, Abundance, and Habitat Use of North Pacific Right Whales
BOEMRE/ NMML	Cook Inlet	MM	03	Distribution and Abundance of Harbor Seals in Cook Inlet
BOEMRE/ NMML	Cook Inlet	MM	04	Movements and Habitat Use of Harbor Seals in Cook Inlet
Social Systems				
BOEMRE	AK	SS	09	Testing, Improvement, and New Alaska Data for MAG-PLAN
BOEMRE/ NSSI	BS	SS	09	Aggregate Effects Research & Environmental Mitigation Monitoring of Oil Operations in the Vicinity of Nuiqsut
BOEMRE	AK	SS	03	Social and Economic Assessment of Major Oil Spill Litigation Settlement for the Alaska OCS Region
BOEMRE/ NMML	BS	SS	08	Continuation of Impact Assessment for Cross Island Whaling Activities-Beaufort Sea
BOEMRE	BS	SS	02	Subsistence Mapping of Nuiqsut, Kaktovik and Barrow: Past and Present Comparison
BOEMRE/ CMI	BS	SS	09	Subsistence Use and Knowledge of Beaufort Salmon Populations
BOEMRE	CH	SS	09	COMIDA: Impact Monitoring for Offshore Subsistence Hunting
BOEMRE/ CMI	CH	SS	07	Traditional Knowledge Regarding Bowhead Whales in the Chukchi Sea
BOEMRE/ CESU {UAF} /NSF	CH / BS	SS	07	Study of Sharing Networks to Assess the Vulnerabilities of Local Communities to O&G Development Impacts in Arctic Alaska
BOEMRE	NAB	SS	08	Subsistence Study for North Aleutian Basin

Multidisciplinary				
BOEMRE	BS	MULTI	03	Continuation of Arctic Nearshore Impact Monitoring in Development Area (cANIMIDA)
BOEMRE	BS	MULTI	03	TO#2 - Hydrocarbons and Metal Characterization of Sediments in the cANIMIDA Study Area
Information Management				
BOEMRE/ CMI	AK	IM	08	BOEMRE-University of Alaska Fairbanks-State of Alaska Coastal Marine Institute Management
NPRB / BOEMRE	AK	IM	10	Alaska Marine Science Symposium (co-sponsor)
BOEMRE	AK	IM	07	Management, Logistics, and Warehouse Storage of Oceanographic Equipment
BOEMRE	AK	IM	08	Conference Management and Reports on BOEMRE Results
Other (Research Partnerships)				
BOEMRE Technology Assessment and Research Program (TAR)				
BOEMRE-University of Alaska Fairbanks-State of Alaska Coastal Marine Institute (CMI) Cooperative Ecosystem Studies Unit (CESU); University of Alaska Fairbanks (UAF); University of Washington (UW)				
USGS/Biological Resources Division (BRD)				
National Oceanographic Partnership Program; eg. Comprehensive Modeling Approach Towards Understanding and Prediction of the Alaskan Coastal System Response to Changes in an Ice Diminished Arctic				
Federal Inter-agency Agreements: eg. NOAA-National Marine Fisheries Service (NMFS) / National Marine Mammal Laboratory (NMML) / US Fish and Wildlife Service (FWS) / PMEL (Pacific Marine Environmental Laboratory)				
National Science Foundation (NSF)				
North Slope Science Initiative (NSSI)				
North Pacific Research Board (NPRB)				
National Aeronautics and Space Administration (NASA)				
National Fish and Wildlife Foundation				
Alaska Ocean Observing System (AOOS)				
Aleutians East Borough (AEB)				
Alaska Department of Fish and Game (ADF&G)				
Industry Studies				
Arctic Monitoring and Assessment Programme (AMAP)				
Canadian Department of Fisheries/Oceans (DFO)				
Discipline Codes				
AQ = Air Quality		FE = Fates & Effects		MM = Marine Mammals and Protected Species
IM = Information Management		SS = Social Systems		
PO = Physical Oceanography		HE = Habitat & Ecology		
Planning Area Codes				
BS = Beaufort Sea		CH = Chukchi Sea		NAB = North Aleutian Basin Other = Other Regions
CI = Cook Inlet		AK = All Planning Areas		

SECTION 2.0 PROPOSED STUDY PROFILES

2.1 Introduction

The BOEMRE Alaska OCS Region proposes eleven new studies for FY 2011. The proposed studies focus on the Beaufort and Chukchi Seas and the North Aleutian Basin. Budget estimates for FY 2011 proposed new starts total \$11 million.

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 2011 proposed new starts.

Profiles of ongoing studies can be found at:

http://alaska.boemre.gov/ess/ongoing_studies/ongoing_studies/Ongoing%20Studies.pdf

This website is updated two times each year and includes:

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

For completed Alaska OCS Region Studies, go to:

<http://www.boemre.gov/alaska/ref/AKPUBS.HTM>

2.2 Profiles of Studies Proposed for FY 2011 NSL

Table 2. Alaska OCS Region Studies Proposed for the FY 2011 NSL

Page No.	Discipline	Title	Ranking
37	FE	Updates to the Fault Tree for Oil-Spill Occurrence Estimators needed under the forthcoming BOEMRE 2012-2017, 5-Year Program	1
39	SS/FE	Onshore Effects of Offshore Oil Development: Oil Spill Occurrence Estimators for Onshore Alaska and Canada North Slope Crude and Refined Oil Spills	2
41	PO	Hanna Shoal Ecosystem Study	3
43	IM	Synthesis Report Generation: Technical Support for Environmental Analyses on Select Regional Topics	4
45	MM/PO	Marine Mammal/Physical Oceanography Synthesis	5
47	MM	Monitoring the Distribution of Arctic Whales (COMIDA/BWASP Extension)	6
49	HE	Distribution of Fish, Crab and Lower Trophic Communities in the Chukchi Sea Lease Area	7
51	SS	Social Indicators in Coastal Alaska: Arctic Communities	8
53	HE	Shorebirds and infaunal abundance and distribution on delta mudflats along the Beaufort Sea	9
55	IM	Oilspill Lessons Learned Workshop	10
57	FE	Maximum Credible Blowout Occurrence and Size Estimators for the Alaska OCS	11
59	IM	ShoreZone Mapping of the North Slope of Alaska	12
61	IM	Workshop—Interagency Protocols for Immediate On-the-Scene Oil Spill Impact Science	13
63	HE	Arctic Cod Genomics, a Pilot Study	14
65	FE	ANIMIDA III: Contaminants, Sources, Bioaccumulation	15
AQ = Air Quality		FE = Fates & Effects	MM = Marine Mammals and
IM = Information Management		SS = Social Systems	Protected Species
PO = Physical Oceanography		HE = Habitat & Ecology	REN = Renewable Energy

ENVIRONMENTAL STUDIES PROGRAM: Studies Development Plan FY 2011-2013

Region: Alaska

Planning Area(s): Beaufort Sea, Chukchi Sea, Hope Basin, Norton Basin

Title: Updates to the Fault Tree for Oil-Spill Occurrence Estimators needed under the forthcoming BOEMRE 2012-2017, 5-Year Program

BOEMRE Information Need(s) to be Addressed: The Oil Spill Risk Analysis (OSRA) is a cornerstone to regional EISs, EAs, and oil-spill contingency planning. Oil-spill issues constitute a significant portion of public comments submitted on sale or development EISs in the Alaska OCS Region. This study is necessary to incorporate fault-tree spill occurrence estimators into NEPA analyses for Arctic oil and gas lease sales or Arctic development in the expected BOEMRE 2012-2017, 5-Year Plan.

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

Period of Performance: FY 2011-2016

Description:

Background: The OCS spill occurrence rates used in non-Arctic BOEMRE NEPA analyses are based on historical platform, pipeline or tanker crude oil-spill rates, almost entirely from the Gulf of Mexico and Pacific OCS. Since 2002, the BOEMRE Alaska OCS Region has incorporated a fault-tree approach which considers 1) differences in oil-spill occurrence factors between the Arctic and Gulf of Mexico OCS and 2) Arctic-specific factors. Recent examples of such analyses include:

- Bercha, F. G. 2006. Alternative Oil Spill Occurrence Estimators and Their Variability for the Chukchi Sea - Fault Tree Method. MMS OCS Study 2006-033. Prepared by Bercha Group, Calgary, Alberta, for BOEMRE Alaska OCS Region, Anchorage, AK.
- Bercha, F. G. 2008. Alternative Oil Spill Occurrence Estimators and Their Variability for the Alaskan OCS - Fault Tree Method: Update of GOM OCS Statistics to 2006. MMS OCS Study 2008-025. Prepared by Bercha Group, Calgary, Alberta, for BOEM Alaska OCS Region, Anchorage, AK.
- Bercha, F. G. 2008. Alternative Oil Spill Occurrence Estimators and Their Variability for the Beaufort Sea - Fault Tree Method. MMS OCS Study 2008-035. Prepared by Bercha Group, Calgary, Alberta, for BOEM Alaska OCS Region, Anchorage, AK.
- Bercha, F. G. 2008. Alternative Oil Spill Occurrence Estimators and Their Variability for the Chukchi Sea - Fault Tree Method. MMS OCS Study 2008-036. Prepared by Bercha Group, Calgary, Alberta, for BOEM Alaska OCS Region, Anchorage, AK

Objectives: Provide an update to fault tree spill occurrence rates and confidence intervals for NEPA analyses for any Arctic (including Norton Basin) OCS Lease Sales or for OCS offshore oil and gas developments during the contract period of performance.

Methods: This study will: 1) review and assimilate oil-spill occurrence reports, data and geohazard data from alternative sources and locations as needed; 2) use updated Gulf of

Mexico OCS historical data together with its measures of spill size and frequency variance to run the Monte Carlo fault tree model with these measures of variance; 3) provide updated fault tree analyses for Arctic oil and gas lease sales based on BOEMRE-supplied exploration and development scenarios, generating life-of-field oil spill occurrence rates and indicators; 4) provide up to two additional fault-tree analyses for Beaufort and/or Chukchi Seas for site-specific oil and gas development taking into account site-specific geohazards and generating life-of-field occurrence indicators; 5) provide a formal report documenting each analytical or fault-tree update, and 6) provide professional support to BOEMRE in regard to statistical issues of occurrence rates and estimator(s) related to this study and its results.

Revised Date: March 2010

ENVIRONMENTAL STUDIES PROGRAM: Studies Development Plan FY 2011-2013

Region: Alaska

Planning Area(s): Beaufort Sea, Chukchi Sea

Title: Onshore Effects of Offshore Oil Development: Oil Spill Occurrence Estimators for Onshore Alaska and Canada North Slope Crude and Refined Oil Spills

BOEMRE Information Need(s) to be Addressed: The Oil Spill Risk Analysis (OSRA) is a cornerstone to regional EISs, environmental assessments, and oil-spill-contingency planning. Oil-spill issues constitute a significant portion of public comments submitted on sale or development EISs in the Alaska OCS Region. Information from this study will be used by Alaska OCS Region staff to estimate small oil spill occurrence (<1,000 bbl) in preparing future, approximately biannual, Arctic exploration and development EISs or EAs, future developmental EISs, and in reviewing oil spill contingency plans for OCS and coastal facilities.

Cost Range: (in thousands) \$140-\$210

Period of Performance: FY 2011-2014

Description:

Background: Because of lack of developed hydrocarbon and road transportation systems onshore of areas of Arctic OCS oil and gas interest, BOEMRE is required to analyze the effects of onshore infrastructure development in NEPA analyses. Local stakeholders are particularly concerned with possible effects of oil spills. In Alaska environmental assessments and environmental impact statements, the BOEMRE uses various datasets and models to estimate the likelihood of large spills ($\geq 1,000$ bbl) and small spills (<1,000 bbl) occurring at sea and on land. For the Liberty EA, British Petroleum Exploration, Alaska (BPXA) collated industry data through 2006 for crude and refined oil spills and developed statistical estimators based on spills per billion barrels of production for spills greater than or equal to 200 bbl. The industry data for spills greater than or equal to 50 bbl were made available to BOEMRE, but the data for smaller spills were not.

The BOEMRE has collated and analyzed Alaska North Slope small spill data, but not since 2000. More than a decade has passed since a comprehensive analysis of Alaska North Slope crude and refined small spills has been completed by BOEMRE. As oil production continues to decline on the North Slope, concern has been raised that spill rates may increase, as hypothesized in the bathtub curve model of industry spillage. In this model, spillage rates are initially higher in early years of development as part of a learning curve, decrease during maturity, and increase again as the infrastructure ages. Since BOEMRE's last analysis in 2000, concern has been raised over increasing spillage from corroded pipelines on the North Slope, and industry has been sued by both State and Federal governments for not properly maintaining pipeline integrity in recent years.

Recent stakeholder criticisms have stated that BOEMRE must do a better analysis and reporting of sources of variance and magnitude of confidence intervals for spillage estimates. A full study of sources of variance and confidence intervals in small oil spill occurrence estimators for the Alaska North Slope has not been attempted by BOEMRE in the past because of limited data availability.

The BOEMRE has worked hard to improve spill data sets along with associated infrastructure data sets. Statistical findings and assumptions merit reanalysis with a more extensive and improved data string. This study will test the assumptions of Poisson distribution for small spills, reconsider the suitability of pipeline length or blended spill estimators, and develop confidence intervals for spill occurrence estimators used by BOEMRE.

Objectives:

- Update and collate crude and refined oil spills on the Alaska North Slope from industry, U.S. Coast Guard (USCG), Environmental Protection Agency (EPA), USDOJ, BLM, BOEMRE and Alaska Department of Environmental Conservation (ADEC) data sets through 2010.
- Develop relative spill occurrence estimator(s) suitable for use for onshore small oil spills on the Alaskan North Slope using an appropriate exposure variable.

Methods: With an understanding of historical statistical approaches, BOEMRE rationales for estimating oil spill occurrence rates, and possible sources of variance. Investigators will conduct a preliminary meeting to discuss acceptable statistical methods. The discussion will include: methods for deriving historical spill frequencies from Alaska North Slope spill records; exposure variables for spill frequency such as North Slope pipeline miles, volume of throughput, age, and well years; implications for using different exposure variables; and recommended standard data format for exposure variables and accident data.

The investigators will collect, examine and reconcile spill records and cleanup reports for the North Slope and Canadian Beaufort Sea coastal areas for spills >1 bbl into an electronic database in a standard format. Exposure data for Alaska North Slope and Canada will be collected and the number of wells, flow, and pipeline miles by year provided when available. The investigators will also calculate accident frequencies for small spills and perform appropriate statistical analyses, including trend analysis.

Deliverables will include user-friendly models and/or algorithms to allow BOEMRE staff to recalculate the contractor's measures of variability as additional information or data become available.

Revised Date: March 2010

ENVIRONMENTAL STUDIES PROGRAM: Studies Development Plan FY 2011-2013

Region: Alaska

Planning Area(s): Chukchi Sea

Title: Hanna Shoal Ecosystem Study

BOEMRE Information Need(s) to be Addressed: This study will constitute a key component of Chukchi Sea environmental studies pertinent to Chukchi Sea Lease Sale 193 held in 2008. The highest oil industry interest is in the Burger prospect bordering Hanna Shoal to the south. The BOEMRE 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) \$3,200-\$4,800 **Period of Performance:** FY 2011-2016

Description:

Background: The ongoing COMIDA CAB study is highlighting the importance of Hanna Shoal in the NE Chukchi Sea as a biological oasis 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 bergy bits and deep-keeled sea ice. A reoccurring polynya is created downcurrent of the grounded ice.

Bering Sea water entering the Chukchi Sea and flowing north is thought to flow both to the east and west of the shoal. Historically, the transport of this warmer Bering Sea water past Hanna Shoal has resulted in melt out of open water “bays” in the ice cover on either side of Hanna Shoal. In most recent years with global warming, floating pack ice in summer persists in this area longer than elsewhere in the Chukchi, often surrounded by open water even to the north. This persistence strengthens the vertical stratification over Hanna Shoal as this residual summer ice melts and freshens the surface layer. Taylor columns may be responsible for maintaining ice in the regions of Herald and Hanna shoals. Circulation processes around Hanna Shoal are poorly understood, but the circulation here is part of a broader circulation field that connects the Chukchi and Beaufort. Waters draining through Herald Valley to the western Chukchi shelf and slope regions are carried to the eastern Beaufort, where outer shelf and slope waters are very likely brought back onto the shelf.

Biological “hot spots” in the Chukchi Sea are thought to be related to couple pelagic and benthic productivity. A high abundance of bottom fauna is correlated with high pelagic primary production, possibly associated with the ice-edge, that reached the seabed mostly ungrazed. However, the mechanisms that must explain the productivity at Hanna Shoal are relatively poorly understood. With the retreat of the summer ice-edge to deeper, more northern waters in recent years, this pelagic/benthic coupling may be weakening at Hanna Shoal. The ongoing productivity of this region depends on the timing and position of the ice edge. Other BOEMRE projects in the Chukchi are showing sustained benthic productivity in

the area of Hanna Shoal accompanied by higher concentrations of water birds, walrus, and whales.

Ongoing BOEMRE studies looking at ocean heat transport across the central U.S. Chukchi Sea, to the south and at circulation to the east, toward Barrow Canyon will provide context to this study.

Objectives:

- Determine surface and 3-D circulation and density fields in and around Hanna Shoal.
- Determine physical and oceanographic features (water masses) and compare among community assemblages.
- Document ice conditions at Hanna Shoal and its relation to oceanographic processes.
- Measure and determine causes of water column and benthic primary and secondary productivity and biomass.
- Integrate these data with Hanna Shoal portions of BOEMRE and other Chukchi Sea studies of higher trophic levels.
- Verify and enhance the food web/contaminant bioaccumulation structure developed for the COMIDA area in the COMIDA CAB study.

Methods: Appropriate moored and shipboard measurements of currents, sea-ice drift, and hydrography (including geochemistry) will examine circulation and density fields. Drifter/drogues will be deployed. Moorings will use Arctic winches for long term profiling of temperature and salinity. These measurements will be supplemented with cross-shoal hydrographic (< 5 km spacing) measurements from ADCP, towed vehicle transects, and/or drifter/drogues. Water column primary and secondary production and biomass will be measured. Cruise zooplankton data will be supplemented by data from moored zooplankton ADCP units. COMIDA CAB benthic sampling, food web analysis, and contaminant measurements will be continued in this project. Additional oceanographic data from HF radar, moored acoustic Doppler current profilers (ADCP), meteorological buoys, and gliders may be obtained from the proposed extension of the Chukchi oceanographic study. Formal integration with other BOEMRE projects will be made through the proposed study “Marine Mammal/Physical Oceanography Synthesis” to provide upper trophic components to the study. Coordination will occur with other international, NSF, NOAA, ADEC, and industry research in the Chukchi Sea.

This study will develop a high-resolution, regional, baroclinic coupled ice-ocean circulation model simulation for the Chukchi Sea, with focus on Hanna Shoal. In-depth analyses will be performed on the model results to examine interactions of the flow field with the topography and density structure and to diagnose the physics underlying the circulation patterns. An ecosystem model may also be incorporated into the simulations.

