

**Alaska Outer Continental
Shelf Region**

Alaska Annual Studies Plan Final FY 2011

**U.S. Department of the Interior
Bureau of Ocean Energy Management,
Regulation and Enforcement
Alaska Outer Continental Shelf Region
Anchorage, Alaska
October 2010**

Prepared by
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October 2010

This document may be accessed electronically at <http://alaska.boemre.gov/ess/index.htm>. To request a hard copy, please contact Dr. Heather Crowley at (907) 334-5281 or by email at Heather.Crowley@boemre.gov.

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

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United States Department of the Interior

BUREAU OF OCEAN ENERGY MANAGEMENT,
REGULATION AND ENFORCEMENT
Alaska Outer Continental Shelf Region
3801 Centerpoint Drive, Suite 500
Anchorage, Alaska 99503-5823

October 4, 2010

Dear Stakeholder:

Thank you for your interest in the Environmental Studies Program of the Bureau of Ocean Energy Management, Regulation and Enforcement (BOEMRE). FY 2010 has been a year of significant transition for us; please see the "Preamble" on page ix for a brief account of recent events that affect our studies planning process.

The agency assesses its information needs and develops new study profiles on an annual basis. We follow a well-established process that involves a role for both stakeholder input and scientific peer review. We are interested to know your perspectives and to receive any suggestions or comments you may have for the BOEMRE *Alaska Annual Studies Plan, Fiscal Year (FY) 2012*, which we are now beginning to formulate. For your convenient reference, we are providing the *Alaska Annual Studies Plan (ASP) Final FY 2011*, developed from submissions we received over the past year.

To assist us in processing any suggestions for new studies, we ask that you follow the formatting guidance for a study profile as shown on the next page. Please keep in mind that studies proposed for our consideration must address specific BOEMRE mission and decision needs (see Section 1.3). Comments or suggestions need to be received by us no later than November 15, 2010, to assure consideration for the 2012 fiscal year. Following revisions to the plan, we will issue a Final FY 2012 Alaska ASP in the autumn of 2011.

We sincerely appreciate your participation in this process and we look forward to receiving your suggestions. If you have any questions about our process, you are urged to contact Dr. Heather Crowley, ASP Coordinator, at (907) 334-5281.

Sincerely,

Dee Williams, Ph.D.
Chief, Environmental Studies Section

**Bureau of Ocean Energy Management, Regulation and Enforcement
Alaska Environmental Studies Program**

Proposed Study for FY 2012

Formatting Guidance: We recommend study profiles be less than 2 pages. Please do not try to make this a detailed scope of work. If the study is selected for further consideration, BOEMRE will prepare a more detailed scope of work. Please provide the following categories of information.

Region: Alaska [Standard for all.]

Planning Area(s): [e.g., Beaufort Sea, Chukchi Sea, North Aleutian Basin as applicable. See Fig.1 of the Plan.]

Title: [Fill in concise title.]

BOEMRE Information Need(s) to be Addressed: *Provide brief and conclusive reason(s) why BOEMRE needs the information. For example, identify how the study relates to analysis under the National Environmental Policy Act and/or specific BOEMRE decision(s), such as formulation of a mitigation measure. Please be as specific as possible.*

Period of Performance: FY 2012-20XX

Description:

Background: *Please provide 1 to 2 paragraphs on relevant issues. Explain what information is required and provide pertinent background. Include details about whether this study ties in with other efforts, and if so, how. Include a description of the current status of information. That is, what is the level of adequacy of existing information, does any exist, does it need to be more geographically specific?*

Objectives: *Clearly and succinctly state the objective(s) of the study. Explain what hypothesis will be tested or what questions will be answered by this study. We encourage the use of lists (1, 2, 3, etc.) for multiple, related objectives.*

Methods: *Provide brief detail on what information, techniques or methods are available that could be used. Explain how the objectives of the study will be accomplished.*

Date information is required: *Provide dates when products would be most useful, such as "Final report is needed by December 2014." If the product of the study is something additional to the scientific report (e.g. database, model, bibliography), explain in this section.*

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ACRONYMS

ADCP	Acoustic Doppler Current Profiler
ADEC	Alaska Department of Environmental Conservation
ADF&G	Alaska Department of Fish and Game
AEWC	Alaska Eskimo Whaling Commission
AKMAP	Alaska Monitoring and Assessment Program
ANIMIDA	Arctic Nearshore Impact Monitoring in Development Area
AOOS	Alaska Ocean Observing System
BEST	Bering Sea Ecosystem Study
BLM	Bureau of Land Management
BOEMRE	Bureau of Ocean Energy Management, Regulation and Enforcement
BPXA	British Petroleum Exploration Alaska
BRD	Biological Resources Division (USGS)
BSIERP	Bering Sea Integrated Ecosystem Research Program
BSMP	Beaufort Sea Monitoring Program
BWASP	Bowhead Whale Aerial Survey Project
CAB	Chemistry and Benthos
cANIMIDA	Continuation of Arctic Nearshore Impact Monitoring in Development Area
CESU	Cooperative Ecosystem Studies Unit
CMI	Coastal Marine Institute
COMIDA	Chukchi Offshore Monitoring in Drilling Area
DFO	Canadian Department of Fisheries and Oceans
DPP	Development and Production Plan
EA	Environmental Assessment
EFH	Essential Fish Habitat
EIS	Environmental Impact Statement
EP	Exploration Plan
EPA	Environmental Protection Agency
ESA	Endangered Species Act
ESP	Environmental Studies Program (National Program)
EVOS	<i>Exxon Valdez</i> Oil Spill
FY	Fiscal Year
GIS	Geographic Information Systems
GPS	Global Positioning System
GSA	General Services Administration
HF	High Frequency
ITM	Information Transfer Meeting

IUM	Information Update Meeting
JIP	Joint Industry Project
MMPA	Marine Mammal Protection Act
MMS	Minerals Management Service
NAB	North Aleutian Basin
NASA	National Aeronautics and Space Administration
NEPA	National Environmental Policy Act
NMFS	National Marine Fisheries Service
NMML	National Marine Mammal Laboratory
NOAA	National Oceanic and Atmospheric Administration
NOPP	National Oceanographic Partnership Program
NPRB	North Pacific Research Board
NSB	North Slope Borough
NSSI	North Slope Science Initiative
NSF	National Science Foundation
NSL	National Studies List
OCS	Outer Continental Shelf
OCSLA	Outer Continental Shelf Lands Act
OSRA	Oil-Spill-Risk Analysis
OSU	Oregon State University
PAH	Polycyclic Aromatic Hydrocarbon
ROV	Remotely Operated Vehicle
RUSALCA	Russian-American Long-term Census of the Arctic
SDI	Satellite Drilling Island
SOO	Suspension of Operations
TAR	Technology Assessment and Research Program
UAF	University of Alaska-Fairbanks
uERD	ultra Extended Reach Drilling
URI	University of Rhode Island
USCG	U.S. Coast Guard
USCOP	U.S. Commission on Ocean Policy
USDOI	U.S. Department of the Interior
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
UW	University of Washington
WHOI	Woods Hole Oceanographic Institution

PREAMBLE

The past year (FY10) has been a time of significant transition for this Bureau and the Environmental Studies Program (ESP). Most notably, the catastrophic Deepwater Horizon explosion on April 20, 2010, and the resulting oil spill in the Gulf of Mexico prompted official reorganization and a wide array of institutional adjustments and investigations that are still not complete, even as our FY11 Annual Studies Plan goes to press. This preamble to our annual narrative is intended to help stakeholders follow some of the landmark events over the past year, as well as understand some of the immediate implications of these events on our ongoing study efforts in support of responsible decision-making about resource management on the Outer Continental Shelf (OCS) of Alaska.

On March 31, Secretary of the Interior Ken Salazar announced his comprehensive strategy for OCS oil & gas development and exploration. In the Alaska Region, the strategy cancelled 2010-2012 Beaufort and Chukchi Sea lease sales in the Arctic, and withdrew the North Aleutian Basin Planning Area from leasing consideration through 2017. Cook Inlet remained, but subject only to interest-based sales. Secretary Salazar also asked the United States Geological Survey (USGS) to assess what information is known and what is not known about resources, risks, and environmental sensitivities in Arctic areas, with a report expected by April 1, 2011.

Since the Deepwater Horizon explosion, the Secretary of the Interior has taken aggressive action on multiple fronts to strengthen OCS safety and environmental protection, and to improve overall management, regulation, and oversight of offshore operations.

- On April 30, the Secretary announced the formation of the OCS Safety Oversight Board to identify, evaluate, and implement new safety requirements. This led to a Safety Report on May 27 and a Secretarial Order on September 30 that established new rules to help improve drilling safety.
- On May 19, the Secretary announced the restructuring of the Minerals Management Service (MMS), separating the responsibilities performed by MMS into three new management structures to help ensure strong and effective management and oversight of our nation's offshore energy resources. In June, the Secretary changed the name of the Minerals Management Service to the Bureau of Ocean Energy Management, Regulation and Enforcement (BOEMRE). In addition, several changes in leadership personnel have occurred (including agency Director and Offshore Associate Director), and a new Investigations and Review Unit was created within BOEMRE. This new unit will investigate any allegations of misconduct and/or unethical behavior against Bureau personnel, and spearhead more aggressive enforcement actions against the oil and gas industry.
- On May 27, the Secretary suspended proposed exploratory drilling of five wells in the arctic.

- Additional reforms will be influenced by several investigations and reviews. The National Commission on the BP Deepwater Horizon Oil Spill and Offshore Drilling is tasked with providing options on preventing and mitigating future spills. The Council on Environmental Quality, working with the Department of the Interior, conducted a review of National Environmental Policy Act (NEPA) policies, practices, and procedures for decisions about OCS oil and gas exploration and development and issued a report on August 16. The Department of the Interior Office of Inspector General is also conducting a review to evaluate the effectiveness of the environmental review and compliance processes for the OCS.

Additional changes are underway in the governance of ocean management policies. For example, on July 19 the President signed an Executive Order establishing the National Ocean Council to provide guidance for the implementation of the recommendations of the Interagency Ocean Policy Task Force. The Executive Order envisions a comprehensive, national approach to ocean planning, and establishes a national policy for the stewardship of the ocean, the Great Lakes and our coasts to support the preservation and sustainable uses of these bodies of water. The Administration is also building on reform efforts to strengthen the OCS budget and to undertake new legislation to amend the OCS Lands Act, such as allowing BOEMRE more time to conduct environmental analysis on an exploration plan

With regard to arctic science, a July 22 Presidential Memorandum assigned responsibility for arctic research coordination to the White House National Science and Technology Council. The change intends to improve arctic research planning across multiple agencies and to ensure greater alignment with other national research priorities, such as climate change adaptation.

In consideration of these recent events and dynamic circumstances, our studies planning process faces administrative and budgetary challenges for which we are adjusting our research priorities. Our FY11 priorities now include: updates and improvements in our oil spill risk analysis models; lab research on biological effects of oil/gas and dispersants in cold water; planned workshops to document Gulf spill “lessons learned” for spill planning and response in arctic waters, as well as multilateral preparation for damage assessment fieldwork protocols; improved baseline for monitoring shorezone habitat and bioremediation; and efforts to enhance oil spill detection technologies and “nowcast” oceanographic instrumentation. Additional efforts to update and improve data collection for catastrophic event analysis in the arctic will undoubtedly follow in FY12.

We look forward to receiving stakeholder input for additional suggestions. In the midst of change, the Environmental Studies Program continues to serve the information needs of BOEMRE, our various stakeholders, and the public. Continued dialogue and extensive planning coordination with other agencies, stakeholders, and the public remain our steadfast goal as we move forward.

SECTION 1.0 PROGRAMMATIC OVERVIEW

1.1 Introduction to the Region

1.1.1 Background

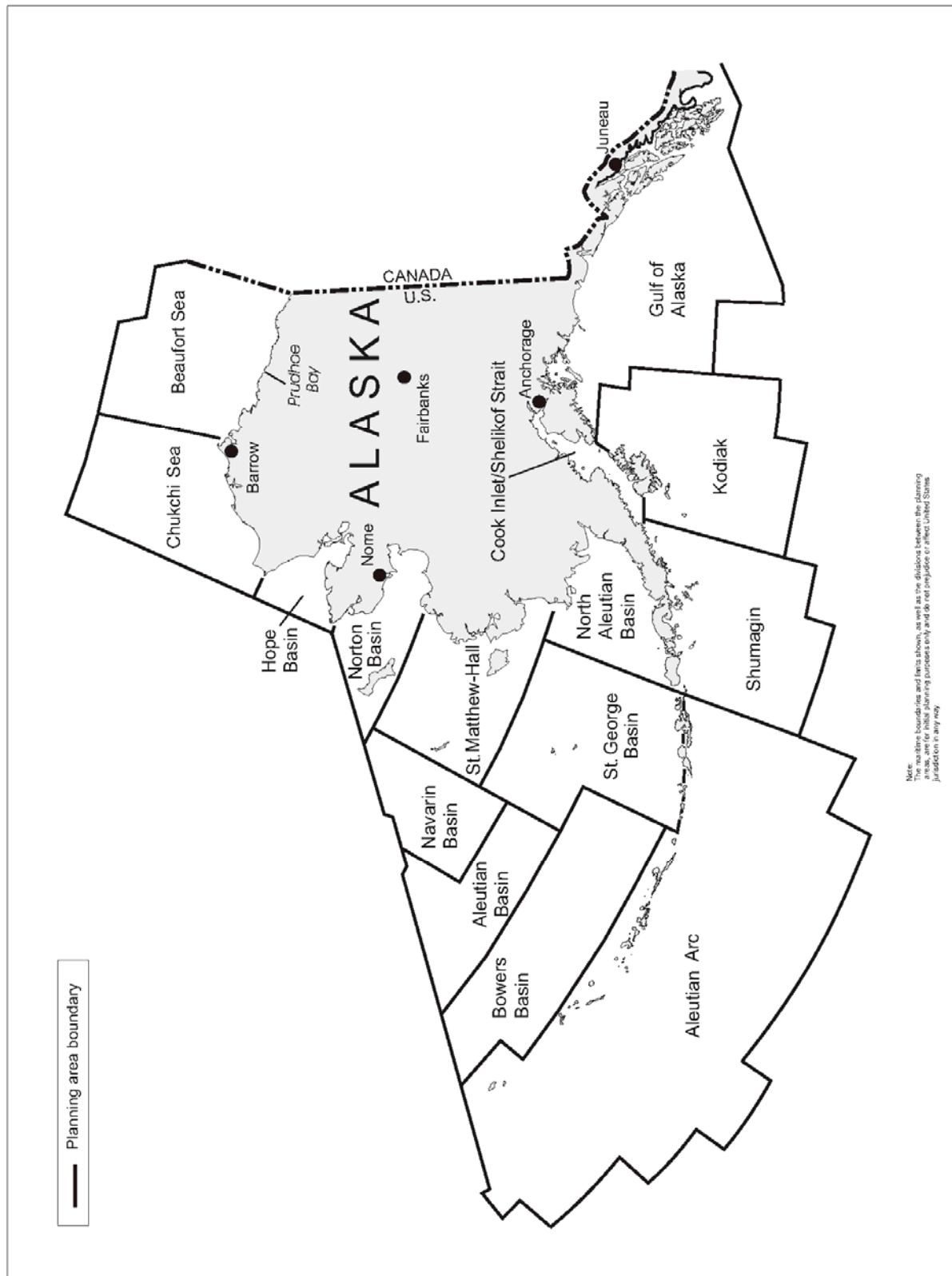
The Bureau of Ocean Energy Management, Regulation and Enforcement Environmental Studies Program was established and funded by the United States Congress to support the offshore oil and gas leasing program of the U.S. Department of the Interior (USDOI) in pursuit of national energy policies. The Environmental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

The Outer Continental Shelf Lands Act (OCSLA) of 1953, as amended (43 U.S.C. 1331 et seq.), provides guidelines for implementing an OCS oil and gas exploration and development program based on the need to balance orderly energy resource development with protection of the human, marine, and coastal environments. The basic mission of BOEMRE 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 decision-making that may have effects on the environment. Federal laws impose additional requirements on the offshore leasing process, including the Coastal Zone Management Act; Federal Water Pollution Control Act Amendments; Marine Mammal Protection Act (MMPA); Endangered Species Act (ESA); and Marine Protection, Research and Sanctuaries Act.

The ESP operates on a national scale to assist in predicting, projecting, assessing and managing potential effects on the human, marine and coastal environments of the OCS that may be affected by oil and gas development. Lease-management decisions are enhanced when current, pertinent and timely information is available. Final reports from the ESP are most directly utilized by teams of NEPA analysts within the 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 MMS/BOEMRE have funded nationally more than \$875 million for environmental studies through fiscal year (FY) 2010. More than \$350 million of that amount has funded studies in Alaska across 15 planning areas in the Arctic, Bering Sea and Gulf of Alaska sub-regions (see Figure 1) to produce more than 400 different

Figure 1 Alaska OCS Region Planning Areas



study reports. The ESP manages ongoing study projects in Alaska (currently about 45) in disciplines such as physical oceanography, fate and effects of pollutants, protected and endangered species, wildlife biology, and the social sciences. Completed study reports are posted on our website at <http://alaska.boemre.gov/ref/AKPUBS.HTM>.

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

As 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 ESP has initiated Synthesis Meetings, Information Transfer Meetings (ITMs) and Information Update Meetings (IUMs) to gather maximum expertise and assess the status of existing information, as well as to plan the best possible approach to a study within the constraints of time and resources. As 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 MMS Alaska Region to study coastal topics associated with the development of natural gas, oil and minerals in Alaska's OCS. Under this arrangement, the ESP taps the scientific expertise of regional and local experts through UAF/UAA to collect and disseminate environmental information about resource issues of mutual interest. Through the CMI, the ESP stimulates important studies in a cost-saving one-to-one match structure. 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 MMS 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 MMS/BOEMRE has committed \$750,000 per year with a dollar-for-dollar match arrangement. More information can be found at <http://www.sfos.uaf.edu/cmi>.

The Alaska Region ESP also conducts cooperative research with universities through the Cooperative Ecosystem Studies Units (CESUs). The CESUs are working partnerships among leading academic institutions, federal, state, and non-governmental organizations. A national network of seventeen CESUs has been established, with each unit 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 Advisory Committee, an external peer review body that meets on an annual basis. Other involvement of external scientists occurs through forums such as participation on project-management review boards, which greatly facilitates 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 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 ensure 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 Annual Studies Plan FY 2011* complements and reinforces the goals of the Environmental Studies Program. The ESP is guided by several broad themes, which include:

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

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 decision-makers. Currently the Alaska ESP has primary focus on upcoming developments, exploration activities and existing leases, as well as potential future lease sales, in the Beaufort Sea and Chukchi Sea Planning Areas.

Current offshore oil and gas-related issues addressed by ongoing and proposed studies in the Beaufort Sea and the Chukchi Sea include, but are not limited to:

- What refinements are there to our knowledge of major oceanographic and meteorological processes and how they influence the human, marine and coastal environment?

- What role will currents play in distribution of anthropogenic pollutants near development prospects?
- What long-term changes in heavy metal and hydrocarbon levels may occur near Beaufort Sea development prospects, such as Liberty, or regionally along the Beaufort Sea coast?
- How do we improve our model predictions of the fate of potential oil spills?
- If oil is spilled in broken ice, what will its fate be?
- What effects might pipeline construction have on nearby marine communities or organisms?
- What changes might occur in sensitive benthic communities such as the Stefansson Sound “Boulder Patch,” and other Beaufort Sea kelp communities or fish habitats?
- What are the current spatial and temporal use patterns of these planning areas by species that are potentially sensitive, such as bowhead whales, polar bears, other marine mammals, seabirds and other birds, or fish?
- What is the extent of endangered whale feeding in future proposed or potential lease sale areas?
- What changes might occur in habitat use, distribution, abundance, movement or health of potentially sensitive key species such as bowhead whales, polar bears, other marine mammals, seabirds and other birds, or fish?
- What interactions between human activities and the physical environment have affected potentially sensitive species?
- What changes might occur in socioeconomics and subsistence lifestyles of coastal Alaska communities?
- What are current patterns of subsistence harvest, distribution and consumption and what changes might occur in key social indicators as a result of offshore exploration and development?
- How can we continue to integrate local and/or traditional knowledge into studies related to the 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 Annual Studies Plan FY 2011* reflects consideration of the many changes occurring in the Alaska OCS Region, as well as anticipated needs for the future. In a frontier region such as the Alaskan Arctic, planning lead-time is necessary to conduct adequate environmental studies. Challenges include: large and remote planning areas, diverse and extreme environmental conditions, still-evolving hydrocarbon extraction technology, and potential environmental hazards associated with offshore activities.

Preparation of an EIS is an essential part of the pre-lease process that requires environmental information. In particular, information is needed in time to prepare draft EISs for proposed lease sales. Although much information exists for certain Alaska OCS lease areas, data are sparse in other areas. In addition, changing conditions and environments often lead to the need to update past studies so that EIS information is current and accurate.

Three lease sales were held under the *Final Outer Continental Shelf Oil and Gas Leasing Program 2002-2007* (USDOJ, MMS, 2002), all of them in the Beaufort Sea Planning Area (see Figure 2). Other lease sales in that *Program* were postponed or were cancelled due to a lack of industry interest. The MMS issued the *Final Outer Continental Shelf Oil and Gas Leasing Program 2007-2012* (USDOJ, MMS, 2007) in April 2007. The first lease sale under this *Final Program* was held in February 2008 in the Chukchi Sea Planning Area (see Figure 3). This *Final Program* also proposed lease sales in the Beaufort Sea, the Chukchi Sea, the North Aleutian Basin, and a special interest sale in Cook Inlet. In March 2010, the MMS released a *Preliminary Revised Program Outer Continental Shelf Oil and Gas Leasing Program 2007-2012* (USDOJ, MMS, 2010) that cancelled the lease sales planned for the Beaufort and Chukchi seas. In addition, the President issued a memorandum withdrawing the North Aleutian Basin from consideration for leasing through June 2017. Industry interest in the Cook Inlet is still minimal and has not increased since Sale 211 was cancelled earlier.

The *Preliminary Revised Program* cited the need for additional exploration and scientific, environmental and oil spill risk analysis before more area in the Arctic is considered for leasing. The Beaufort Sea and Chukchi Sea planning areas are being evaluated for possible leasing under the upcoming *Outer Continental Shelf Oil and Gas Leasing Program 2012-2017*.