Revised Date: March 2010

ENVIRONMENTAL STUDIES PROGRAM: Studies Development Plan FY 2011-2013

Region: Alaska

Planning Area(s): All Alaska Planning Areas

Title: Synthesis Report Generation: Technical Support for Environmental Analyses on Select Regional Topics

BOEMRE Information Need(s) to be Addressed: The BOEMRE Alaska OCS Region increasingly requires short-term technical synthesis reports and literature searches that cannot be adequately developed through in-house effort. The purpose of this study allocation is to develop a longstanding procurement vehicle through cooperative agreement to facilitate information management on an “indefinite delivery, indefinite quantity” basis. Each project task will be reviewed on its own merits. Projects such as this would help meet BOEMRE objectives under the OCSLA, NEPA and other laws such as the Fishery Conservation and Management Act, Endangered Species Act, the Archaeological Resources Protection Act and the Clean Air Act.

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

Period of Performance: FY 2011-2016

Description:

Background: The Alaska Region BOEMRE science and environmental assessment staff often encounter short-term information needs that, if conducted through a university source, would enhance the efforts of BOEMRE Alaska science and environmental assessment programs. A synthesis report on Higher Trophic Linkages in the Beaufort Sea is a case in point. Higher trophic food web linkages are important to consider in preparing sound analyses required under various laws. This study would use existing literature to bring together in one report (and a large journal-referenced graphic) Beaufort Sea higher trophic connections in the U.S. A particular emphasis would be placed on fish as prey, particularly in the Alaskan Beaufort Sea.

A Cooperative Ecosystem Studies Unit (CESU) or other cooperative agreement could provide a mechanism to obtain short-term technical university assistance through a standing source and administrative structure for projects such as literature searches and bibliographic review, topical papers, database searches and cleanup, analysis of historic databases, mapping of existing data, and summary papers. The goal of the nationwide CESU network is to provide high quality scientific research, technical assistance and education through their working partnerships among universities, government agencies and non-governmental organizations. The CESUs could provide BOEMRE with standing administrative agreements and access to a wide range of university research faculty, staff and students at a reasonable overhead cost. A CESU can provide assistance in biological, physical, social, and cultural sciences and address interdisciplinary problems.

In addition to the proposed “Synthesis Report on Higher Trophic Linkages in the Beaufort Sea” examples of the type of short-term technical projects envisioned include:

- Conduct a literature review concerning the effects of oil, gas and dispersants on biota at Various Depths in the U.S. Arctic;
- Conduct a literature and data review of air quality and meteorology information on the Alaska OCS to establish baselines for pollutant emissions and climate, and estimate annual emissions anticipated during potential exploration and development;
- Conduct a multivariate statistical analysis from existing Beaufort Sea Community Data to generate descriptive statistics of relationships within households and between communities;
- Conduct a database search and literature review on invasive species (marine and terrestrial) that have been documented in or near arctic, subarctic and Antarctic environments worldwide;
- Complete the task of geo-referencing the records in the Shipwreck database managed by BOEMRE Alaska (which contains approximately 5000 records);
- Use existing NOAA Observer bycatch data to establish the occurrence of squid and jellyfish in the Bering and southern Chukchi Sea regions;
- Research ice breaker activities and obtain scientific information and research documents that were collected within and adjacent to the Alaska OCS for the Chukchi and Beaufort seas but are not available in existing databases.

Objectives:

- Establish an agreement through CESU or other academic entity to obtain short-term technical products on an IDIQ basis.
- Initiate Task 1 within this procurement framework. The proposed Task 1 will develop a Statement of Work to synthesize existing information on higher trophic interactions in the Beaufort Sea in a summary report and in graphical form.

Methods: This study will conduct a thorough literature search on higher trophic interactions in the Beaufort Sea, with a particular emphasis on post-1980s studies; prepare a synthesis report of this literature, including summary tables of the information and bibliography; and prepare a large graphic poster depicting the main trophic linkages with literature referenced on the linkages.

Revised Date: August 2010

ENVIRONMENTAL STUDIES PROGRAM: Studies Development Plan FY 2011-2013

Region: Alaska

Planning Area(s): Beaufort Sea, Chukchi Sea

Title: Marine Mammal/Physical Oceanography Synthesis

BOEMRE Information Need(s) to be Addressed: The changing physical environment of the U.S. Arctic OCS is hypothesized to drive a rapid tempo of change in the distribution and behavior of a number of protected marine mammals that inhabit those waters. The same species may be affected by oil and gas activities within BOEMRE Planning Areas, with strong potential for deleterious interactions between natural and human induced phenomena. Under NEPA and the ESA, BOEMRE is required to evaluate whether and how federal actions associated with oil and gas development may affect these protected populations. Information on ocean circulation and hydrography is useful for those evaluations as well as for input into various models used to predict the outcome of oil spills and other physical phenomena. Given recent high investment in interdisciplinary biological and oceanographic research by the Governments in the region, a synthesis of results of completed and ongoing studies would be useful to inform management decision makers and may be useful in determining needs of future research activities.

Cost Range: (in thousands) \$1,200-\$1,800 **Period of Performance:** FY 2011-2016

Description:

Background: The physical climate of the western Arctic appears to be rapidly changing. The summer minimum sea ice extent in 2007 and 2008 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. High water temperatures and dense concentrations of zooplankton have been observed near Barrow. 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, as expected from the CO₂ anthropogenic contribution alone.

During the same period, several marine mammals have exhibited unusual movements or behaviors that may be related to these environmental changes. The range of humpback whales has moved northward to include the northern Chukchi and western Beaufort Seas. Fin whales have expanded their range northward to include waters north of Icy Cape in the Chukchi. In 2009, bowhead whales fed extensively in the northern Chukchi Sea, a phenomenon not observed since the end of commercial whaling one hundred years ago. In recent years, gray whales have fed in increasing numbers along the coastline between Wainwright and Barrow. In 2007 and 2009, walrus formed large aggregations on shore between Norton Sound and Barrow. This behavior appears to be related to the summer retreat of sea ice well northward of traditional walrus feeding areas on the shelf break.

Given the continuing retreat of sea ice and the known high-latitude range of these species in other oceans, it is likely that the recent sightings represent a climate-related range expansion that will continue in future years. Other changes in behavior and/or expansion of feeding areas also may accelerate as ice continues to degrade and water temperatures rise.

Between the years 2005 and 2015 BOEMRE will invest approximately \$50,000,000 in marine mammal and related oceanographic studies in the western Arctic. These data will increase our body of knowledge about the region considerably, but interpretation will be complicated by concurrent environmental changes. This study proposes a synthesis of research from the ongoing studies in the Region. These studies include, but are not limited to:

- Bowhead Whale Feeding Variability in the Western Alaskan Beaufort Sea: Satellite Tracking of Bowhead Whales & Oceanography and Feeding
- Passive Acoustic Detection and Monitoring of Endangered Whales in the Arctic
- Ecosystem Observations in the Chukchi Sea: Biophysical Mooring and Climate Modeling
- Distribution and Relative Abundance of Marine Mammals: Aerial Surveys
- Monitoring the Distribution of Arctic Whales (also known as BWASP)
- Walrus Habitat Use in the Potential Drilling Area
- Pinniped Movements and Foraging: Bearded Seals
- Arctic marine research studies supported through NOPP
- Studies conducted by the State of AK and the North Slope Borough under BOEMRE's Coastal Impact Assistance Program (CIAP)

Objectives:

- Increase scientific understanding of the inter- and intra-relationships of oceanographic conditions, lower trophic prey species, such as small fish and krill, and marine mammal distribution and behavior in the Chukchi Sea lease area, and adjacent waters.
- Enhance capability to predict future changes in oceanographic features such as currents, upwellings, and ice leads and associated changes in the behavior of marine mammals and their prey.

Methods: Using a synthetic approach, PIs will analyze data available from BOEMRE supported, and related, studies in the Chukchi Lease Sale Area and adjacent waters, using available statistical and other models to identify and test hypotheses that cross scientific disciplines. This study will be guided by an oversight committee formed of senior scientists and accomplished through annual, or more frequent, meetings (with significant data preparation and analysis beforehand). In the first meeting participants will inventory available data and deem its sufficiency for use to address specific hypotheses and questions identified by the participants in facilitated sessions. Recommendations for further analyses and publication development will be provided in a report to BOEMRE summarizing that meeting. After BOEMRE review and approval, subgroups of interdisciplinary scientists will work together to prepare data for integration and conduct appropriate statistical analyses or modeling to identify interdisciplinary relationships and/or test hypotheses previously identified. If useful, PIs may integrate data with on-going oceanographic programs (e.g. RUSALCA and the Distributed Biological Observatory [DBO]) to inform ecosystem models and enhance their predictive capability. After analyses are completed, sub-groups will prepare multi-authored manuscripts for publication in appropriate peer review literature and/or in proceedings. Topics for synthesis include, but are not limited to, inter- and intra-relationships of oceanographic circulation, sea ice, hydrography, lower-trophic abundance and distribution, and marine mammal distributions and behavior.

Revised Date: March 2010

ENVIRONMENTAL STUDIES PROGRAM: Studies Development Plan FY 2011-2013

Region: Alaska

Planning Area(s): Beaufort Sea, Chukchi Sea

Title: Monitoring the Distribution of Arctic Whales (COMIDA/BWASP Extension)

BOEMRE Information Need(s) to be Addressed: This continuing BOEMRE study is needed for decisions on environmental assessment and exploration monitoring for past and upcoming OCS activity in the Beaufort Sea. It supplements behavioral information needed to identify areas of interest to feeding bowhead whales. Information from this study also will be needed to support ESA and NEPA analysis and documentation for Beaufort Sea Lease Sales, EPs, DPPs, and monitoring of production at Northstar and Liberty.

Cost Range: (in thousands) \$1,600-\$2,400 **Period of Performance:** FY 2011-2013

Description:

Background: The BOEMRE has conducted aerial surveys of the fall migration of bowhead whales each year since 1987. Methods are comparable from year to year, based on similar monitoring dating to 1979. The study provides the only long-term database for evaluating potential cumulative effects of oil- and gas-exploration activities on the entire bowhead-migration corridor across the Alaskan Beaufort Sea. Project reports compare distances from shore and the water depths used by migrating bowheads. Data are collected in a robust GIS-compatible data structure. The bowhead whale is protected under the Endangered Species Act and is of great importance to Alaskan Natives for cultural and subsistence purposes.

Objectives:

- Define the annual bowhead fall migration, significant inter-year differences, and long-term trends in distance from shore and water depth at which whales migrate.
- Monitor temporal and spatial trends in the distribution, relative abundance, habitat, and behaviors (especially feeding) of endangered whales in arctic waters.
- Provide real-time data to BOEMRE and the NMFS on the general status of the fall migration of bowhead whales across the Alaskan Beaufort Sea for use in protection of this Endangered Species, if needed.
- Provide an objective area-wide context for management interpretation of bowhead migrations and site-specific study results.

Methods: Aerial surveys, based out of Deadhorse, Alaska, during September and October, monitor the fall bowhead migration between 140° W. and 157° W. longitude, south of 72° N. latitude. Particular emphasis is placed on regional randomized transects, statistical tests, and power analyses to assess fine scale shifts in the migration axis of bowhead whales across the Beaufort Sea, and on the coordination of effort and management of data necessary to support seasonal offshore drilling regulations. The project analyzes migration timing, distribution, relative abundance, habitat associations, swim directions, water depths, and behaviors

(especially potential feeding) of whales, as well as ice type and percentage at bowhead sightings. Belugas, gray whales, and polar bears are regularly recorded along with incidental sightings of other marine mammals. Data are also shared with site-specific studies to define bowhead responses to individual oil-industry activities. Incidental oceanographic observations are shared with the National Ice Center and National Weather Service to ground-truth satellite imagery.

Field work will be conducted and various analyses and reports will be prepared by the NMFS, NMML. Survey results will be available after each survey flight on a website maintained by the NMML. A comprehensive master database, with metadata, will also be available on the website. Aircraft operations will be managed by the NOAA AOC.

Revised Date: January 2010

ENVIRONMENTAL STUDIES PROGRAM: Studies Development Plan FY 2011-2013

Region: Alaska

Planning Area(s): Chukchi Sea

Title: Distribution of Fish, Crab and Lower Trophic Communities in the Chukchi Sea Lease Area

BOEMRE Information Need(s) to be addressed: This study will provide information on the abundance and distribution of fish, crab, and lower trophic communities in the Chukchi Sea lease area. The study will provide the basis for a better understanding of distribution and relative importance of fish communities. The Alaska OCS Region identified a need for continued fish and invertebrate baseline monitoring during the 2007 BOEMRE-sponsored “Chukchi Sea Information Status and Research Planning Meeting” to provide useful information to upcoming NEPA reviews and post sale needs.

Cost Range: (in thousands) \$1,800-\$2,600 **Period of Performance:** FY 2011-2013

Description:

Background: This study proposes to develop a broader understanding of abundance and distribution of demersal and pelagic fish, crab, and lower trophic communities needed to evaluate and mitigate the effects of offshore oil and gas development. Interim results from a current BOEMRE funded Coastal Marine Institute (CMI) project, “Current and Historic Distribution and Ecology of Demersal Fish in the Chukchi Sea Planning Area,” have identified temporal, seasonal, and spatial gaps in data on fish in the Chukchi Sea in particular to sampling on or near the lease areas. This proposal was designed specifically to fill these information needs. It will build upon recent information on invertebrate communities in the Chukchi offshore lease area obtained by the BOEMRE 2009 study “Chukchi Sea Offshore Monitoring in Drilling Area (COMIDA): Chemistry and Benthos (CAB).” This study would be the first comprehensive assessment of pelagic fishes in the northeast Chukchi Sea. Data from this study will provide abundance and distribution information for NEPA analysis on fish and invertebrate species.

In the well-studied Bering Sea, it is apparent that the distribution and community composition of fish has changed in recent decades and many species are shifting their distributions northward. A BOEMRE Beaufort Sea fish survey in 2008 indicated presence of common Bering Sea species, such as walleye pollock and dense aggregations of snow crab in the western Beaufort Sea. These species are also likely to be present in the adjacent Chukchi Sea. This study will increase the extent of fisheries information within the lease area and extend a baseline for further studies linking species distributions between the Bering and Beaufort Seas.

The demersal fish and invertebrate community of the Chukchi Sea is thought to be less dense and diverse than in the Bering Sea and does not support major commercial fisheries at this time. The Chukchi Sea, however, is critical to the existence of many protected species of

marine mammals and birds. Alaskans living in coastal Chukchi villages depend on the Sea for many of their subsistence foods critical to their way of life. Although the Chukchi has historically been considered a benthic dominated system, the data that are available indicate that there is a large biomass of pelagic fish in the area that has not been adequately sampled. This pelagic fish community seems to be dominated by forage fish, including Arctic cod, sand lance and capelin. These species serve as an important mechanism of energy transfer to top predators such as birds, ice-dependent seals, and cetaceans.

Objectives:

- Document, characterize and understand the distribution of pelagic and demersal fish and invertebrate communities in the Chukchi Sea lease area.
- Estimate the geographic range of fish, invertebrates, and lower trophic biomass in the lease area.
- Provide a comparison of these communities with that of prior studies, as well as adjacent regions (Beaufort and Bering Seas) and relate the data to oceanographic fronts.

Methods: Conduct a comprehensive acoustic survey of Chukchi Sea lease area. The abundance of pelagic fish, jellyfish, and large zooplankton (e.g., euphausiids) will be estimated with a multi-frequency echo-sounder and ground-truthed using pelagic gear. The results will be directly comparable to surveys conducted by RUSALCA, Conoco/Shell, CMI surveys, and Beaufort surveys which will allow them to be placed into a broader latitudinal context. A series of coordinated bottom trawls would use the same survey methodology used by in the 1990/1991 Chukchi Sea Survey, and the CMI and RUSALCA surveys 2004-2008. The results will extend the time series (2004-2008) and build upon the earlier surveys (1990, 1991) of demersal fish and invertebrate communities. To interpret the distribution of fishes and their importance as prey, water column properties (temperature, salinity, light level, chlorophyll fluorescence) will be measured at all trawl stations. This study will coordinate with other ongoing BOEMRE or other agency or university studies in oceanography and biology to maximize data needs and study design.

Revised Date: March 2010

ENVIRONMENTAL STUDIES PROGRAM: Studies Development Plan FY 2011-2013

Region: Alaska

Planning Area(s): Beaufort Sea, Chukchi Sea

Title: Social Indicators in Coastal Alaska: Arctic Communities

BOEMRE Information Need(s) to be Addressed: This study will update key socio-cultural and economic baseline data for analysis of potential local and regional impacts from offshore exploration and development activities that may occur in federal waters off the North Slope of Alaska. Information from this study will be used for Outer Continental Shelf Lands Act (OCSLA) and National Environmental Policy Act (NEPA) analyses, for documentation, and may serve as the basis for long-term monitoring for Chukchi and Beaufort oil and gas exploration and development in the region.

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

Period of Performance: FY 2011-2013

Description:

Background: The goal of this study is to update baseline data measuring the pace, direction, and magnitude of regional socio-economic changes, as well as the sense of well-being as expressed by residents in select Arctic coastal communities. These data will assist in NEPA evaluation of the effects of exploration and possible development of offshore energy resources in the Chukchi and Beaufort Seas on local populations through the formulation of social indicators nested within sets of key social domains. This study will facilitate evaluation of current conditions and trends in: economic prosperity; the status of health and safety; cultural continuity and well-being; changes in the status of indigenous rights and local control; quality of the physical environment; and education. Likely communities for sampling will include: Pt. Lay, Wainwright, Barrow, Nuiqsut, and Kaktovik.

Objectives:

- Formulate a set of key social indicators nested within domains that will facilitate the monitoring of changes in human well-being in coastal communities of the Alaskan Arctic most proximate to proposed oil and gas exploration and development.
- Obtain an OMB control number for a longitudinal survey instrument that can be repeated to identify long term trends, periodic changes, and fluctuations in the rate of change throughout coastal Alaska.
- Provide useful information on regional socioeconomic conditions and regional aspirations from which government officials and stakeholders can monitor and evaluate potential changes in well-being resulting from oil and gas exploration and development.

Methods: Establish formal contact with potential host communities and develop a written protocol to facilitate community participation and meaningful collaboration in the performance of this research. Conduct a literature search on previous northern social indicator studies. Utilize existing identified arctic social indicators or develop alternative

relevant social indicators in conjunction with the BOEMRE. Prepare a strategic survey instrument, pre-test it, and obtain the necessary approvals for use from relevant BOEMRE review offices and the Office of Management and Budget, and administer it. Organize data into a workable database and analyze with appropriate multivariate statistical techniques. Conduct a comprehensive analysis of the results of all prior tasks and prepare a draft report of the study findings. Circulate the draft report to the BOEMRE and host community leaders to facilitate parallel reviews by peer scientists and interested stakeholders; respond to review comments and prepare a final report, incorporating reviewer edits and comments where appropriate; report the study results to participating communities through public meetings or workshops.

Revised Date: August 2010

ENVIRONMENTAL STUDIES PROGRAM: Studies Development Plan FY 2011-2013

Region: Alaska

Planning Area(s): Beaufort Sea

Title: Shorebirds and Infaunal Abundance and Distribution on Delta Mudflats along the Beaufort Sea

BOEMRE Information Need(s) to be Addressed: More information is needed about species composition, abundance, or distribution of the microfauna and meiofauna living within the interstitial spaces of the littoral zones along the Beaufort Sea coast. Shorebirds depend on meiofauna for food for pre-migratory fattening. Additionally, these organisms make important contributions to bioremediation of oil spills. The information obtained from this jointly-funded research will contribute to development of mitigation measures and strategies to reduce potential impacts from post-lease exploration and development.

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

Period of Performance: FY 2011-2014

Description:

Background: The Beaufort Sea coast includes a variety of biologically productive habitats in lagoons, barrier islands, river deltas, and adjacent tundra areas. These habitats support diverse biota and could be affected by oils spills or disturbance resulting from offshore oil exploration in the Beaufort Sea. Oil spills could impact shorebirds through direct oiling, potentially impacting their prey and the benthic invertebrate community. The impacts of oil on aquatic invertebrates can be significant. Some components of the infaunal invertebrate community would be extirpated, while in others recovery may take 3-5 years depending on the conditions of the oil and environment. These ecosystems are particularly vulnerable to predicted climate-change effects, such as inundation and increased erosion caused by rising sea levels and longer periods of open water. More information is needed about the species composition, abundance, or distribution of the aquatic invertebrates that shorebirds depend upon for pre-migratory fattening along the Beaufort Sea coast. This information need extends to the lower trophic levels forming the base of these complex food webs. Their contributions to shore bird foraging, migration, and reproductive biology as well as bioremediation of oil spills has been shown to be important factors in the recovery and cleanup of past oil spill events in Alaska and other regions. Microfauna (e.g. bacterial, fungal, or protozoan populations), and meiofauna (nematodes, gastrotriches, and other eukaryotic organisms) living within the interstitial spaces of these zones become important considerations in mitigation of long and short-term damage due to anthropogenic oil spill contamination in these microhabitats and surrounding environments.

Quality foraging habitat for shorebirds is determined by the abundance of benthic invertebrates, but can also be influenced by lagoon water levels that can inundate the delta making the habitat inaccessible to shorebirds. Most of the change in water level on delta mudflats comes from wind driven waves. If wind patterns are consistent then available habitat is predictable, but changes in tide due to westerly storms can be significant and may

inundate the whole delta for several days. Climate change may change the frequency of storms and seems to have changed the intensity of the storms by increasing the size of waves because the reduced amount of ice results in fewer impediments to wave build up. This has the potential to change the availability of shorebird feeding areas, making the occurrence of this habitat less predictable to birds during the post-breeding period.

In addition to quantifying invertebrate resources, the study will assess whether the resources available to shorebirds are sufficient to prepare the birds for their fall migration. A functional response model will be used for this assessment based on the capture rate and handling time modeled against invertebrate abundance.

This study will survey the shorelines and consist of taking core samples for laboratory analysis for population structure, numbers of individuals, and diversity of populations from the interstitial spaces within the littoral zone of coastlines along the Beaufort Sea.

Objectives: The specific objectives of this study are to:

- Quantify the spatial and temporal distribution of benthic invertebrates at coastal lagoons and river deltas along the Beaufort Sea coast within the FWS Arctic Refuge- at 3 sites associated with the coastal lagoons at the Jago, Okpilak, and Canning Rivers.
- Assess whether patterns of invertebrate abundance and distribution correspond to foraging shorebird abundance and distribution.
- Develop a model describing the connection between wind patterns and water levels on the mudflat that can be used to assess available foraging habitat for shorebirds.
- Assess whether shorebirds respond physiologically to a greater abundance in food resources through increased triglyceride levels in the blood indicating an increased fattening rate.
- Assess whether available invertebrate resources in the coastal lagoons and river deltas along the Beaufort Sea are sufficient for pre-migratory fattening of shorebirds or provide information for bioremediation.

Methods: This study builds on an existing study with Fish and Wildlife Service (FWS) and tiers off a BOEMRE/CMI previous shorebird study by Abby Powell across the Beaufort and Chukchi Sea coasts. This study focuses intensively on a few sites along the coast of the FWS Arctic Refuge and two years data collection has been funded by FWS. The USGS/BOEMRE partnership would collect data on a few sites intensively within the FWS Arctic Refuge at 3 sites associated with the coastal lagoons at the Jago, Okpilak, and Canning Rivers for two additional field seasons. This project will provide additional sampling locations and core analysis to analyze population structures, numbers of individuals, and diversity of populations from the interstitial spaces within the littoral zone. The project will continue to map the distribution of common functional groups of invertebrates using spatial analysis kriging techniques. Results will produce data reflecting measures of abundance of benthic invertebrates using mudflat core samples to determine availability of food resources for shorebirds.

Revised Date: August 2010

ENVIRONMENTAL STUDIES PROGRAM: Studies Development Plan FY 2011-2013

Region: Alaska

Planning Area(s): Beaufort Sea, Chukchi Sea

Title: Oil Spill Lessons Learned Workshop

BOEMRE Information Need(s) to be Addressed: BOEMRE needs to reassess potential oil spill impacts and mitigation measures in Arctic waters to incorporate lessons learned from the April 2010 Gulf of Mexico *Deepwater Horizon* blowout and other historical oil spills. This reassessment will better inform analysis under the National Environmental Policy Act and formulation of additional mitigation measures.

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

Period of Performance: FY 2011-2012

Description:

Background: The April 2010 Gulf of Mexico *Deepwater Horizon* well blowout radically changes the statistics of historical oil spills on the OCS. As a result of this exploration phase oil spill, the degree of concern and scrutiny of NEPA documents related to development of the OCS will increase, requiring additional analysis and mitigation measures.

This effect will not only be felt in the Gulf of Mexico, but also in the Alaska OCS. Offshore development is historically a more controversial issue in Alaskan waters than in the Gulf of Mexico. Alaskan residents have repeatedly expressed deep concerns about the potential of an oil spill impacting unique Alaskan subsistence resources and cultural lifestyle preferences that are not easily replaced by imported foods.

Public interest is likely to demand more in-depth analysis of large and worst case spills and the development of increased prevention and mitigation measures in Arctic waters. The major spills in Alaska and elsewhere have been predominantly associated with the transportation of oil after exploration and development and production. Because the *Deepwater Horizon* blowout occurred during the exploration phase, we anticipate the need for greater depth of analysis at all stages of development, including lease, exploration, and drilling.

While much research on the *Exxon Valdez* has occurred, there has been no organized effort to document lessons learned in preventing and mitigating impacts. Documenting and exploring those lessons will improve BOEMRE's understanding of potential effects and effective mitigations. It is especially important to explore the similarities and differences of the Gulf spill and other spills including the *Exxon Valdez* (which occurred in the sub-arctic waters rather than arctic waters) to potential oil spills in the frigid arctic waters of the Alaska OCS. One of the challenges will be to apply the lessons to the more geographically specific arctic region and environment. This study will tie in with concurrent effort to update spill statistics, ongoing studies of fish, invertebrate and other members of arctic ecosystems.

Objectives:

- Host a multidisciplinary review of lessons learned from relevant oil spills.
- Use the lessons learned to develop potential prevention and mitigation measures for Arctic OCS leases, exploration, and production permits.

Methods: A 'lessons learned' workshop would be scheduled and planned for FY 2011. Presentations will include both invited and submitted papers. Emphasis would be on how the lessons learned from other oil spills would apply to OCS waters in the arctic.

Revised Date: August 2010

ENVIRONMENTAL STUDIES PROGRAM: Studies Development Plan FY 2011-2013

Region: Alaska

Planning Area(s): All Alaska OCS Planning Areas

Title: Maximum Credible Blowout Occurrence and Size Estimators for the Alaska OCS

BOEMRE Information Need(s) to be Addressed: Information from this study will be used for NEPA documentation for future lease sales under the forthcoming 2012-2017 5-Year Plan and for NEPA documentation and oil-spill-contingency plan review for existing Beaufort Sea and Chukchi Sea leases. This study will address the recommendations in “Report Regarding the Minerals Management Service’s National Environmental Policy Act Policies, Practices, and Procedures as They Relate to Outer Continental Shelf Oil and Gas Exploration and Development” for consideration of maximum credible blowouts.

Cost Range: (in thousands) \$140-\$210

Period of Performance: FY 2011-2012

Description:

Background: BOEMRE has primarily used the historical spill record on the Outer Continental Shelf (OCS) as an indicator of future spill occurrence rates on the OCS. These data are supplemented in other ways, for example by engineering and fault tree studies of spill occurrence. Often as part of environmental assessments, BOEMRE is tasked with providing analysis and occurrence of what at varying times has been known as a maximum credible blowout, worst case, catastrophic case, or very-large-low-probability case spill. These low-probability spill occurrence statistics cannot be provided by BOEMRE Field Operations or Resource Evaluation offices. In response to this issue, the BOEMRE Technology Assessment and Research (TAR) Program initiated a study in 2000 to estimate maximum credible pipeline spills, primarily for the Gulf of Mexico, and considered, but was unable to extend that study to cover blowouts. The largest spill from a single well control incident in the history of offshore oil industry, *Deepwater Horizon* has since occurred in the Gulf of Mexico OCS. The study described here will evaluate the probabilities of occurrence of very large well control incidents on the U.S. OCS during exploration and development phases, including larger than the *Deepwater Horizon* blowout.

Objectives:

- Analyze worldwide well control incidents for exploration and development.
- Derive statistical/engineering procedures to extrapolate occurrence rates for very large OCS oil blowouts.
- Derive statistical/engineering procedures to extrapolate mean or expected value spill sizes.
- Develop model/algorithm that would allow desktop PC estimation of well control incident spill size given a probability of occurrence and the probably of occurrence for a given spill size.

Methods: The investigators will review existing maximum credible blowout examples (probability, size, and basis) from regional (Alaska) oil spill contingency plans and environmental assessments. They will evaluate applicability of alternate approaches against data needs and availability for each approach, giving consideration to geological formation constraints, environmental and geological hazards specific to individual planning areas and more local hazards that may affect size or likelihood of well control incidents, and to how engineering design may affect size or likelihood of maximum credible blowout incidents. A model will be developed that provides well control incident size or probability of occurrence, given the other parameter, for very large or maximum credible blowout incidents.

Revised Date: August 2010

ENVIRONMENTAL STUDIES PROGRAM: Studies Development Plan FY 2011-2013

Region: Alaska

Planning Area(s): Beaufort Sea, Chukchi Sea

Title: ShoreZone Mapping of the North Slope of Alaska

BOEMRE Information Need(s) to be Addressed: ShoreZone mapping is a technique that will provide BOEMRE with the most comprehensive biological, physical, and geomorphologic data of the Beaufort and Chukchi coastal areas. The BOEMRE analysts and decision makers will use the information for identifying high priority fish and wildlife habitats in NEPA and ESA (Endangered Species Act) analyses and documentation for Lease Sales, EPs and DPPs and in post-sale and post-exploration decision making. The data will also provide an improved level of detail for coastal contingency planning, oil spill response; activities, and habitat recovery efforts in the context of future offshore oil, gas and mineral development activities upland of Beaufort and Chukchi Seas;

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

Period of Performance: FY 2011-2012

Description:

Background: The ShoreZone program is a partnership of scientists, GIS specialists, web specialists, nonprofit organizations, and governmental agencies. The multi-agency program offers the opportunity to build a contiguous, integrated coastal resource database that extends from the mouth of the Columbia River through BC, the Gulf of Alaska, Bristol Bay, and northward to the Arctic Coast (on the order of 100,000 km).

ShoreZone is a powerful coastal habitat classification, mapping, and inventory system that relies on the collection and interpretation of aerial imagery of the intertidal zone, nearshore, and estuarine environments. Aerial video and high resolution still photos are collected by geologists and biologists at extreme low tides. This imagery is georeferenced and then mapped, providing a recording of the physical and biological features of the intertidal zone, nearshore, and estuarine environments, including archaeological resources and manmade features. The digital imagery and associated data are made accessible to the public through the National Oceanic and Atmospheric Administration (NOAA) National Marine Fisheries website as a collaborative partnership with BOEMRE.

Coastal video imagery of the North Slope from Barrow to Harrison Bay (1,090 km) and from Flaxman Island to the Canadian border (890km) was collected in 2001 under a BOEMRE contract (Polaris Applied Sciences Inc. and Environmental Mapping Ltd) for the purpose of Environmental Sensitivity Indices (ESI). This aerial video exists in the form of 11 DVDs and is suitable for ShoreZone mapping. The USGS has also collected coastal video imagery in the Arctic.

Objectives:

- Analyze and characterize existing coastal video imagery by mapping through use of the ShoreZone methodology.
- Make the completed imagery and mapping package available to BOEMRE and the public via the NOAA ShoreZone website (<http://www.fakr.noaa.gov/maps/szintro.htm>).
- Collect additional imagery as needed.

Methods: The *ShoreZone Coastal Habitat Mapping Protocol for the Gulf of Alaska* will be used to map the 1,980 kilometers of imagery collected in the North Slope, Alaska.

http://www.fakr.noaa.gov/habitat/shorezone/goa_protocol.pdf

The completed ShoreZone Mapping will provide a comprehensive region-wide database of nearshore habitat and physical attributes and will also be linked to the existing web interface hosted by NOAA 'Nearshore Fish Atlas of Alaska'

(<http://www.fakr.noaa.gov/habitat/fishatlas/>).

Revised Date: August 2010

ENVIRONMENTAL STUDIES PROGRAM: Studies Development Plan FY 2011-2013

Region: Alaska

Planning Area(s): Beaufort Sea, Chukchi Sea

Title: Workshop—Interagency Protocols for Immediate On-Scene Arctic Oil Spill Impact Science

BOEMRE Information Need(s) to be Addressed: This study would provide a mechanism, should a spill occur, to obtain interdisciplinary information about the immediate effects of an oil spill in Alaskan seas. The resulting information will provide improved analyses and mitigation measures as required by the National Environmental Policy Act.

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

Period of Performance: FY 2011-2012

Description:

Background: Many of the impacts of oil spills happen in the first three days after oil or gas is spilled. In the past 20 years, two major marine oil spills, the *Exxon Valdez* and the *Selendang Ayu*, have occurred in Alaska. Most recently, the blowout preventer failure and resulting oil spill in the Gulf of Mexico is referred to in BOEMRE NEPA terms as “the maximum credible” spill scenario. In all these cases, collection of scientific data in the critical initial period was hampered by lack of standing interagency understandings, agreements and science protocols for interagency pre-oil and post oil surveys.

Information produced by such initial oil spill studies would potentially supply BOEMRE with information needed to address issues that result from unlikely but potentially catastrophic oil spills. Successful completion of Alaskan protocols and agreements would facilitate replication in other OCS areas.

Objectives:

- Develop a protocol for sampling during the initial stages of an Alaska marine oil or gas spill.
- Develop interagency working agreements or other instruments necessary to implement immediate scientific sampling should an oil spill occur in marine waters.

Methods: BOEMRE NEPA analysts and other interagency scientists would be queried about information needed at onset of an oil spill. Sampling protocols to meet those information needs will be drafted. Appropriate framework documents with Coast Guard and other relevant agencies that will allow and facilitate immediate implementation of the sampling protocols will be developed and signed implementing agreements put in place.

Revised Date: August 2010

ENVIRONMENTAL STUDIES PROGRAM: Studies Development Plan FY 2011-2013

Region: Alaska

Planning Area(s): Beaufort Sea, Chukchi Sea

Title: Arctic Cod Genomics and Toxicity Study

BOEMRE Information Need(s) to be Addressed: A major element of NEPA analyses in the Alaska OCS program is the assessment of effects of accidental releases of oil and gas in arctic waters and on arctic species. A greater understanding of the keystone species Arctic cod is necessary to assess the potential effects of offshore development in Arctic waters. Arctic cod plays a critical ecological role as key prey species and the primary pathway through which lower trophic production gets funneled to marine mammals, birds and fish. Thus Arctic cod dynamics are critical to EFH-, ESA- and MMPA-related NEPA analyses. The extent of its ice dependency makes Arctic cod itself a potential ESA species. In order to assess effects from potential oil and gas development on Arctic cod and the cumulative effects from climate change, it is important to understand the ability of Arctic cod to survive and adapt as the ice retreats. Understanding how Arctic cod are affected by oil and dispersants under arctic conditions will support both impact assessments and development of oil spill response and monitoring protocols.

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

Period of Performance: FY 2011-2013

Description:

Background:

Whether the Arctic cod is likely to be driven to extinction as the arctic ice retreats is a subject of discussion in scientific circles. Genomics can shed light on whether Arctic cod (*Boreogadus saida*) are truly ice dependent or whether there is potential to adapt to retreating ice through differential expression of existing genes.

Following the *Deepwater Horizon* explosion in the Gulf of Mexico and the subsequent oil and gas release, a renewed focus is directed towards the effects of subsurface blowouts. In the Alaska OCS, the effects of accidental oil or gas releases and use of dispersants must be considered in light of the conditions unique in the arctic. Assumptions and practices from different geographic locations may not accurately transfer to the U.S. Arctic. Although the question of subsurface oil, gas and dispersant behavior in the Gulf of Mexico is currently on the forefront, these same questions need to be addressed separately and proactively for the U.S. Arctic. Carefully designed toxicity laboratory research on Arctic cod at controlled temperatures, pressures (i.e. depth) and light would begin to address some of these complex questions of effects of oil, gas and dispersants on species at various depths in the arctic.

This proposed combination of genomic and toxicity testing by BOEMRE and of Canadian genetic studies respond to basic questions that need answers for NEPA analyses addressing future oil and gas developments in the Arctic. Examples of the questions to be answered include: Are Arctic cod a single pan-Arctic population that exhibits varied genomic responses

under different conditions or are Arctic cod a number of genetically distinct stocks that are individually at risk to offshore development? How do the oil spill effects on and the response of Arctic cod vary to a complex of different oil/gas/dispersant mixtures, different life stages, different temperatures and different depths (different pressures and light regimes) typical of the US Arctic waters?

The genomics pilot and toxicity testing will benefit from close association with several ongoing and planned BOEMRE studies. The pilot genomics study has ties to the ongoing Central Beaufort Fish Survey under ice and open water survey (NSL 10-09). Small budgetary increases in the Central Beaufort Fish survey will support collection of frozen and live Arctic cod from both the 2011 open-water and 2012 under ice field operations for the genetic, genomic and toxicity testing proposed here.

The study will also benefit from international collaboration. Opportunistic samples from an international Chukchi Sea fish survey in September 2010 have been committed for the pilot BOEMRE genomic survey and Canadian genetic survey. The genomic study also has ties to a Canadian Department of Fisheries and Oceans (DFO) Arctic cod genetic study to assess genetic differentiation of the Arctic cod population. Additional collaboration with other Canadian genetic research is being pursued. The collaboration proposed here will contribute to planning beyond the immediate genomic/genetic and toxicity studies proposed here to joint BOEMRE/DFO fisheries surveys and Arctic cod studies being proposed for 2012.

Objectives:

- Assess the feasibility of genomics as a study tool to assess the ice dependency of Arctic cod.
- Assess the effects on Arctic cod (and perhaps other species) of accidental subsurface release of oil and gas and the efficacy and effects of dispersants at low temperatures, various pressures (depths) and oceanographic conditions typical of the U.S. Arctic.
- Participate in pan-arctic genetic stock separation study of Arctic cod.