Figure 2 Beaufort Sea Oil and Gas Leasing Activity

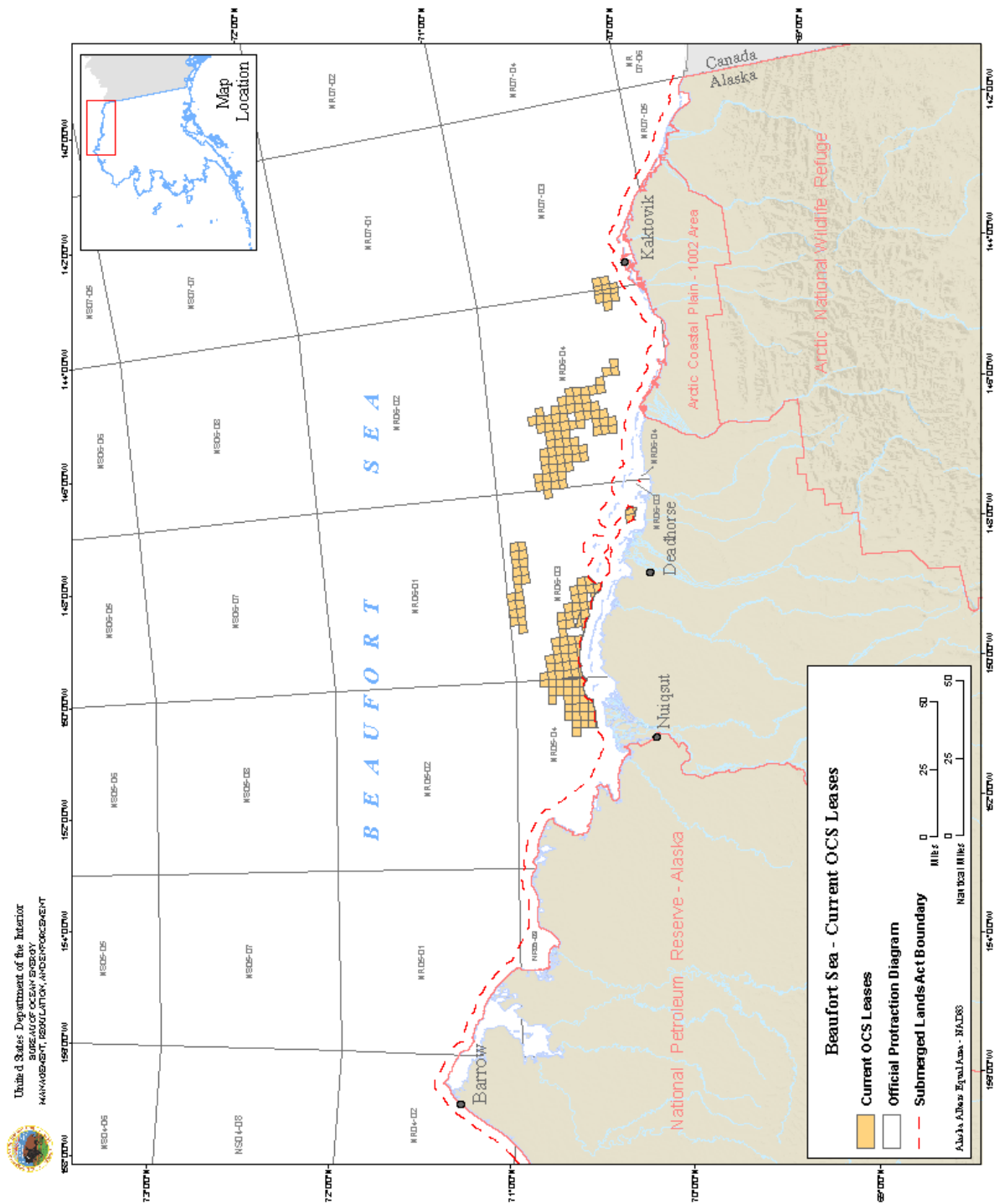
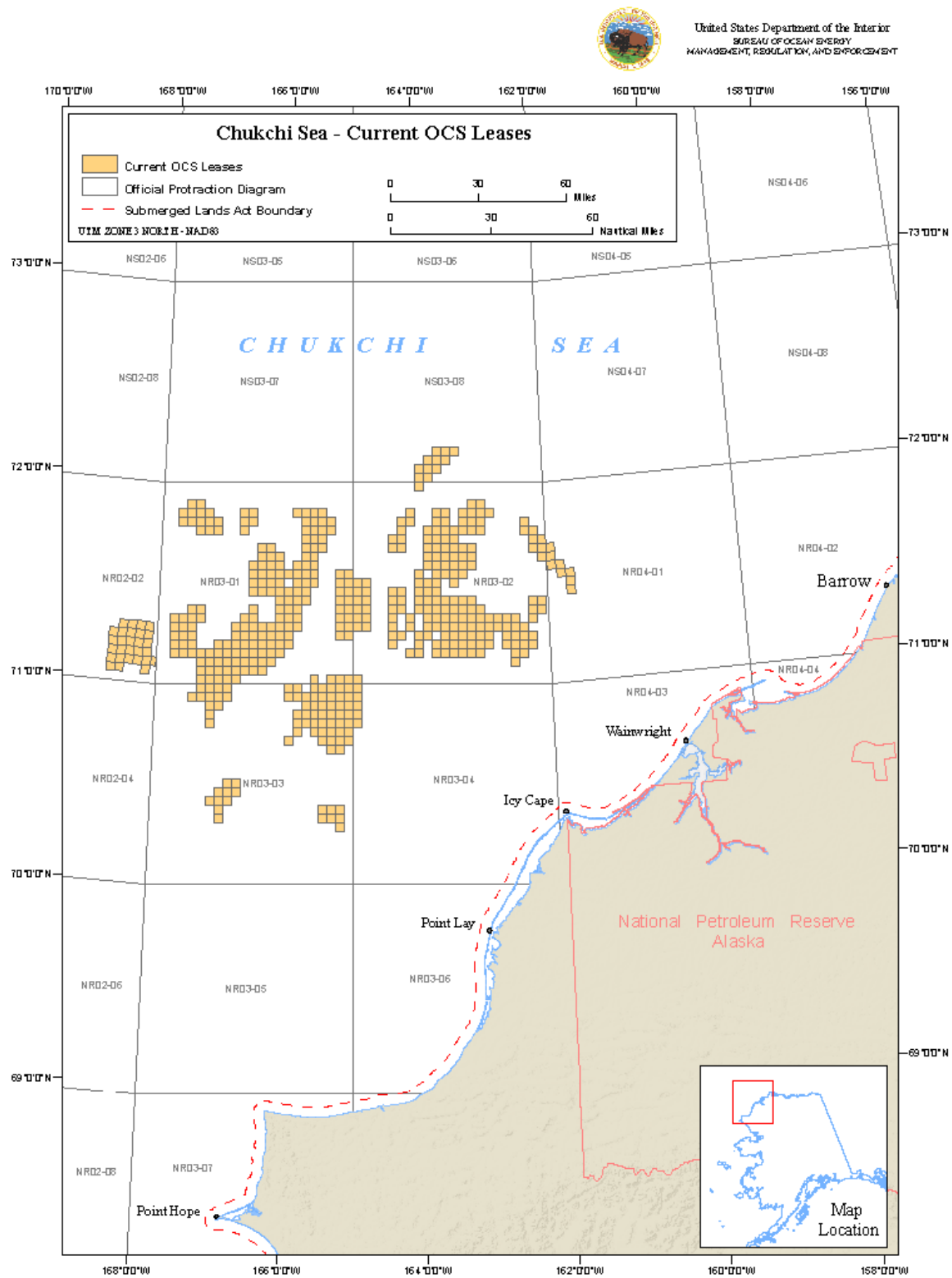


Figure 3 Chukchi Sea Oil and Gas Leasing Activity



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)
- Oil spill detection, containment, clean-up and damage assessment

In the Beaufort Sea Planning Area, there have been 929 tracts leased in ten OCS Lease Sales. Industry has drilled 31 exploratory wells and determined 11 to be producible. As of August, 2010, there are more than 180 active leases in the Beaufort federal offshore area. Lease Sale 193 in February 2008 resulted in 487 leases being issued in the Chukchi Sea Planning Area. The only other active leases are in the Cook Inlet/Shelikof Strait Planning Area (see Figure 4). 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.

Legal Challenges: Litigation remains a constant for Alaska OCS activities. Over 30 years almost every action has been litigated. Currently, there are three active cases.

Native Village of Point Hope v. Salazar, No. 1:08-cv-00004-RRB (D. Alaska) (Sale 193). On July 21, 2010, the U.S. Alaska District Court decided the litigation connected with the Chukchi Sea Lease Sale 193 by issuing an *Order Remanding to the Agency*. The Court found that, although much of the BOEMRE's extensive investigation was appropriate, the BOEMRE failed to comply with NEPA in certain circumstances. The Court directed the BOEMRE to analyze the environmental impact of natural gas development, address whether missing information identified by the agency was relevant or essential under 40 C.F.R. §1502.22, and determine whether the cost of obtaining the missing information was exorbitant, or the means of doing so unknown. The Court enjoined all activities under Lease Sale 193. To remedy the Court's remand the BOEMRE is preparing a Supplemental Environmental Impact Statement. The Court's remand constitutes a delay under the

regulations at 30 C.F.R. 250.172(a) and would allow for a Directed SOO (Suspension of Operations) to all Chukchi Sea leaseholders. Leaseholders in the Beaufort Sea are not affected by the Court's remand. On August 2, 2010, the Court clarified its Order to allow Shell to conduct its scientific studies. On August 5, 2010, the District Court issued an "Amended Order Remanding to Agency." The District Court stated that the order was "intended to be narrow." On August 5, 2010, the District Court Order amended the July 21 Order by narrowing the scope of the order to be only those activities associated with Lease Sale 193 and organizations which were party to the lawsuit and allowed Shell to conduct scientific studies which had already been approved; allowed the BOEMRE to issue permits to Statoil or others for Geological and Geophysical surveys; and allowed the BOEMRE to process routine paper transactions relating to Lease Sale 193.

Center for Biological Diversity v. DOI, Nos. 07-1247, 07-1433 (D.C. Cir.). Due to the U.S. Court of Appeals for the District of Columbia Circuit decision in April 2009 with clarification in July 2009 on the *2007-2012 Oil and Gas Leasing Program*, on March 31, 2010, Secretary Salazar released the *Preliminary Revised Program* and cancelled the remaining four lease sales in the *2007-2012 Program* for the Chukchi and Beaufort Seas in the Arctic and the North Aleutian Basin. The Secretary also decided that Chukchi Sea Sale 193 held in 2008 was appropriate as part of this *Preliminary Revised Program*, but a final decision needs to be filed with the Court.

State of Alaska v. Secretary of the Interior Salazar, et al., No. 3:10-cv-00205-JWS (D. Alaska). On September 9, 2010, the State of Alaska filed a Petition for Writ of Mandamus and Petition for Review and Request for Injunctive Relief. The State of Alaska is alleging that the Secretary of the Interior has instituted a moratorium on drilling in the Arctic and failed to give the State of Alaska or Governor Parnell notice or an opportunity to participate in the moratorium decision. The State's petition states that the Secretary violated the OCSLA.

Development:

Liberty – The Liberty prospect is located in the central Beaufort Sea about 5-8 miles east of the existing Endicott Satellite Drilling Island (SDI). British Petroleum Exploration Alaska (BPXA) will use ultra Extended Reach Drilling (uERD) technologies to lengths of 5-8 miles, allowing the Liberty unit to be developed from an expansion of the existing Endicott Satellite Drilling Island. All drilling activity will be from surface locations on State lands using a land-based rig and surface blowout preventer. The State of Alaska and the BOEMRE will both have to approve applications for permit to drill. BPXA has delayed the initial wells pending better understanding of Federal and State requirements, due to changes from the Deepwater Horizon incident. Both the BOEMRE and the State are reviewing requirements for blowout preventers and relief wells for projects. The BOEMRE will be coordinating with the State to review respective requirements to provide BPXA with clear and consistent direction. BPXA estimates that the reserves for the Liberty project are 105 million barrels of oil.

Cosmopolitan – Pioneer Resources plans to develop the Cosmopolitan Federal/State Unit in Cook Inlet by drilling from shore. The Federal leases are on the fringe of the prospect and the BOEMRE does not expect wells to be drilled into the Federal leases (only into State waters). The Unit enables the BOEMRE to protect Federal royalty interests from drainage.

Figure 4 Cook Inlet Oil and Gas Leasing Activity

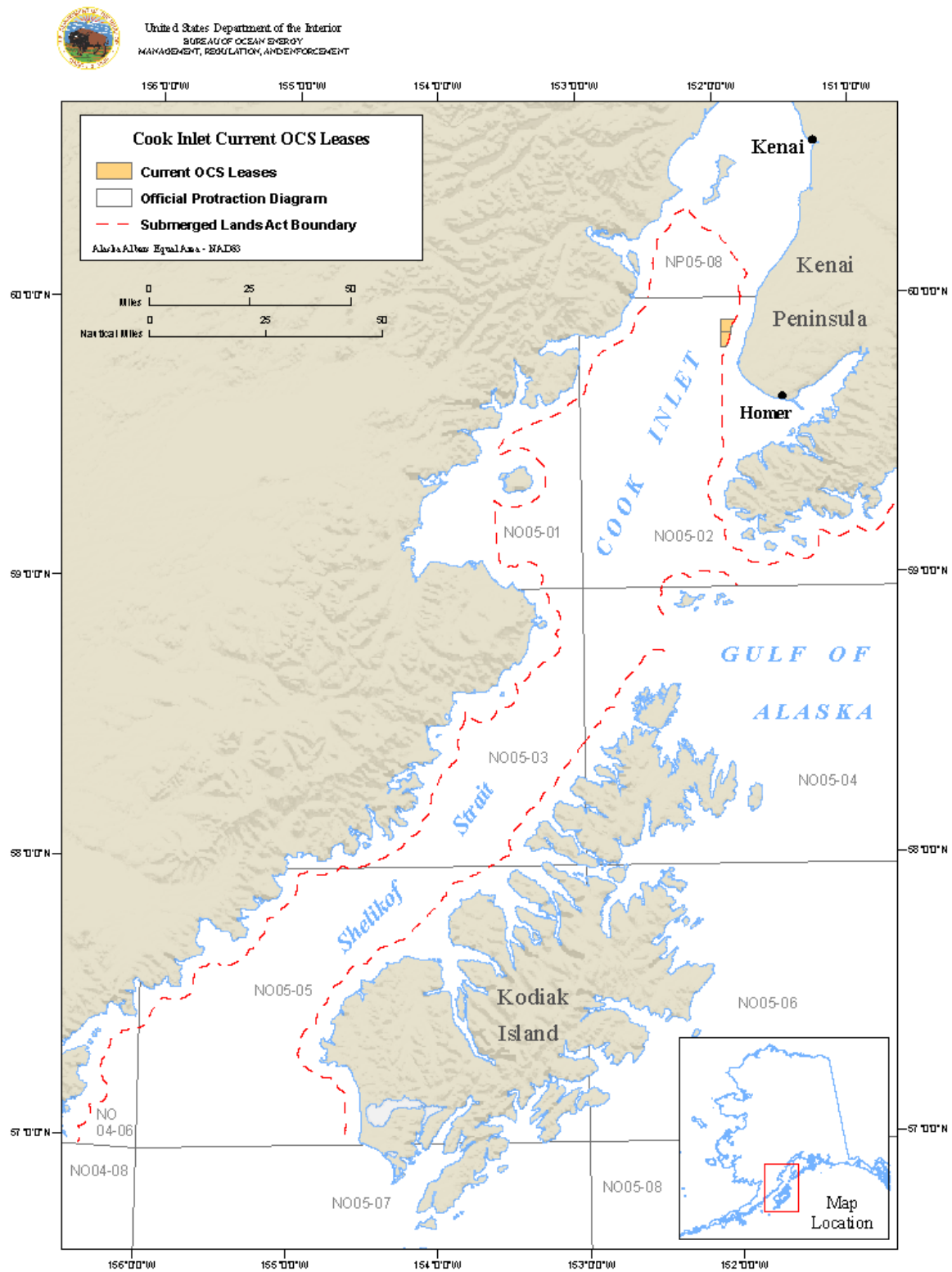
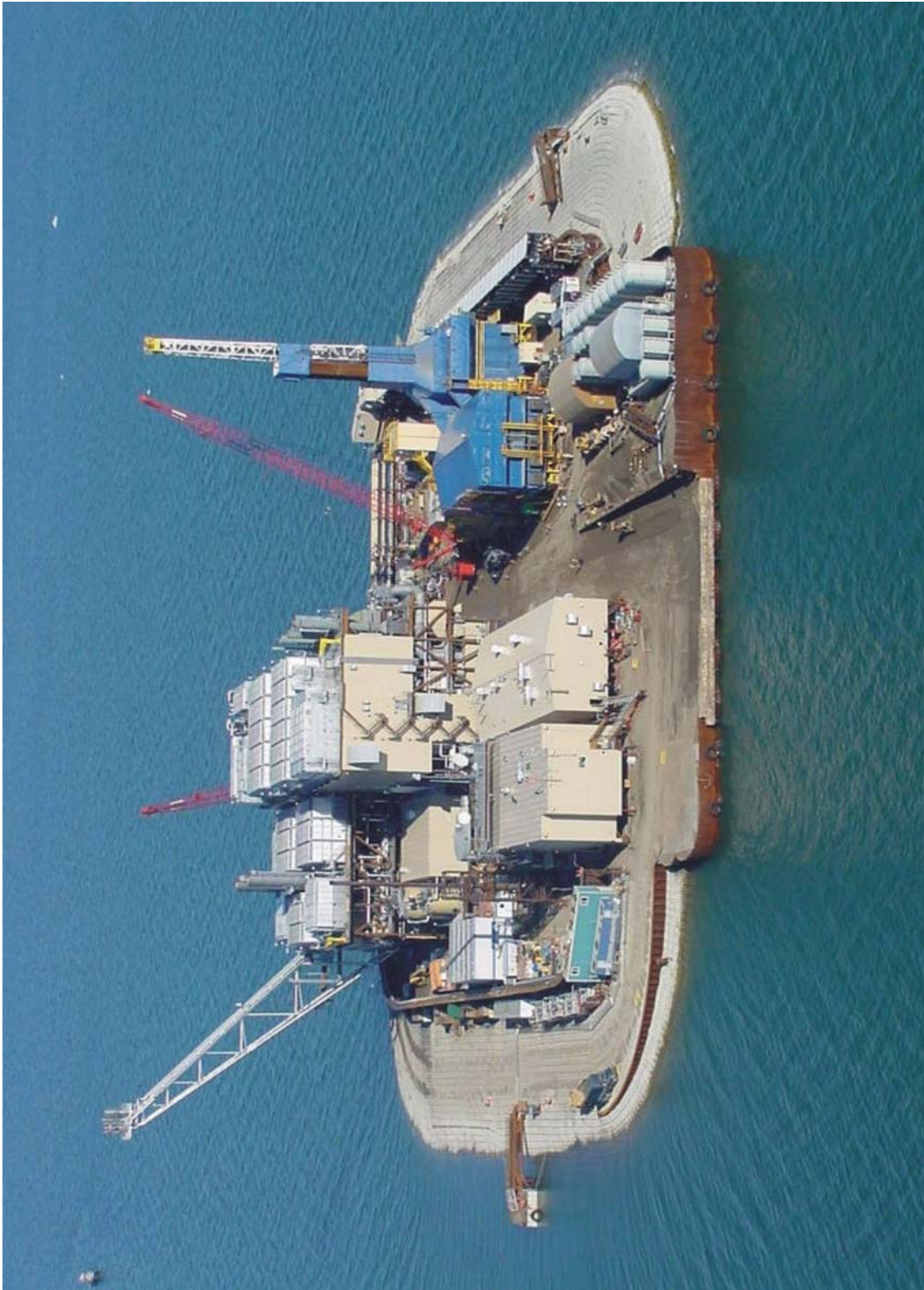


Figure 5 Northstar Island, August 2000



Production:

Northstar – Northstar (see Figure 5) is a joint Federal/State of Alaska unit located in the Beaufort Sea about 12 miles northwest of Prudhoe Bay. BP Exploration Alaska, Inc. (BPXA) is the lessee and operator of Northstar. The six producing Federal wells fall under BOEMRE regulatory authority, the State wells fall under the State's oversight. Since 2001, total production through June 2010 is near 145 million barrels; with the Federal portion about 26 million barrels. All the wells have been drilled and the rig has been demobilized.

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 MMS. The MMS/BOEMRE, along with numerous organizations and agencies, also sponsors the Alaska Marine Science Symposium held in Anchorage, Alaska each year. In addition, MMS/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 MMS 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 MMS needs. Invitations were sent to over 150 scientists and stakeholders, including local and regional governments, tribes, native associations, oil industry and environmental groups. Over 100 scientists and stakeholders attended. Thirteen monitoring study profiles were developed by four working groups, discussed by the workshop participants, and submitted to MMS for prioritization and inclusion in the COMIDA field effort. The workshop report was published in April 2007 (USDOI, MMS, Alaska OCS Region, 2007) and has become a useful planning tool that continues to influence our study priorities.

1.3.1 Beaufort Sea General Information Needs

Monitoring of Interdependent Physical, Biological and Social Processes: Both offshore and onshore oil and gas development and production activities are 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.

The "Arctic Nearshore Impact Monitoring in Development Area" (ANIMIDA), a program started in 1999, was developed to address these issues. This suite of studies provided baseline data and monitoring results for chemical contamination, turbidity, and subsistence whaling in the vicinity of Northstar and Liberty development sites. The recently concluded 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 final study reports from cANIMIDA are available on our website of completed study reports and at the cANIMIDA website: <http://www.duxbury.battelle.org/canimida/home/index.cfm>.

Much of this work planned to extend beyond the cANIMIDA project. The five-year "Continuation of Impact Assessment for Cross Island Whaling Activities" is approaching the mid-point. Also, 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.

A number of currently ongoing studies take an integrated approach to examining the interdependence of physical, biological and social processes and filling identified information needs across the various disciplines. Highlights of these and other important research projects are provided under the discipline headings below.

Current keystone oceanographic studies include:

Mesoscale Meteorology: Accurate specification of the surface wind and stress field is essential to predict ocean and ice circulation, and to improve oil spill models. In partnership with UAF, this study conducts a long-term hindcast simulation with an optimized data-modeling system to produce a high resolution meteorological dataset and to document climatological features of the Beaufort 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. Current 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

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 MMS/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 AEWC, 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. This study 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 MMS launched a study in 2005, 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, this study collects data to estimate the demographic composition and inter-annual patterns of use of coastal areas by the sub-population of polar bears summering on land in Alaska. The project will also evaluate the implications of extended summer use of land on polar bear health and nutrition, behavior, and population status.

Fish: Fishes in the Beaufort and Chukchi seas 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 and to distinguish between changes due to anthropogenic and natural effects.

Beaufort Sea Marine Fish 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 Iñupiaq culture and spiritual life. People are concerned that a temporary or permanent elimination of primary subsistence foods would cause North Slope residents either to shift to less desired subsistence resources or to replace subsistence foods with expensive Western foods. 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:

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 appear within the Chukchi Sea are not typically found within the Beaufort Sea. One major difference is that MMS 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, MMS/BOEMRE has developed a new suite of studies in the Chukchi Sea, leveraging more than \$40 million (through FY 10, with another \$10 million planned for FY 11) to conduct interim baseline research and monitoring in all the following fields of interest: meteorology, ice dynamics and basic oceanography, benthic fauna and sedimentation, marine mammals (including whales, walrus, seals, and polar bear), fish, birds, and social systems. Most of the projects exhibit complex, multilateral collaborations, with explicit inter-disciplinary linkages between the physical and biological sciences, and many of them also provide a role for active participation by 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 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, this study conducts a long-term hindcast simulation with an optimized data-modeling system to produce a high resolution meteorological dataset and to document climatological features of the Beaufort/Chukchi Seas.

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.

Marine Mammals

Distribution and Relative Abundance of Marine Mammals: Aerial Surveys: In collaboration with the National Marine Fisheries Service (NMFS), this study 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 with NMFS, this study documents the general presence of bowhead, right, fin, gray, and other baleen whales in areas of potential seismic, drilling, construction, and production activities. Data will be useful for estimating temporal limits and formulating designs of mitigation for such activities. The study 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, this study collects data to estimate the demographic composition and inter-annual patterns of use of coastal areas by the sub-population of polar bears summering on land in Alaska. The project will also evaluate the implications of extended summer use of land on polar bear health and nutrition, behavior, and population status.

Pinniped Movements and Foraging: Bearded Seals: Large numbers of pinnipeds migrate through and potentially occupy prospective oil and gas areas in the Chukchi Sea, including habitat near the Burger Prospect. Pinnipeds may be affected in a variety of ways during all stages of oil and gas exploration, development, and production. In collaboration with NMFS,

this study develops a phased cooperative project with Native subsistence hunters to track the movements and habitat use of bearded seal in the western Chukchi Sea.

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

Monitoring Marine Birds of Concern in the Eastern Chukchi Nearshore Area (Loons): This collaboration with USGS-Biological Resources Division (BRD) provides updated information 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.

Habitat and Ecology

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. This study, in collaboration with USGS, synthesizes ecological and behavioral information for freshwater, diadromous, and marine fish species occurring in the Beaufort and Chukchi Seas.

Biogeochemical Assessment of the 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 northern Bering Sea and in the Chukchi Sea and evaluates its vulnerability to climate change. The study involves three years of oceanographic sampling focused on measurements of dissolved organic and inorganic nutrients and carbon, total alkalinity, particulate organic matter, and pCO₂.

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.

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 Renewable Energy General Information Needs

Section 388 of the Energy Policy Act of 2005 amended the OCSLA to give discretionary authority to the MMS 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 MMS/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 topic “Renewable Energy Capacity Inventory in Coastal Alaska” 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 research are to: 1) establish firm intellectual understanding over the range of options, processes, economic feasibility, and potential management strategies that are relevant to development prospects for renewable energy sources on the OCS of Alaska and 2) systematically collect a variety of technical and socio-economic data to produce a resource inventory database about the realistic prospects and related social impacts of specific alternative energy development scenarios for the Alaska region. The RFP was eventually terminated as premature for the State of Alaska. In that context, we encourage input from regional stakeholders to help us assess the extent of industrial interest to lease and develop renewable resources on the Alaska OCS.

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SECTION 2.0 STUDY PROFILES

2.1 Profiles of Ongoing Studies

Information about ongoing studies can be found at:
<http://alaska.boemre.gov/ess/index.htm>

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

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ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2011

Region: Alaska

Planning Area(s): Beaufort Sea

Title: Beaufort/Chukchi Seas Mesoscale Meteorology Modeling Study
Phase II (AK-06-05)

BOEMRE Information Need(s) to be Addressed: The final modeled data will improve the predictive capabilities of the BOEMRE oil-spill trajectory model and the Foundation for Scientific and Industrial Resources of the Norwegian Institute of Technology (SINTEF [Norwegian acronym]) weathering model for the Beaufort Sea. Information will be used in NEPA analysis and documentation for Beaufort Sea Lease Sales, Exploration Plans (EPs), and Development and Production Plan (DPPs).

Total Cost: \$1,750,000

Period of Performance: FY 2006-2012

Conducting Organization: UAF Geophysical Institute

BOEMRE Contact: [Chief, Alaska Environmental Studies Section](#)

Description:

Background: An initial phase of the Beaufort Sea mesoscale meteorology was conducted during 2006–2008 by the University of Alaska Fairbanks. The Phase I study conducted a literature review with the aim of summarizing past and present research efforts concerning the mesoscale meteorological models that would best support BOEMRE objectives for the study of the Beaufort Sea mesoscale meteorology. Based on the review, the Weather Research and Forecasting (WRF) model was selected as the preferred model to be used in this study. Initial sensitivity tests with WRF were conducted in the Phase I study, which included an analysis of sensitivity to forcing data and to the modeling configuration, including the horizontal resolution, model physics, and the nudging technique. The model's performance in simulating the wind field was analyzed, with emphasis placed on evaluating the capabilities of WRF to accurately simulate the sea breeze and topographic effects. A Phase II study plan has been developed with the aim of achieving accurate simulation of the Beaufort and Chukchi seas surface wind and associated mesoscale meteorology. The final products from the Phase II study will be a 30-year (1979-2009) observational database; a 5 and 30-year hindcast simulation of the Beaufort/Chukchi seas; as well as a final report documenting the observational database quality control methods, final model sensitivity analysis, and climatological analysis of both the collected observations and long-term model simulation.

Objectives:

- Produce a geospatial surface meteorological database for the Beaufort and Chukchi seas and the adjacent coastal areas by collecting available conventional and unconventional surface and atmospheric data and conducting field work;

- Establish a well-tuned Beaufort/Chukchi seas mesoscale meteorology model through further modeling studies for the optimization and improvement of the model physics and configuration;
- Conduct a long-term hindcast simulation with the optimized data-modeling system and produce a high resolution meteorological dataset for the Beaufort and Chukchi regions; and
- Document the high-resolution climatological features of the Beaufort/Chukchi seas surface winds, including an analysis of the interannual variability and long-term change, as well as the physical processes and mechanisms for shaping the Beaufort/Chukchi seas wind field climatology.

Methods:

The contractor shall research the availability of observational data from all sources, including both conventional in situ and satellite, which are present across the project study area for the period 1979–2009. The contractor will collect and store the QuikSCAT SeaWinds and COSMIC soundings for the Beaufort and Chukchi regions. The contractor shall deploy meteorological buoy(s) out to 80 km off the coastline, to be monitored for a period of two (2) to three (3) months during the open water season in the first year (2009) of the project. The contractor shall import the existing MMS/BOEMRE database, plus all newly collected and quality-controlled data, including the observations collected in the field work, into an Oracle version 10g database, named as the Beaufort/Chukchi Seas Mesoscale Meteorology Surface Observational Database. The contractor shall conduct a climatological analysis of the collected in situ data over the entire thirty-year period (1979-2009). The contractor shall continue the sensitivity analysis for the evaluation of WRF model simulations based on the initial results achieved in the Phase I study. The contractor shall implement a thermodynamic sea ice model into WRF. The contractor shall produce a five-year experimental wind field simulation (2005-2009) and a thirty year hindcast simulation. The contractor shall use the new high spatial- (10 km) and temporal- (hourly) resolution surface wind data from the 30-year production simulation to examine its climatological features, interannual variability, and long-term change. The contractor shall analyze the output of the 30-year production simulation and perform a climatological analysis of the model output. The contractor shall investigate the physical processes and mechanisms along with the diagnostic and statistical analyses of various aspects of the wind field climatology, variability, and long-term change.

Revised Date: August 2010

ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2011

Region: Alaska

Planning Area(s): Beaufort Sea

Title: Support of the Collection of Meteorological Data on the North Slope and Beaufort Sea, Alaska (AK-06-x13)

BOEMRE Information Need(s) to be Addressed: The data and analysis from the collection of these meteorological data is invaluable to ongoing BOEMRE scientific studies. These data are presently being used to validate the output from the Beaufort Sea Mesoscale Meteorological Model, currently under development by the University of Alaska-Fairbanks. Other uses of the data would be testing of oceanographic and oil-spill trajectory models to assist in BOEMRE management in the Beaufort Sea region; to assist with the validation of surface current measurements collected by high frequency radar and subsurface currents collected by Acoustic Doppler Current Profilers (ADCP); BOEMRE field operations studies, and air quality measurements from offshore operations.

Total Cost: \$40,000

Period of Performance: FY 2007-2011

Conducting Organization: UAF

BOEMRE Contact: [Chief, Alaska Environmental Studies Section](#)

Description:

Background: The US Department of Interior, MMS operated five meteorological stations along the Beaufort Sea Coast, Alaska. Data collection at four of the meteorological stations began on January 1, 2001. A fifth station at Cottle Island was added to the study area on August 21, 2002. These stations operated until September 30, 2006. These five meteorological stations collected data on wind speed, wind direction, barometric pressure, relative humidity, solar radiation, and air temperature. The MMS produced two final reports from the analysis of these and other coastal meteorological station data from Barrow, Alaska to the Mackenzie delta. The analysis can be found within OCS final reports MMS 2005-069 and MMS 2007-011.

At the end of the contract period in 2007, instead of demobilizing the stations and warehousing them, MMS transferred the stations to the University of Alaska-Fairbanks so they would be incorporated into a larger network of stations previously established by the University of Alaska (<http://www.uaf.edu/water/>). The University of Alaska is planning to integrate these stations into a larger network of stations that will support multiple organizations. The lead organizations for operating and maintaining the network will be the University of Alaska-Fairbanks, Water and Environmental Research Center (WERC). The location of these stations will also help serve as a linkage between terrestrial and ocean observing network in the Arctic. The Network approach is also consistent with the major

recommendations of key variables needing long-term monitoring for an Arctic Observing Network (National Research Council, 2006).

Objectives: The collection of meteorological data along the North Slope and nearshore Beaufort Sea in support of other BOEMRE study efforts and field surveys.

The data collection network will be upgraded to help meet current project needs and those of the project partners. The upgrades will enhance data collection and objectives of the network, such as adding precipitation gauges and measurements at the stations. The identified priority stations are Milne Point, Badami, and Cottle Island. The objectives of the modified data network will include:

- Provide data to help characterize the west-east distribution of winter and summer precipitation. Applications include area-wide precipitation analysis for North Slope lake water use research and management.
- Provide soil temperature and moisture information for applications in both hydrology and tundra travel management.
- Provide wind data for research efforts on coastal atmospheric models, including coastal erosion applications and oil-spill evaluation and response modeling efforts.
- Provide radiation data to help improve estimates of evaporation and evapo-transpiration in the network region.
- Provide data on the Internet in hourly updates to benefit field operations, traveler weather information, and emergency response.
- Provide data for National Weather Service forecasting use to help improve daily forecasts in network region.

Methods: This study will: 1) update meteorological and communication equipment at three meteorological stations along the Beaufort Sea coast; 2) provide real time meteorological data to BOEMRE via a server at the University of Alaska-Fairbanks; 3) provide annual data quality reports and an annual quality controlled database to BOEMRE.

Revised Date: August 2010

ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2011

Region: Alaska

Planning Area(s): Chukchi Sea

Title: COMIDA: Factors Affecting the Distribution and Relative Abundance of Endangered Whales: Biophysical Moorings and Climate Modeling (AK-09-02)

BOEMRE Information Need(s) to be Addressed: BOEMRE is studying marine mammal distribution, benthic biota, and anthropogenic chemicals to monitor for environmental effects of oil and gas exploration in the Chukchi OCS. Interannual and seasonal variability in the Chukchi is very high and there is a need to distinguish oil and gas effects from those related to variability in the physical environment or from local effects of global warming. This task would provide that context to other monitoring tasks and also greatly improve our understanding of first order physics in the NE Chukchi Sea. The data from this task would be used in validation and skill analysis of the current circulation and oil-spill-risk models used for potential future Chukchi and Beaufort Sea lease sales. The data would also be used for post-lease, site-specific modeling of circulation in oil-spill contingency planning and National Pollutant Discharge Elimination System (NPDES) permitting. In addition, this study will provide information necessary for ground-truthing and tuning of the numerical models, particularly the climate models and oil trajectory models.

Total Cost: \$2,068,928 plus Joint Funding **Period of Performance:** FY 2010-2015

Conducting Organization: NOAA-Pacific Marine Environmental Laboratory

BOEMRE Contact: [Chief, Alaska Environmental Studies Section](#)

Description:

Background: During the last three decades there has been a northward shift of some fish species in the eastern Bering Sea. It is hypothesized that these changes are a result of global climate change and the loss of sea ice. The western Arctic physical climate is 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. 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. This reduction in sea ice area opens up vast new regions of the Arctic Ocean to increased absorption of sunlight and storage of heat. This heat is returned to the atmosphere in the following autumn resulting in increased Arctic temperatures of more than 5° C, extending the sea ice free season into November, and causing changes in wind patterns. Such Arctic changes appear to be irreversible. As the sea ice that has lasted for several years melts away and extra heat is stored in the ocean during autumn, potential future periods of colder than

normal air temperatures may not be sufficient to rebuild the summer sea ice cover. Previous sea ice and climate analyses and projections for the Chukchi Sea are out of date.

One of the methods to be applied to the Chukchi Sea includes measuring the changing ecosystem in the eastern Bering Sea through long term biophysical moorings coupled with shipboard observations. These will provide critical information on the ecosystem, including physical drivers of primary production and higher trophic levels, and support the development of hypotheses for mechanisms controlling ecosystem organization. The coupling of the passive listening device for whales with active acoustics for zooplankton size distribution and biovolume from the moorings has provided some interesting relationships between primary production, zooplankton biovolume and the presence/absence of fin whales. Moorings permit observations during ice covered periods and the critical spring and early summer when spring phytoplankton blooms occur. Such measurements are impossible to obtain from ships, because of the relatively short duration they spend in the area.

Euphausiids are important prey items for bowhead whales in the Chukchi Sea. Availability and prey concentrations are important factors in the habitat utilization of whales in the study area. Euphausiids are thought to be transported from the northern Bering Sea as reproduction of euphausiids within the Chukchi has not been observed. Modeled trajectories of passively floating particles to simulate euphausiid transport have been analyzed. The results suggest that the majority of euphausiid prey in the study area is derived from the northern Bering Sea. Furthermore, particles in close association with the bottom were more likely to be transported to the study area than particles in the surface waters.

Objectives:

- Obtain two full years of biophysical measurements on the shallow Chukchi shelf utilizing moorings at three sites, and collect hydrographic and lower trophic level data during deployment/recovery of the moorings.
- Collaborate with the protected-species study: “COMIDA: Factors Affecting the Distribution and Relative Abundance of Endangered Whales: Passive Acoustic Detection and Monitoring of Endangered Whales in the Arctic” in order to evaluate the extent to which variability in environmental conditions such as sea ice, oceanic currents, water temperature and salinity, and prey abundance influence whale distribution and relative abundance.
- Rerun the National Center for Atmospheric Research (NCAR) climate model (Community Climate System Model: CCSM) for future projections using the sea ice extents from 2007/2008 as initial conditions.
- Analyze multiple ensemble members from the NCAR model and other International Panel on Climate Change (IPCC) models to assess the future variability of sea ice cover and extended sea ice free seasons during fall for the Chukchi Sea.
- Provide long-term estimates of habitat use for large whale species and compare this with predictions about annual ice coverage in order to establish predictive variables to describe large whale occurrence.

Methods: A pair of moorings will be deployed at three different sites of tight-acoustic arrays on the Chukchi Sea shelf (See protected-species study: “COMIDA: Factors Affecting the

Distribution and Relative Abundance of Endangered Whales: Passive Acoustic Detection and Monitoring of Endangered Whales in the Arctic.”) Moorings will be deployed in August for one year, to be recovered the following August. Each mooring site has two moorings; one is a bottom mounted upward-looking ADCP with instruments that measure fluorescence, temperature, and oxygen deployed beneath the ADCP; the second mooring will contain the instrument to measure ice thickness with instruments that will measure nitrate, temperature and salinity beneath it. At one site there will also be an upward looking TAPS-8 (on the P mooring), which acoustically measures zooplankton biovolume as a function of size. During each deployment/recovery cruise, hydrographic data (temperature, conductivity, nutrients, chlorophyll, oxygen) and zooplankton will be collected at each mooring site, along the transect between moorings and at other selected sites in northern part of the Bering Sea and in the Chukchi.

Samples for mesozooplankton and micronekton will be collected using double-oblique tows of paired bongo frames (60-cm frame with 0.333 mm mesh and 20-cm frame with 0.150 mm mesh) or when appropriate, (e.g. for groundtruth of the acoustic data) using a Tucker Sled which allows us to collect samples right next to the bottom.

The climate modeling task will adapt the NCAR CCSM to examine the influence of natural variability on sea ice loss and compare results with a new set of IPCC model results. Within a year a new round of IPCC models will be available for analysis and we will evaluate them for application to Chukchi Sea climate projections. Recent satellite sea ice analyses, including high resolution AMSR-E microwave analyses from Europe, multiyear sea ice fraction from QuikSCAT, and ICESat thickness data are critical data to evaluate climate change as well as the numerical climate models. These data together with data from the moorings will be used for model verification.

Revised Date: August 2010

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ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2011

Region: Alaska

Planning Area(s): Beaufort Sea, Chukchi Sea

Title: Mapping and Characterization of Recurring Polynyas and Landfast Ice in the Chukchi and Beaufort Seas (AK-09-04)

BOEMRE Information Need(s) to be Addressed: Because the predominant oil-spill movement in the Chukchi OCS Planning Area would be from east to west, the potential interaction of oil and wildlife in the polynya system is a major concern. A better understanding of locations and characteristics of the polynyas and landfast ice would allow for a more accurate estimate of oil-spill trajectories. In addition, this information is useful for validating ice models.

Total Cost: \$462,000 plus Joint Funding

Period of Performance: FY 2009-2012

Conducting Organization: CMI, UAF

BOEMRE Contact: [Chief, Alaska Environmental Studies Section](#)

Description:

Background: Polynyas in the Chukchi Sea reoccur every year to the west of Barrow. The size, frequency, and latitudinal extent of these polynyas are poorly defined south of Icy Cape along the U.S. eastern Chukchi coast and along the Russian Chukchi coast. A recently completed OCS study by Eicken et al. (MMS 2005-068) mapped and quantified the spatial and temporal extent of landfast ice and leads, including Polynyas along the Beaufort Sea coast and a portion of the Chukchi coast utilizing high resolution satellite imagery. Data from this completed study was incorporated into the BOEMRE Oil-Spill-Risk Analysis (OSRA), and in our EIS for the Beaufort Sea. In the study, polynyas along a small northeast segment of the Chukchi Sea coast and lease area were mapped, but areas to the south of Icy Cape, consisting of most of the Chukchi lease sale area were not. This new study effort will quantify the spatial and temporal extent of the leads, polynyas and landfast ice, including any recent changes in their extent south of Icy Cape, and update the information from the previous study effort for the Chukchi Sea and the Beaufort Sea.

It is also important to obtain better information on how polynyas and the mobile ice pack interact because this interaction is the key to how much spilled oil gets encapsulated in pack ice and impacts biota associated with these systems. Bowhead whales migrate to Barrow along these leads and head eastward toward the Canadian Beaufort in the spring. Polar bears are also found along these leads during the winter months. The leads are also heavily used by spring migrating waterfowl.

Objectives:

- Document spatial and temporal extent of recurring polynyas and leads to the west and south of Icy Cape, and their extent across the Chukchi Sea.
- Document temporal and spatial occurrence of shoreward landfast ice line across the Alaskan and Russian and Chukchi Sea.
- Update the spatial and temporal extent of the landfast ice and leads for the Beaufort and Chukchi seas based upon the previous work done for OCS Study MMS 2005-068.
- Examine the effect of Climate State on polynya and landfast ice characteristics.
- Provide mean, minimum, and maximum monthly shoreward land fast ice line.
- Provide monthly mean, minimum, and maximum polynya extent along the Chukchi and Beaufort seas coasts. Provide monthly probability lead statistics as gridded data.
- Provide summaries of ice dynamics within the Beaufort and Chukchi seas.
- Develop a web site that documents the studies progress and provides interim products to the study team.
- Conduct a literature search on the impacts of sea ice by Icebreakers
- Develop a comprehensive ArcGIS database and final report

Methods: Collect and analyze current and historical remote-sensing imagery for recurring polynyas and shoreward landfast ice line. Review and synthesize literature and local information sources. Create a Geographic Information System (GIS) database which quantifies the spatial and temporal distribution of spring leads in the Alaskan Chukchi Sea, in addition to updated information for the Beaufort Sea. Provide individual years as well as statistical representation of polynya/lead occurrence and distribution. Create a GIS database and statistical summaries showing the monthly distribution of the shoreward landfast ice line across the Chukchi Sea to the Russian Chukchi Coast at 174 W. Provide individual months per year as well as statistical representation of landfast ice occurrence and distribution. Analyze ice dynamics within the Beaufort and Chukchi seas. Provide relevant attributes to spatial data for use in a GIS. Provide a final report, database, and database documentation. Provide a project team web site.

Revised Date:

August 2010

ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2011

Region: Alaska

Planning Area(s): Chukchi Sea

Title: Surface Current Circulation High Frequency (HF) Radar Mapping in the Chukchi Sea (AK-09-06)

BOEMRE Information Need(s) to be Addressed: The collection of surface current data will be used to validate the BOEMRE ocean circulation model for the Chukchi Sea. These data will support the BOEMRE Oil-Spill-Risk Analysis (OSRA). OSRA is a cornerstone to regional EISs, environmental assessments (EAs), and oil-spill contingency planning. Information from this study will be used in NEPA analysis and documentation for Chukchi, DPPs, and oil-spill contingency plans.

Total Cost: \$994,000 plus Joint Funding

Period of Performance: FY 2009-2013

Conducting Organization: UAF

BOEMRE Contact: [Chief, Alaska Environmental Studies Section](#)

Description:

Background: Ocean currents play a critical role in the transport and fate of spilled oil, but there is lack of direct circulation measurements for the Chukchi Sea either within the open leads, during breakup and ice melt-out, or during the open water season. Presently, ocean circulation and oil-spill trajectory models do not capture the nearshore surface current circulation fields or the finer scale circulation patterns that are an important consideration for the Chukchi Sea. Surface circulation currents captured by HF radar would be extremely important in the validation of a Chukchi ocean circulation model.

The University of Alaska-Fairbanks, under contract to MMS successfully collected surface current measurements within the central Beaufort Sea Outer Continental Shelf out to 70 km, covering an area over 2500 km². These measurements were collected during break up of the landfast ice zone, under mixed ice and open water conditions, and during the fall freeze-up period. The processed data will be used to validate surface currents generated by the Beaufort Sea ocean circulation model in the near future. This knowledge and experience in the Beaufort Sea will be applied to the Chukchi Sea where surface current information is also needed for model validation and in support of OSRA.

Ocean current circulation fields will be collected and analyzed within the northeastern Alaskan Chukchi Sea through the deployment of coastal HF radar systems and offshore bottom mounted Acoustic Doppler Current Profilers (ADCPs). These instruments shall capture the changes in surface and subsurface currents. Surface current fields will be collected on an hourly basis out to 180 km from shore from three coastal locations proposed for Barrow, Wainwright, and Point Lay. Automated Underwater Vehicles (AUV) shall be

deployed to measure the changes in water stratification. Data collection will continue throughout the open water season, approximately July through mid November. The Principle Investigator will work with industry and government agencies in a collaborative effort to deploy, maintain, and to collect data from these instruments.

Objectives:

- The deployment of HF radar instruments along the Chukchi Sea coast for the purpose of collecting high resolution surface currents within a portion of the proposed OCS Chukchi lease sale boundary from July through October for four field seasons.
- Collection of surface currents within the opening lead systems during the early summer months, during the open water season, and during the fall freeze up period.
- Provide hourly data measurements in near real time over the internet.
- Analyze surface current data against existing temperature and salinity measurements, sub-surface currents from existing ADCPs, surface drifters, wind data from coastal meteorological stations, and varying ice conditions from satellite imagery.
- For a specific period of time, combine surface current fields from HF radar with QuikSCAT currents to produce a best case current field for the entire Chukchi lease area.
- Provide an annual reports, final report, and spatial database.

Methods: This study will: 1) field test potential locations to deploy long range HF Doppler radar systems along the Chukchi Sea coast beginning near Barrow and extending down the Chukchi coast to Point Lay; 2) work with Alaska Native groups and scientific organizations on the North Slope and along the Chukchi coast to enhance their participation in the project; 3) collect surface current measurements on an hourly basis between the months of July and November for three to four field seasons in near real time and distribute over the Internet; 4) collaborate with other agencies and industry to obtain needed data on subsurface currents and surface current parameters; 5) deploy ADCPs to measure subsurface currents, changes in bottom temperature and salinity; 6) deploy AUVs to measure the changes in water stratification; 7) analyze the changes and connectivity between the surface current and subsurface current circulation fields for the northeast Chukchi Sea; 8) compare changes in surface and subsurface currents to the changes in measured wind fields; 9) provide surface and subsurface current flow fields to modeling group for model validation; 10) provide final report of results.

Revised Date: August 2010

ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2011

Region: Alaska

Planning Area(s): Beaufort Sea, Chukchi Sea, North Aleutian Basin

Title: Evaluation of the Use of Hindcast Model Data for OSRA in a Period of Rapidly Changing Conditions (AK-10-07)

BOEMRE Information Need(s) to be Addressed: The BOEMRE uses surface current data derived from ocean circulation hindcast models for oil-spill trajectory analysis. Not only is much of the surface current data outdated, but BOEMRE needs to consider effects due to climate change and assess whether hindcast data remain satisfactory for the purposes of OSRA.

Total Cost: \$124,924

Period of Performance: FY 2010-2012

Conducting Organization: SAIC

BOEMRE Contact: [Chief, Alaska Environmental Studies Section](#)

Description:

Background: The pace at which conditions are changing and sea ice is being lost in the Arctic raises several questions, including: How might the ocean circulation be changing? Do the hindcasts continue to adequately represent current patterns in the region? Does BOEMRE need to incorporate a 20-40 year forecast-modeling mode? 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. Most datasets of modeled surface currents now used in OSRA are more than 10 years old—pre-dating the period of most rapid change.