Methods: Opportunistically obtain Arctic cod genetic samples from the Chukchi and US Beaufort Sea. Conduct a pilot full-sequence RNA transcriptome on a sample of approximately five Arctic cod individuals to assess feasibility of a genomic study of Arctic cod. Compare transcriptome results to resolution from international collaborators conducting genetic DNA micro-satellite studies of Arctic cod population separation. Develop recommendations for further genomics study based on the pilot results. Obtain live samples of Arctic cod, and design and conduct controlled laboratory toxicity studies to test the toxicity effects of gas/oil/dispersant mixtures on Arctic cod and snow crab at critical lifestages, at a range of temperatures and at different depths (pressures) typical of the U.S. Arctic. Assess both physical and genomic response reactions of Arctic cod to the toxicity. Relate results to potential oil and gas spill response and monitoring protocols. Incorporate results into planning of future joint US/Canada fisheries surveys and Arctic cod ecology studies.

Revised Date: August 2010

ENVIRONMENTAL STUDIES PROGRAM: Studies Development Plan FY 2011-2013

Region: Alaska

Planning Area(s): Beaufort Sea

Title: ANIMIDA III: Contaminants, Sources, and Bioaccumulation

BOEMRE Information Need(s) to be Addressed: This project has monitored the development area in the Beaufort Sea OCS, with last sampling of contaminants, sources, and bioaccumulation in 2007. There is a continuing, ongoing need for this monitoring in the development area within the Beaufort Sea during the performance period of the study, which will coincide with continued production from Northstar, development and production from Liberty, and Camden Bay delineation and potential development. The information will be used for NEPA analysis and documentation for Beaufort Sea Lease Sales and DPPs.

Cost Range: (in thousands) \$2,650-\$3,950 **Period of Performance:** FY 2011-2016

Description:

Background: The Arctic Nearshore Impact Monitoring in Development Area (ANIMIDA) and continuation of ANIMIDA (cANIMIDA) started in 1999 and, has provided baseline data and monitoring results for chemical contamination, turbidity, Boulder Patch productivity, and subsistence whaling in the vicinity of oil industry development in the Beaufort Sea OCS. Northstar and Liberty prospects were monitored prior to development and Northstar into development and production. A second continuation of the subsistence whaling task is already under way. BOEMRE has approved a development plan for the Liberty prospect that would use directional drilling from an enlarged Satellite Drilling Island (SDI) at the east end of the Endicott Causeway. Shell has submitted an exploration plan to BOEMRE that would delineate existing oil discoveries in the Sivulliq and Torpedo prospects in Camden Bay. Ongoing industry activities necessitate ongoing monitoring projects.

Objectives:

- Continue the ANIMIDA/cANIMIDA sediment chemistry monitoring emphasizing hydrocarbon and priority metal concentrations.
- Improve the cANIMIDA conceptual model of suspended sediment interactions, loading, and export from the ANIMIDA area, continue to delineate and quantify the offshore dispersion of river runoff and suspended sediments during the spring melt, trace the dispersion of suspended sediments into deeper, outer shelf water, continue to refine sourcing techniques for suspended sediments particularly in the expanded eastern ANIMIDA area, expand the chemical analyses of suspended sediments to include hydrocarbon composition, investigate the contribution of shoreline erosion, Mackenzie River, and offshore waters to suspended sediment load and composition.
- Continue development of a conceptual model of bioaccumulation and trophic interaction in ANIMIDA biota, monitor bioaccumulation of contaminants in selected species, and continue ANIMIDA/cANIMIDA contaminant monitoring program for amphipod and bivalve samples.

- Evaluate the impact from additional activities at the Liberty prospect on the Boulder Patch kelp community.
- Estimate the importance of and extent of Camden Bay Kelp Patches.

Methods:

Field logistics for both phases include helicopter support and small vessel (e.g., BOEMRE Launch 1273) support in the “open” water season and snow machine support in winter/spring. Larger vessel support may be needed in offshore Camden Bay. Field surveys should occur in the open-water period, during breakup with high river flow, and at least once during the ice-covered season.

Sediment and biota sampling in different years will alternate between the central Beaufort (Northstar, Liberty) and eastern Beaufort summer (Sivulliq and Torpedo), focusing on potential impacts from the Northstar and potential Liberty development. Bivalve and amphipod samples will be collected and analyzed as in cANIMIDA/ANIMIDA. Alternative sampling schemes may be substituted depending on the degree of agreement of prior ANIMIDA data and on proposed development activities in the Beaufort Sea OCS. Such alternative sampling programs shall be designed to improve scientific context of prior Task Order 2.

Chemical fingerprinting and cANIMIDA/ANIMIDA ratio techniques will be used to characterize sources of suspended sediments. Profiles for turbidity, salinity, temperature and current would be obtained from numerous sites around the pertinent project area at the time of sampling. The choice of elemental and isotope parameters to be analyzed for suspended sediment will be designed to maximize the potential for discriminating among different sources of particles. A variety of dispersion models and predictive tools should be considered.

Measure kelp production using established or comparable techniques. Monitor ambient light intensity and total suspended solids using established or comparable techniques. Combine with an existing long-term dataset. Survey the extent of Kelp in Camden Bay. Construct GIS maps of kelp and implied (boulder and or hard bottom) kelp beds in the study area.

The cANIMIDA conceptual food web model will help guide development of specific objectives for this task, increase statistical viability of the results with the goal of longer-term strategy for biological contaminant monitoring. The selected species for bioaccumulation measurements will include indigenous bivalves, benthic amphipods, and four species of fish (minimum). Emphasis is on resident species. Caged bivalves at development sites and reference locations will be used as contaminant integrators.

Revised Date: March 2010

2.3 Profiles of Studies Proposed for FY 2012 NSL

Table 3. Alaska OCS Region Studies Proposed for the Fiscal Year 2012 NSL

Page No.	Discipline	Title
69	SS	Impact Assessment for Kaktovik Whaling Activities
71	MM	Cape Lisburne Seabird Colony Productivity and Foraging Areas
73	HE	Eastern Beaufort Sea Marine Fish and Lower Trophic Survey
75	PO	Physical Oceanography of the Chukchi Sea Oil and Gas Lease Areas (Extension of AK-09-06)
77	PO	Eastern Boundary Oceanography of the Beaufort Sea
79	MM	Field Evaluation of an Unmanned Aircraft System (UAS) for Studying Cetacean Distribution, Density, and Habitat Use in the Arctic
81	SS	Baseline Nutritional Survey: Inventory and Content Analysis of Subsistence and Market Foods as Consumed by North Slope Communities
83	SS	Enclave Development: Alternative Approaches for Housing Transient Workers in Rural Alaska
AQ = Air Quality FE = Fates & Effects MM = Marine Mammals and IM = Information Management SS = Social Systems Protected Species PO = Physical Oceanography HE = Habitat & Ecology REN = Renewable Energy		

ENVIRONMENTAL STUDIES PROGRAM: Studies Development Plan FY 2011-2013

Region: Alaska

Planning Area(s): Beaufort Sea

Title: Impact Assessment for Kaktovik Whaling Activities

BOEMRE Information Need(s) to be Addressed: Offshore exploration at Camden Bay is proximate to known Kaktovik whaling areas. Using the Cross Island whaling mitigation and monitoring as a model, this study will involve long-term study efforts to monitor potential effects of development activities on Kaktovik whaling activities. There is a need for this monitoring in the development area within the Beaufort Sea during the performance period of the study, which will coincide with continued production from Northstar, development and production from Liberty, and Camden Bay delineation and potential development. The information will be used for NEPA analysis and documentation for Beaufort Sea Lease Sales and DPPs.

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

Period of Performance: FY 2012-2017

Description:

Background: The Arctic Nearshore Impact Monitoring in Development Area (ANIMIDA) and continuation of ANIMIDA (cANIMIDA) started in 1999 and, has provided baseline data and monitoring results for Cross Island subsistence whaling in the vicinity of oil industry development in the Beaufort Sea OCS. Northstar and Liberty prospects were monitored prior to development and Northstar into development and production. BOEMRE has approved a development plan for the Liberty prospect that would use directional drilling from an enlarged Satellite Drilling Island (SDI) at the east end of the Endicott Causeway. Shell has submitted an exploration plan to BOEMRE that would delineate existing oil discoveries in the Sivulliq and Torpedo prospects in Camden Bay. This proposed study intends to conduct long-term ethnographic monitoring effort for subsistence whaling activities that occur in association with Kaktovik whaling efforts.

This study will gather long-term monitoring data to help the BOEMRE assess whether OCS oil development activities at Northstar, Liberty, or Camden Bay result in changes to bowhead whale subsistence hunting practices, or to hunting success by Kaktovik whalers.

Objectives:

- Assess the amount of variability in Kaktovik subsistence whaling over time.
- Ascertain whether such variation can be attributed to offshore oil and gas industrial activities.

Methods: This study calls for systematic observational and interview data collection from local informants about: a) number of whales taken; b) GPS location of whale strikes, with direction and distance from Camden Bay; c) number and composition of crews; d) periodic “census” of whaling participants from Kaktovik, e) duration of whaling season by active days;

f) timing of whaling; g) length of trips and area searched while whaling; h) records of catch per unit effort; and i) observations of whaling participants. The study will also record systematic and observational/interview data on non-whaling subsistence activities on and near Camden Bay and observations of local subsistence users. Hard copy maps should be appended as necessary for clarification of location information. The recorded data should be presented in an annual report using tabular information on harvest levels and locations of subsistence resources taken on or near Camden Bay.

Revised Date: March 2010

ENVIRONMENTAL STUDIES PROGRAM: Studies Development Plan FY 2011-2013

Region: Alaska

Planning Area(s): Chukchi Sea

Title: Cape Lisburne Seabird Colony Productivity and Foraging Areas

BOEMRE Information Need(s) to be Addressed: The proposed project will provide the BOEMRE with up-to-date information on the productivity of seabirds nesting at Cape Lisburne, and identify the foraging areas used by colony birds during nesting and molting. Common and Thick-billed Murres and Black-legged Kittiwakes are known to use offshore areas under consideration for exploratory drilling in 2010 for feeding and molting. The likely source for those birds is the Cape Lisburne breeding colony, the northernmost significant seabird colony in the U.S. Arctic. Comprehensive data on Cape Lisburne colony productivity were last collected during 1995-1998 and this study will add to that dataset. Updated baseline data on productivity and information on foraging/molting areas will be useful to BOEMRE for NEPA analysis, DPPs, and other documentation.

Cost Range: (in thousands) \$1,200-\$1,800 **Period of Performance:** FY 2012-2017

Description:

Background: Cape Lisburne currently supports the largest seabird rookery in the eastern Chukchi Sea. At present, this colony supports about 400,000-500,000 murres (70% Thick-billed Murres and 30% Common Murres) and 20,000-30,000 Black-legged Kittiwakes, about half the murres and kittiwakes breeding north of Bering Strait in Alaskan waters. OCS Study Report BOEMRE 99-0011 documented a long-term time-series of data on seabird behavior and productivity at these colonies. However, the 2000 report only contains data on murre and kittiwake productivity obtained prior to 1998, and thus, is out of date and no longer adequate as a source of information on seabird populations nesting near the proposed Chukchi Sea lease areas. During 1999-2009, Alaska Maritime NWR personnel monitored seabirds at Cape Lisburne but only during late July – mid-August, a period too short to encompass the nesting season and allow detailed information to be collected on productivity. Collecting this kind of information requires field seasons that begin about one month earlier and last through late August, because 7-8 plots containing about 25-30 nest sites have to be checked every 2-3 days throughout the incubation and chick-rearing periods.

Recent surveys have documented summer use of Ledyard Bay as a foraging area during murre chick rearing. Other surveys have indicated that later in the summer, male murres and young-of-the-year forage in large numbers to the north, in waters recently leased for oil and gas development. Kittiwakes feed in the vicinity of the breeding colony but details of their foraging area are not well known. These feeding and molting birds are potentially at risk due to oil spills and disturbance as a result of exploratory drilling and oil field development that may occur over the next several years.

Objectives:

- Estimate productivity of Common and Thick-billed Murres and Black-legged Kittiwakes at the Cape Lisburne colony.
- Estimate the relative importance of several foraging areas, especially those potentially affected by oil and gas development, to various life history stages and demographic groups.

Methods: Data on kittiwake and murre productivity will be collected by two biologists and one volunteer in funding partnership with other entities over 4 years during 70-day-long field seasons using the methods described by Roseneau et al. in the earlier BOEMRE-sponsored study. Foraging birds will be monitored under a separated module by another team of two biologists using satellite, GPS, and aircraft supported telemetry, as appropriate. Adult and fledgling birds will be tagged at the colony. This study will coordinate with other ongoing BOEMRE studies of oceanography and prey biology to aid interpretation of foraging behavior at sites of interest.

Revised Date: March 2010

ENVIRONMENTAL STUDIES PROGRAM: Studies Development Plan FY 2011-2013

Region: Alaska

Planning Area(s): Beaufort Sea

Title: Eastern Beaufort Sea Marine Fish and Lower Trophic Survey

BOEMRE Information Need(s) to be Addressed: This project continues collection of a marine fish baseline in the Beaufort Sea. A new Exploration Plan (EP) approved in Camden Bay highlighted the need to accelerate collecting an eastern Beaufort Sea baseline. Study information will also be used in NEPA analyses for future Beaufort Sea Lease Sales and contribute to Marine Spatial Planning.

Cost Range: (in thousands) \$6,200-\$9,200 **Period of Performance:** FY 2012-2016

Description:

Background:

The 2009 International Arctic Fisheries Symposium highlighted the lack of data in the Beaufort Sea and emphasized the need for more information in the wake of Arctic climate change concerns, including marine spatial planning efforts. A three-week BOEMRE open-water survey in the western Beaufort Sea in 2008 documented an unexpected level of diversity, including several commercial fish species common in the Bering Sea that until now were unknown in the Beaufort Sea. Whether these fish have always inhabited the Beaufort Sea or whether this is a change due to climate and regime shifts enabling these fish to successfully inhabit the Beaufort Sea is still unknown.

For evidence of important eastern Beaufort Sea marine fish mating, spawning, rearing, feeding and migration habitats, BOEMRE NEPA analysts rely on those limited historical samples, estuarine shoreline surveys, and generalizations from other Arctic and sub-Arctic marine locations.

For up to three-quarters of the year, Beaufort Sea marine fish habitat is ice-covered. For over 30 years BOEMRE workshops have emphasized the need to survey and understand the ice-covered environment despite the challenging logistics and working environment of the Arctic winter. This eastern Beaufort Sea survey would continue the development of under-ice survey methods by BOEMRE and our Canadian counterparts.

In addition to the need for basic marine fish distribution data, NEPA analysts in multiple disciplines require ecological information to assess potential effects of offshore development. In order to increase our knowledge of critical or sensitive life history stages and habitats and the trophic structure of the eastern Beaufort Sea, the survey will include sea bird and marine mammal observations, fish stomach content analyses, lower trophic invertebrate and primary production sampling, and oceanography measurements to address those ecological relationships. The addition of bird and marine mammal observations and zooplankton and

primary production sampling will provide transect data in offshore areas where data for those species is as sparse as for fish species.

Objectives:

- Extend a baseline geographic range of fish, invertebrate, and primary producer abundance, distribution and biomass for both the open water and the ice-covered seasons.
- Estimate seasonal and inter annual variability of fish abundance and distribution.
- Document differences in spatial distribution patterns between the central and eastern Beaufort and Chukchi seas.
- Identify spatial and community relationships among fish, zooplankton, bird, and marine mammal species in this area to extent allowed by logistical and budgetary constraints.
- Provide GIS based maps and attribute tables of marine fish and lower trophics for OSRA and NEPA analysis.

Methods: The survey will sample fish and related biological and oceanographic habitat characteristics in the eastern Beaufort between longitudes 141° and 147°. The study will employ active sampling gears to target Beaufort Sea fish assemblages and to measure concurrent oceanographic and trophic conditions in order to elucidate relationships between marine fish species seasonal abundance and distribution to fish life stage, habitat, and other trophic levels. The methods developed and refined in the western and central Beaufort Sea surveys (AK-06-04 and AK-10-06) for both the open water and under-ice seasons will be employed. Those methods are designed to monitor both demersal and pelagic fishes at all life history stages across depths and habitats. In order to provide a better measure of interannual variability, field surveys will be performed every other year for a total of three years.

In order to provide rudimentary baseline of the often neglected lower trophic elements of the food web, the survey will increase sampling for zooplankton and primary producers over previous surveys. To fully utilize the research vessel and logistics the survey would include: sea bird and marine mammal observations, fish stomach analyses, lower trophic invertebrate and primary production sampling, and oceanography measurements where possible. To the degree resources limit the extent of either field collections or laboratory analyses, voucher, energetics, genetics, and otolith samples will be collected and archived for future BOEMRE studies. This study is designed to contribute shelf wide oceanography transect data to the Eastern Beaufort Boundary Conditions study also proposed for 2012.

Revised Date: March 2010

ENVIRONMENTAL STUDIES PROGRAM: Studies Development Plan FY 2011-2013

Region: Alaska OCS Region

Planning Area(s): Chukchi Sea

Title: Physical Oceanography of the Chukchi Sea Oil and Gas Lease Areas
(Extension of AK-09-06)

BOEMRE Information Need(s) to be Addressed: The physical oceanography of the Chukchi lease area will provide important inputs for calculating estimates of the transport and fate of oil and related materials within the leased area. These calculations provide the basis for estimating potential impacts of oil on resources and potential impacts on coastal communities. Also wind, current and wave information will provide information relevant to general oceanographic modeling, as well as ice management, and search and rescue operations.

Cost Range: (in thousands) \$3,000-\$4,000 **Period of Performance:** FY 2012-2017

Description:

Background: This new study will expand the geographic boundary of the ongoing oceanographic study “ Application of High Frequency Radar to Potential Hydrocarbons Development Areas in the Northeast Chukchi Sea” to include much of Sale 193 leased blocks. Theory, modeling, and limited observations suggest that waters from the central Chukchi Sea shelf may flow counterclockwise around Hanna Shoal such that central shelf waters are carried into the Barrow Canyon area. This implies northern flow on the shoal’s western flank and eastern flow along its northern flank. BOEMRE began measuring surface currents within the Chukchi Sea in September 2009 with the deployment of CODAR long range high frequency (HF) radar systems at Barrow and at Wainwright (see www.chukchicurrents.com). Hourly surface current measurements from mid September to mid November have been collected between Barrow and Wainwright out to over 150 kilometers from shore. These data have shown that there is a high degree of surface current variability. By combining regional HF radar surface current measurements with data from ADCPs, AUVs, and surface meteorological buoys, this project will assist in documenting the physical oceanography at a regional scale. A web site will be extended to communicate live data collection and analysis to the coastal communities, the public and the broader scientific community including any ongoing BOEMRE projects within the region. The ongoing field work and web site shall be used as an ocean observing laboratory for the Chukchi Sea and provide data for future model validation efforts.