Objectives:

- Describe the impacts that climate change is having on surface circulation in the Arctic Ocean.
- Evaluate whether the hindcast data that is currently used for OSRA adequately represents the surface currents in the region.
- Evaluate averaging methods used for ensemble forecasting.

Methods: Hold a workshop that includes experts in the fields of ocean circulation, meteorological and climate modeling. Possible topics of discussion include: trends evident in available long-term ocean datasets that can be linked to the effects of climate change; comparisons of hindcast/forecast results from various ocean models including those used in ongoing studies co-funded by MMS/BOEMRE (i.e., Parallel Ocean Program [POP], Regional Ocean Modeling System [ROMS]); challenges associated with ensemble forecasting.

Revised Date: August 2010

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ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2011

Region: Alaska

Planning Area(s): Beaufort Sea, Chukchi Sea

Title: Adaptation of Arctic Circulation Model (NT-08-02)

BOEMRE Information Need(s) to be Addressed: Oil spill trajectory analysis for impact assessment is needed for the Beaufort and Chukchi Planning Areas. Oil Spill Risk Analysis (OSRA) is a cornerstone foundation for evaluating alternatives in OCS oil and gas leasing EIS preparation and for evaluating mitigation, such as oil spill contingency plans. Development and application of state-of-the-art circulation models are essential to future OSRA-based EIS analyses.

Total Cost: \$350,000

Period of Performance: FY 2011-2012

Conducting Organization: Rutgers University

BOEMRE Contact: [Chief, Alaska Environmental Studies Section](#)

Description:

Background: BOEMRE proposes to lease within the Beaufort and Chukchi Sea Planning Areas. To maintain its state-of-the-art in oil-spill-risk analysis, BOEMRE seeks to take advantage through time of the increasing skill of circulation models supported by more and better data. MMS partnered with NOPP in 2007 to produce a high-resolution circulation model covering Arctic OCS waters. The study produced an eddy resolving coupled sea ice/ocean model of the Beaufort and Chukchi Seas. With some additional adaptation, this modeling or any other coupled ice/ocean model can be modified and expanded to capture provide multi-year circulation, ice, and forcing fields for use in BOEMRE NEPA oil-spill-risk analysis and post-sale oil spill response planning.

Objectives: Adapt and maximize the utility of an existing, coupled ice-ocean circulation model to represent the physical processes, especially circulation, within the Chukchi and Beaufort Sea Planning Areas. Provide BOEMRE with ten-to-twenty years of relevant modeled field, such as gridded wind, surface water, and ice velocity, ice cover; and limited other modeled fields as agreed on between contractor and BOEMRE.

Methods: A coupled ice/ocean model will be modified to maximize utility in the Chukchi and Beaufort seas and to capture the agreed upon model fields. Three-hour gridded velocity fields (wind, surface water, ice) and ice cover will be provided to BOEMRE in agreed format for a ten-to-twenty year hindcast simulation. Sensitivity testing and validation of the model and results will be conducted. BOEMRE anticipates providing HF-radar results for Beaufort and Chukchi coasts to aid in validation. Documentation would be through the model manual, final report, and submittal of a peer-reviewed journal article.

Revised Date: August 2010

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ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2011

Region: Alaska

Planning Area(s): Beaufort Sea

Title: Idealized Process Model Studies of Circulation in the Landfast Ice Zone of the Alaskan Beaufort Sea (AK-93-48-65)

BOEMRE Information Need(s) to be Addressed: This study responds to a weakness in our understanding of first order physics of circulation along the landfast ice edge that was identified in the MMS Beaufort Sea Physical Oceanography Workshop and in prior MMS under-ice, nearshore current measurements. The information gained will improve our circulation and oil-spill trajectory models used in pre-lease Beaufort Sea environmental assessments and post-lease evaluation of oil-spill contingency plans.

Total Cost: \$77,171 plus Joint Funding

Period of Performance: FY 2006-2011

Conducting Organization: CMI, UAF

BOEMRE Contact: [Chief, Alaska Environmental Studies Section](#)

Description:

Background: Winds and river runoff influence the dynamics and circulation pathways over the innermost portion (water depths $\sim < 20$ m) of most continental shelves. While this is true for Arctic shelves as well, the effects of wind stress and buoyancy are substantially modulated by the annual freeze/thaw cycle, which controls the phasing and duration of the landfast ice season and river discharge. Because much of our understanding of shelf dynamics derives from studies on ice-free shelves, it is not clear how well these lessons apply to Arctic shelves, particularly regions influenced by landfast ice.

Landfast ice, which covers the innermost Alaskan Beaufort shelf from October to June, is anchored at the coast along the 2 m isobath and extends offshore to the 20-40 m isobath, covering 25% of the total shelf area. In the absence of landfast ice, currents are swift (20-100 cm/s) and both currents and sea level are coherent with one another and with the local winds. When landfast ice is present, recent MMS studies have shown that the under-ice currents are weak (< 5 cm/sec), variable, and uncorrelated with winds and sea level. Thus landfast ice (but not moving pack ice) inhibits momentum transfer from wind to water. This presumably results in an abrupt transition in surface stress at the transition between landfast and pack ice. Although there are no observations of this transition region, the physics should force an along-shore ice edge jet and a cross-shelf circulation cell. The direction of the ice edge jet, east or west along the Beaufort coast would depend on the water depth at the landfast ice edge.

Objectives: The overall goal of this study is to better understand the physical processes controlling circulation in the landfast ice zone of arctic shelves when forced by winds and buoyancy and subjected to various parameterizations of ice-water stress.

Methods: This is a modeling study. Using the Regional Ocean Model System, the under-ice circulation responses to the following forcing will be determined: 1) along- and cross-shelf wind stress patterns offshore of the landfast ice zone, 2) along-shore flows imposed at the eastern or western edges of the modeling domain, 3) river inflow introduced at the coastal boundary without ambient stratification, and 4) river inflow introduced at the coastal boundary with ambient stratification.

The responses to the forcings above will be examined subject to the following landfast ice-water stress scenarios: 1) no stress, 2) spatially constant stress, 3) stress that increases linearly in the offshore direction out to the landfast ice edge, and 4) spatially random stress.

Revised Date: August 2010

ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2011

Region: Alaska

Planning Area(s): Chukchi Sea

Title: Chukchi Sea Offshore Monitoring in Drilling Area (COMIDA):
Chemistry and Benthos (CAB) (AK-08-03)

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 scheduled for 2008. Industry has expressed strong interest in leasing in this area, likely followed by exploration and possibly development. 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.

Total Cost: \$2,560,000

Period of Performance: FY 2008-2012

Conducting Organization: University of Texas at Austin

BOEMRE Contact: [Chief, Alaska Environmental Studies Section](#)

Description:

Background: The November 2006 COMIDA workshop described the importance of benthos and chemical monitoring to evaluate the health of the Chukchi ecosystem. The MMS/BOEMRE Scientific Committee (SC) recommended an adaptive initial two year sampling program that closely coordinated separate chemical and benthos monitoring efforts. This document combines those two efforts.

Benthic biological monitoring needs to be initiated in order to establish a current benthic community baseline prior to new oil and gas exploration activities. Our knowledge of the benthic fauna along the Chukchi shelf is largely based on MMS/Outer Continental Shelf Environmental Assessment Program (OCSEAP) surveys between the 1970s and early 1990s. A review of this information revealed “hot spots” of high and highly variable benthic biomass in several regions of the Chukchi Sea. The high abundance of bottom fauna was correlated with high pelagic primary production, possibly associated with the ice-edge and most of which reached the seabed ungrazed. With the retreat of the summer ice-edge to deeper, more northern waters in recent years, this pelagic/benthic coupling may be weakening. Recent changes in seabird and marine mammal distributions described in the COMIDA workshop may reflect undocumented changes in benthic hot spots in the Chukchi Sea as well as greater retreat of the ice pack.

Among the primary concerns about offshore oil and gas are anthropogenic inputs of metals and hydrocarbons. Earlier MMS/OCSEAP-sponsored monitoring design workshops for the Beaufort Sea and Bering Sea recommended that MMS (now BOEMRE) develop multiyear contaminant baselines prior to offshore development. The Oceanography/Fate and Effects

working group of the COMIDA Workshop considered multi-year monitoring of sediment metals, hydrocarbons, and other anthropogenic compounds to be a priority.

Objectives:

- Establish baseline for benthic biomass, species composition, and oil industry anthropogenic chemicals to detect changes as the result of future oil and gas activities.
- Initiate past and future time trend analyses for benthic populations and anthropogenic chemicals
- Distinguish among changes due to development, climate, and food web structure
- Identify natural or other anthropogenic sources of contaminants to the study area.
- Initiate and develop a conceptual food web related to bioaccumulation and risk of trophic transfer of oil industry anthropogenic chemicals.

Methods: BOEMRE anticipates substantial collaboration and coordination of CAB with other Chukchi Sea Offshore Monitoring in Drilling Area (COMIDA) projects: Distribution and Relative Abundance of Marine Mammals: Aerial Surveys and Impact Monitoring of Offshore Subsistence Hunting. CAB will collaborate directly with the Alaska Monitoring and Assessment Program (AKMAP) and more site-specific oil industry studies. We are sharing logistical platforms and samples.

For anthropogenic chemicals, the 2-year sampling strategy collects surface sediments for the determination of standard sediment hydrocarbon parameters such as polycyclic aromatic hydrocarbon (PAH), relevant metals, including the Environmental Protection Agency (EPA) priority metals [total iron (Fe), manganese (Mn), aluminum (Al), barium (Ba), chromium (Cr), vanadium (V), lead (Pb), copper (Cu), cadmium (Cd), nickel (Ni), arsenic (As), silver (Ag), mercury (Hg), selenium (Se), beryllium (Be), thallium (Tl), tin (Sn), antimony (Sb), and zinc (Zn)]; supporting/normalizing parameters such as grain size, organic carbon or organic matter, etc.; and sourcing parameters such as diagnostic hydrocarbon ratios. The biological sampling is combined with the sediment sampling and Contractor-selected other sampling/assays/analyses to complete a sediment triad approach to evaluating effects of ambient anthropogenic chemical levels.

There is a full Quality Assurance/Quality Control (QA/QC) program with inter-laboratory comparisons and reference standards. Normalization techniques developed in BOEMRE Beaufort Sea monitoring will be adopted to minimize sample variability.

Pre-drilling activity baseline sampling was conducted in 2009, emphasizing the area leased by industry in the proposed Chukchi Sea oil and gas lease sale held in February, 2008.

Additional adaptive sampling will occur in 2010, predicated on the findings and success in 2009 and locations of likely oil industry post-sale activities. Dated sediment cores are used to capture interannual variability of anthropogenic chemicals and normalization techniques to minimize effects of sample variability. Sampling design will be adaptive to incorporate locations of concentrated bird and marine mammal feeding and their prey within the COMIDA area. To identify sources of anthropogenic chemicals to the study area, limited sampling will be conducted of sources such as water column, air, drilling mud, river input, seeps, or shoreline erosion.

A conceptual food web model related to bioaccumulation and trophic transfer of potential oil industry contaminants is part of initial study planning based on literature review and data-mining. Water and biota sampling are conducted to better understand pelagic/benthic coupling and other trophic transfer. The food-web model will be risk-based, conceptually considering mechanism, magnitude, and likelihood of contaminant transfer. The model will continue to be developed and updated throughout COMIDA, incorporating COMIDA results and other information, and will also be used as a tool to refine sampling strategy during COMIDA and recommend post-COMIDA monitoring strategy.

Revised Date: August 2010

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ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2011

Region: Alaska

Planning Area(s): Chukchi Sea

Title: Current and Historic Distribution and Ecology of Demersal Fishes in the Chukchi Sea Lease Area (AK-93-48-67)

BOEMRE Information Need(s) to be Addressed: This study will provide information on the past and present fish presence, distribution, and abundance that is needed to evaluate and mitigate the effects of offshore development. The BOEMRE analysts and decision makers will use the information from this study in NEPA analysis and documentation for Lease Sale(s), EPs and DPPs, and in post-sale and post-exploration decision making, mitigation, and monitoring in the Chukchi Sea.

Total Cost: \$342,810 plus Joint Funding

Period of Performance: FY 2007-2011

Conducting Organization: CMI, UAF

BOEMRE Contact: [Chief, Alaska Environmental Studies Section](#)

Description:

Background: After a two-decade hiatus, Offshore Oil and Gas leasing is to commence in the Chukchi Sea. Very little historic fisheries information has been collected in the lease sale area. Like the Bering Sea, the Chukchi Sea has historically been a benthic dominated ecosystem. With arctic climate change, however, the Bering Sea is now shifting from a shallow, ice-dominated system in which bottom-dwelling fishes prevail to one more dominated by pelagic fishes. Further examination of the Chukchi Sea may indicate similar changes.

At present, we can only speculate what may be occurring in the Chukchi Sea, as there is a paucity of information about fishes in this area. The Chukchi Sea is outside the range of the NOAA Alaska Fishery Science Center regular fish trawls surveys, thus information on fishes in the Chukchi is limited to a few historic surveys. Currently the niche of benthic consumers in the Arctic, including the Chukchi Sea, is filled by seabirds and marine mammals. However, with decreasing sea ice in the Chukchi Sea, demersal fishes moving northward from the eastern Bering Sea might usurp the place of birds and mammals as benthic consumers. Without current baseline data, effects of offshore development cannot be separated from recent changes due to other factors.

This project will assemble data into a searchable database and collect additional field data to meet BOEMRE needs.

Objectives: The overall project is to document the abundance and distribution of fishes in the Chukchi Sea. Specific objectives include:

- Collect fishes and document species presence, abundance, distribution, geographic range, species diversity, species assemblages, and habitat parameters.
- Assess physical and oceanographic feature (water mass) characteristics that define demersal fish habitat.
- Assess physical characteristics that define juvenile and adult fish communities and compare among collection periods and with historic collections.
- Correct the identification of historical archived fish specimens for accurate comparison with the proposed collections in the Chukchi Sea Planning Area.
- Synthesize historic distribution patterns of fish species in and near the Chukchi Sea Planning Area, and compare with 2007-2008 collections.
- Incorporate both historic and current scientific fish collection data from the northeast Chukchi Sea into electronic format suitable for incorporation into the BOEMRE database.
- Provide a basis for post-sale monitoring of fishes in the Chukchi Sea.

Methods: Two years of sampling during July 2007 and 2008 will provide new collections of fish specimens and habitat data in the northeastern Chukchi Sea aboard the *Oshoro-Maru*. Additionally, relevant historic collections of fish specimens will be evaluated for species correctness. These two sets of data (both current and historic) will be summarized by the habitat types occupied by species in the Chukchi Sea Planning Area. A relational data base will be provided to BOEMRE that will contain data on species presence and abundance from both past and present collections. This will expand the current BOEMRE fish database and be suitable for GIS.

Revised Date: August 2010

ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2011

Region: Alaska

Planning Area(s): Beaufort Sea

Title: Testing Molecular and Otolith Tools to Investigate Population-of-Origin and Migration in Arctic Cisco Found in the Colville River, Alaska (AK-06-08)

BOEMRE Information Need(s) to be Addressed: Arctic cisco is an important subsistence resource for the village of Nuisquit. Subsistence users have expressed concern over declines in harvests and size of arctic cisco from the Colville River. A workshop hosted by MMS in Nuisquit in 2003 identified a high priority list of issues concerning genetic stock identification based on population-of-origin, life history and recruitment variation over time, and changes in migration and diet of arctic cisco. This pilot project will test two scientific tools, molecular genetics and otolith microchemistry to address local subsistence harvest concerns in an area for offshore oil and gas development.

Total Cost: \$490,000 plus Joint Funding

Period of Performance: FY 2006–2012

Conducting Organization: USGS-BRD

BOEMRE Contact: [Chief, Alaska Environmental Studies Section](#)

Description:

Background: The lowest harvest rates ever occurred in the critical subsistence resource, Colville River arctic cisco, raised urgent concerns about the possible effects of offshore oil and gas development in the early 2000s. A 2003 Arctic Cisco Workshop conducted in Nuiqsut with both scientific and local arctic cisco experts identified the highest priority information needs with regard to the Colville River arctic cisco subsistence population. Identification of the source populations of arctic cisco recruits and their movement along the North Slope is a question of considerable importance to the native people in this area, and their subsistence harvest. The recent declines in the number and size of fish in the subsistence harvest have made this question a high priority for BOEMRE in our responsibility to manage offshore development of oil and gas in the Beaufort Sea Planning area. This study will help assess the level of vulnerability of the Colville River arctic cisco by establishing the level of genetic and geographic isolation of the spawning stock. The study will also test the ability of recent innovations in otolith (fish ‘ear bone’) microchemistry technology to answer the above question. The otolith microchemistry will also be tested to assess whether it can test another hypothesis of local residents, that fish have grown thinner over recent years and ascertain whether the amount of growth during the larval phase migration of young of the year (from the Mackenzie River in Canada to the Colville River) has changed.

Objectives:

- Test genetic diversity of molecular loci developed from other species in DNA amplifications from Colville River arctic cisco.
- Develop new microsatellite markers directly from arctic cisco DNA.
- Examine the rigor and applicability of microsatellite loci developed from Colville arctic cisco in comparison with molecular markers from the current literature.
- Assess the usefulness and rigor of selected nuclear microsatellite and mitochondrial DNA loci to assess population structure in Colville River arctic cisco.
- Test genetic differentiation among samples based on molecular genotypes of samples of arctic cisco from the 2005 harvest
- Establish the best suite of molecular markers to address the putative stream of origin for arctic cisco in the Colville River.
- Develop a protocol to compare length at age of arctic cisco captured in the Colville River so that age and growth histories can be compared.
- Using otolith strontium to calcium ratios (Sr:Ca) to ascertain whether the chronology of migrations between freshwater, brackish water and saltwater environments can be documented in arctic cisco.
- Describe the variability of multi-elemental signatures of otoliths to assess the feasibility of these methods to identify the tributary of origin.

Methods: Arctic cisco sampling collections will include the Colville River, Alaska in 2005 and 2006; the Arctic Red River, Canada in 2007; and the Peel River, Canada in 2007. Genomic DNA is extracted from fin, gill or muscle tissue from the sample areas. These samples will be tested and analyzed for nuclear microsatellite DNA markers, mitochondrial DNA, and otolith microchemistry. Highly polymorphic microsatellite molecular markers will be produced from a Colville River arctic cisco DNA library for populations scale analysis. Otoliths will be tested for the range and rigor available from micro chemical analyses to address migration patterns to and from freshwater habitats.

Revised Date: August 2010

ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2011

Region: Alaska

Planning Area(s): Beaufort Sea, Chukchi Sea

Title: Arctic Fish Ecology Catalogue (AK-07-05)

BOEMRE Information Need(s) to be Addressed: BOEMRE needs organized fish ecology and behavioral information for NEPA analysis of fisheries resources, including Essential Fish Habitat and rare species. Study products will be used in post-sale NEPA analysis, review of EPs, DPPs and other reviews for post-sale and post-exploration BOEMRE decision making and mitigation. Also, study results will be used in similar pre-lease analyses and documentation for potential future Chukchi Sea Lease Sale(s).

Total Cost: \$475,000 plus Joint Funding

Period of Performance: FY 2008-2011

Conducting Organization: USGS

BOEMRE Contact: [Chief, Alaska Environmental Studies Section](#)

Description:

Background: A comprehensive synthesis of ecological and behavioral information concerning arctic fishes of Alaska is important to BOEMRE fisheries scientists investigating arctic fish resources. The MMS co-funded the most recent reference on Alaskan fishes. However, the latter is primarily a taxonomic key to Alaska fish species with summary distribution maps. A companion volume describing the ecology and behavior of important fish species has yet to be funded. Limited sub-arctic commercial and forage fish data are available in gray literature, e.g., the NMFS groundfish assessment documents for Gulf of Alaska, the Bering Sea and Aleutian Islands. Arctic fish ecological and behavioral information has not been synthesized; it is only available piecemeal from a wide range of peer-reviewed and gray literature.

Objectives:

- Synthesize ecological and behavioral information into species by species accounts Arctic Alaska fish, including future information needs, for use by BOEMRE NEPA analysts
- Synthesize reviews of present knowledge of general arctic fish ecology topics.

Methods: This study will 1) Develop review of the knowledge of each fish species that may occur or expand into Arctic Alaska waters; 2) include freshwater, diadromous, and marine fish species occurring in the Beaufort and Chukchi seas and possibly adjacent Arctic waters (eastern Russia and western Canada); 3) synthesize ecological and behavioral information into a desk reference catalogue for use by BOEMRE NEPA analysts.

The first portion of the catalogue will include species-specific accounts 1-3 pages in length per species. Pertinent information for each species will include: species binomen; synonymy; common names; illustration; field marks; diagnostic features; geographical distribution (including GIS maps of documented occurrences and habitat areas by life history stage); biology (e.g. reproductive biology); behavior, ecology, and habitat (e.g. life history strategy, habitat types and areas, migration); size; interest to fisheries; literature; and remarks. Data deficiencies and areas for future research for each species will be identified.

The second portion of the catalogue will include articles synthesizing ecological and behavioral information by topic. Broad topics will include, but are not limited to: environmental and organism constraints, foraging and feeding ecology, bioenergetics, use of time and space, growth, reproduction, predation and parasitism, competition and mutualism, dynamics of population abundance and production, life history strategies, fish assemblages, information needs and areas for future research.

The study will publish as a desk reference available to fisheries scientists and the greater public to use in research and education.

Revised Date: August 2010

ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2011

Region: Alaska

Planning Area(s): Beaufort Sea

Title: Beaufort Sea Marine Fish Monitoring Survey in the Central Beaufort Sea (AK-10-06)

BOEMRE Information Need(s) to be Addressed: Fish resources are important to upper trophic levels in the Beaufort Sea ecosystem and to the coastal communities. NEPA analysts need additional species presence and abundance information for assessing potential impacts of offshore development activities. Study information will be used in NEPA analyses and documentation for Beaufort Sea Lease Sales, EPs, and DPPs in 2011 and beyond.

Total Cost: \$1,764,000 plus Joint Funding **Period of Performance:** FY 2010–2013

Conducting Organization: NMFS

BOEMRE Contact: [Chief, Alaska Environmental Studies Section](#)

Description:

Background: Enhanced marine fish information is needed for Beaufort Sea NEPA analyses. Data at the most basic level—e.g., fish species presence/absence and distribution data—are not only spotty, but also outdated. Fish assemblages and populations in other marine ecosystems off Alaska have undergone observable regime-shifts in diversity and abundance over the last 20-30 years. While the same is likely true of the Beaufort Sea, it is unconfirmed because the scant distribution and abundance data available are pre-regime-shift.

Furthermore, important marine mating, spawning, rearing, feeding, and migration habitats (pre or post regime-shift) is yet to be delineated. A baseline of fish species, distribution, relative abundance, and the locations of critical or sensitive life history stage habitats in this central lease area remains a very high-priority information need for NEPA analyses. The original central Beaufort target area remains the region of most intense industry interest and thus the region of greatest BOEMRE information need.

An under-ice pilot survey is included because the Beaufort Sea lease area is under ice for half to three-fourths of the year. Thus, it is important that BOEMRE obtain a more complete data set that encompasses the under-ice season. The addition of the under-ice pilot survey study will provide a more complete methodology and a baseline data set that encompasses all seasons in the Beaufort Sea, including ice-covered seasons. Such a data set will allow BOEMRE to support environmentally sound offshore oil and gas exploration and development decisions.

The addition of bird and marine mammal observers and zooplankton sampling will provide transect data in offshore areas where data for those species is as sparse as for fish species.

The contemporaneous collection will also enable first-time correlations between fish, zooplankton, birds and marine mammal species in this area.

Objectives:

- Identify the fish species that occupy the central OCS Beaufort Sea lease area.
- Develop and recommend a methodology adapted to arctic conditions and specific BOEMRE information needs in the Beaufort Sea for use in future surveys.
- Identify the fish species that occupy the central lease area during the ice-covered season.
- Correlate observation of seabirds and marine mammals to fish and zooplankton for increased understanding of this arctic ecological system.

Methods: The survey will sample fish and zooplankton in the central Beaufort between 147° and 152° west longitude, where BOEMRE information needs are greatest. Due to logistical conflicts encountered in 2008, it will incorporate new strategies for timing surveys to avoid interference from industry seismic exploration. It will also assess additional options to effectively sample bottom habitats. Addition of bird and marine mammal observers will provide transect data to those specialties and allow correlations between fish, zooplankton, birds, and marine mammals.

A pilot under-ice marine survey will implement a design outlined in the 2007 MMS “Under-Ice Sampling Workshop.” The survey will occur in three stages: 1) assemble local and traditional knowledge with Inupiat residents; 2) under-ice sampling by local residents and time lapse under-ice cameras, 3) test survey of three different and difficult-to-sample Arctic cod habitats at the ice-water interface with DIDSON sonar (dual frequency identification sonar), remotely operated vehicles (ROVs), and shallow-water scuba transects. The pilot study will provide statistical hypothesis testing between the open water, ROV and dive surveys, which will provide a baseline for subsequent surveys and provide sampling statistics, including variance estimators, for future time-series analyses.

The final products will include Geographic Information Systems (GIS) and report formats. Intermediate results will be provided for NEPA analyses.

Revised Date: August 2010

ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2011

Region: Alaska

Planning Area(s): Beaufort Sea, Chukchi Sea

Title: Joint Funding Opportunities in Existing Marine Fish Studies
(AK-10-09)

BOEMRE Information Need(s) to be Addressed: Data on the distribution, abundance and feeding ecology of fish in the offshore environment is valuable for understanding key ecological transfer events that cascade to higher trophic level predators. This information is valuable for assessing oil-spill risks. Data on fish will be useful in Essential Fish Habitat and NEPA analysis in terms of fish themselves and as prey items for marine birds and mammals. Information resulting from fish surveys will be useful for developing mitigation measures to reduce potential impacts to upper trophic level birds, fish, and marine mammals from proposed oil and gas exploration and development activities.

Total Cost: \$88,000

Period of Performance: FY 2010–2012

Conducting Organization: Various TBD, including UAF

BOEMRE Contact: [Chief, Alaska Environmental Studies Section](#)

Description:

Background: More information about fishes in the Chukchi and Beaufort seas is needed because marine fish 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. The Chukchi and Beaufort seas are outside the range of the NOAA Alaska Fishery Science Center regular fish trawl surveys, subsistence and commercial fisheries are presently limited to very near shore (within 3 *nmi*), and the logistical effort and cost of offshore fishery investigations can be prohibitive. Often there are existing research venues that collect important fish data and specimens. To address this information need for arctic fishes, this project will build off other recently established (and ongoing) at-sea survey programs that will collect distribution data on key fish species (demersal and pelagic) via partnership and collaboration among the NOAA-Fisheries, the Alaska Monitoring and Assessment Program (AKMAP) from the Alaska Department of Environmental Conservation (ADEC), U.S. Coast Guard (USCG), the Russian-American Long-term Census of the Arctic (RUSALCA), and other vessel-based programs both inshore and offshore of lease areas.

Additional baseline data for fish species in the Chukchi and Beaufort seas will help explain effects of climate change. Such information will help to distinguish between anthropogenic and natural effects of change without a basis of comparison. Thus it is important to assess the distribution and abundance of fishes in the Chukchi Sea prior to oil exploration, and oil extraction in the Beaufort. Current research focuses on current and historic distribution and ecology of demersal fishes in the Chukchi Sea Lease Area for small bottom fishes. Those

collections enhance the NOAA-funded joint US-Russian RUSALCA program that collects fishes further north, south, and west. However, sampling of fishes in Lease Sale 193, especially in the vicinity of the leases, is lacking. Additionally opportunistic sampling within the Beaufort Sea areas is also needed. There remains a paucity of data for demersal fishes in these areas and information for pelagic fishes is lacking entirely. Filling these needs will be valuable for addressing impacts from oil and gas exploration.

Objectives:

- Estimate the spatial distribution, species composition and feeding ecology for fish species in designated and potential planning areas.
- Process the data (GIS based maps and attribute tables) for entry into BOEMRE Fish database for future accessibility and to facilitate new information for Oil-Spill-Risk Analysis and Essential Fish Habitat designations
- Preserve specimens for further study and for Alaska Museum voucher specimens.
- Identify high priority locations for mitigation or deferral areas under consideration in environmental assessments.

Methods: Fish samples, as well as abundance and distribution data, will be collected on ships of opportunity, primarily via partnership and collaboration among the NOAA-Fisheries, AKMAP, USCG, RUSALCA, and other vessel-based programs both inshore and offshore of lease areas. If permitted scientific personnel may be deployed to assist in sample collection.

Revised Date: August 2010

ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2011

Region: Alaska

Planning Area(s): All Planning Areas

Title: Seabird Distribution and Abundance in the Offshore Environment (AK-10-10)

BOEMRE Information Need(s) to be Addressed: More information on the distribution and timing of use by marine birds, including listed and candidate species under the ESA (Spectacled Eider, Steller's Eider, Short-Tailed Albatross, Kittlitz's Murrelet) is necessary to assess potential impacts of oil and gas exploration and development in the Chukchi Sea and North Aleutian Basin (NAB) Planning Areas. Data on the distribution of marine birds is needed for ESA Section 7 consultations and NEPA analyses, DPPs and other documentation. The information obtained from these surveys may assist in development of mitigation measures and strategies to reduce potential impacts.

Total Cost: \$100,000

Period of Performance: FY 2010–2013

Conducting Organization: USFWS

BOEMRE Contact: [Chief, Alaska Environmental Studies Section](#)

Description:

Background: Basic information on timing and duration of use within designated (Chukchi Sea) and potential Beaufort Planning Areas is necessary to better define the impacts of perturbations and ultimately population effects. Breeding seabirds are generally monitored at colonies, yet they spend most of the year dispersed offshore. Additionally, one half or more of all seabirds do not breed in a given year, thus management of marine birds requires knowledge of spatial and temporal patterns of seabird distribution at sea. The North Pacific Pelagic Seabird Database (NPPSD) is used to consolidate marine bird survey data, but most of these data were collected in the 1970s-80s. Since then, many seabird species have declined and changes have occurred in ocean ecosystems. These changes may have affected the foraging patterns of seabirds. Further changes due to predicted Arctic climate change are anticipated. To address these needs, this project will build off of a recently established at-sea survey program, to collect distribution data on seabirds via partnership and collaboration among the USFWS, NOAA-Fisheries and other vessel-based programs.

Species composition of marine birds varies tremendously by season. For example, in the Bering Sea, shearwaters (*Puffinus* spp.) are the dominant species in summer and fall, accounting for 40-60 % of total marine bird density (birds/km²). When shearwaters return to their southern breeding grounds in winter and spring, seaducks (*Anatidae* spp.) and Murres (*Uria* spp.) dominate. These species groups have very different dispersal patterns and foraging behaviors, thus seasonal changes should be integrated into management schemes. Furthermore, there is little information on seabird distribution during the migration and winter

phases, and filling these information needs will be valuable for mitigating impacts from oil and gas exploration.

The results of this study will complement recent and on-going surveys of marine birds which are partially funded by the North Pacific Research Board (NPRB) and the USFWS. In 2006-2007, NPRB project placed 637 seabird observers on NOAA and NSF-funded vessel-based projects. During those two years, USFWS seabird observers joined 27 cruises and surveyed in excess of 42,000 km. Data on more than 547,000 birds were added to the NPPSD.

However, only two of those cruises covered waters in the Chukchi or NAB areas. The at-sea survey program recently received additional funding from NPRB for 2008-2011, as part of the Bering Sea Ecosystem Integrated Research Program. Again, the funded surveys do not adequately provide coverage of the Chukchi or Beaufort areas. With minimal additional funding, the USFWS at-sea survey program could expand to other research cruises that will provide coverage of the lease sale areas. In combination, these surveys will provide a more complete and current data set on marine bird use of the region.

Objectives:

- Estimate the spatial distribution, species composition and seasonal changes in species and abundance for marine birds in designated and potential planning areas.
- Process the data for entry into the North Pacific Pelagic Seabird Database for future accessibility and facilitate management decisions for marine bird use of planning areas.

Methods: Seabird observers will be placed on ships of opportunity, primarily NOAA and NSF-funded research vessels. Based on on-going NOAA and NSF programs, we anticipate availability of at least two additional cruises per year in the Chukchi and Beaufort planning areas or within the Bering Sea. Observers use standardized protocols for marine bird surveys and data is entered directly into a laptop computer with a GPS interface. The presence of marine mammals is also recorded, although the seabird protocol differs from those used exclusively for marine mammal surveys. Data will be processed for entry into the NPPSD, providing access to multiple users.

Revised Date: August 2010

ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2011

Region: Alaska

Planning Area(s): Beaufort Sea

Title: Recovery in a High Arctic Kelp Community (AK-08-12-02)

BOEMRE Information Need(s) to be Addressed: Information from this study will be used by Alaska OCS Region staff to acquire a better understanding of how sessile communities recover after disturbances in the Boulder Patch, a high Arctic kelp community. This will be needed in preparing future, Beaufort Sea exploration and development EISs, future developmental EISs, and in reviewing oil-spill-contingency plans for OCS and coastal facilities.

Total Cost: \$123,000 plus Joint Funding

Period of Performance: FY 2008-2012

Conducting Organization: CMI, UAF

BOEMRE Contact: [Chief, Alaska Environmental Studies Section](#)

Description:

Background: The Boulder Patch kelp community in the Prudhoe Bay area of the Beaufort Sea is a sensitive habitat which has the potential of being impacted by oil and gas activities. Some rocks there were cleared in 2002 and have been monitored from 2002 to 2006. Because of the very slow natural recruitment observed then it is necessary to continue this monitoring for another four years to clarify the reasons for this slow recruitment, how the communities naturally recover from disturbances, the initial recruitment, and possibly the natural succession.

Objectives:

- Assess the timing of natural recruitment onto hard substrates.
- Assess the effect of grazers to the timing of recruitment.
- Assess the effect of sedimentation to the timing of recruitment.
- Assess the rate of vegetative re-growth of various sessile organism groups.
- Assess fish occurrence.

Methods: This project will be completed in the Boulder Patch at Dive Site 11 (DS-11) in Stefansson Sound, Alaska. This site has nearly complete rock and kelp cover, is in a water depth of 6-7 m, and is the logical location for this study because this is the location of previous recovery studies in the Boulder Patch. All cleared and uncleared boulders from the 2002 study will be monitored yearly. Two additional new experiments will also be part of this project to assess the effects of sedimentation on recruitment and recovery rates via vegetative re-growth.

Revised Date: August 2010

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ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2011

Region: Alaska

Planning Area(s): North Aleutian Basin, Chukchi Sea

Title: Biogeochemical Assessment of the North Aleutian Basin Ecosystem:
Current Status and Vulnerability to Climate Change (AK-08-12-03)

BOEMRE Information Need(s) to be Addressed: The oil and gas industry has expressed interest in leasing part of the North Aleutian Basin (NAB) to search for and possibly develop oil and gas deposits. This study would provide an assessment of the current status of the ecosystem and its vulnerability to acidification or other aspects of climate change to use in evaluation of potential local and regional impacts from offshore exploration and development activities that may occur in federal waters. The information from this study will be used for NEPA analysis and documentation for the North Aleutian Basin prior to oil and gas exploration and development in that region.

Total Cost: \$557,000 plus Joint Funding

Period of Performance: FY 2008–2012

Conducting Organization: CMI, UAF

BOEMRE Contact: [Chief, Alaska Environmental Studies Section](#)

Description:

Background: This study initially emphasized the North Aleutian Basin in the southeastern Bering Sea, one of the most productive marine ecosystems in the world. The scope of the study has expanded to include measurements in the northern Bering Sea and in the Chukchi Sea. Over the last decade, the character of the ecosystem productivity in the southeastern Bering Sea has undergone dramatic changes due to variability in hydrographic and climate forcings. In recent years, the system has changed from one dominated by cold-water, Arctic species to organisms more indicative of temperate zones with the historically rich fishing areas shifting northward. Available data suggest decreased coupling of benthic and pelagic production. The National Science Foundation's multi-component Bering Sea Ecosystem Study (BEST) is examining these changes and this study is an Alaska Coastal Marine Institute Task Order being conducted in conjunction with BEST and also the Bering Sea Integrated Ecosystem Research Program (BSIERP).

The BEST represents a once-in-a-decade opportunity to measure the rates of ocean acidification in the Bering Sea. Because the surface waters of the Bering Sea are cold and experience intense physical forcing (wind and brine formation), the region is susceptible to increased uptake of carbon dioxide from the atmosphere which will lower the pH of the waters in the region.

Objectives:

- Quantify upper ocean net ecosystem production (NEP) in North Aleutian Basin.
- Assess the fate of NEP in North Aleutian Basin.
- Assess the effect of ocean acidification on the marine environment of the Bering Sea.

Methods: The Task participates in spring and summer BEST cruises and other cruises of opportunity for three years. Dissolved organic and inorganic nutrients and carbon, total alkalinity, particulate organic matter, and pCO₂ measurements are used to calculate net ecosystem production and acidification. The seasonal changes in stocks of inorganic C and N are a measure of NEP. The fraction of NEP accumulating in the dissolved organic matter, suspended particulate matter, and sinking particulate matter pools will be estimated.

Revised Date: August 2010

ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2011

Region: Alaska

Planning Area(s): Chukchi Sea

Title: Trophic Links: Forage Fish, Their Prey, and Ice Seals in the Northeast Chukchi Sea (AK-08-12-05)

BOEMRE Information Need(s) to be Addressed: This study will provide BOEMRE NEPA analysts with sorely needed basic diet information for both fish and seals in the Chukchi Sea. Because of the close association of the three trophic levels, it will greatly increase understanding of the ecological connections between invertebrates, fish, and seals and also provide measures of natural variability across a series of years that include both warm and cold ocean temperatures. This information is needed to meet Essential Fish Habitat and Marine Mammal Protection Act and NEPA requirements in the EISs for the 2010 and 2012 Chukchi Lease Sales.

Total Cost: \$532,000 plus Joint Funding

Period of Performance: FY 2009-2013

Conducting Organization: CMI, UAF

BOEMRE Contact: [Chief, Alaska Environmental Studies Section](#)

Description:

Background: In preparation for oil and gas exploration and the impending Lease Sale 193, BOEMRE Alaska OCS Region conducted a Chukchi Offshore Monitoring in Drilling Area (COMIDA) workshop in November 2006. That workshop identified a clear need for knowledge about distribution and abundance of forage fish prey resources for marine mammals in the Chukchi Sea. Not only is there a pressing need for knowledge about fishes in the Chukchi Sea, but it is also essential to evaluate those fishes as prey resources for marine mammals. An additional factor that is making the requirement for information in the Chukchi Sea imperative is the potential listing of three species of ice seals under the Endangered Species Act. The decision to list is still pending for ringed seals (*Phoca hispida*), bearded seals (*Erignathus barbatus*), and spotted seals (*Phoca largha*). The petition for listing prepared by the Center for Biological Diversity states that global warming is threatening ice seals with extinction due to loss of sea ice habitat as argued for the recently-listed polar bears. An additional ice seal species, the ribbon seal (*Phoca fasciata*), was also proposed for listing, but NOAA decided not to list the ribbon seal at this time.

Oil exploration is likely to take place in the northeast Chukchi Sea simultaneously with ever-increasing rates of global warming. It will not be possible to discern the cause or extent of effects on this Arctic ecosystem without first determining its current status. There is a paucity of data and limited ecological understanding for pelagic and demersal fishes in Lease Sale areas. The rapidly receding sea ice in the Arctic has received much attention recently and record minima were recorded in both 2007 and 2008. The loss of habitat for ice seals has

resulted in three species being considered for listing under the Endanger Species Act. Dietary differences among forage fishes in the Lease Sale area may propagate into higher trophic levels such as ice seals. Thus, it is essential to evaluate fishes as prey resources, or “forage,” for marine mammals. The study design aligns fish, prey and seals sampled in the Chukchi Sea, not only across both diet and isotopic signals, but also matched over three recent and consecutive years to provide an essential measure of interannual variability. The proposed study will produce a more comprehensive picture of forage fishes in the Chukchi Sea and then trophically relate fishes and their prey to ice seals and their diets in the Chukchi Sea to provide an essential new understanding of the ecosystem. The resulting increase in basic knowledge of the Chukchi Sea ecosystem will facilitate good stewardship by the oil and gas industry.

Objectives:

- Assess the diet composition of forage fishes;
- Establish trophic level of forage fish species and of their prey;
- Analyze interannual differences in diet of fishes and in the trophic level of fishes and their prey;
- Document the trophic level of ice seals;
- Document ice seal trophic history;
- Develop isotopic mixing models;
- Compare trophic levels of forage fishes to those of ice seals;
- Provide diet and trophic level data to BOEMRE in electronic format;
- Complete data archiving with NODC and make available to BOEMRE in a GIS compatible format.

Methods: This study will: 1) conduct interannual diet and trophic analyses using fishes caught during 2007, 2008 and 2009; 2) analyze fish muscle for the effect of lipid-removal on stable carbon and nitrogen ratios; 3) assess the relative importance of functional groups of prey taxa in the diet of each fish species; 4) perform stable isotope analysis to assess the trophic level of the fish species that are consumed by ice seals.

Revised Date: August 2010

ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2011

Region: Alaska

Planning Area(s): Beaufort Sea, Chukchi Sea

Title: Population Connectivity and Larval Dispersal in Bering, Chukchi and Beaufort Sea Snow Crab Populations: Estimating Spatial Scales of Disturbance Impacts. (AK-08-12-06)

BOEMRE Information Need(s) to be Addressed: This study will provide information on genetic population structure in the snow crab, *Chionoecetes opilio*, in terms of population connectivity between exploited and unexplored regions. This information is needed to evaluate and mitigate the potential environmental effects on marine invertebrates of offshore development. The BOEMRE analysts and decision makers will use the information from this study in NEPA analysis, EPs and DPPs, mitigation, and monitoring in the Beaufort and Chukchi Seas.

Total Cost: \$120,000 plus Joint Funding

Period of Performance: FY 2009-2011

Conducting Organization: CMI, UAF

BOEMRE Contact: [Chief, Alaska Environmental Studies Section](#)

Description:

Background: Changing climate in the Arctic is manifesting as warming temperatures and changing sea ice conditions, which appear to be causing changes in marine communities, and northward range contractions of Arctic species. Range extension and colonization of new habitat may appear to benefit the invading species, but these shifts also alter competitive and predatory interactions within existing communities. For commercially important species in particular, we must understand the ecological and environmental parameters that influence population structure and species distributions if we are to predict how human activities such as oil and gas exploration will affect both new and established populations in sensitive areas.

Despite fairly thorough stock assessments in fishing-intensive areas (Bering Sea), virtually no attention has been paid to *C. opilio* stocks in the Chukchi and Beaufort seas where sizeable populations do appear to exist. These unexplored populations may well be sources or sinks for genetic exchange with other, more intensively fished populations. Thus, knowledge of dispersal patterns and degrees of genetic connectivity between populations are essential in determining the spatial scales over which localized disturbances will be felt, and over which environmental impact studies should be conducted.

This study will utilize genetic tools to investigate population structure in snow crabs, *C. opilio*, in the N Bering, Chukchi and Beaufort Seas, and the degrees of genetic exchange between these regions. This information will also aid in defining the general distribution for crab species Essential Fish Habitats (EFH).

Objectives: The objectives of this project are to establish genetic population structure for adult *C. opilio* in the N Bering, Chukchi, and Beaufort Seas, and assess whether populations are truly panmictic, given potential long-distance dispersal of larvae;

- Complete 20 adult females from each three putative populations (Bering, Beaufort, and Chukchi) as preliminary analysis.
- Consult with BOEMRE and determine if complete analyses (Steps 3-7) are warranted.
- 300 plus adult specimens of *C. opilio* from sites throughout the study areas in the Bering, Chukchi, and Beaufort seas will be examined using a microsatellite approach.
- 300 additional adult specimens of *C. opilio* from five locations in the Northern Bering Sea will be examined using a microsatellite approach.
- Additional samples during the RUSALCA 2009 cruise in the Russian sector of the Chukchi Sea will be examined.
- A limited number of mitochondrial gene sequences (COI) for inclusion in phylogenetic studies and for DNA barcoding purposes will occur.
- Isolate 8 – 10 highly polymorphic DNA microsatellite loci from adult specimens, and compare genotypes of adult crabs between regions using isolation by distance models, which indicate spatial scales of genetic exchange.
- Complete quality control to test within-lab variability including a blind re-run of 3-4% of samples.
- Complete larval component: Remove and identify larvae from plankton samples and design of alternate PCR protocol for working with small amounts of tissue.
- Complete data archiving with NODC and made available to BOEMRE in a GIS compatible format.

Methods: Collected adult specimens of *C. opilio* throughout the Bering, Chukchi and Beaufort seas will be examined for degrees of genetic variation in adult populations using a microsatellite approach. Additionally, a limited number of mitochondrial gene sequences will be generated for inclusion in phylogenetic studies and for DNA bar coding purposes. Polymorphic DNA microsatellite loci from adult specimens will be isolated, and compared with the genotypes of adult crab between regions using isolation by distance models. This will indicate spatial scales of genetic exchange. This project will provide genetic data from a public database. The data generated can be used meet BOEMRE planning needs.

Revised Date: August 2010

ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2011

Region: Alaska

Planning Area(s): Beaufort Sea, Chukchi Sea

Title: Populations and Sources of Recruitment of Polar Bears (AK-05-02)

BOEMRE Information Need(s) to be Addressed: The study will enhance BOEMRE analysis of oil-spill/polar bear mortality models and provide direct input to population-recovery models currently under development for the Alaskan Beaufort Sea Region. Study information will be used for NEPA analysis and documentation for Beaufort Sea Lease Sales. It will also contribute information used for mitigation related to Northstar, Liberty, if approved, and DPPs.

Total Cost: \$1,319,000 plus Joint Funding **Period of Performance:** FY 2005-2012

Conducting Organization: University of Alberta, Canada

BOEMRE Contact: [Chief, Alaska Environmental Studies Section](#)

Description:

Background: The approximately 22,000-27,000 polar bears of the world are currently divided among 19 recognized “populations” circumscribing the Arctic Region of the Northern Hemisphere. Although these units are referred to as “populations” there is no genetic or behavioral basis for assuming genuine isolation. The designation of these geographic populations has been largely political, in conformance with management needs, even though the units are inadequate for evaluating population discreteness, for estimating recovery from perturbations, setting harvest goals, or accounting for gene flow. Polar bears are important for subsistence, are considered a high-profile species by the general public, are the focus of a rapidly developing ecotourism industry in several Arctic coastal villages, and may be affected by disturbance and spilled oil potentially associated with OCS oil-and-gas development. Long-term monitoring of juvenile-adult polar bears has not previously been accomplished and will greatly enhance understanding of basic biology and population demographics for this key age group and the population as a whole.

Past studies of individual polar bear movements suggest that adults occupy somewhat restricted home ranges; however data are generally restricted to females because it is difficult to fit adult males with transmitter collars. In any case, adult movements do not accurately represent population structure because natal dispersal is the dominant control against population isolation in most vertebrates, with male-biased natal dispersal dominant among mammals. Thus, data on the movements of juvenile polar bears, including their adult home-ranges, is the missing critical element.

One benefit of the study is to expand collaboration between local university/government researchers and subsistence hunters along the Canadian Beaufort Sea (and adjacent

coastlines). Such collaboration will complement previous/ongoing studies conducted in the Alaskan Beaufort Sea Region, but will add fresh new insights because of the emphasis on representative gene flow and dispersal. Approximately 200 polar bears are already expected to be captured in the Canadian Beaufort Region each year for the next 4 years. This study is timed to take advantage of considerable savings in logistics by partnering with that ongoing Canadian study.