Objectives:

- Document the surface current flow conditions within Chukchi OCS active leases, including those areas adjacent to Hanna Shoal.
- Document the changes in surface and subsurface current connectivity with changes in water column stratification to the south and west of the present study area through the deployment of additional ADCP’s Acoustic Doppler Current Profilers (ADCP) and Autonomous Underwater Vehicles (AUV) Gliders.

- Document how offshore winds impact changes to surface and subsurface circulation and changes in water column stratification through the deployment of two offshore meteorological buoys during the open water season.
- Document the spatial and temporal changes to the Alaska Coastal Current with changes in wind regime and other environmental parameters.
- Document unique, recurring oceanographic features such as the large eddies mapped off of Barrow Canyon during the summer of 2009.
- Develop a Chukchi Sea Ocean Observation Network Web Site that distributes collected real time data and information to the local coastal communities, the public, and to the broader scientific community.
- Provide data for validation of oceanographic and oil-spill models and to support development of the oceanographic process model for the proposed Hanna Shoal Ecosystem study.
- Produce a report and database that documents the physical oceanography of the Chukchi Sea OCS.

Methods: Long range SeaSonde systems could be modified by utilizing twin transmit antennas, increasing the observable range from a maximum range of 180 Km to over 240 km. These longer range systems can capture surface currents to the outer boundary of the leased areas of the Chukchi Sea. Over 70% of the leased area could be captured every hour. In addition, every effort will be made to fill in the data gaps where needed (e.g., off of Barrow). Likewise, we plan to deploy bottom mounted Acoustic Doppler Current Profiler's and Autonomous Underwater Vehicles to capture the subsurface changes in temperature, and salinity. Underwater Slocum Gliders shall collect continuous temperature and salinity profiles across a portion of the study area and transmit the data in near real time. Surface meteorological buoys will be deployed across the study area to measure the changes in near surface winds in addition to surface temperature. Scientists will visit the local coastal communities of Barrow, Wainwright, and Point Lay and give a presentation to the local Elders and schools regarding ongoing activities. A final report shall document the physical oceanography of the Chukchi Sea OCS. A comprehensive database shall be built for future model validation efforts.

Revised Date: March 2010

ENVIRONMENTAL STUDIES PROGRAM: Studies Development Plan FY 2011-2013

Region: Alaska

Planning Area(s): Beaufort Sea

Title: Eastern Boundary Oceanography of the Beaufort Sea

BOEMRE Information Need(s) to be Addressed: Exploration and delineation activities in both the US Beaufort and Canadian Beaufort are increasing and moving toward the US/Canada border. A better understanding of the eastern boundary of the US Beaufort Sea will support the BOEMRE Oil Spill Risk Analysis (OSRA) and water quality modeling. The OSRA is a cornerstone to regional EISs, environmental assessments (EAs), and oil spill contingency planning.

Cost Range: (in thousands) \$3,000-\$4,500 **Period of Performance:** FY 2012-2017

Description:

Background: Canada has completed oceanographic studies off the mouth of the Mackenzie further east and BOEMRE has studies primarily in the central and western US Beaufort Sea. The BOEMRE has spent little effort in the eastern US Beaufort, because of the lack of logistical infrastructure and past lack of interest by oil industry.

The eastern US boundary adjoins the Canadian sector of the Beaufort Sea where oceanographic conditions are profoundly influenced by year-round runoff from the Mackenzie River, possibly by water upwelled onto the shelf through Mackenzie Canyon, and by orographic winds steered by the Brooks Range as it approaches the coast. Substantial quantities of Mackenzie River water have been measured as far west as the Northwind Ridge and Chukchi Cap (north of the Chukchi Shelf) suggesting that the Mackenzie influence might extend over the entire Beaufort Sea shelf. The coastal zone is also an important migratory corridor for whitefish, a subsistence food fish) that migrates between the Mackenzie and Colville rivers.

As a result of the Mackenzie and other river flow, shoreline runoff, and melting sea ice, the waters of the nearshore Beaufort Sea are subject to intense stratification in the summer. Concerns have been raised about water quality and dispersion of discharges from offshore facilities into this system. Strong density stratification will tend to shut down vertical mixing, retaining any near-surface discharges in the upper layer of the water column. Strong winds can disrupt stratification for short periods, but stratification is quickly reestablished when the winds relax.

This study was recommended by the BOEMRE Beaufort Sea Oceanography Workshop (<http://www.boemre.gov/Alaska/reports/2003rpts/2003-045.pdf>). The feasibility and study design for this project are being addressed in BOEMRE Contract M06PC00030 "Feasibility and Study Design for Boundary Oceanography of the Beaufort Sea" with final report due March 2010.

Objectives:

- Determine large scale surface and 3-D circulation and density fields and their interannual variation
- Determine whether Mackenzie River water enters the study area seasonally and year-round
- Provide the seasonal development of buoyancy forced coastal circulation in the eastern Beaufort Sea
- Provide a detailed framework and model for the seasonal development of stratification including implications for water quality. Determine the relative contributions of heat and freshwater fluxes to variations in stratification. Determine the effects of variations in stratification and vertical mixing on dispersion of dissolved and suspended materials in the water column.

Methods: A coordinated effort with Canadian researchers on their side of border will be encouraged and BOEMRE costs for a 5-year program assume sharing of coordination and logistical costs. Observations of the three-dimensional circulation and thermohaline field associated with the river discharges and seasonal warming are needed during the open water period. Ocean surface current mapping radars, satellite tracked drifters, gliders and ship-borne surveys with a towed instrument package (to examine the 3-dimensional thermohaline structure), air-borne salinity mapper (surface salinity distribution), arctic winch moorings for profiling temperature and salinity, acoustic doppler current profilers (ADCP) (for the vertical velocity structure), and satellite imagery are all appropriate tools for examining this important aspect of the shelf circulation. The measurements should cover a variety of spatial (<1 km – 100 km) and temporal scales (hours – months) and extend over the width of the shelf and cover an alongshore extent of at least 100 km. Mooring measurements would be supplemented with cross-shelf hydrographic (< 5 km spacing) transects. Meteorological buoys will be deployed. Geochemical tracers and salinity would be used to trace Mackenzie River water.

This study will develop a high-resolution, regional, baroclinic coupled ice-ocean circulation model simulation for the Beaufort Sea shelf. An in-depth analysis will be performed on the model results to examine the dependence of flow structure on seasonal variations in density stratification and vertical mixing. Spreading of passive tracers and suspended sediments from point sources will be examined to determine the effect of water column structure on dispersal of potential contaminants.

Revised Date: January 2010

ENVIRONMENTAL STUDIES PROGRAM: Studies Development Plan FY 2011-2013

Region: Alaska

Planning Area(s): Beaufort and Chukchi Seas

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

BOEMRE 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, BOEMRE 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 Period of Performance: FY 2012-2014

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 BOEMRE 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 BOEMRE studies in the region, including aerial surveys studying the distribution, density, and feeding ecology of cetaceans.

Revised Date: March 2010

ENVIRONMENTAL STUDIES PROGRAM: Studies Development Plan FY 2011-2013

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

BOEMRE 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 BOEMRE compliance with Executive Order 12898 on Environmental Justice and will facilitate BOEMRE research coordination with multi-agency initiatives.

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

Period of Performance: FY 2012-2014

Description:

Background: Many previous BOEMRE 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 epidemiology 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 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 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, the North Slope Borough, and private industry. Additionally, potential sources of information and collaborators include U. of North Carolina (Popkin), University of Maine (Ranco), Center for Alaska Native Research at UAF (Bersamin), and ANTHC (Ritter).

Objectives:

This study will investigate if 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. The project will:

- Improve understanding of contemporary patterns of food consumption within each sampled community.
- Analyze representative food consumption patterns and portions for nutritional value and potential contaminants.
- Estimate the percentage and dosage of food energy derived from subsistence and market sources for sampled subgroups in each community.
- Link nutritional data to existing subsistence surveys and sharing network studies to enhance analysis of potential health impacts from oil and gas development.

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 of nutritional epidemiology to characterize the mixed market-subsistence nutritional system of participating communities and provide incentives to ensure participation due to personally invasive nature; 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: March 2010

ENVIRONMENTAL STUDIES PROGRAM: Studies Development Plan FY 2011-2013

Region: Alaska

Planning Area(s): Chukchi Sea

Title: Enclave Development: Alternative Approaches for Housing Transient Workers in Rural Alaska

BOEMRE Information Need(s) to be Addressed: With the construction of Prudhoe Bay oil facilities, transient industrial workers on the North Slope of Alaska were housed in enclaves separate from existing indigenous communities. Subsequent BOEMRE social and economic impact models are still based upon this premise of enclave housing, even though more recent economic development opportunities in places like Nuiqsut and Wainwright demonstrate a move toward less segregation. Workers are increasingly based in Alaska Native villages with temporary housing provided by Village Corporations. The situation calls for re-evaluation of assumptions of the enclave model and reanalysis of potential community impacts.

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

Period of Performance: FY 2012-2014

Description:

Background: A defining pattern of North Slope oil production is that oil development historically has taken place in isolated industrial enclaves where most workers are out-of-region residents working in shifts. Because they have little or no direct association with proximate Alaska Native villages, this arrangement has helped to limit direct impacts on local communities. A recent analysis of the Chukchi Exploration Plan disclosed that oil companies have negotiated with the Alaska Native community of Wainwright to construct a shorebase facility for transient workers, at least during the exploration phase. This study intends to analyze available community data to assess and predict more thoroughly the potential consequences from increased community contact with industrial workers.

Nuiqsut could serve as one example from which to process data and draw analytical conclusions. In Nuiqsut, industry has replaced the enclave model with hotel accommodations at nearby Alpine for housing some transient workers. Two more large units are planned for construction, yet little analysis to assess effects on local residents has been undertaken except a Human Health Impact Analysis (HHIA). The HHIA predicted that the demographic change could result in stresses including diminished access to subsistence resources, with potential resulting changes in: a) diet and food security; b) psychosocial/gender effects, such as increased substance/alcohol abuse, violence/homicide, or accelerated assimilation; and c) occupational/community health effects, such as expanded workplace health screening and immunization protocols, STI transmission prevention strategies, and substance abuse enforcement.

The BOEMRE recognizes that there are distinct cultural differences between the Iñupiat Eskimo who live in the North Slope and transient industrial workers. Currently, decision

documents stipulate implementation of mitigation through education, and industry is required to enhance employee cultural sensitivity through educational presentations administered prior to deployment to the region and thereafter on an annual basis. One component of this study would be to assess if this is an effective mitigation measure that will offset potential conflicts and socio-cultural changes resulting from a rotating series of strangers embedded in the community through no personal choice of their own.

Objectives: The purpose of this study is to assess current and trend-line housing practices for transient workers throughout the North Slope of Alaska, to re-evaluate historical assumptions about enclave models of development, and to analyze potential community impacts based on fresh data and analysis in Nuiqsut and Wainwright.

Methods: This study will employ various social science methods, focusing on select communities that have historically provided housing for transient workers. The collection and analysis of data to assess short-term and longer-term effectiveness will be accomplished through the following: 1) compilation of an annotated bibliography with a special emphasis on identification of industrial housing policies in the past in Alaska; 2) ethnographic review of past development activities associated with oil and gas elsewhere to assess effects upon local indigenous populations by transient industrial workers; 3) review and assessment of premises in existing Human Health Impact Assessments and current epidemiological data for the North Slope; 4) synthesis of available social indicator data and broader discussion regarding effects of enclave development in light of local support to engage in profitable contractor services. Draft and final reports will be provided.

Revised Date: March 2010

SECTION 3.0 TOPICAL AREAS FOR FY 2013

This section presents a general forecast of significant topical issues and concerns to be addressed by studies to be proposed for FY 2012 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 Alaska ESP. These projects will focus on BOEMRE 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 2011 and FY 2012 address the topical areas described below. These will be re-assessed as part of the FY 2012 planning process.

As noted in Section 1.2.1 of this document, BOEMRE released its *Final Outer Continental Shelf Oil and Gas Leasing Program 2007-2012* in April 2007 (USDOJ, BOEMRE, 2007). This program includes proposed lease sales in four planning areas within Alaska, two of which (the Chukchi Sea Planning Area and the North Aleutian Basin Planning Area) exhibit particularly acute information needs. It will also be important for BOEMRE 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 North Pacific right whales, polar bears, pinnipeds and other marine mammals may continue into 2011 and beyond. Additional studies may be brought online which address fish and migratory waterfowl. 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 BOEMRE are based on surface current data derived from ocean circulation hindcast models. As climate change continues, hindcast modeling may need to shift to a forecast modeling mode.

Climate change also entrains many socioeconomic 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 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. Development and application of state-of-the-art circulation models is important for future OSRA-based EIS analyses. The BOEMRE has partnered with NOPP and with Rutgers University to produce high-resolution circulation models covering Arctic OCS waters and the NAB Planning Area, respectively.

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.

The accuracy of surface wind fields, ocean currents, and information regarding the spatial and temporal variability of polynyas, leads, and landfast ice are important for determining the fate of spilled oil in this region and the impacts on biota associated with these systems. Studies conducted by the BOEMRE 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 landfast ice.

3.3 Fates 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 current cANIMIDA project. The cANIMIDA task of monitoring of Cross Island whaling has been continued. A continuation of ANIMIDA/cANIMIDA sediment chemistry monitoring, emphasizing hydrocarbon and priority metal concentrations, is also proposed as a new FY 2011 study. The study proposed for FY 2011 has been expanded to include Camden Bay, where drilling is planned for summer 2010 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 BOEMRE 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.

3.4 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. The BOEMRE anticipates the continuation of region-wide monitoring of the fall migration by the Bowhead Whale Aerial Survey Project and the additional knowledge it obtains on bowhead feeding patterns. The BOEMRE also 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.

3.5 Marine Fish Migrations, Recruitment and Essential Fish Habitat

The BOEMRE 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 BOEMRE 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. The Bering Sea and the North Aleutian Basin support the most important commercial fisheries in the U.S. 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. 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.

Residents and non-residents dependent on commercial fisheries are concerned about development activities interfering with those fisheries. Even the mere public perception of tainted commercial fish could cause detrimental effects on fish markets for years to come. Alaska Native villagers are also 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. The study "Eastern Beaufort Sea Marine Fish and Lower Trophic Survey" is proposed for FY 2012 to complement surveys in the western and central Beaufort.

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.

3.6 Subsistence

Residents of the North Slope coastal communities frequently express concern about cumulative impacts of offshore and onshore developments on their subsistence lifestyle.

Relative to existing oil and gas operations, the villages of most pressing concern are Nuiqsut, Kaktovik and Barrow. Consideration of cumulative impacts is an increasingly important issue for BOEMRE in preparing NEPA documents. 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.

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 2012 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 2011-2013
Studies Development Plan
Headquarters**

**U.S. Department of the Interior
Bureau of Ocean Energy Management, Regulation, and Enforcement
Headquarters
Herndon
2010**

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SECTION 1.0 PROGRAMMATIC OVERVIEW

1.1 Introduction

The Bureau of Ocean Energy Management, Regulation, and Enforcement (BOEMRE) serves as the steward for America's offshore energy and mineral resources on the Outer Continental Shelf (OCS) and is one of the top revenue collectors for the United States. The BOEMRE provides, on average, over \$8 billion in annual revenues for the Nation, States, and American Indians. The BOEMRE plays a key role in America's energy supply by managing the mineral resources on 1.7 billion acres of the OCS. The OCS is a significant source of oil and gas for the Nation's energy supply. The approximately 43 million leased OCS acres generally account for about 15 percent of America's domestic natural gas production and about 27 percent of America's domestic oil production. The BOEMRE's oversight and regulatory frameworks ensure 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. The BOEMRE estimates of oil and gas resources in undiscovered fields on the OCS (2006, mean estimates) total 86 billion barrels of oil and 420 trillion cubic feet of gas. These volumes represent about 60 percent of the oil and 40 percent of the natural gas resources estimated to be contained in remaining undiscovered fields in the United States.

The OCS Lands Act requires the Department of the Interior (DOI) to prepare a 5-year program that specifies the size, timing and location of areas to be assessed for Federal offshore 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 and offshore Alaska. 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.

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 BOEMRE planning process links BOEMRE activities to the Department of the Interior's Strategic Plan in two major mission component areas: Resource Use and Serving Communities. Careful planning ensures that goals and strategies are cascaded throughout the organization.

The major offshore program objectives linked to the Department's Strategic Plan include: Energy Access and Development, Responsible Use, Safety, Non-Energy/Alternative Use, Management, Improved Assessment and Information for Decisions, and Optimal Value. Within BOEMRE, Offshore Energy and Minerals Management's (OEMM) strategies guide 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 OEMM'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 conserve natural resources, provide energy for the Nation, protect citizens and marine life, and ensure a fair return for development of OCS lands. This work includes ongoing critical research on the environment and safety-related technologies, and preparation of rigorous environmental assessments for proposed development activities. The environmental research component is conducted through the Environmental Studies Program (ESP).

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:

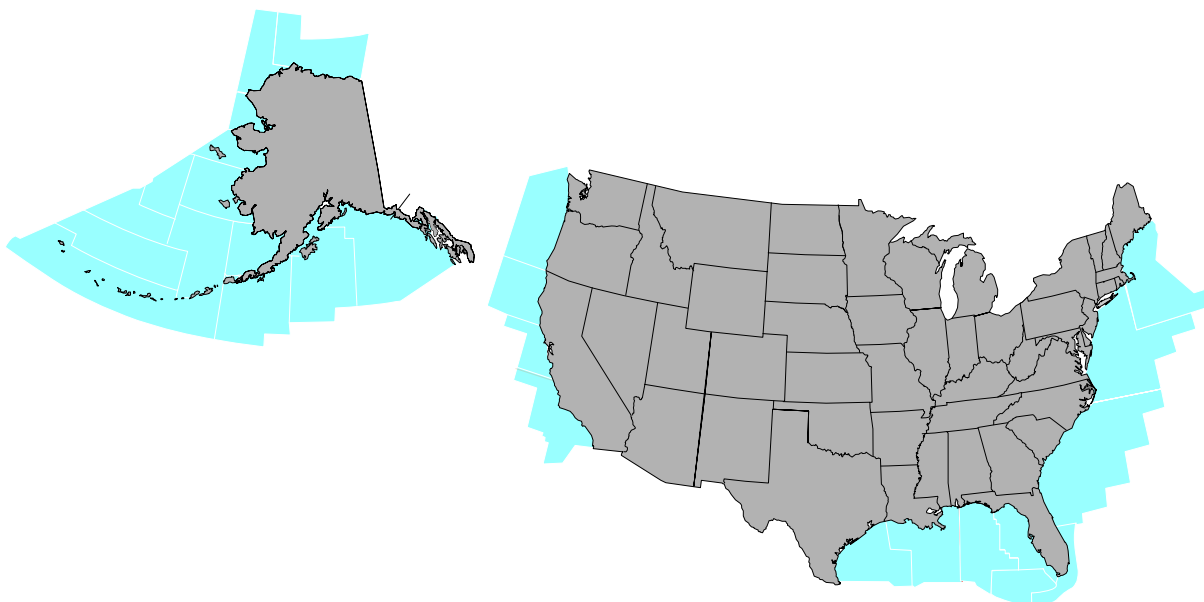
- Provide the information needed for assessment and management of environmental impacts on the human, marine, and coastal environments of the OCS and the potentially affected coastal areas;
- Predict impacts on the marine biota which may result from chronic, low level pollution or large spills associated 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 are now focused predominantly in the Gulf of Mexico (GOM), with recent development and promising leasing activity in Alaska's Beaufort and Chukchi Seas and potentially new leasing in the North Aleutian Basin and offshore of Virginia, as well as some production in southern California. Studies conducted in these areas are focused on characterizing environmental processes to address critical OCS information needs.