Objectives: The objective of this study is to provide data necessary for interpretation of the population structure of polar bears in North America. Emphasis will be placed on understanding the importance of natal dispersal in polar bears and, specifically, on the extent to which bears born in, or near, Canada make use of United States land, nearshore, or OCS habitats at various life stages

Methods: This study will 1) develop a partnership between University and Canadian Government polar bear biologists and Canadian Natives to implement a study of juvenile polar bears using long-lived satellite transmitters for monitoring; 2) test and deploy satellite transmitters with the capability to permit multi-year (3-5 year) monitoring of juvenile polar bears, and verify and test remote release mechanisms for the collars; 3) capture juvenile polar bears and deploy up to 15 such satellite transmitters per year for 3 years; 4) as possible, take blood and tissue specimens for archiving at the Alaska Marine Mammal Tissue Archival Project (AMMTAP), for genetic analysis, and for contaminants analysis; 5) evaluate current and potentially more ecologically rigorous population designations in light of data from this study and other sources.

Revised Date: August 2010

ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2011

Region: Alaska

Planning Area(s): Beaufort Sea

Title: Assessing Reproduction and Body Condition of the Ringed Seal near Sachs Harbour, Northwest Territory, Canada, through a Harvest-based Sampling Program (AK-05-05)

BOEMRE Information Need(s) to be Addressed: This study will assist BOEMRE in its responsibility for identifying and mitigating potential effects of OCS development on ringed seals and polar bears and will be relevant to the interpretation of results from a Canadian polar bear population assessment underway in the Beaufort Sea. The information will be used for NEPA analysis and documentation for Beaufort Sea Lease Sales and DPPs.

Total Cost: \$115,000 plus Joint Funding

Period of Performance: FY 2005-2010

Conducting Organization: Department of Fisheries and Oceans, Canada

BOEMRE Contact: [Chief, Alaska Environmental Studies Section](#)

Description:

Background: Ringed seals are the most abundant pinniped in the Arctic Ocean and along the Alaskan Beaufort Sea coastline. Population stocks of the ringed seals have not been delineated but ringed seals are capable of having large home ranges, with some seals making long movements between wintering and summering habitats. For example, ringed seals tagged at Cape Parry, Northwest Territory, Canada, in September of 2001 and 2002, were found to migrate westward along the Alaskan Beaufort Sea coastline and into the Chukchi Sea for over-wintering. Since ringed seals from the U. S. Beaufort and seals from Western Canada appear to intermix in the Beaufort and Chukchi Seas, and habitat is fairly similar along those respective coastlines, information from ringed seal studies in the Western Arctic of Canada is potentially useful for understanding the health status of ringed seals in Alaska, including those spending at least some of the year near the oil and gas developments along the shoreline of the Beaufort Sea and Beaufort OCS.

The health and condition of ringed seals in the Beaufort Sea are important to biologists, hunters and managers for several reasons. They have been proven to be useful indicators of the physical and biological environment. As ubiquitous and important prey, they are critical to the well being of polar bears. Also, they are valued as a subsistence resource by the Inupiat and the Inuvialuit. Changes in the seal population that have been documented in the western Arctic in the past, have included a reduction in ovulation rates among mature females, reduced percent pups in the harvest, reduced number of birth lairs, a possible shift in the age of sexual maturity, and changes in relative abundance during both ice-covered and open water periods. Moreover, changes in the reproduction and condition of ringed seals in the eastern Beaufort Sea can have profound effects on the polar bear population, according to a review in 2002. In particular, during years when the ice conditions are particularly heavy, seal fatness,

reproduction and pup survival have been observed to decline, resulting in a subsequent decline in reproduction of polar bears and survival of their cubs.

The purpose of this study is to cosponsor a sampling program jointly funded with the Department of Fisheries and Oceans (DFO), Northwest Territories, Canada and in cooperation with Inuvialuit subsistence hunters in the Sachs Harbour area. Data on seal body condition and reproductive output will provide an assessment of the status of the ringed seal population in relation to its environment and as a prey resource for Beaufort Sea polar bears.

Objectives:

- In coordination with ongoing seal monitoring studies in Holman and along the Alaskan Beaufort Sea coastline, to sample and measure ringed seals taken by Inuvialuit hunters in the Sachs Harbour area (minimum of n = 80).
- Use reproductive status and body condition as indicators to evaluate ecosystem productivity and fluctuations in the seal population.
- To contribute biological data on Beaufort Sea seal populations for use in interpretation of condition and reproduction rate data on polar bears collected in the same general study area through the same time period.
- To examine these aspects in the context of annual variation in regional ice conditions.
- To coordinate with, and provide samples for, "stock health" related studies, such as disease and contaminants.

Methods: The study will be coordinated by the Canadian Department of Fisheries and Oceans, Stock Assessment Section, in collaboration with its Resources, Wildlife and Economic Development Section and the Canadian Wildlife Service. The project will utilize the same methods as an ongoing project in Holman, Northwest Territory and collect data that are comparable to existing data sets for seals in this area: in the 1970s by the Canadian Wildlife Service; in 1987-1989 by the Canadian Fisheries Joint Management Council; and in 1992 by the Department of Fisheries and Oceans. Further information on this is available from Canadian Beaufort Sea ringed seal studies at: www.beaufortseals.com and several other sources. Body condition of ringed seals harvested by Inuvialuit hunters near Sachs Harbour, and two parameters of seal reproduction (ovulation rate and percent pups in the harvest) will be analyzed. These parameters were selected because they varied with changes in the seal population during work in this same area in the 1970s and 1990s, so that new data can be compared with results from past years. Also, it is possible and practical to monitor these aspects over several years through a harvest-based study in the community of Sachs Harbour, Northwest Territory, Canada.

Revised Date: August 2010

ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2011

Region: Alaska

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

Title: Bowhead Whale Feeding Variability in the Western Alaskan Beaufort Sea: Satellite Tracking of Bowhead Whales (AK-06-01; AK-10-01)

BOEMRE Information Need(s) to be Addressed: With additional information on the importance of the study area to feeding bowhead whales, and a better understanding of potentially predictable factors that correlate with variations in whale behavior, alternative mitigation options for future Beaufort Sea lease sales may be feasible. Also, this study addresses a conservation recommendation in NMFS' 2001 *Arctic Region Biological Opinion*. The recommendation is that BOEMRE study "the use of the Beaufort Sea by feeding bowheads and assess the importance of this feeding to the health and well being of these animals." Information from this study will be used for permit approvals for all Beaufort Sea Lease Sales and NEPA analysis and documentation for Beaufort Sea Lease Sales and DPPs.

Total Cost: \$1,999,995 plus Joint Funding **Period of Performance:** FY 2005-2012

Conducting Organization: ADF&G

BOEMRE Contact: [Chief, Alaska Environmental Studies Section](#)

Description:

Background: A previous MMS study estimated the extent to which the bowhead whale population utilizes OCS areas in the eastern Alaskan Beaufort Sea for feeding, as well as that area's importance to individual whales. Additional research on this subject has been requested particularly at locations other than those included in the previous study. In a 2001 Arctic Region Biological Opinion NMFS made a Conservation Recommendation that MMS (now BOEMRE) continue to study "the use of the Beaufort Sea by feeding bowheads and assess the importance of this feeding to the health and well being of these animals." Other stakeholders have recommended that MMS/BOEMRE expand the scope of the research to include the entire Alaskan Beaufort Sea.

This profile describes the satellite tracking task in support of the Bowhead Feeding Variability Study. Overall, the study, aims at achieving an understanding of the factors enhancing or limiting the expression of feeding behavior in various locations in the western Alaskan Beaufort Sea. Implicit to the proposed study is the assumption that feeding by bowhead whales occurs with some degree of regularity during August-October the western Beaufort Sea study area. It is further assumed that variation in feeding behavior potentially results from any, or all, of a variety of environmental and behavioral variables including, but not limited to: sea ice coverage, oceanographic conditions, prey concentrations, and movements by whales, potentially from summering areas in both the Beaufort Sea and Chukchi Sea. By understanding how such factors are related to bowhead feeding in western Beaufort Sea

locations near offshore oil and gas leases, BOEMRE would be in a better position to mitigate potential effects of such actions on bowheads and their populations.

Objectives: To better understand the relationship between feeding, environmental and behavioral variables on the timing and spatial extent of bowhead feeding in the western Alaska Beaufort Sea; specifically to:

- Document the movements of whales of various ages, sexes, and reproductive statuses from the Beaufort Sea and Chukchi Sea within, into and out of the study area.
- Document feeding and other behaviors at locations in the Beaufort and Chukchi seas with emphasis on timing and dynamics/variability.
- Estimate the rate and timing of travel of whales during migration.

Methods: Collaborations will be developed between whaling captains, AEWC, NSB, ADF&G, NMFS, BOEMRE and other interested parties to resolve roles in permitting, co-sponsorship and implementation. Satellite transmitters will be deployed on bowhead whales near Native villages in the Beaufort, Chukchi and Bering seas during spring and fall migrations. Transmissions would be monitored and data analyzed. The study will be carefully coordinated with the AEWC and Whaling Captains Associations in Barrow, Nuiqsut and Kaktovik to avoid interference with fall subsistence hunts and, where feasible, to involve whaling communities directly in the conduct of the study.

Revised Date: August 2010

ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2011

Region: Alaska

Planning Area(s): Beaufort Sea, Chukchi Sea

Title: Bowhead Whale Feeding Variability in the Western Alaskan Beaufort Sea: Oceanography and Feeding (AK-06-01; AK-10-02)

BOEMRE Information Need(s) to be Addressed: With additional information on the importance of the study area to feeding bowhead whales, and a better understanding of potentially predictable factors that correlate with variations in whale behavior, alternative mitigation options for future Beaufort Sea lease sales may be feasible. Also, this study addresses a conservation recommendation in NMFS' 2001 *Arctic Region Biological Opinion*. The recommendation is that BOEMRE study "the use of the Beaufort Sea by feeding bowheads and assess the importance of this feeding to the health and well being of these animals." Information from this study will be used for permit approvals for all Beaufort Sea Lease Sales and NEPA analysis and documentation for Beaufort Sea Lease Sales and DPPs.

Total Cost: \$8,187,320 plus Joint Funding **Period of Performance:** FY 2006-2012

Conducting Organization: NMFS NMML, WHOI, UAF, URI, NSB, OSU, UW

BOEMRE Contact: [Chief, Alaska Environmental Studies Section](#)

Description:

Background: A previous MMS study estimated the extent to which the bowhead whale population utilizes OCS areas in the eastern Alaskan Beaufort Sea for feeding, as well as that area's importance to individual whales. Additional research on this subject has been requested particularly at locations other than those included in the previous study. In a 2001 Arctic Region Biological Opinion NMFS made a Conservation Recommendation that MMS (now BOEMRE) continue to study "the use of the Beaufort Sea by feeding bowheads and assess the importance of this feeding to the health and well being of these animals." Other stakeholders have recommended that MMS/BOEMRE expand the scope of the research to include the entire Alaskan Beaufort Sea.

In this proposed study, emphasis will be placed on achieving an understanding of the factors enhancing or limiting the expression of feeding behavior in various locations in the western Alaskan Beaufort Sea. Implicit to the proposed study is the assumption that feeding by bowhead whales occurs with some degree of regularity during August-October the western Beaufort Sea study area. It is further assumed that variation in feeding behavior potentially results from any, or all, of a variety of environmental and behavioral variables including, but not limited to: sea ice coverage, oceanographic conditions, prey concentrations, and movements by whales, potentially from summering areas in both the Beaufort Sea and Chukchi Sea. By understanding how such factors are related to bowhead feeding in western

Beaufort Sea locations near offshore oil and gas leases, BOEMRE would be in a better position to mitigate potential effects of such actions on bowheads and their populations.

Objectives: To better understand the relationship between feeding and environmental and behavioral variables on the timing and spatial extent of bowhead feeding in the western Alaska Beaufort Sea; specifically to:

- Document the movements of whales of various ages, sexes, and reproductive statuses from the Beaufort Sea and Chukchi Sea within the study area.
- Document feeding behavior and prey utilization by bowheads at locations in the western Alaska Beaufort Sea with emphasis on timing and dynamics/variability.
- Document variability in locations and densities of potential prey of bowhead whales.
- Estimate variability of physical oceanographic conditions associated with concentrations of bowheads and their prey.
- Integrate results from this study with previous results from other sources to develop a dynamic model of bowhead feeding behavior in the western Alaska Beaufort Sea.
- Synthesize existing results and conclusions in a scientifically reviewed monograph to be published in an appropriate journal or other similar outlet.

Methods: This study will be conducted over geographic and temporal scales sufficient to include normal variability associated with environmental phenomena including local currents and upwellings, variation in ice conditions, and el Nino. The study area will be encompassed by the polygon bounded by the shoreline, 100 m isobath, 152° W and 155° W meridians.

Collaborations will be developed among whaling captains, AEWC, NSB, ADF&G, NMFS, BOEMRE and other interested parties to clarify roles in research permitting, co-sponsorship and implementation. Based on preliminary observations of locations of bowhead feeding having high potential for more comprehensive study and analysis, project planning and research would be initiated using logistics and field methods including, but not limited to, those similar to those used to accomplish the previous eastern Alaskan Beaufort Sea bowhead feeding study. These could include placement of permanent moorings for passive acoustic and sea-water current, temperature and salinity monitoring, fieldwork such as analyses of stomach contents at Barrow and Cross Island, behavioral observations by aircraft, bowhead tagging from Native operated boats, plankton tows by small vessel, stable isotope ratios in baleen layers, fatty acid comparisons, recording of traditional knowledge, and computer modeling of feeding information. Real-time distribution of whales in the Beaufort Sea, as well as historic information on bowhead whale feeding activity in the study area, would also be provided by the ongoing BOEMRE *Bowhead Whale Aerial Survey Project*. The study would be carefully coordinated with the AEWC and Whaling Captains Associations in Barrow, Nuiqsut and Kaktovik to avoid interference with fall subsistence hunts and, where feasible, to involve whaling communities in the conduct of the study.

Revised Date: August 2010

ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2011

Region: Alaska

Planning Area(s): Beaufort Sea, Chukchi Sea

Title: Monitoring the Distribution of Arctic Whales (AK-07-01)

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 NEPA analysis and documentation for Beaufort Sea Lease Sales, DPPs, and monitoring of production at Northstar and Liberty.

Total Cost: \$4,800,000 plus Joint Funding **Period of Performance:** FY 2007-2011

Conducting Organization: BOEMRE, NOAA AOC and NMFS NMML

BOEMRE Contact: [Chief, Alaska Environmental Studies Section](#)

Description:

Background: The MMS/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: August 2010

ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2011

Region: Alaska

Planning Area(s): Chukchi Sea

Title: Monitoring Marine Birds of Concern in the Eastern Chukchi Nearshore Area (Loons) (AK-07-04a)

BOEMRE Information Need(s) to be Addressed: The initial MMS environmental impact analysis for the 5 Year Program, 2007-2012, identifies species of concern in the Chukchi Sea and recent Conservation Recommendations to MMS/BOEMRE (Section 7 Consultation, Beaufort Sale 186) recommended research on migratory species of concern. Thus, updated information on marine bird distribution, species composition, molting, staging and timing of use in the eastern Chukchi coastal area between Barrow and Point Hope is needed. Avian species of moderate-high concern include the Spectacled Eider, Yellow-billed Loon, Red-throated Loon, and Pacific Black Brant. Both the threatened Spectacled Eiders and the Yellow-billed Loon occur in coastal and marine environments from Barrow south to Cape Lisburne. Ledyard Bay is ESA Critical Habitat for the Spectacled Eiders, and limited surveys indicate Peard Bay may also be an important molting area.

Study findings will be used in post-sale NEPA analysis, ongoing ESA Section 7 Consultations, review of EPs, DPPs and other reviews for post-sale and post-exploration decision making and mitigation. Also, study results will be used in similar pre-lease analyses and documentation for potential future Chukchi Sea Lease Sale(s).

Total Cost: \$750,000 plus Joint Funding

Period of Performance: FY 2007-2012

Conducting Organization: USGS-BRD

BOEMRE Contact: [Chief, Alaska Environmental Studies Section](#)

Description:

Background: Specific areas identified for study in this profile are very important Chukchi Sea coastal lagoons and embayments where waterfowl seasonally concentrate. These locations are vulnerable to industrial disturbance or oil spills potentially associated with offshore oil and gas exploration and development. Scientists have identified the lagoons, bays, and barrier islands along the Alaskan coast of the Chukchi Sea as important feeding, staging, and molting areas for relatively large numbers and a diverse assemblage of water birds breeding in both Alaska and Canada. Peard and Ledyard Bays and Kasegaluk Lagoon, in particular, appear to represent important staging and/or molting habitat for a variety of shorebirds, seabirds (nesting colonies at Point Hope, Cape Lewis, Cape Lisburne, Point Lay, Icy Cape, and Cape Thompson), and waterfowl. In particular, it is critical to identify high-use areas by threatened Spectacled Eiders. Also, the USFWS was petitioned in 2004 to list the Yellow-billed Loon under the ESA and thus this species is of concern to BOEMRE. USFWS aerial surveys recorded fairly sizeable concentrations of Spectacled Eiders in Peard Bay, particularly in

August which are presumably molting birds. Scientists have identified Kasegaluk Lagoon as a major fall staging area for a large proportion of the Pacific Flyway population of Black Brant (approximately 40%). Coastal aerial surveys and on-shore migration surveys encountered Yellow-billed Loons, particularly in the fall. Recent satellite telemetry locations of post-breeding Yellow-billed Loons provide additional evidence of the importance of nearshore habitat at Peard and Ledyard Bays, and offshore habitat near Point Hope in the Chukchi Sea. Though the OCS Environmental Assessment Program completed several avian studies in this region, most were done 15-20 years ago.

The BOEMRE share shown above represents 50 percent of the estimated total joint funding needed for a single component, loons only. Joint funding may be established through coordination with NSSI, BLM, USFWS, or USGS.

Objectives: Document spatial distribution, species composition, timing of use and residence times by foraging, molting, and staging Spectacled Eider, Yellow-billed and Red-throated Loons, and Pacific Black Brant in the vicinity of Peard Bay, Ledyard Bay, and Kasegaluk Lagoon in the eastern Chukchi nearshore environment.

Methods: Periodic low-level (45-50 meters) aerial surveys will be conducted along transects established perpendicular to the shoreline (late summer) and along open-water leads (spring) to document spatial distribution, species composition and timing of use by marine birds and waterfowl. Using a combination of implanted satellite and VHF transmitters, both local and long-distance movements of marked individuals will be documented during the breeding and post-breeding period for Yellow-billed and Red-throated Loons and staging Pacific Black Brant. A combination of behavioral observations and monitoring of implanted transmitters will be used to estimate distance flown/feeding flight, time away from nest, and food items provisioned to young for Yellow-billed and Red-throated Loons. Either satellite telemetry or transmitters and remote stations will be used to estimate peak arrival and departure times, as well as residence times, for a sample of Pacific Black Brant in Kasegaluk Lagoon. Using either focal or scan sampling techniques, proportion of time spent feeding (versus other behaviors) by staging Pacific Black Brant will be documented. Foraging behavior (e.g., foraging bout length, pecks/minute) and foods consumed will be quantified via direct observation. Collection of birds on various dates post-arrival would provide invaluable information on both diets and nutrient acquisition and energetics.

Revised Date: August 2010

ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2011

Region: Alaska

Planning Area(s): Chukchi Sea

Title: Pinniped Movements and Foraging: Bearded Seals (AK-07-08)

BOEMRE Information Need(s) to be Addressed: Large numbers of pinnipeds migrate through and potentially occupy areas of high oil and gas potential 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. Study findings will be used in post-sale NEPA analysis, review of EPs, DPPs and other reviews for post-sale and post-exploration BOEMRE decision making and mitigation. Also, study results will be used in pre-lease analyses and documentation for potential future Chukchi Sea Lease Sale(s).

Total Cost: \$1,163,000 plus Joint Funding **Period of Performance:** FY 2007-2012

Conducting Organization: NMFS NMML

BOEMRE Contact: [Chief, Alaska Environmental Studies Section](#)

Description:

Background: Bearded seals are one of the most important resources for Alaska Native subsistence hunters of coastal northern and western Alaska. Early estimates of the Bering-Chukchi Sea population range from 250,000 to 300,000, and surveys flown from Shishmaref to Barrow during May-June 1999 and 2000 provided preliminary results indicating densities up to 0.652 seals km⁻². However, densities could not be converted into abundance estimates without information on the proportion of animals hauled out. As adult bearded seals in these areas have never been live captured and instrumented with devices for estimating the haul-out proportion, a reliable estimate for the abundance of the Alaska stock of bearded seals is considered unavailable. Therefore, understanding the timing of haul-out behavior is important because abundance estimates are needed for developing sound plans for conservation, management, and response to potential environmental impacts of planned oil and gas activities.

Little is known of bearded seals' distribution throughout much of the year; however they are known to concentrate in specific areas for breeding and molting. Identification of these areas is important to assessment of potential impacts from industrial activities. Any potential industrial impacts on bearded seals could potentially be mitigated or magnified by climatic-induced change in the physical and biological habitat. Magnification of impacts seems the most likely, especially because reductions in sea ice may de-couple the co-occurrence of suitable ice and suitable benthic prey communities in those areas that have become traditional breeding and molting grounds for bearded seals.

The Burger Prospect has potentially strong renewed interest for oil and gas exploration and development and is located just south of Hanna Shoal. It is thus situated between winter habitat and potentially important summer feeding habitat on, and around, Hanna Shoal. Plans for geophysical exploration, field delineation, and development of production facilities and pipelines in that region are being developed and such activities may have consequences for pinniped movements and habitat utilization, which in turn could alter the availability of walrus and ice seals for subsistence by Natives in villages along the northwestern Alaskan coastline. Identification of migration routes and high-use habitat areas is critical to assessment of potential impacts from oil- and gas-related industrial activities on pinniped populations and subsistence use by Alaskan Natives.

Objectives:

- Estimate the seasonal movements and patterns of distribution and behavior of bearded seals in the Chukchi Sea Planning Area.
- Identify and evaluate the priority of importance of specific marine habitats used by bearded seals in the Chukchi Sea Planning Area associated with key life history events such as breeding, pup rearing, foraging, and molting. Emphasis will be placed on movements of seals between nearshore areas where they are hunted for subsistence and offshore areas where industrial development is anticipated, such as potential high biomass areas in the vicinity of the Burger Prospect and Hanna Shoal.
- Improve the accuracy and precision of estimates of bearded seal abundance in the Chukchi Sea Planning Area by developing a haul-out correction factor that can be used to adjust existing survey counts for the proportion of seals that are at sea and not observed during aerial surveys.

Methods: Phases I & II will involve cooperation with Alaska Natives in northwestern Alaska.

Phase I will include: 1) communicating with hunters in villages along the coastline of northwest Alaska and St. Lawrence Island and other interested parties, to evaluate levels of interest in the proposed study and holding a workshop if useful; 2) evaluating satellite tagging technology, including equipment, deployment and attachment methods and making recommendations for proposed study(s); 3) considering the above, preparing an implementation plan for satellite tagging and data collection and exploring joint funding opportunities.

Phase II will include: 1) review of literature and data to develop hypotheses about habitat use and seasonal movements between winter and summer habitat; 2) training Native hunters or other coastal village residents to deploy satellite transmitters on selected pinnipeds in the vicinity of respective villages; 3) deployment of transmitters to test hypotheses developed—since tags will have a relatively short lifespan, sampling is to be spread among villages and, to the extent possible, divided among northward and southward migrating pinnipeds; 4) analyzing data to test hypotheses and developing recommendations for mitigations of any likely effects of development on habitat use and migration; 5) maintaining data in a GIS and providing summaries of individual movements regularly on a public website. Results will be shared with residents of communities near the study area and participation of local Natives, especially young people, in analysis and interpretation of findings and conclusions will be encouraged.