Additionally, the passage of the Energy Policy Act of 2005 gave BOEMRE 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. The BOEMRE also is responsible for other mineral production offshore, which currently includes using sand and gravel for coastal restoration projects.

The ESP Headquarters component of the Studies Development Plan (SDP) provides the national “context” of the Program and the linkages between BOEMRE’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 BOEMRE’s physical oceanography studies to support oil spill risk assessment (OSRA).

1.2 Map of the Planning Area



1.3 Projected OCS Activities

1.3.1 General Program Support and Quality Assurance

Annual support for the activities of the OCS Scientific Committee will continue to be provided as a Headquarters Office function. The Scientific Committee was established to advise the Director of BOEMRE 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, the BOEMRE routinely provides support to scientific conferences and symposia. In some cases, symposia may have a dedicated session on OCS research. Sometimes, OCS-sponsored research may be presented within the context of a wider scientific discipline. In other cases, BOEMRE will support meetings which have topics with strong relevance to mission related information needs.

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 the BOEMRE Environmental Studies Program have been carefully maintained through the NMNH's archiving standards and made available to taxonomists around the world. Nearly 300 new species have been discovered in BOEMRE contributions.

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.

1.3.2 General Peer Review Planning

Section V of OMB's Final Information Quality Bulletin for Peer Review 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:

- External review of proposals
- Review and critical input by Scientific Review Boards or Modeling Review Boards
- Review and critical input by scientific advisory committees under the Federal Advisory Committee Act
- 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. In addition, projects are regularly presented at BOEMRE Information Transfer Meetings and special workshops facilitating both scientific peer-review and public/stakeholder input. In 2009 the BOEMRE published the “Integrity and Code of Conduct for Science, Scientific Assessment, and other Similar Technical Activities” to provide guidelines to ensure integrity in all science, scientific assessments, and similar technical activities used in decision-making from data collection. The policy explicitly delineates the OEMM’s expectation that employees will be objective, diligent, and transparent in their scientific activities, including use of government resources and advancing and utilizing the best scientific data possible.

1.3.3 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.

Rapid information dissemination is a key information management activity. The Environmental Studies Program Information System (ESPIS) allows for easy access to ESP products. 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. In addition, full text search capabilities were added. This system makes the ESP contracted research information directly available to the public through the internet at: <http://www.boemre.gov/eppd/sciences/esp/index.htm>.

Information concerning ongoing research supported through the ESP is accessible at: <http://www.boemre.gov/eppd/sciences/esp/HappeningNow.htm>. The ongoing research is arranged by BOEMRE 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, the BOEMRE 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 (NODC). Another effort that BOEMRE supports is the Census for Marine Life. Efforts are underway to fill a gap in the archiving of data for marine mammals and other marine life. In

support of coastal and marine spatial planning, the BOEMRE is pursuing new ways to provide access to data collected through the ESP including support of the Marine Cadastre and regionally directed data access activities.

1.3.4 Physical Sciences and Oil Spill Risk Analysis

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 is 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.

The BOEMRE is committed to the continuous improvement of its Oil Spill Risk Analysis (OSRA) estimations, and is using the results of field and modeling studies of ocean circulation to fulfill that commitment. The BOEMRE 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 proposed. The fate of spilled oil is another area of focus. Laboratory analysis is conducted on the various types of oil, computer models predict the behavior of an oil spill in the ocean environment. Furthermore, Headquarter staffs actively seek cooperative efforts with other agencies and private industries in such matters. These efforts leverage BOEMRE's resources, while providing additional needed information and external review.

In response to the proposed lease sale off the coast of Virginia, the BOEMRE contracted for a modeling study of the Mid-Atlantic area in January of 2009. Four additional studies covering the North and South Atlantic Planning Areas and the planning areas off California are proposed to support future OSRA modeling efforts, should these areas be made available.

1.3.5 OCS Renewable Energy

The Energy Policy Act of 2005, delegated to BOEMRE 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). Initially, the ESP prepared a separate Studies Development Plan focusing on the renewable energy program. With the proposed establishment of a new Atlantic regional office, renewable energy information needs have been folded into the appropriate regional plans. The Atlantic region focuses on wind energy while the Gulf of Mexico region is now responsible for renewable energy projects off Florida, including those addressing ocean currents. Studies focused on other coasts now are incorporated into the appropriate regional plans.

1.3.6 Global Climate Change

Recognized changes in the global climate are of concern to BOEMRE. 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 Coast and Atlantic, sea level rise and the implications of changing patterns of storm activity are concerns. The BOEMRE 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 are evaluating marine ecosystems assist in the understanding of climate effects and changes that are occurring.

1.3.7 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 since 2002. We have funded research through NOPP focused on chemosynthetic communities, the archaeological and biological effects of shipwrecks, surface circulation radar mapping in Alaska, and most recently improving cetacean electronic data loggers and a variety of renewable energy projects. Two of our NOPP-related studies have received awards. The study, Archeological and Biological Analysis of World War II Shipwrecks in the Gulf of Mexico (Church et. al 2007) was awarded the NOPP Excellence in Partnering Award and also the U.S. Department of the Interior Partnership in Conservation Award. The Deepwater Program: Investigations of Chemosynthetic Communities on the Lower Continental Slope of the Gulf of Mexico study also was awarded the DOI Partnership in Conservation Award.

We are also working through our Coastal Marine Institutes to develop ways in which our research can include educational components and we are exploring processes whereby ESP-sponsored projects can include Optional Tasks to produce “educational” materials using a process similar to that used by NOPP.

The BOEMRE 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. As part of the support for this effort, BOEMRE contributes to a fund which is used to provide services for supporting the working group.

1.3.8 Ecosystem-based Management

We continue our efforts to integrate ecosystem management into the studies planning process. BOEMRE 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 Fish & Wildlife Service's ecologically defined "coastal characterization" studies, and each included a standard suite of reports: habitat descriptions, species profiles, socioeconomic, 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, Miss-Ala Shelf, West Florida Shelf, SW 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.

1.3.9 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 Outer Continental Shelf (OCS) is growing.

The BOEMRE has jurisdiction over all marine mineral resources on the OCS. Public Law 103- 426, enacted October 31, 1994, gave the BOEMRE 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, the BOEMRE has authorized the use of over 35 million cubic yards of sand for 26 coastal restoration projects resulting in the restoration of over 135 miles of coastline. Yet, as the demand for OCS sand has increased, sand management issues and potential environmental conflicts have also become more complex.

The BOEMRE 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 50 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.

Site-specific studies at existing or high-potential borrow areas offshore coastal states have been a cornerstone of past research. The biological aspect of these site characterization studies has concentrated on the potential effects on sessile benthic invertebrates, defining community structures/dynamics in context of sediment characteristics and impacted and non-impacted areas. Relatively fewer studies have documented mobile invertebrates or fishes, or food web and ecosystem dynamics. The physical aspect has generally focused on wave climate, wave transformation, sediment transport, and the potential for dredging operations to impact shallow coastal processes and shoreline change. Project sponsors are now required to provide site-specific information traditionally obtained through BOEMRE-sponsored research. A synthesis of research projects in support of environmental evaluations of sand and gravel dredging is proposed as well as criteria for effective borrow area management.

The BOEMRE continues to support the study of a wide range of cross-cutting programmatic topics, such as the protection of archaeological resources, modeling of turbidity plumes, and the physical process effects of altering offshore bathymetry through dredging. These focus studies, which may be comprised of a combination of literature review, field observations, laboratory analyses, and numerical modeling, have broad application across diverse regions and projects. The topic-focused research is often state-of-the art, addressing highly uncertain impacts using or testing cutting-edge methodologies. Focus studies target the resources, processes, and potential impacts that remain poorly documented and understood.

1.4 Identification of Information Needs

The exploration for hydrocarbon and sand/gravel resources, siting of renewable energy facilities, construction and operation of offshore infrastructure and decommissioning will introduce sound into the marine environment (e.g., pile driving and vessel noise). Marine mammals and other marine life (e.g., sea turtles, fish) rely on sound to communicate, find mates, navigate, detect predators, and to gain information about their environment critical to survival and reproductive success. Current information suggests that anthropogenic noise (human-induced sound), in certain situations, can affect marine mammals, fish and sea turtles. Some of these impacts may be immediately detectable (i.e., injury, observed avoidance of an area) while others may be more subtle or difficult to detect (i.e., masking important intraspecies communication, deterring animals from preferred breeding or foraging habitat, interrupting important behavior such as nursing and caring for young). Further, sound perception and sensitivities vary by species, and even individuals within a species. The ultimate question is to discover at what point does anthropogenic noise interfere with the animals' functions (behavioral and physiological) such that it becomes disruptive to important biological processes (i.e., breeding, feeding, reproductive success) and possibly biologically significant. Further research is key to answering this challenging question.

Part of the required analysis of the Five Year Oil and Gas Program is a discussion of environmental sensitivity and marine productivity. Scientifically rigorous protocols for calculating these scores are essential to meeting our mandates to conduct offshore activities in an environmentally sound manner.

Oil spill risk analysis models constantly undergo revision to enhance computational efficiencies and improve the probability estimates of oil-spill contacts. Better processes, mechanisms and features are needed to advance the efficiency and accuracy of the models.

One of the ESP’s primary concerns is collecting the information necessary to mitigate the effects of program activities on marine mammals. Part of the ongoing effort to improve protection and stewardship in this area is an effort to improve our ability to detect, classify and locate marine mammals. Through the National Oceanographic Partnership Program, BOEMRE will consider a contribution to multi-agency efforts to explore and evaluate technologies to achieve this.

To ensure the maximum utility of ESP sand and gravel efforts, a synthesis of the results of previously funded research is needed. This review and summary of work will evaluate the currency of the information and identify data gaps for future research

1.5 New Starts for FY 2010 and Ongoing Studies

The following section focuses on the ongoing studies for FY 2010 and beyond.

Table 1. Headquarters New Starts for FY 2010 and Ongoing Studies

Program Lead	Planning Area	Start FY	Discipline	Study Title
NEW STARTS				
BOEMRE	NAT	10	MM	Support for NOPP Project on Improving Cetacean Electronic Data Loggers
BOEMRE	ATL	10	HE	Exploration and Research of North- and Mid-Atlantic Deepwater Hard Bottom Habitats
BOEMRE	NAT	10	FE	Workshop to Develop Methodologies for Studying the Effects of Seismic Survey Air Guns on Commercial, Recreational and Subsistence Fish and Shell Fish in the Atlantic and Alaska
BOEMRE	NAT	10	FE	Support for the Development of a Marine Mammal Data Archive
BOEMRE	NAT	10	AQ	Improving Emission Estimates and Understanding of Pollutant Dispersal
BOEMRE	NAT	10	IM	Support for Second International Conference on the Effects of Noise on Aquatic Life
BOEMRE	NAT	10	PO	Best Practices for Physical Process and Impact Assessment in Support of Beach

ONGOING STUDIES				
<i>Fates & Effects</i>				
BOEMRE	NAT	08	FE	Effects of Pile Driving Sounds on Auditory and Non-auditory Tissues of Fish
BOEMRE	NAT	03	FE	Analysis of Potential Biological and Physical Dredging Impacts on Offshore Ridge and Shoal Features/Engineering Alternatives and Options to Avoid Adverse Environmental Impacts
BOEMRE	GOM	06	FE	Environmental Investigation of the Long-Term Use of Trinity and Tiger Shoals as Sand Resources for Large Scale Beach and Coastal Restoration in Louisiana
<i>Habitat & Ecology</i>				
BOEMRE	ATL	08	HE	Potential for Interactions between Endangered and Candidate Bird Species with Wind Facility Operations on the Atlantic OCS
BOEMRE	ATL	08	HE	Compendium of Avian Information and Comprehensive GIS Geodatabase
BOEMRE/ BRD	GOM	03	HE	Investigation of Finfish Assemblages and Benthic Habitats Within Potential Borrow Areas in Federal Waters Offshore Southeastern Texas and Southwestern Louisiana
BOEMRE/ BRD	NAT	03	HE	Focused Analysis/ Review of Benthic Assemblages on Ridge and Shoal Features of the US East and Gulf of Mexico Coasts
BOEMRE/ BRD	ATL / GOM	04	HE	Utilization of Benthic Communities by Fish Populations on Shoals along the U.S. East Coast and Gulf of Mexico
BOEMRE	NAT	09	HE	Estimation of Marine Productivity in BOEM Planning Areas
BOEMRE	NAT	09	HE	Archiving of Outer Continental Shelf Invertebrates by the Smithsonian Institution
BOEMRE	ATL	09	HE	Surveying for Marine Birds in the Northwest Atlantic
BOEMRE	ATL	09	HE	Determining Distributions and Movements of Long-tailed Ducks Using Satellite Telemetry
<i>Physical Oceanography</i>				
BOEMRE	NAT	08	PO	Extension of Ocean Model Calculations
BOEMRE	ATL	09	PO	Mid-Atlantic Ocean Model Calculations
BOEMRE	AK	10	PO	Adaptation of Arctic Circulation Model
BOEMRE	NAT	09	PO	NAS Study: An Ocean Infrastructure Strategy for U.S. Ocean Research in 2030

<i>Social & Economic</i>				
BOEMRE	NAT	09	SE	OCS Renewable Energy and Space-Use Conflicts and Related Mitigation
<i>Information Management</i>				
BOEMRE/ BRD	NAT	07	IM	Synthesis of Available Information for the Florida East and West Coasts Relevant to Evaluating Potential Environmental Impacts Associated With Offshore Sand Dredging for Beach and Coastal
<i>Marine Mammals</i>				
BOEMRE	PAC	09	MM	Hearing in Sea Otters (<i>Enhydra lutris</i>): Measurement of Auditory Detection Thresholds for Tonal and Industry Sounds
<i>Other (Research Partnerships)</i>				
BOEMRE Technology Assessment and Research Program (TAR)				
USGS/Biological Resources Division (BRD)				
Discipline Codes				
AQ = Air Quality FE = Fates & Effects HE = Habitat & Ecology				
IM = Information Management MM = Marine Mammals and Protected Species				
PO = Physical Oceanography SS = Social Sciences				
Planning Area Codes				
AK = Alaska ATL = Atlantic GOM = Gulf of Mexico				
NAT = Nationwide PAC = Pacific				

SECTION 2.0 PROPOSED STUDY PROFILES

2.1 Introduction

Five Headquarters studies are proposed for FY 2011.

2.2 FY 2011 Table

Table 2. Headquarters Studies Proposed for Fiscal Year 2011 NSL

Page #	Discipline	Title	Rank
15	FE	Evaluation of the Relative Environmental Sensitivity and Marine Productivity of the Outer Continental Shelf (OCS)	1
17	FE	Source and Propagation Characteristics of High Frequency Sound Used for High Resolution Geophysical Surveys	2
19	PO	Update to the BOEMRE Oil Spill Risk Analysis (OSRA) Model	3
21	PO	Characterization of Bottom Sediment Transport During Extreme Events in the Northern Gulf of Mexico Using State-of-the Art Coupled Modeling	4
23	FE	Workshop on Alternative Technologies to Air Guns (Deep-Penetrating) Used in Offshore Seismic Surveys	5
25	MM	Development of Software and Hardware to Acoustically Detect, Classify, and Locate Marine Mammals	6
27	SS	Synthesis, Legislative Review, and Case Law History applicable to Cultural Heritage in the Marine Environment	7
29	SS	Observation and Validation of Exclusion Zones Designed to Protect Sensitive Archaeological Resources and Benthic Habitats Following Sand Extraction Activities on the OCS	8
31	IM	A Synthesis of the Results and Currency of Research Projects Completed for the Environmental Protection, Leasing, and Extraction of Offshore Sand	9
33	IM	Continued Support for the Development and Maintenance of a Marine Biological Data Archive	10
35	SS	Modeling and Testing of Commercial Fish Hang Data as a Proxy for Historic Shipwreck Sites	11
37	MM	Co-funding the Third International Conference on Acoustic Communication by Animals	12
AQ = Air Quality FE = Fates & Effects HE = Habitat & Ecology IM = Information Management MM = Marine Mammals and Protected Species PO = Physical Oceanography SS = Social Sciences			

ENVIRONMENTAL STUDIES PROGRAM: Studies Development Plan FY 2011-2013

Region: National

Planning Area(s): All

Title: Evaluation of the Relative Environmental Sensitivity and Marine Productivity of the Outer Continental Shelf (OCS)

BOEMRE Information Need(s) to be Addressed: BOEMRE is required by the Outer Continental Shelf Lands Act (OCSLA) to conduct environmental analyses for each five-year oil and gas program. One required analysis is to evaluate the relative environmental sensitivity and marine productivity of different areas of the Outer Continental Shelf (OCS). This study will develop the analysis for the upcoming 2012-2017 Five-Year Program. The analysis compares and ranks the environmental sensitivity and marine productivity of the 26 OCS planning areas. The successful completion of this study is essential for the implementation of the 2012-2017 Five-Year Oil and Gas Program.

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

Period of Performance: FY 2011-2012

Description:

Background: The OSCLA mandates that BOEMRE conduct leasing on the OCS through five-year programs. The OSCLA also requires BOEMRE to conduct several analyses to evaluate the economic and environmental costs and benefits of OCS leasing. One requirement is to evaluate the relative environmental sensitivity and marine productivity of the 26 OCS planning areas. BOEMRE has traditionally performed a separate analysis of relative environmental sensitivity and another for marine productivity. A separate BOEMRE study is currently underway to update and prepare the marine productivity analysis. The relative environmental sensitivity analysis prepared for the 2007-2012 Program was successfully litigated on the basis that its use of a single indicator of coastal oil spill sensitivity did not address the sensitivity of the marine environment. The remanded analysis used an approach that calculated planning area sensitivity by summing the individual sensitivity scores for the marine habitat, marine fauna, marine productivity, and coastal habitat components within and near the planning area. The remanded analysis also analyzed climate change effects on sensitivity.

Objectives: The objectives of this study are to develop and recommend options for replacing or supplementing previous BOEMRE methodologies, evaluate approaches and information sources, and conduct the environmental sensitivity and marine productivity analyses of the 26 OCS Planning Areas. This study also will evaluate whether information developed in the marine productivity analysis should be incorporated into the environmental sensitivity scoring or should be presented separately.

Methods: A review and assessment of previous analyses, other methodologies and relevant information sources will be conducted to inform the recommendations and analyses. Methods used in the analysis will be constrained by the following considerations.

1. Data - Data and information used to depict locations, abundance, and other characteristics of environmental features used to calculate environmental sensitivity and marine productivity will optimally have the following characteristics:
 - National coverage
 - Available in digital format
 - Authoritative information source
2. Scale - The resolution of data and analytic methods used in the analysis should be appropriate for depicting broad differences in environmental sensitivity and marine productivity among planning areas. Fine scale data is not required but can be used if generalized to a broader scale.
3. Documentation - All assumptions and parameters used to calculate environmental sensitivity and marine productivity must be based on current authoritative information. Full citations must be provided.
4. Modeling - BOEMRE does not intend to develop complex models or custom software for the analysis. Models will be either conceptual to assist in guiding and standardizing the analyses, or computer-based models developed in standard PC software such as MS Excel or Access. Custom programming will be limited to the use of scripting languages provided with the software.

A report will be prepared that describes the methodologies and information that were used to develop the scorings of the relative environmental sensitivity and marine productivity of the 26 OCS Planning Areas. This report will document other possible methods that were not used, reasons for the selection of the approach that was used, and any weaknesses of the selected approach.

Revised Date: March 30, 2010

ENVIRONMENTAL STUDIES PROGRAM: Studies Development Plan FY 2011-2013

Region: National

Planning Area(s): All

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

BOEMRE Information Need(s) to be Addressed: High resolution geophysical surveys utilize high frequency sound sources that emit noise within the water column at an intensity and frequency which may harm marine life (e.g., marine mammals, sea turtles, and fish). Limited information is 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 sound source and propagation characteristics is crucial to assess more accurately the potential impacts to marine species and determine appropriate mitigation, as required under NEPA, MMPA, ESA and MSFCMA. Information garnered from this study applies across all BOEMRE program areas (oil/gas, renewable, and sand and gravel) and in all planning areas.

Cost Range: (in thousands) \$800 - \$1,200

Period of Performance: FY 2011-2012

Description:

Background: The data collected during geophysical surveys is critical for industry and BOEMRE to make both pre- and post-leasing decisions. High frequency sound sources are commonly used during infrastructure siting, geological characterization, and shallow hazard or site clearance surveys to collect high resolution geophysical information. Although air guns may be used for these surveys, the sound sources currently in use generally include boomers, sparkers, chirpers, side-scan sonar, and single, swath, and multi-beam bathymetry. Little information exists on the 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 types, shallow water processes (i.e., breaking waves), and mesoscale oceanographic properties. At the same time, the little existing data suggests that the sources produce noise within the water column at an intensity and frequency which may adversely affect marine life (e.g., marine mammals, sea turtles and fish). Improved understanding of the sound source and 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 BOEMRE program areas (oil/gas, renewable, hydrate assessment, sand/gravel) and in all BOEMRE Planning Areas.

Objectives: The objectives of this study are two-fold: (1) define the sound source and 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) modify a 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 zone of influence from these sound sources in future environmental compliance assessments.

Methods: There are several possible vehicles for this study, including the use of a broad agency announcement to solicit novel approaches directly from qualified offerors. The study methods will consist of at least the following components:

- Review of existing information about the types and intensities of sound generated from these alternative sound sources.
- Modify and tune sound propagation model(s) for use in shallow waters (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.
- Design and complete the field work necessary to: (1) characterize the sound source(s), bathymetry, geologic environment, and oceanographic processes at the field site(s); and (2) document propagation characteristics of sources.
- 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 model development, field work design, and data validation/analysis.

Revised Date: March 30, 2010

Revised Date: March 30, 2010

ENVIRONMENTAL STUDIES PROGRAM: Studies Development Plan FY 2011-2013

Region: National

Planning Area(s): All

Title: Update to the BOEMRE Oil Spill Risk Analysis (OSRA) Model

BOEMRE Information Need(s) to be Addressed: BOEMRE needs improved methods for estimating the contact probabilities of oil spill trajectories for environmental analyses.

Cost Range: (in thousands) \$175-\$195

Period of Performance: FY 2011-2012

Description:

Background: One of the primary issues addressed in the BOEMRE environmental documents is the probability of oil-spill contact to environmentally sensitive areas or areas of commercial or recreational value. For many years, BOEMRE has used an oil spill risk analysis (OSRA) model to estimate the likelihood that hypothetical spills from prospective oil and gas development will contact areas of known vulnerability to spilled oil. Over those years, the OSRA model has undergone improvements to enhance the probability estimates, including adopting recommendations from a National Research Council review of the model done in 1990. The OSRA model has also been updated in terms of computational efficiency and accuracy. These enhancements are in keeping with the BOEMRE policy of using the best available information for safe operations and environmental protection. There are increasing needs for the oil spill risk assessments in Gulf of Mexico Region, the Alaska Region, the Pacific Region, and the Atlantic Region. These new challenges demands a more efficient, accurate, and productive OSRA model.

This study seeks to upgrade the OSRA model to make better estimates of the probabilities of oil-spill contact to areas of sensitivity, to further enhance the computational efficiency and accuracy of the model, and to upgrade the working environmental of the OSRA model using the latest GIS technology.

Objective: The objective of this study is to make the OSRA model more accurate, efficient, and productive to meet the increasing needs in oil spill risk assessments in the OCS areas.

Methods: This study will explore the possibility of including better processes and mechanisms into the model. Based on the enhancements already made in the recent years, the OSRA model will be further improved for efficiency and accuracy. To improve the input and output procedures of the model, the latest GIS technology will be employed to reduce the time needed in an OSRA application.

Revised Date: February 22, 2010

ENVIRONMENTAL STUDIES PROGRAM: Studies Development Plan FY 2011-2013

REGION: Gulf of Mexico

PLANNING AREA: Northern shelf and slope areas

Title: Characterization of bottom sediment transport during extreme events in the northern Gulf of Mexico using a state-of-the-art coupled model.

BOEMRE Information Need(s) to be Addressed: Characterization of bottom sediment transport under extreme circumstances (e.g., hurricanes, intense eddies) will expand BOEMRE's knowledge of pollutant and nutrient dispersion in areas. By characterizing bottom sediment transport this study will specifically expand and/or have important implications for BOEMRE's knowledge in: (a) Oil-Spill-Risk Analysis (OSRA), (b) Water quality studies (c) Benthic communities (e.g., deep sea corals). This study is aligned with the recommendations set forth in the August 16, 2010 report prepared by the White House's Council for Environmental Quality (CEQ) for BOEMRE.

Cost range: (in thousands) \$400-\$600

Period of Performance: FY 2011-2013

Description:

Background: The displacement of sediments following extreme events has very important implications for the dispersion of pollutants and organic substances that commonly deposit on and/or are trapped in the accumulated sediments. In the northern shelf, shelf-break and slope areas of the Gulf of Mexico, there are several well known sources of pollutants: rivers, *produced waters* from oil rigs, and oil spills (e.g., from oil rigs, oil tankers and ruptured pipelines) among others. It is during some of these events that environmental disasters are more likely to occur. This modeling study aims to provide a comprehensive, four-dimensional view including characterization of sediment transport for a variety of extreme atmospheric and oceanic conditions, while setting the path for future observational studies. Turbidity currents are similar to snow avalanches in that they respond to both accumulation over time and a triggering event, while they are driven by gravity down a slope. The main focus area for this study is the very near bottom level between the coastline and the continental rise areas. While historical bottom sediment studies have addressed isolated aspects/regions/instances, there are no studies that have produced a comprehensive dataset using state-of-the-art coupled models. There is also a particular vacuum of information with respect to turbidity currents in the Gulf of Mexico, especially during extreme events of annual occurrence (i.e., hurricanes).

Objectives:

1. Provide BOEMRE with an overall (in space and time) characterization of sediment transport and deposition over the entire study area during extreme atmospheric and oceanic events and including turbidity currents.
2. Establish, qualitatively and quantitatively, how bottom sediment profiles are affected by extreme events in river discharge.
3. Determine the impact of hurricanes of different intensity and paths on the generation sediment transport in the study area in general, and of turbidity currents in particular.

Methods: Due to the complexities and nature of the problem in question, a state-of-the-art very high resolution model, at least including forcing by winds, tides and rivers, in addition to a very realistic bathymetry, shall be used to reach the above mentioned objectives. Coupled to this circulation model, sediment and wave models must be used in order to generate realistic sediment transport and accumulation values at different locations over the study area. Due to the nature of the problem under consideration, a terrain-following vertical coordinate system is highly preferred. Data assimilation capabilities and innovative modeling ideas are welcomed components into the study. Historical (observed) sediment data must be used for both comparison and initialization. A final report shall document the key findings, while a comprehensive database shall also be built for future reference and use.

Revised Date: August 24, 2010

ENVIRONMENTAL STUDIES PROGRAM: Studies Development Plan FY 2011-2013

Region: National

Planning Area(s): All

Title: Workshop on Alternative Technologies to Air Guns (Deep-Penetrating) Used in Offshore Seismic Surveys

BOEMRE Information Need(s) to be Addressed: Environmental statutes, such as the Endangered Species Act (ESA), Marine Mammal Protection Act (MMPA) and Magnuson Stevens Fishery Conservation and Management Act (MSFCMA), as well as the Outer Continental Shelf Lands Act (OCSLA) all mandate that BOEMRE require seismic surveys be conducted in an environmentally sound manner (i.e., maximize protection). Although air guns are the main sound source used for deep-penetration seismic surveys, BOEMRE is aware of the potential adverse impacts from the use of air guns. It is therefore imperative that BOEMRE determine whether other sound source technologies for deep-penetration surveys with fewer environmental impacts are available while still allowing industry to obtain needed data. This workshop would provide a thorough examination of alternative technologies. Information garnered would be relevant for all BOEMRE program areas and would be subsumed into BOEMRE compliance efforts related to NEPA, ESA, MMPA and MSFCMA.

Cost Range: (in thousands) \$250 - \$300

Period of Performance: FY 2011

Description:

Background: The data collected during seismic surveys are used by industry and BOEMRE to locate hydrocarbon resources, site renewable and other offshore energy infrastructure and assess potential sand and gravel resources. Where these surveys require deeper penetration into the sea floor, a high intensity sound source, such as air guns is needed. Although air guns are an effective means for exploring and siting, the sound source levels and propagation characteristics of air guns technologies can result in potentially harmful impacts to marine mammals and other marine life (e.g., fish and sea turtles).

BOEMRE has developed mitigation and monitoring strategies to reduce or eliminate potential harmful effects from air guns. Further, the BOEMRE Technology and Assessment Research Program currently is investigating ways to limit the horizontal propagation of air gun noise, thus focusing the air gun sound pathway and reducing the amount of noise traveling outside of this pathway. (Another effort proposed in this plan will collect information on high frequency, more shallow-penetration sound sources currently in use to gather geophysical information, such as boomers, sparkers, chirpers, side-scan sonar, and single, swath, and multi-beam bathymetry).

It is imperative for BOEMRE to consider ways to reduce effects through the use of alternative sound sources to air guns for deep-penetration surveys. These alternatives may either be existing or currently in development (e.g. marine vibrators, passive seismics, electromagnetic fields) and may be able to achieve the data collection needs of BOEMRE and industry but with a smaller acoustic (and resulting biological) impact on the environment.

This workshop would provide a thorough examination of potential alternative sound sources to air guns for deep-penetration surveys, including a better understanding of the requirements for their operation, limitations to their use, potential impacts on the environment, any further steps and time needed for their development, and the quality and value of the data collected from these alternative sound sources compared to that from air guns. The workshop will draw from a wide range of expertise, including developers of new alternative technologies, acoustics operators, biologists, interested industry personnel, representatives from federal and state regulatory agencies, and non-governmental organizations. It will provide BOEMRE and other agencies with information needed to determine the usefulness and appropriateness of these alternative technologies for a variety of mitigation and monitoring situations.

Objectives: The objectives of the proposed workshop are to:

1. Review and examine recent developments in alternative technologies for deep-penetration surveys, whether proposed or in development.
2. Identify the requirements for operation and any limitations to use.
3. Evaluate data quality and cost-effectiveness of these alternative technologies as compared to that from air guns for deep-penetration surveys.
4. Examine any potential environmental impacts from these alternative technologies.
5. Identify which alternative sources, if any, are most promising for full or partial replacement of air gun use for deep-penetration surveys and specify the conditions which might warrant their use (e.g., specific limitations to water depth, use in Marine Protected Areas).
6. Provide BOEMRE and industry with guidance on the applicability, feasibility and usefulness of these alternative technologies.
7. Identify next steps, if appropriate, for the further development of these alternative sources.

Methods: In meeting these objectives, the following methods will be used:

1. Formation of Scientific Advisory Panel, comprised of BOEMRE staff and at least four independent experts, to identify available information, key issues and speakers and 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 panel for workshop and agenda development; identify key participants, organize equipment rental; and prepare the workshop proceedings.

ENVIRONMENTAL STUDIES PROGRAM: Studies Development Plan FY 2011-2013

Region: Headquarters

Planning Area: Nationwide

Title: Development of Software and Hardware to Acoustically Detect, Classify, and Locate Marine Mammals

BOEMRE Information Needs to be Addressed: This study will inform BOEMRE's rulemaking for the purpose of offshore operator compliance with the mitigation requirements under the Marine Mammal Protection Act and the Endangered Species Act.

Cost Range: (in thousands) \$200 - \$250 **Period of Performance:** FY 2011-2013

Description:

Background: Governmental agencies and industries that focus on marine environments need to optimally detect, locate and identify marine mammals during a variety of activities including marine geophysical surveys, naval exercises, and population assessment surveys. Of particular interest is achieving a capability for the detection, classification and localization (DCL) of marine mammals under circumstances where standard visual observation from ship-based marine mammal observers (MMOs) is ineffective, such as during night-time operations, periods of bad weather, with animals below the sea surface and/or beyond visual range. The 2009 report of the Joint Subcommittee on Ocean Science & Technology (JSOST) titled, "Addressing the effects of human-generated sound on marine life: An integrated research plan for U. S. Federal Agencies" identified the development of new methods to detect, identify, locate and track marine mammals in order to increase the effectiveness of detection and mitigation as an item of highest research priority.

Mitigation requirements under Marine Mammal Protection Act (MMPA) and Endangered Species Act (ESA) provisions require the development of real-time (or near real-time) monitoring capability of marine mammals. Multiple agencies and groups have interest in the improvement of passive and active acoustic monitoring capability as a complement to standard visual observations from ship-based platforms. Ideally, a ship operator would have a single tool to detect, classify and locate marine mammals within a certain operational area such as an exclusion zone. Unfortunately, operational areas within the marine environment are often complex and unique, especially when operations are not conducted in a standard or fixed location. For example, some marine geophysical surveys, which use towed seismic equipment to collect data for research on Earth systems, are driven by scientific questions and therefore are conducted in various locations around the world from deep-ocean to more shallow coastal environments. Some methods may be more appropriate than others under certain environmental conditions, such as deep ocean water versus shallow coastal environments. Therefore, while a single method for DCL would be ideal, due to the complexities of the marine environment and unique operations, different methods, or combinations of methods forming a DCL "system" for different environments may be

necessary. Ultimately, any method developed needs to demonstrate, with a high level of confidence, the detection, localization, and range to marine mammals within a specified area.

Objective: The objective is to broadly solicit research proposals on the active and/or passive acoustic detection, classification and localization of marine mammals for the purpose of funding meritorious proposed research that will advance our current capabilities in these areas.

Methods: Through the National Oceanographic Partnership Program process, BOEMRE will join the National Science Foundation and the Office of Naval Research to solicit and review research proposals on the topic of interest. Proposals judged to be of scientific value by a panel of outside-the-government experts will be reviewed subsequently for relevancy to BOEMRE's informational needs. BOEMRE will co-fund those projects that have both scientific merit and serve BOEMRE's informational needs.

The solicitations will be through a broad agency announcement and will explicitly request proposals in the following areas.

Detection, Classification, and Localization Algorithms - the development and testing of fast, accurate and efficient algorithms for processing raw signals, and storing and transmitting processed information in such a manner (e.g. via sonograms) that overcomes limitations of current state-of-the-art technologies (e.g. memory, storage capacity, bandwidth for data transmission).

Active Acoustic Monitoring - using broadcast sound to actively detect the presence of marine mammals and other animals whether vocalizing or not; assessing the frequency-dependent ratio between the intensity of sound that strikes the target and that return to the sonar system; examining the development of multiple frequency bands to differentiate species

Database Services & Computational Capacity - the development of database services for the research community and collaborators; the development of computational capacity for timely data processing and display; constructing metadata formats useful for acoustic databases; develop new database structures enabling users to query against known human or machine-generated annotations (detections, classifications) of existing data; constructing new annotation sets including detailed information on how they were created, export data products to external visualization services, and interface with existing external analytical tool sets; develop community access methods, which may include a user interface, to high performance computing centers (HPC), such as the Open Science Grid (OSG). HPC interface may be incorporated into existing visualization and/or analytical tool sets. Demonstration of HPC capability should address need for sustainability of access by acoustic community.

Novel Use of Existing Technologies - develop uses of existing (or minor adjustments/enhancements to existing) hardware and software to achieve the goal of real-time detection, classification, and localization of marine mammals in habitats that may not otherwise have been surveyed or monitored with conventional approaches

Revised Date: August 25, 2010

ENVIRONMENTAL STUDIES PROGRAM: Studies Development Plan FY 2011-2013

Region: Headquarters

Planning Area: All

Title: Synthesis, Legislative Review, and Case Law History applicable to Cultural Heritage in the Marine Environment

BOEMRE Information Needs to be Addressed: The BOEMRE is required under multiple statutes (OCSLA, NEPA, and NHPA) to take into consideration the impacts of OCS activities on cultural and archaeological resources. To achieve compliance with these laws, BOEMRE has developed regulations and guidance documents directing lease and permit holders to avoid impacting any archaeological resources found during the survey or development of their leases. With passage of the Energy Policy Act of 2005, BOEMRE has assumed jurisdiction for some types of renewable energy development on the OCS, and the expansion of cultural resource review responsibilities beyond those that might reside on or below the seafloor. The majority of the legal guidance regarding BOEMRE responsibilities for the survey and protection of archaeological resources was developed in the early 1980s with periodic revisions in the 1990s. All of the guidance is dated and does not take into account revisions to the NHPA law and regulations, nor BOEMRE's expanded responsibilities for renewable energy development on the OCS. This study will synthesis all of the information pertaining to cultural heritage legislation and case law relevant to BOEMRE's jurisdiction on the OCS to assist BOEMRE archaeologists and DOI solicitors with developing legally sound regulations and guidance.

Cost Range: (in thousands) \$100 - \$150

Period of Performance: FY 2011-2012

Description:

Background: The interpretation of cultural resource legislation related to maritime heritage on the outer continental shelf is a challenging topic, relying on the understanding of U.S. law, customary maritime law, international conventions, and often confusing and overlapping maritime jurisdictions. Statutory interpretation is often complicated due to confusion surrounding agency jurisdiction over different resources on and under the seafloor. Many court cases revolving around the ownership, protection, and management of historic shipwrecks have relied on legal precedent and the analysis of congressional intent to come to a final decision. Without access to the extensive legal resources that law firms and the courts rely on to make these decisions, it is difficult for BOEMRE subject matter experts and management to have reliability in the limited interpretation of the existing statutes and regulations with which they must comply.