Revised Date: August 2010

ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2011

Region: Alaska

Planning Area(s): North Aleutian Basin

Title: Distribution, Abundance, and Habitat Use of North Pacific Right Whales (AK-07-x13)

BOEMRE Information Need(s) to be Addressed: The *Final Outer Continental Shelf Oil and Gas Leasing Program 2007-2012* (USDOI, MMS, 2007) considers a North Aleutian Basin (NAB) oil and gas lease sale for 2011. The proposed sale area (or areas adjacent) supports very important commercial and subsistence fisheries, provides habitat to numerous marine mammals, and is an important migration and staging area for internationally important waterfowl. Marine mammal species known to occur in or near the NAB include the listed Endangered or Threatened North Pacific right whale, fin whale, humpback whale, and Steller sea lions; the recently delisted gray whale; and the sea otter, which is proposed for listing. The study described here will provide information that was identified by the Alaska OCS Region as a highly time-sensitive and important decision-applicable information need for proposed oil and gas leasing. Information obtained is planned to be used in Section 7 Endangered Species Act consultation, for enhancing compliance with provisions of the Marine Mammal Protection Act and for pre- and post-sale NEPA/EIS analysis, documentation, and mitigation of potential effects of OCS exploration and development.

Total Cost: \$5,450,000 plus Joint Funding **Period of Performance:** FY 2007-2011

Conducting Organization: NMFS, NMML

BOEMRE Contact: [Chief, Alaska Environmental Studies Section](#)

Description:

Background: The eastern population of the North Pacific right whale (*Eubalaena japonica*) is arguably the rarest stock of whales anywhere in the world. Right whales throughout the North Pacific were drastically reduced by commercial whaling beginning in 1835, and the remnant eastern population was almost wiped out by illegal Soviet catches in the 1960s. Today, the surviving population likely numbers fewer than 100 whales, although little is known of its abundance, movements and current habitat use. Because of its endangered status under the Endangered Species Act (and designated as “critically endangered” by the IUCN), the eastern North Pacific right whale is among the highest priorities for recovery efforts by NOAA Fisheries. Historical data as well as recent observations confirm that the NAB lease-sale area is used by right whales for at least the period May-September; although it is generally assumed that the animals migrate out of the area during winter, this is based on very little information and has never been confirmed. It is also assumed that right whales occupy the NAB area to feed upon copepods, but oceanographic and foraging ecology studies of the region are lacking.

Objectives:

- Estimate seasonal distribution, abundance and movement patterns in and adjacent to the lease sale area.
- Characterize right whale habitat, foraging behavior, health, and prey distribution.

Methods: Activities will be coordinated with other programs (e.g. Bering Ecosystem Study [BEST], North Pacific Research Board's Integrated Ecosystem Research Program) so these relatively small-scale observations can be put into the broader context of conditions and processes occurring over the Bering Sea. Integrated ship-based research activities will provide information on right whale ecology and behavior at various spatial scales. Specifically, methods to be used include: 1) fixed-winged aircraft and ship-based surveys (focused in lease sale and adjacent area); 2) acoustic and satellite tagging of individual whales (lease sale area and critical habitat); 3) ship-based passive acoustic methodology to locate whales for tagging and observation; 4) passive acoustic methodology for year-round monitoring of presence and relative abundance (lease sale area, critical habitat, and potential migration routes from Bering Sea; 5) biopsy samples of right whales will be taken during tagging operations for analysis of genetics, pollutants and diet. In addition, samples of copepods will be taken during oceanographic operations to establish a baseline for contaminants in right whale prey prior to oil and gas development activity.

Revised Date: August 2010

ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2011

Region: Alaska

Planning Area(s): Chukchi Sea

Title: COMIDA: Distribution and Relative Abundance of Marine Mammals: Aerial Surveys (AK-08-02)

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 scheduled for 2007. Industry has expressed strong interest in leasing in this area, likely followed by exploration and possibly development. The COMIDA Workshop in November 1-3, 2006 recommended the monitoring of marine mammal distribution and relative abundance. This study is needed to support post-lease NEPA analysis, ESA Section 7 consultations, and Development and Production Plans (DPPs) for Outer Continental Shelf (OCS) activity in the Chukchi Sea. 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.

Total Cost: \$1,600,000 plus Joint Funding **Period of Performance:** FY 2008-2011

Conducting Organization: NMFS NMML

BOEMRE Contact: [Chief, Alaska Environmental Studies Section](#)

Description:

Background: Bowhead whales (*Balaena mysticetus*), gray whales (*Eschrichtius robustus*), beluga whales (*Delphinapterus leucas*), Pacific walrus (*Odobenus rosmarus divergens*), polar bears (*Ursus maritimus*), and bearded seals (*Phoca fasciata*), and several other species of ice seals, are known to occupy the Chukchi Sea, at least during some seasons. 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. Moreover all of these species are used for subsistence by Eskimos both in Russia and the US and form an important part of the diet and cultural base for most people in villages along the Chukchi coast. Having a good understanding of the seasonal distribution, relative abundance, and habitat use of marine mammals in the Chukchi Sea is fundamentally important to evaluating the potential environmental impacts associated with oil and gas exploration and development and other anthropogenic activities. Reliable, up-to-date information of this type is currently unavailable for marine mammal populations in the Chukchi Sea. Aerial surveys of marine mammals are an efficient tool because they offer quick coverage of large marine areas. Past surveys are available for comparison with new data to assess whether changes in distribution or abundance have occurred since the earlier surveys were completed.

Objectives:

- Document the distributions and relative densities of marine mammals in the Chukchi Sea Planning Area.
- To the extent possible, delineate the areas that are most important to marine mammals during critical seasons of their annual life history cycles such as molting, calving/pupping, and feeding.

Methods: Aerial line transects surveys will be flown in the Chukchi Sea Program Area during: June, July, August, October and early-November. Methodology shall follow protocols used by the BOEMRE Bowhead Whale Aerial Survey Project so that data are comparable with earlier surveys in the Chukchi Sea.

Revised Date: August 2010

ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2011

Region: Alaska

Planning Area(s): Chukchi Sea

Title: Pinniped Movements and Foraging: Walrus Habitat Use in the Potential Drilling Area (AK-09-01)

BOEMRE Information Need(s) to be Addressed: Large numbers of pinnipeds migrate through and potentially occupy areas of high oil and gas potential 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. Study findings will be used for NEPA analysis of lease sales scheduled for 2010 and 2012, review of EPs, DPPs and other reviews for post-sale and post-exploration BOEMRE decision-making and mitigation.

Total Cost: \$1,529,000

Period of Performance: FY 2009-2013

Conducting Organization: ADF&G

BOEMRE Contact: [Chief, Alaska Environmental Studies Section](#)

Description:

Background: The majority of the reproductive component of the Pacific walrus population (i.e., females, calves, and juveniles) migrate through the Chukchi Sea twice annually between winter and summer areas. Each summer, as winter pack ice receded, walruses, bearded seals, and other pinnipeds have followed the ice edge from wintering areas to its northern margin. For example, large numbers of walruses migrated past the Lisburne Peninsula northward over rich potential feeding habitat such as Hanna Shoal and adjacent areas of high oil and gas potential. During this northward migration, many walruses moved along coastal leads between Point Hope and Point Barrow and were hunted by Natives.

Over the past few years, summer distribution of walruses may be changing as a result of changes in summer pack ice. Concern has been expressed by Native hunters that in recent summers, sea ice (which females use as a platform for rest between feeding bouts) has been receding faster and further to the north, making walrus less available to the communities that depend on them. Walruses are less likely to follow the ice edge beyond the shelf break and have been using land haul-outs instead. For example, in summer 2007, large numbers of walruses were hauled out on land between the villages of Point Lay and Wainwright. Many additional tens of thousands hauled out along the Chukchi coastline in Russia. In the future, less sea ice will likely make land haul-outs more important and feeding areas near those haul-outs of great importance. Updated information is needed on how walruses move through this region, where they haul out, and where they forage.

The Burger Prospect has potentially strong renewed interest for oil and gas exploration and development and is located just south of Hanna Shoal. It is thus situated between winter habitat and potentially important summer feeding habitat on, and around, Hanna Shoal. Plans for geophysical exploration, field delineation, and development of production facilities and pipelines in that region are being developed and such activities may have consequences for pinniped movements and habitat utilization, which in turn could further alter the availability of walrus and ice seals for subsistence by Natives in villages along the Northwestern Alaskan coastline. Identification of migration routes and high-use habitat areas is critical to assessment of potential impacts from oil- and gas-related industrial activities on pinniped populations and subsistence use by Alaskan Natives. A planning phase is currently being accomplished under a cooperative agreement with the University of Alaska-Fairbanks by the Alaska Department of Fish and Game.

Objectives:

- Develop a phased cooperative project to study the movements and habitat use of selected walrus in the Chukchi Sea Planning area.
- Develop considerations for enhanced monitoring of changes in habitat use and movements.

Methods: This study is modeled on a cooperative study of bowhead whale distribution and movements that is currently supported by BOEMRE. Review literature and existing data to develop hypotheses about habitat use and seasonal movements between winter and summer habitat. Work with Natives in coastal villages to compile and analyze traditional ecological knowledge concerning walrus movements and habitat use. Train Native hunters or other coastal village residents to deploy satellite transmitters on walrus in the vicinity of respective villages. Deploy transmitters to test hypotheses developed. Since tags will have a relatively short lifespan, sampling is to be spread among villages and to the extent possible divided among northward and southward migrating walrus. Involve local Natives in shore-based monitoring of walrus hauling out along the Chukchi Sea coastline with emphasis on relationships between tagged-walrus behaviors and general haul-out use patterns. Analyze data to test hypotheses and develop considerations for enhanced monitoring of changes in habitat use and migration. Maintain data in a Geographical Information System (GIS) database and provide summaries of individual movements regularly on a public website. Share results with residents of communities near the study area. Encourage participation of local Natives, especially young people, in analysis and interpretation of findings and conclusions to the extent possible.

Revised Date: August 2010

ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2011

Region: Alaska

Planning Area(s): Beaufort Sea, Chukchi Sea

Title: COMIDA: Factors Affecting the Distribution and Relative Abundance of Endangered Whales: Passive Acoustic Detection and Monitoring of Endangered Whales in the Arctic (AK-09-02)

BOEMRE Information Need(s) to be Addressed: Information from this study will document the general presence of bowhead, right, fin, gray, and other baleen whales in areas of potential seismic, drilling, construction, and production activities. Study results may be useful for estimating temporal limits and formulating designs of mitigation for such activities. Findings may be used for evaluating potential deferral areas and other potential limitations on offshore leasing and development. This study will provide useful information needed to support NEPA analysis and documentation for Beaufort and Chukchi Sea Lease Sales, DPPs, and monitoring. Results will support ESA consultations, MMPA permitting, and preparation of Biological Evaluations and Biological Opinions.

Total Cost: \$4,304,300 plus Joint Funding **Period of Performance:** FY 2010-2015

Conducting Organization: NOAA, NMML

BOEMRE Contact: [Chief, Alaska Environmental Studies Section](#)

Description:

Background: The observed northward retreat of the minimum extent of summer sea ice has the potential to expand oil and gas-related exploration and development into previously closed seasons and localities in the Alaskan Arctic. This change, coupled with steadily increasing abundance and related seasonal range expansion by the bowhead, gray, humpbacked, fin, and possibly other whales, indicates that more complete information on the year-round presence of large whales is needed in the western Beaufort Sea and Chukchi Sea planning areas. Aerial surveys can provide some of the needed coverage, but are not cost-effective for extended use on a year-around basis. Nor will planned aerial surveys provide the geographic extent of coverage potentially available from passive acoustic monitoring.

Passive acoustic detection and tracking is a proven tool for assessment of large whales in Alaskan seas. Specifically, acoustic detection has proven a key addition to the census of bowhead whales (*Balaena mysticetus*) during their spring migration past Barrow, and in relation to oil and gas development activities offshore Prudhoe Bay. More recently, gray whale calls have been detected year-round near Barrow on long-term recorders deployed in collaboration with the NSF/Shelf-Basin Interaction Study. Other data have been obtained on North Pacific right, humpback, and fin whales in the southern Bering Sea.

The proposed study will fund the fabrication and deployment of arrays of long-term acoustic recorders in the Beaufort and Chukchi seas that are capable of continuous recording, year-round. Acoustically recording the Beaufort and Chukchi seas year-round for several years will provide previously unattainable assessment of the seasonal occurrence of large whales in these regions and their response to environmental changes (including climate and anthropogenic use of the area).

Objectives:

- Assess the year-round seasonal occurrence of bowhead, gray, and other baleen whale calls in the Beaufort and Chukchi Seas.
- Track individuals through a hydrophone array to estimate relative abundance.
- Evaluate whether changes in seasonal sea ice extent is enabling a northward shift of Bering Sea cetacean species such as fin, humpback and North Pacific right whales.
- Provide long-term estimates of habitat use for large whale species and compare this with annual ice coverage in order to establish predictive variables to describe large whale occurrence.
- Collaborate with the study entitled: “Physical Supporting Data for Chukchi Offshore Monitoring in Drilling Area (COMIDA)” in order to evaluate the extent to which variability in environmental conditions such as sea ice, oceanic currents, water temperature and salinity, and prey abundance influence whale distribution and relative abundance.

Methods: Build autonomous hydrophones based on a proven design, modified for cold, shallow water deployment for 365 days per deployment. Deploy instruments in tight arrays having a minimum of 3 instruments to facilitate evaluating the movements of individual animals. Refurbish and redeploy instruments annually. Analyze annual data for whale calls to estimate: seasonal occurrence by species, inter-annual differences in occurrence by species, variation in occurrence due to changes in ice extent, types and strengths of anthropogenic noise in the study area.

Revised Date:

August 2010

ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2011

Region: Alaska

Planning Area(s): Beaufort Sea, Chukchi Sea

Title: Migration and Habitat Use by Threatened Spectacled Eiders in the Eastern Chukchi Near and Offshore Environment (AK-09-03)

BOEMRE Information Need(s) to be Addressed: Research focusing on the distribution and timing of habitat use by the threatened (ESA) Spectacled Eiders was identified as an information need at the COMIDA workshop held on Nov. 1-3, 2006. Lease sales are planned for the Chukchi Sea Planning Area in 2010 and 2012. This information will be used for ESA Section 7 consultations, NEPA analyses, Exploration Plans, DPPs and other documentation. The information obtained from this jointly-funded research will contribute in development of mitigation measures/strategies to reduce potential impacts.

Total Cost: \$919,000

Period of Performance: FY 2009-2013

Conducting Organization: USGS

BOEMRE Contact: [Chief, Alaska Environmental Studies Section](#)

Description:

Background: Basic information on timing and duration of habitat use by Spectacled Eiders within the Chukchi Sea Planning Area (CSPA) and the Beaufort Sea Planning Area (BSPA) is necessary to better define parameters used to model the impacts of perturbations and ultimately population effects. Recent improvements in satellite telemetry have yielded some information on the distribution and movements of Long-tailed Ducks and King and Common Eiders, many of which stage, migrate or molt in the Eastern Chukchi Sea. Changing patterns of sea ice could shift some use to the BSPA. In 1996 the spectacled eider was listed by USFWS as threatened species. When the petition to list was submitted, studies began in 1993 to map and document the distribution, timing of migration, and wintering areas of the three populations. At that time, the molting, staging, and wintering areas of Spectacled Eiders in the Arctic and North Pacific Oceans were unknown. Subsequently, Ledyard Bay, Point Lay, and Peard Bay were identified as areas used by migrating, molting, and staging eiders that bred on the Indigirka River Delta, Russia; Yukon-Kuskokwim Delta, western Alaska; and the Prudhoe Bay region. Information on the timing and use of areas by Spectacled Eiders during fall migration, staging, and molting is now dated and limited because of small sample sizes. There is little information available about the timing of spring migration or locations of spring staging areas.

Objectives:

- Estimate the spatial distribution, demographic composition, timing of use, and residence times of male and female spectacled eiders in the CSPA and BSPA.
- Evaluate the fidelity of individual Spectacled Eiders to areas within the eastern Chukchi Sea and western Beaufort Sea.

Methods: This study will use implantable satellite transmitters to document spatial distribution and timing of use by adult and juvenile Spectacled Eiders. Each tagged individual will supply two years of data from which assessments of individual and population affinity and variation will be made. Also using satellite telemetry, scientists will document both local and long-distance movements of individual Spectacled Eiders during migration; they will identify spring and autumn staging areas, and molting sites. After examining measures of bathymetry, weather, ice, and bird status, the project will develop models to represent factors influencing timing of movements and distribution of individual Spectacled Eiders during spring, summer (molt), and autumn.

Revised Date: August 2010

ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2011

Region: Alaska

Planning Area(s): Beaufort Sea, Chukchi Sea

Title: Demography and Behavior of Polar Bears Summering on Shore in Alaska (AK-09-05; AK-09-05b)

BOEMRE Information Need(s) to be Addressed: A jointly-funded study could address information needs identified in a 2005 MMS funded study by USFWS, “Beaufort Sea Polar Bear Monitoring Workshop.” It would provide useful information on the sub-population of polar bears summering in areas of increasing oil and gas activities along the Alaskan Arctic coastline. New information will support NEPA analysis and documentation for Beaufort and Chukchi Sea Lease Sales, Draft Production Plans, MMPA permitting, and development of related mitigation.

Total Cost: TBD plus Joint Funding (BRD) **Period of Performance:** FY 2009-2014

Conducting Organization: USGS Alaska Science Center, USFWS Marine Mammals Management

BOEMRE Contact: [Chief, Alaska Environmental Studies Section](#)

Description:

Background: ESA candidate polar bear use of terrestrial habitat along the Beaufort and Chukchi Sea coastlines of Alaska has increased in recent years, with up to 10% of the polar bears inhabiting the southern Beaufort Sea remaining on land during the open water period. The remaining bears continue to summer on the pack ice, but now find themselves far north of the productive waters over the continental shelf. Neither situation seems favorable for polar bear foraging, and recent observations of starvation, cannibalism, drowning, and poor survival of young, suggest that polar bears in this region are increasingly subject to nutritional stresses. Although future survival of polar bears will depend on the strategies adopted in the diminishing ice environment; relative advantages and consequences of summering on land or deep Arctic sea ice are unknown. Simultaneously, long-term expansion of oil and gas development is being contemplated in the southern Beaufort Sea and northern Chukchi Sea. Polar bear-human interactions may increase because areas of importance to polar bears for resting, feeding, and traveling are becoming coincident with areas of high interest for oil- and gas-related development.

Results from aerial surveys as well as a recent study monitoring polar bears feeding on bowhead whale carcasses at Barter and Cross islands indicates that all age/sex classes of polar bears are present along shore during the fall open water period and that approximately 50 percent of the bears are represented by family groups. Large numbers of bears have been observed near Barter Island, Cross Island, and Barrow. Industrial operators in the Prudhoe

Bay area report an increasing trend in the numbers, frequency, and duration of polar bear use during the open water period.

Partnership opportunities, such as those with other USDOJ Bureaus, may be available and will be explored as a potential means for initiating this study.

Objectives:

- 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.
- Evaluate the implications of extended use of land during the open water period to polar bear health, behavior, and population status.
- Estimate the potential for the health and behavior of polar bears summering along the Beaufort Sea and Chukchi Sea coastlines to be influenced by oil- and gas-related activities and development.
- Develop draft conservation recommendations to reduce the possibility that industrial activity and changing environmental conditions will interact to the detriment of the polar bear population.

Methods: The investigator will conduct a thorough literature review and develop hypotheses about implications 1) to the management and stability of the polar bear population, and 2) to the health and behavior of individual bears in specific demographic groups of increasing numbers of polar bears remaining on land for extended periods during the open water period. Behavioral observations supported by application of appropriate technology (e.g. satellite tags, radio-frequency tags, and similar tags) will be used to monitor representative polar bears in Alaska that show a tendency to remain on land during the open water period. Movements, site fidelity, and limited life history data will be used to test specific hypotheses. Physical exams will be used to evaluate the health and physical condition of representative bears to test specific hypotheses. Predictions and observations will be reconciled and a plan developed to reduce the possibility of negative interactions between polar bears and oil- and gas-related development in a changing physical environment.

Revised Date: August 2010

ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2011

Region: Alaska

Planning Area(s): All Alaska Planning Areas

Title: Social and Economic Assessment of Major Oil-Spill Litigation Settlement for the Alaska OCS Region (AK-03-12)

BOEMRE Information Need(s) to be Addressed: The potential social costs of major coastal oil spills are a public concern associated with OCS development in the U.S. Insofar as the effects of EVOS continue to frame community response to oil and gas development, comprehensive understanding of the event and its various effects are of great interest to the BOEMRE and the Alaska OCS Region. This study will be used in EAs and EISs for predicting and mitigating social effects potentially resulting from major oil spills and resulting oil-spill litigation. This information will be used for NEPA analysis and documentation for Beaufort Sea Lease Sales, Cook Inlet Lease Sales, Chukchi/Hope Basin Lease Sales, and DPPs.

Total Cost: \$252,000

Period of Performance: FY 2003-2011

Conducting Organization: Impact Assessment, Inc.

BOEMRE Contact: [Chief, Alaska Environmental Studies Section](#)

Description:

Background: Major oil spills such as the 1978 *Amoco Cadiz* and 1989 *Exxon Valdez* oil spill (EVOS) events led to a variety of documented social and economic effects. But spill-related litigation and settlement processes and their effects have not been a common topic of socioeconomic research. Regarding EVOS, social scientists speculate that final settlement and distribution of award monies will lead to various beneficial and detrimental secondary effects in addition to those related to the original spill and cleanup events and subsequent phases of litigation. The nature and intensity of such effects hypothetically relate to socioeconomic, demographic, and other attributes of recipients, and to the nature of experience with the spill and litigation.

A recently completed MMS-sponsored study about EVOS, its cleanup and litigation, which collected social impacts information and analysis, provides a comprehensive qualitative overview of general information which will provide useful background to the present quantitative effort.

Objectives: Analyses of data collected in spill-affected communities soon after the EVOS event report that existing social problems were heightened in relation to the influx of spill clean-up monies and resources, particularly in rural-Native communities where access to subsistence resources was limited. Subsequent analyses suggest that larger communities have benefited from opportunities such as eco-tourism that were not extant before the spill. It may be hypothesized that spill clean-up and restoration monies and resources served to amplify

social, demographic, and economic trends and attributes of the awardees in all cases at individual, familial, and community levels of analysis. The objective of this study is to test this hypothesis given potential future influx of monies and resources via final litigation settlement.

Methods: The study will require compilation and analysis of existing data, collection of new pertinent information, coordination with similar research conducted in the region, detailed comparative analysis, and development of summary conclusions. The methods are:

1. Compile and summarize existing data and scholarship regarding pre- and post-EVOS socio-economic conditions and trends on Kodiak Island. Continue to monitor annually updated public access data for changes in demographic trends throughout the study period.
2. Secure ethnographic research access from appropriate local authorities in two different Kodiak village communities. Also secure ethnographic research access to the City of Kodiak.
3. Conduct ethnographic fieldwork in all three Kodiak locations. The fieldwork will involve community level participant-observation in relevant public forums, as well as open ended conversations with a sample of community households in each location from different levels of socioeconomic strata. The fieldwork is intended to gather information about potential changes in key socioeconomic indicators such as: residency and migration patterns, occupational profiles, patterns of investment and return, specialization vs. diversification in commercial fishing operations, specialization vs. diversification in traditional subsistence activities, and other selected social practices.
4. Conduct focus-group forums in all three fieldwork locations to supplement and compare with insights gained from step 3 above. It is expected that different community-level concerns and issues relevant to the litigation settlement process will surface in a focus-group forum that go unexpressed at household level conversations.
5. Analyze the various data compiled above to develop a descriptive comparative analysis of the interim socioeconomic effects and expectations of the litigation experience in each community under investigation. Report the findings at the end of project Phase One (prior to final spill litigation settlement/award distribution).
6. After a final litigation settlement is reached, conduct a second round of fieldwork to gather comparable data for the same categories of variables from all three communities. Analyze the data and report the findings at the end of project Phase Two (some months after the final distribution of settlement awards).
7. Produce a detailed written summary analysis that is responsive to the original hypothesis of the project. Report on major insights and general recommendations relevant to the effective management of future potential oil spills and related litigation and settlement.