Objectives: This study will synthesis all of the information pertaining to cultural heritage legislation and case law relevant to BOEMRE's jurisdiction on the OCS to assist BOEMRE

archaeologists and DOI solicitors with developing legally sound regulations and guidance. Products the study will generate include: a digital collection of all of the sources used in the study; annotated bibliography focusing on statute's applicability toward cultural resources on the OCS; bibliographic database of the sources hyperlinked to the digital collection; and, a report describing the methods and results of the study.

Methods: The study will entail developing legislative histories of all of the major statutes related to cultural resource and environmental protection of maritime heritage in the marine environment. A sample of some of the laws to be considered include: Outer Continental Shelf Lands Act; National Historic Preservation Act of 1966; National Environmental Protection Act; Archaeological Resource Protection Act of 1979; Antiquities Act of 1906; Abandoned Shipwreck Act of 1987; National Marine Sanctuaries Act; Sunken Military Craft Act; Archeological and Historic Preservation Act of 1974; Native American Graves Protection and Repatriation Act (NAGPRA); American Indian Religious Freedom Act (AIRFA); Admiralty Law; and United Nations Convention on the Law of the Sea. All of the source documents (statutes, statutory history, regulations, congressional material, case law, executive orders; international conventions, etc.) will be digitized and provided to BOEMRE in a searchable and indexed portable document format. An annotated bibliography will be developed referencing the pdf and focusing on each statute's applicability toward cultural resources on the OCS. All sources used in the study will be entered into reference management software (e.g., Endnote), tagged with key words, and hyperlinked to a digital copy of the document.

Revised Date: September 2, 2010

ENVIRONMENTAL STUDIES PROGRAM: Studies Development Plan FY 2011-2013

Region: Headquarters

Planning Area: All

Title: Observation and Validation of Exclusion Zones Designed to Protect Sensitive Archaeological Resources and Benthic Habitats Following Sand Extraction Activities on the OCS

BOEMRE Information Needs to be Addressed: This study will document the effectiveness of archaeological and habitat exclusion zones established to avoid 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) \$350-\$500

Period of Performance: FY 2011-2016

Description:

Background: The National Historic Preservation Act and the National Environmental Policy Act require that the BOEMRE considers the impacts of permitted OCS development activities, including sand and gravel extraction, on cultural resources and the environment. Resources of particular concern include shipwrecks, prehistoric sites, and sensitive biological habitats (e.g., hard bottom and reef communities). The BOEMRE has previously funded a study to analyze the impacts of dredging on cultural resources and provide recommendations for the creation of exclusion zones to avoid impacting resources during sand extraction (Michel et al., 2004). The BOEMRE has not specifically investigated the effectiveness of exclusion zones for protecting sensitive benthic habitats. Long-term sediment dynamics have not been taken into consideration in the BOEMRE-funded research done to date. Recent research, funded by United Kingdom's English Heritage through the Aggregate Levy Sustainability Fund (Dix et al., 2007), suggests that exclusion zones need to account for the direct impact of the activity, as well as the influence of longer term physical processes that may interact with and negatively impact adjacent sensitive resources.

Objectives: The study seeks to better understand if, when, and how changed physical processes resulting from sand extraction in 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: The study will identify an appropriate borrow area(s) where there are known sensitive archaeological resources and/or benthic habitats that could be used for a before-after controlled impact analysis. Field methods include bottom boundary layer observations, repeat high-resolution bathymetric and side-scan sonar (or other appropriate) surveys, and underwater camera and video observations.

Revised Date: September 2, 2010

ENVIRONMENTAL STUDIES PROGRAM: Studies Development Plan FY 2011-2013

Region: National

Planning Area(s): Atlantic OCS, Gulf of Mexico, and Pacific OCS

Title: A Synthesis of the Results and Currency of Research Projects Completed for the Environmental Protection, Leasing, and Extraction of Offshore Sand

BOEMRE Information Need(s) to be Addressed: BOEMRE conducts studies at potential sand and gravel borrow sites to 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 then used in making current and future management decisions.

Motivation for the proposed study is the lack of integration of domestic literature on dredging for beach nourishment/coastal restoration with international literature on the impacts of marine aggregate dredging, beach nourishment, etc. The information collected by both domestic and international studies is used to prepare environmental analyses for EAs or EISs which are required before a lease can be issued. The studies identify impacts or potential impacts which may preclude issuing the lease or they recommend mitigation techniques that become part of the terms and conditions of the lease. Consolidation and synthesis of this large volume of work will enable more efficient use of the previously funded studies and identify areas of data omission that need to be addressed.

Cost Range: (in thousands) \$50-\$100

Period of Performance: FY 2011-2012

Description:

Background: Since 1993, 51 environmental studies have been completed for the Marine Minerals Program. The studies fall into three general areas 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) environmental impact studies, which evaluate the effects of particular types of dredging techniques on various aspects of the physical, chemical, and biological environments and develop appropriate mitigation techniques to alleviate or prevent adverse impacts. The studies have also included site-specific research at high-potential or existing sand borrow areas offshore of ten states.

Several other initiatives have been organized domestically through the U.S. Army Corps of Engineers (ACOE), as well as internationally through BMAPA, Crown Estate, Aggregate Levy Sustainability funded research in the UK, DHI in Denmark, Delft, Rijkswaterstaat in Netherlands, and others. Research initiated by the ACOE and the USGS has generally been completed within state waters and has more recently begun to extend into the OCS as deeper

sources become more accessible. European countries including the UK, Denmark, Netherlands, and Germany all have a pro-active approach to stemming beach erosion. The actively nourishing countries, especially the UK, have well established monitoring protocols which have provided extensive data on erosion rates, both before and after a nourishment project, but tend to be less progressive with environmental and biological monitoring.

Although all of the BOEMRE studies are available in the BOEMRE database and are posted on the BOEMRE website, the results of the studies have never been summarized and analyzed systematically for data gaps, reviewed for currency, and compared to other domestic and international literature. This would be a companion to the 2007 study, “Critical technical review and evaluation of site-specific studies’ techniques for the BOEMRE Marine Minerals Program” (MMS 2007-047), which focused on the methodology of the studies of specific borrow areas off states that have requested OCS sand.

Objectives: The objectives of the study are to review and summarize all environmental studies done for the Marine Minerals Program and to determine which, if any, no longer reflect state-of-the-art of the subject. Once the review is completed it should be determined if recent non-BOEMRE, both domestic and international, research has updated these studies, conducted studies outside the current study purview of the BOEMRE and identify significant knowledge gaps that need to be addressed. Examples of subject areas in need of study include attenuation of noise from dredges and the entrainment of fish by both suction and cutterhead dredges. Additionally, a significant volume of research on sand dredging impacts has been done overseas in places such as the North Sea, Persian Gulf, and the far Pacific where large dredging projects have taken place.

Methods: Methods for this study are standard library research and summary preparation. An annotated bibliography and copies of research publications found should be provided as final deliverables.

Revised Date: March 24, 2010

ENVIRONMENTAL STUDIES PROGRAM: Studies Development Plan FY 2011-2013

Region: Headquarters

Planning Area: Nationwide

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

BOEMRE Information Needs to be Addressed: This study will enhance all of BOEMRE's environmental impact assessments and consultations involving living marine organisms as well as marine spatial planning efforts by helping to significantly improve the accessibility to a great many marine biological observations now widely distributed among many organizations and existing in a variety of different formats.

Cost Range: (in thousands) \$140 - \$160

Period of Performance: FY 2011-2013

Description:

Background: A great many scientific projects and monitoring efforts involve observing marine mammals and other marine organisms in all aspects of their lives. Many research institutions and governmental agencies have accumulated this information, but, to date, there is no one repository for these observations from which interested groups could obtain the information for their needs. A report of the Joint Subcommittee on Ocean Science & Technology, an interagency task force on anthropogenic sound and the marine environment states "...agencies often have common science and technology needs on this issue that could be most quickly and economically accessed through a coordinated program of effort." . Further, the report recommends that government agencies "support the development, standardization, and integration of online data archives of marine mammal distribution, abundance, and movement for use in assessing potential risk to marine mammals from sound-producing activities" (Southall, et al., 2009).

Given the recognized usefulness of an archive of marine biological observations analogous to that of the National Oceanographic Data Center's (NODC's) physical oceanographic data archive, the Interagency Coordinating Group on the Impact of Noise on Marine Mammals (ICG) has conducted many discussions, investigations, and one workshop sponsored by the National Oceanic and Atmospheric Administration (NOAA) for the purpose of creating such an archive. After more than two years of cooperative effort, the Office of the Assistant Secretary of the Navy (Installations and Environment), the Marine Mammal Commission, the Office of Naval Research, and BOEMRE have decided to build the archive as part of the U. S. A. node of OBIS (Ocean Biogeographic Information System), (OBIS-USA), a component of the long-established U. S. Geological Survey's (USGS's) National Biological Information Infrastructure (NBII). OBIS-USA was born out of the successful OBIS demonstration project at Duke University. (OBIS is now an international effort, and the USGS hosts the U. S. A. node of the international effort.) This archive is in a mature state with well developed, dedicated hardware, user software, and full-time, knowledgeable

personnel maintaining and further developing the system. The management of OBIS-USA is enthusiastic about taking on the role of the federal government's marine biological data archive and expanding the effort to include all marine biological data. The NBII already has a wealth of terrestrial biological data. OBIS-USA was conceived to be the marine biological companion to the terrestrial data archive.

NOAA's National Marine Fisheries Service and the U. S. Navy have committed to contributing their extensive marine biological data to the archive. The NODC has a much more modest collection of marine biological data but is willing to add that to the data archive as well, and data archived in OBIS (international) from foreign sources will be made available to OBIS-USA. There are plans in the future to solicit data contributions from ocean industries and university investigators. The cooperating federal agencies agreed to require all future research efforts funded by them and collecting marine biological data to contribute the data to the new archive. BOEMRE will need to devote some personnel time to gather marine biological data from the many research efforts BOEMRE has funded in past years in order to add its considerable data sets to the archive.

The USGS is currently funding OBIS-USA at a modest level (approximately \$250,000 per year), which has enabled the development of the hardware, software, and personnel infrastructure it now has. In FY 2010, BOEMRE added \$40,000 (from NT-10-12) to begin the preparation for a large influx of data from the above-mentioned federal agencies. With this study, BOEMRE will partially fund the expected major data-gathering effort to begin, hopefully, in late 2010 or early 2011. Other federal agencies will co-fund the effort as well, hopefully at a level comparable to or greater than BOEMRE's funding. In addition, the OBIS-USA management will be asking the USGS for an increased rate of funding to sustain the effort.

Finally, the establishment of a common data format and a quality control method for marine biological observations will need to be worked out. The NODC has independently begun an effort to produce these and has offered to work with the OBIS-USA effort to generate a research-community-wide set of data and meta-data formats.

Objectives: The objectives of this study are as follows.

- partially fund the continued development and maintenance of a marine biological data archive within OBIS-USA at the USGS
- develop a common data and meta-data format for observations of marine mammals
- add BOEMRE's marine biological data to the archive .

Methods: BOEMRE will co-fund OBIS-USA with other federal agencies, assist in the formation of a common data format, and gather, organize, and contribute its marine biological data to OBIS-USA.

Revised Date: August 12, 2010

ENVIRONMENTAL STUDIES PROGRAM: Studies Development Plan FY 2011-2013

Region: Atlantic Renewable Energy
Planning Area: Mid-Atlantic
Title: Modeling and Testing of Commercial Fish Hang Data as a Proxy for Historic Shipwreck Sites

BOEMRE Information Needs to be Addressed: The BOEMRE is required under multiple statutes (OCSLA, NEPA, and NHPA) to take into consideration the impacts of OCS activities on cultural and archaeological resources. To achieve compliance with these laws, BOEMRE has developed regulations and guidance documents directing lease and permit holders to avoid impacting any archaeological resources found during the survey or development of their leases. With passage of the Energy Policy Act of 2005, BOEMRE has assumed jurisdiction for some types of renewable energy development on the OCS. States within the mid-Atlantic region are increasingly becoming focused on the development of off-shore wind energy to supplement or fulfill its alternative energy objectives. Fish hang data from ethnographic surveys of the commercial fisheries sector can provide a method for developing a more reliable data set of known historic shipwreck sites in the Mid-Atlantic region. The development of a proven methodology for collecting and modeling this data would assist BOEMRE in evaluating proposed off-shore wind energy projects and developing the appropriate survey and mitigation measures to avoid harming significant cultural resources during OCS development.

Cost Range: (in thousands) \$200 - \$250 **Period of Performance:** FY 2011-2012

Description:

Background: The low spatial accuracy of reported shipwreck sites within existing historical sources and/or existing databases (e.g., NOAA's Automated Wrecks and Obstructions Information System – AWOIS) makes reliance on this data for environmental decision-making problematic. Because of the way data was reported (e.g., lost between points A and B, or off the coast of C) or collected (e.g., Loran, low-accuracy GPS, line-of-site), these data sets only provide a general indication of the numbers of shipwreck losses in a particular area. Additionally, information within these data sets is often heavily weighted toward wrecks occurring within the 19th and 20th centuries, when wrecking events were more likely to be recorded. Unlike the Gulf of Mexico Region, which has extensive oil and gas development and a Fishermen's Contingency Fund, the mid-Atlantic region does not have a formal mechanism for collecting fish hang data. Moreover, because of the lack of current development activity in the Atlantic, it is postulated that fish hangs would more likely be associated with historic shipwrecks having a degree of relief above the seafloor. Current research shows that 70% of a small sample of known shipwrecks have between 1 to 5 nets and/or dredges on-site (Steinmetz, 2010).

Objectives: This study will develop a methodology for collecting fish hang data from commercial fishermen, create a model for converting the data into reliable spatial format within GIS, test the model with a randomized sample of sites, and reevaluate the model based on testing. Products developed through the study will include: a geodatabase of fish hang sites within the mid-Atlantic region, including spatial reliability indicators; and, a final report that describes the data collection and modeling methodology along with the results from the model testing. The study will complement the recently completed Atlantic Inventory study (TRC, 2010) and will provide a model and template for gathering similar data in other BOEMRE regions.

Methods: The study will rely heavily on the ethnographic surveys of the commercial fishing community within the mid-Atlantic region to compile the initial fish hang data set. The data will be spatially modeled, taking into account reliability factors to weight the data accordingly. Twenty high-reliability sites will be selected through random sampling techniques to test the model. The model will be tested during an electronic remote-sensing survey of the selected sites utilizing high-resolution side-scan sonar or multi-beam and a magnetometer. Qualified SCUBA divers will visually verify sites located in less than 150 feet of water and not clearly identifiable as shipwrecks. Based on the field results, the fish hang model will be reevaluated for its utility as a proxy for historic shipwrecks.

Revised Date: September 2, 2010

ENVIRONMENTAL STUDIES PROGRAM: Studies Development Plan FY 2011-2013

Region: Headquarters

Planning Area: Nationwide

Title: Co-funding the Third International Conference on Acoustic Communication by Animals

BOEMRE Information Needs to be Addressed: This study will enhance BOEMRE's environmental impact assessments and consultations involving, in part, the possible impacts of anthropogenic sound on marine mammals.

Cost Range: (in thousands) \$10 - \$15

Period of Performance: FY 2011-2012

Description:

Background: As with the previous two conferences on this topic, this conference will bring together senior scholars, mid-career researchers and teachers, young investigators, and students to share ideas, data, and methods in the growing field of animal acoustic communication. The emphasis of this conference is the integration of information across animal taxa within the context of how it develops, how it evolved, and its neuroethological basis. Additionally, the conference will examine the detection of acoustic signals, particularly in noisy backgrounds. The multi-level approach that will be taken by this conference will advance the field of animal bioacoustics and, consequently, practical applications thereof such as the responses of marine mammals to anthropogenic sound.

Until recently, the emphasis in the field has been either for the description of sounds, or the analysis of how sound is used for communication, how sounds are produced, and how sound is detected. More recently, investigators have started to take a broader approach that examines acoustic communication in the context of evolution, ontogeny and learning, ecology, social interaction, and overall behavior. Many questions deal with the complex issues of adaptation and how acoustic communication has evolved within very complex acoustic environments.

There is also greater interest in the genetic basis of communication and in the role of acoustic communication within the broader, integrated context of everything that an animal does to communicate. This conference advances the field of acoustic communication by examining classic acoustics issues, topics and areas in the broader context of major biological issues.

This conference is needed, because there are no other meetings or conferences which focus just on animal acoustic communication. While the topic is covered at other conferences, such as those by the Acoustical Society of America, the Animal Behavior Society, and the Society for Marine Mammalogy, the topic of animal acoustic communication is distributed among many widely diverse sessions. The result is that the issues, methods, and results unique to animal acoustic communication become scattered, rather than consolidated. A focused conference helps focus the thinking and work of both established researchers and students.

Objectives: The primary objective is to bring biologists, engineers, and scientists from other disciplines working on acoustic communications in animals together to discuss animal acoustic communication and methods for studying it.

Secondarily, the objectives are:

- educate attendees on acoustic communication by animals;
- provide more networking among experts in acoustic communication of different species and taxonomic groups;
- introduce new techniques and equipment in this rapidly emerging field;
- make attendees aware of research, software products, and equipment in the field so they do not have to rediscover or reinvent solutions;
- explore improving communications among scientists and engineers from various organizations and countries which work on various aspects of acoustic communication of animals;
- improve the understanding of basic acoustics, especially as it relates to animal communication;
- provide more networking between attendees with background in the physical and biological aspects of acoustical communication.

Methods: BOEMRE will co-fund the conference with the Acoustical Society of America, the institution organizing the conference and with whom BOEMRE will contract, and the Ornithology Laboratory of Cornell University.

Revised Date: August 24, 2010

SECTION 3.0 TOPICAL AREAS FOR FISCAL YEAR 2013

This section describes program activities and emerging issues and concerns that are likely to lead to information needs and research in FY 2012 and beyond.

3.1 Physical Oceanography

Future physical oceanographic studies are expected to be directed towards improving the oil spill risk analysis process by incorporating and assimilating observational data into the risk assessment methods and by improving ocean circulation current modeling. The ESP will continue to support programs that provide a better understanding of transporting spilled oil and other materials by ocean currents via simulation modeling and surface drifter observations. The ESP will also continue to develop integrated programs among physical, biological and chemical oceanography disciplines. Areas of study will include the western, central, and eastern Gulf of Mexico; the Santa Maria Basin/Santa Barbara Channel, California; near-shore Beaufort and Chukchi Seas, Cook Inlet, and now the North Aleutian Basin Alaska; and possibly areas off of the east coast, specifically the north and mid-Atlantic Areas.

3.2 OCS Renewable Energy

The geographic range represented for the new activities for this program could include all coastal areas. Many energy projects are expected on the east coast, where the BOEMRE ESP has not operated for many years. Some existing information may be out of date, and entirely new scientific techniques or discoveries demand new data collection and analysis. Studies have been undertaken to address immediate information needs for a proposed wind energy project and future efforts will be developed based on syntheses of information and assessments of proposed technologies. A workshop was held in June 2007 to identify information gaps and studies needs (Michel & Burkhard, 2007). As a result of the workshop, a separate studies development plan for presenting these future studies was prepared and is available on the Renewable Energy Program website:
<http://www.boemre.gov/offshore/AlternativeEnergy/Studies.htm>.

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