Revised Date: August 2010

ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2011

Region: Alaska

Planning Area(s): Beaufort Sea, Chukchi Sea

Title: Study of Sharing Networks to Assess the Vulnerabilities of Local Communities to Oil and Gas Development Impacts in Arctic Alaska (AK-05-04a)

BOEMRE Information Need(s) to be Addressed: The information from this will be used for NEPA analysis and documentation for Beaufort Sea and Chukchi Sea Lease Sales and DPPs.

Total Cost: \$785,000 plus Joint Funding **Period of Performance:** FY 2007-2011

Conducting Organization: UAF, Resilience and Adaptation Program

BOEMRE Contact: [Chief, Alaska Environmental Studies Section](#)

Description:

Background: Many previous MMS studies have documented various aspects of subsistence harvest throughout Coastal Alaska. These studies have identified and hypothesized patterns of change within subsistence-oriented behaviors that occur in association with local changes in income level, demographics, access to resources, and wildlife population/habitat change. Subsistence issues always dominate the public testimonial record, amply demonstrating the continued importance of food harvest, distribution, and consumption to coastal communities and the persistence of their concern over potential cumulative impacts from oil and gas development on social and cultural continuity.

Over the years, MMS has produced a wealth of information about household subsistence harvests by quantity, location, species, and month of harvest. But our research has not yet explored systematically the equally important latter half of the subsistence process: the complex social dynamics of sharing and consuming resources after they are harvested. In Native communities, the distribution and exchange of subsistence resources have traditionally operated under complex codes of participation, partnership, and obligation. It is thus plausible that incremental changes in subsistence activities could have corresponding social system effects. This study seeks to identify key nodes and thresholds in community food distribution networks to assess their vulnerabilities and resiliency to change.

Objectives:

- Explore, quantify, and document the social dynamics and significant changes of subsistence resource distribution and consumption for residents of selected coastal communities of the Beaufort Sea and Chukchi Sea.

- Quantify (through baseline and trend data) and explain (through ethnographic fieldwork) any identifiable changes in the social distribution of subsistence resources over time and geographic space.
- Evaluate from the empirical research the need for further research by assessing whether any documented changes in subsistence activities might feasibly produce substantial changes in the dietary behaviors and health status of identifiable Native groups (such as elders, single women, children, adolescent males, unskilled hunters, etc.).

Methods:

1. Conduct a literature search on the social dynamics of distributing and consuming subsistence resources in the Arctic region of Alaska; Identify what has been documented to date.
2. Evaluate the utility of building upon previous data sets to establish the needed statistical validity and power to establish adequate baseline and trend data for this study.
3. Prepare a strategic survey instrument that is both statistically and socially appropriate, and obtain OMB approval to use it.
4. Coordinate with local communities and appropriately conduct the surveys where feasible.
5. Conduct supplementary ethnographic fieldwork to secure the reliability of collected survey data and to obtain the “emic” perspective necessary to interpret and explain survey results.
6. Assess the field data and estimate confidence in / significance of changes in distribution or consumption of subsistence resources.
7. Explain any documented changes by reference to fieldwork and published literature.
8. Conduct post-fieldwork meetings with appropriate individuals in surveyed communities to cross-check and review fieldwork results.
9. For statistically significant observed relationships, assess the plausibility of linkages between a) regional changes in subsistence and oil development activities and b) changing dynamics in the social distribution and consumption of subsistence resources; assess the need for further research to explore any implications for changing dietary behaviors and health status for identifiable members of coastal communities.
10. Report the results to participating communities through public meetings or workshops.

Revised Date: August 2010

ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2011

Region: Alaska

Planning Area(s): Beaufort Sea

Title: Continuation of Impact Assessment for Cross Island Whaling Activities (AK-08-01)

BOEMRE Information Need(s) to be Addressed: Offshore production at the Northstar facility started in November 2001. The Liberty prospect continues to indicate promise of future production on the OCS. Long-term study efforts to monitor potential effects of such development activities have occurred through the ANIMIDA and cANIMIDA projects, 1999-2007. There remains a continuing, ongoing need to monitor Cross Island whaling activities for potential impacts over the next five years. The information will be used for NEPA analysis and documentation for Beaufort Sea Lease Sales and DPPs.

Total Cost: \$250,000

Period of Performance: FY 2008-2012

Conducting Organization: Applied Social Cultural Research

BOEMRE Contact: [Chief, Alaska Environmental Studies Section](#)

Description:

Background: The Northstar facility is in State waters, but includes production of some OCS oil through directional drilling. The Liberty prospect may access OCS oil deposits through directional drilling from an onshore facility. The last field season for previous ANIMIDA and cANIMIDA multi-disciplinary monitoring efforts in the near-shore Beaufort Sea environment was 2007. This proposed study, however, intends to extend the long-term ethnographic monitoring effort for subsistence whaling activities that occur from the base camp at Cross Island.

Objectives: This study will gather long-term monitoring data to help the BOEMRE assess whether OCS oil development activities at Northstar and/or Liberty result in changes to bowhead whale subsistence hunting practices, or to hunting success at Cross Island. The first objective is to understand Cross Island subsistence whaling variation over time. The second objective is to evaluate the relationship of offshore oil and gas industrial activities to whaling variability.

Methods: This study continues the essential methods established during the ANIMIDA and cANIMIDA phases of research. It calls for systematic observational and interview data collection from local informants about: 1) number of whales taken; 2) Global Positioning System (GPS) location of whale strikes, with direction and distance from Cross Island; 3) number of crews, composition of crews, total number of crew; 4) periodic "census" of whaling participants on Cross Island, 5) duration of whaling season by active days; 6) timing of whaling; 7) length of trips and area searched while whaling; 8) records of catch per unit

effort; and 9) observations of whaling participants. The study will also record systematic and observational/interview data collection on 1) non-whaling subsistence activities on and near Cross Island; 2) observations of local subsistence users. Hard copy maps will be appended as necessary for clarification of location information. The recorded data will be presented in an annual report using tabular information on harvest levels and locations of subsistence resources taken on or near Cross Island.

Revised Date: August 2010

ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2011

Region: Alaska

Planning Area(s): Chukchi Sea

Title: COMIDA: Impact Monitoring for Offshore Subsistence Hunting
(AK-08-04)

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 scheduled for 2007. Industry has expressed strong interest in leasing in this area, likely followed by exploration and possibly development. The COMIDA Workshop in November 1-3, 2006 recommended the monitoring of offshore subsistence hunting. The BOEMRE needs to establish an early baseline in the area and to monitor on an annual basis any significant changes in subsistence activities over time. In particular, monitoring efforts should be directed toward the hunt for marine mammals, including bowhead and beluga whales, walrus, polar bears, and seals. 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.

Total Cost: \$785,000

Period of Performance: FY 2009-2011

Conducting Organization: Stephen A. Braund and Associates

BOEMRE Contact: [Chief, Alaska Environmental Studies Section](#)

Description:

Background: The oil and gas industry has expressed strong interest in leasing in this Planning Area under Sale 193, which may be followed by further exploration and possibly development. In order to assure methodological continuity over time for a potentially large exploration area, appropriate planning and implementation of post-lease monitoring baselines are needed. There is very little up-to-date information about offshore subsistence activities along the Chukchi coast, and there is acute need for more information in the vicinity of Wainwright and Point Lay, where development might make landfall.

Objectives: This study will gather long-term monitoring data to allow the BOEMRE to assess whether OCS oil development activities in the Chukchi Sea will result in changes to offshore subsistence hunting practices. The first research question is whether subsistence hunting in the Chukchi Sea displays significant variation over time. The second question is whether such variation can be attributed to offshore oil and gas industrial activities.

- Monitoring Hypothesis 1: Offshore subsistence hunting patterns in the vicinity of Wainwright and Point Lay do not vary significantly from year to year.
- Monitoring Hypothesis 2: Variations in offshore subsistence hunting patterns are not related to offshore oil and gas activities.

Methods: This project will entail extensive community engagement. Early procedures will involve issue nomination and/or confirmation from the North Slope Borough Fish and Game Management Committee and community representatives. Researcher must establish a protocol or mechanism to facilitate community participation and a meaningful role in the technical aspects of monitoring efforts. Use of focus groups and community dialogue will help to establish acceptable fieldwork procedures for systematic observations and data collection, including: harvesting patterns and numbers; locations of strikes, with direction and distance from shore; number of hunting groups and composition; duration of hunting activities by active days; length of hunt and area searched; estimated costs per unit effort; report of any accidents or mishaps; and report of weather conditions and ice conditions. Much of the technical data may be recorded by Global Positioning System (GPS) instruments that the project will provide to cooperating local hunters, and may be supplemented by ethnographic observation and conversation. Researchers will then analyze collected information and provide a summary report at the end of each hunting season, with review opportunities by respective host communities to achieve collaborative results.

Revised Date: August 2010

ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2011

Region: Alaska

Planning Area(s): North Aleutian Basin

Title: Subsistence Study for North Aleutian Basin (AK-08-06)

BOEMRE Information Need(s) to be Addressed: The proposed North Aleutian Basin (NAB) sale area (or areas adjacent) supports very important commercial and subsistence fisheries, provides habitat to numerous marine mammals, and is an important migration and staging area for internationally important waterfowl. Subsistence is a major and sensitive component of the social and economic system of the area potentially affected by proposed offshore oil and gas leasing in the NAB. The information from this study will be used for pre- and post-sale NEPA/EIS analysis, documentation, and mitigation of potential effects of OCS exploration. Study results will also serve as community baselines to monitor and mitigate any significant future changes in subsistence activities over time.

Total Cost: \$339,793

Period of Performance: FY 2009-2011

Conducting Organization: Idaho State University

BOEMRE Contact: [Chief, Alaska Environmental Studies Section](#)

Description:

Background: More than 20 communities in the SW Alaska-Bristol Bay area rely heavily on subsistence or commercial fisheries. For example, Dutch Harbor processes a peak of 70 million lbs. per week - ½ the total US annual catch and is the largest seafood port in the world. It would be difficult to identify an area in the Bering Sea, or possibly anywhere in the world that has greater fisheries, protected species, or human use issues than this proposed sale area. The MMS-sponsored “North Aleutian Basin Information Status and Research Planning Meeting” recently identified 31 studies that could provide useful information to upcoming National Environmental Policy Act (NEPA) Environmental Impact Statements, analysis of potential mitigation of impacts, and post-sale needs such as for use in NEPA reviews of exploration or development plans. Of those, this study profile has been identified by the Alaska OCS Region as a highly time-sensitive and important decision-applicable information need, and of such mission importance that it should be initiated as soon as possible to assure information availability if NAB remains in the proposed 5 year program. This study would provide key subsistence baseline data for the region. There is an acute need for information in the vicinity of False Pass, Nelson Lagoon, Port Heiden, and other representative communities. Phase I of the study is intended to initiate data collection in those named communities most proximate to the proposed sale area where exploration activities may soon occur. Later phases are anticipated that will increase the range of surveyed communities to establish a broader regional baseline, as potential exploration or development in the NAB achieve greater definition.

Objectives:

- Gather current household and community data on subsistence harvest and sharing activities.
- Supplement survey data with local ethnographic and qualitative context, including household economics and local/traditional knowledge.
- Identify predominant patterns of subsistence activities by household and community, and identify approximate ranges of variation.

Methods: All phases of this study shall be conducted in close collaboration with the BOEMRE and relevant stakeholder institutions at the regional and community level. Researchers will conduct a focused literature search to review and assess the current state of knowledge about subsistence food harvest and distribution behaviors in the region of interest. The researchers will create and implement a survey instrument as appropriate for the study objectives, and obtain formal approval to use it from the US Office of Management and Budget. The researchers shall also conduct focused ethnographic fieldwork on subsistence food harvest and sharing behaviors in host communities. The researchers shall comprehensively analyze the quantitative and qualitative field data to achieve interpretation and explanation of relevant behaviors and submit the full analysis in a final technical report.

Revised Date: August 2010

ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2011

Region: Alaska

Planning Area(s): Beaufort Sea

Title: Aggregate Effects Research and Environmental Mitigation Monitoring of Oil Industry Operations in the Vicinity of Nuiqsut (AK-08-09)

BOEMRE Information Need(s) to be Addressed: The study will serve to verify and/or improve the effectiveness of pre-lease mitigation strategies and post-lease operations for future development activities on the OCS. 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 Beaufort Sea.

Total Cost: \$350,000

Period of Performance: FY 2009-2011

Conducting Organization: Stephen A. Braund and Associates

BOEMRE Contact: [Chief, Alaska Environmental Studies Section](#)

Description:

Background: The recent completion of several oilfield development projects, both onshore and offshore, in the vicinity of subsistence use areas for the village of Nuiqsut creates an opportunity to study and evaluate empirically the effectiveness of specific mitigation measures and processes in village Alaska. Social research can ascertain and document a wide range of information about some of the following pertinent questions:

- What is the track record for implementing mitigation plans over the life of a project?
- Have formal mitigation efforts been effective in reducing anticipated effects?
- What types of mitigation effort seem to work best to reduce social conflict?
- Have informal mitigation mechanisms emerged, and with what effect?
- What is the cumulative effectiveness of regional mitigation across multiple projects?
- How do various responsible agencies actually monitor and measure mitigation effects?
- Have industry operations been responsive to community feedback?
- What scientific parameters are appropriate to evaluate mitigation retrospectively?
- What specific data sets are most useful to collect before, during, and after a project?
- Are there significant social nuances to the mitigation process that merit further research?

This study will proceed as an inter-agency project, with at least collaborative manpower contributions from both federal and state agency representatives. Other cooperative funding may be established through coordination with NSSI, BLM, USFWS, and/or the State of Alaska and private industry.

The study is intended to pilot-test the prospects for a more comprehensive future undertaking by limiting the initial scope of research to a few recent exploration and development projects.

The projects to review would likely include Northstar, McCovey, Endicott, Alpine and satellites, NPR-A exploration, and the most recent fields in Kuparuk (Meltwater and Tarn). The most substantial topics would likely derive from mitigation efforts affecting the human environment in and around the Colville Delta. For example, Alpine provides some concrete manifestations of publicly contested outcomes that might warrant focused research in the proposed study. Nuiqsut residents have asserted prominent discrepancies between pre-development guarantees and post-development realities with regard to many specific issues. The study would encompass research and documentation of both objective and subjective interpretations of mitigation effects.

Objectives:

- Systematically identify the formal and informal mechanisms that relevant actors have negotiated and implemented in Development and Production Plans or Exploration Plans to mitigate specific anticipated impacts from oil development in the vicinity of Nuiqsut and its subsistence area, both onshore and offshore.
- Develop a rigorous analytic method to evaluate the social effectiveness of mitigation measures and their predictability as they pertain to North Slope residents.
- Establish an empirical basis to distinguish offshore/onshore oil related social impacts.
- Provide socio-cultural insights into the challenge of mitigation to enhance government performance in predicting, monitoring, and managing the oil development process.

Methods: Project sponsors will need to establish an appropriate steering committee across federal/state agencies to facilitate the study execution and to achieve a specific division of labor. Researchers will conduct a literature search to investigate and annotate the documented social nuances of mitigating social impacts within the framework of NEPA. Researchers will record a concise history of recent oilfield exploration and development near Nuiqsut. This may involve literature search, interviews, and fieldwork. Researchers will investigate and document the history of negotiated mitigation measures for select oil related exploration and development activities near Nuiqsut. They will identify and analyze both the formal and informal mitigation mechanisms that have emerged over time. Researchers will quantify industry/community interactions in relevant categories of analysis. Researchers will analyze the collected data to develop an objective narrative of events and interactions, including alternative stakeholder interpretations of past interactions to emphasize relevant subjective features of the mitigation process. Researchers will then summarize the findings and provide explicit analysis to improve agency understanding and management of the social process of mitigating impacts from oil development.

Revised Date: August 2010

ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2011

Region: Alaska

Planning Area(s): All Alaska

Title: MAG-PLAN Modification: New Data Collection, Testing, and Streamlining of OCS Economic Impact Model for Alaska (AK-08-10)
(Short Title: MAG-PLAN Alaska Upgrade Study)

BOEMRE Information Need(s) to be Addressed: MAG-PLAN provides the quantitative basis for the mandatory equitable sharing analysis in 5-year program development and the required employment forecasts for 5 year and lease sale Environmental Impact Statements (EISs) and Environmental Assessments. Testing and improvement of MAG-PLAN Alaska, along with incorporation of the most recent data available, will substantially improve confidence in user efficiency and BOEMRE forecasts of employment and personal income expected to result from proposed OCS activities on the Alaska OCS. Better data will aid broader BOEMRE efforts to understand the local and regional consequences of the program as industry activities expand or contract.

Total Cost: \$530,423

Period of Performance: FY 2009-2011

Conducting Organization: Northern Economics, Inc.

BOEMRE Contact: [Chief, Alaska Environmental Studies Section](#)

Description:

Background: BOEMRE maintains two versions of an OCS Economic Impact Model (EIM) called MAG-PLAN to provide a consistent bureau-wide approach to estimating employment, personal income, and similar results of OCS activities. Each version is a Microsoft Access-based, 2-stage model that uses 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. The second stage uses region-specific economic multipliers from the commercial economic modeling system IMPLAN to forecast employment, personal income, and other variables resulting from the initial industry expenditures.

There are four major reasons to upgrade MAG-PLAN Alaska:

1. BOEMRE employees used MAG-PLAN for the latest round of 5-year program and EIS analyses and identified certain problems in the model including file instabilities.
2. Almost all model data came from engineering cost estimates (extrapolating from onshore and State-waters projects) developed for two studies (Arctic IMPAK and Sub-Arctic IMPAK) about a decade ago. MAG-PLAN Alaska adjusts this data to account for inflation, but that adjustment does not fully account for changes that have occurred over the interim, including advances in technology and significant industrial investment in the Alaska OCS.

3. Much of the supporting model data is inadequate for frontier planning areas, which have attracted far more industry interest than was apparent when earlier model planning decisions were made. The frontier planning areas are sufficiently different from the Beaufort Sea and Cook Inlet, respectively, that more targeted data and revised cost functions are needed.
4. The internal sector-allocation equations in the model will have to be changed to make MAG-PLAN compatible with recent changes in the way industry inputs data to IMPLAN.

BOEMRE has created a Modeling Review Board (MRB) to assist in the technical oversight of this MAG-PLAN upgrade effort. The MRB consists of a group of consultants (including the project manager for the two studies that provided the current MAG-PLAN Alaska data) who will provide expert advice to BOEMRE regarding all aspects of this contract. The MRB will provide expertise in evaluating the review and testing of the actual model, suggest possible improvements and solutions to problems, and provide review and comments on all deliverables.

Objectives: The objective of the MAG-PLAN Alaska Upgrade Study is to strengthen and refine the Bureau's procedures for estimating the onshore economic effects of OCS-related activities by updating and enhancing the current version of MAG-PLAN Alaska.

Methods: This project will involve coordinating five linked but separate research efforts:

1. testing and streamlining MAG-PLAN functionality;
2. identifying and collecting industry expenditure data;
3. creating better "Offshore Modeling Area" data and model structure for frontier planning areas;
4. revising industry sector codes to match current IMPLAN sectoring scheme and incorporating the new codes into MAG-PLAN equations; and
5. documenting all efforts.

Revised Date: August 2010

ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2011

Region: Alaska

Planning Area(s): Beaufort Sea

Title: Subsistence Use and Knowledge of Beaufort Salmon Populations
(08-12-04)

BOEMRE Information Need(s) to be Addressed: This study will collect information on subsistence harvest and traditional knowledge (TK) of salmon that will be used to meet Essential Fish Habitat and NEPA requirements for Beaufort Sea lease sales. This research will inform local communities, local and State resource managers, and the BOEMRE of ecosystem health, which is so important to subsistence lifestyle.

Total Cost: \$119,500 plus Joint Funding

Period of Performance: FY 2009-2011

Conducting Organization: CMI, UAF

BOEMRE Contact: [Chief, Alaska Environmental Studies Section](#)

Description:

Background: The National Marine Fisheries Service has defined the entire OCS of the Beaufort Sea as Essential Fish Habitat (EFH) for all five Alaskan salmon species (king, sockeye, coho, chum & pink). As a result, BOEMRE and NMFS must consult about the effects that proposed oil and gas developments in the Beaufort OCS might have on essential salmon habitat. Although salmon EFH has been designated, salmon are rare in the Beaufort Sea. During the summer, adult pink and chum salmon are present in the Colville River and its tributaries, and caught in small subsistence fisheries by Native Alaskans living in the area. Previous studies have not demonstrated significant numbers of adults of other species. Immature life stages and successful spawning have not been found in the Beaufort Sea area. However, local residents have testified in MMS hearings that more and different salmon are being caught in their subsistence fisheries. Salmon populations on the North Slope could expand if the recent trend of mild winters continues. There are no recent estimates on the extent of subsistence use of salmon along the Beaufort Sea.

This study will document local observations of increasing numbers of salmon in subsistence fisheries and close the knowledge gap by synthesizing relevant research and conducting ethnographic fieldwork among the Iñupiat communities about changing salmon populations/species composition. This data will update information on subsistence harvest and TK about salmon. The study will also map and document the spatial and temporal distribution of salmon species in streams, and may provide more specific information about effects of warming temperatures in Arctic waters upon signal species like salmon.

Objectives:

- Establish a strong rapport with local community residents and regional experts.
- Document the current subsistence use of various Beaufort Sea salmon populations in Barrow, Nuiqsut, and Kaktovik or Atkasuk.
- Document the local and traditional knowledge of historic and recent trends in salmon use, abundance, and distribution.
- Better understand the Iñupiaq context for ecological observation and appropriate uses of such knowledge.
- Use spatial and ethnographic data to identify streams and coastal areas where salmon have been harvested or observed.
- Locate and document the principle areas used by various salmon species near OCS developments in the Beaufort Sea.

Methods: This study has two phases, with the second phase being contingent upon recommendations resulting from analyses conducted in Phase I. In Phase I, the investigator will: 1) conduct a literature review; 2) complete about 20 formal interviews with key informants; 3) generate a master map of each community region to mark salmon presence areas as identified by informants; 4) annotated bibliography of relevant literature; 5) prepare a synthesis report encompassing literature, interviews, TK, and spatial data; 6) recommend whether Phase II field research is needed and the methodology to be used to conduct field investigations necessary to fill data gaps. In Phase II, the investigator will: 1) conduct fieldwork using methodology and study designs developed in Phase I; 2) prepare a report updating information, about species composition salmon in the Beaufort Sea, including population sizes, spawning habitat, and rearing habitat.

Revised Date: August 2010

ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2011

Region: Alaska

Planning Area(s): All Alaska Planning Areas

Title: BOEMRE / University of Alaska-Fairbanks/State of Alaska / Coastal Marine Institute – Management (AK-08-12-01)

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

Total Cost: \$500,000 plus Joint Funding

Period of Performance: FY 2008-2013

Conducting Organization: CMI, UAF

BOEMRE Contact: [Chief, Alaska Environmental Studies Section](#)

Description:

Background: This study provides management of a large ongoing program of scientific research into framework issues related to potential future lease sales in the Alaska OCS Region. It is a cooperative program between BOEMRE and the University of Alaska, with State of Alaska participation. The Coastal Marine Institute (CMI) is expected to leverage additional scientific results and logistics capability at levels comparable to the BOEMRE contribution of \$500,000 per year. The Coastal Marine Institute will update and expand our understanding of OCS environmental information and address future needs related to the offshore oil and gas program in Alaska.

Objectives: The purpose of the CMI is to generate scientific information for BOEMRE and State of Alaska decision makers that is consistent with the needs outlined by the Framework Issues. The Framework Issues are:

- Scientific studies for better understanding marine, coastal or human environments affected or potentially affected by offshore oil and gas or other mineral exploration and extraction on the OCS.
- Modeling studies of environmental, social, economic, or cultural processes related to OCS gas and oil activities in order to improve scientific predictive capabilities.
- Experimental studies for better understanding of environmental processes, or the causes and effects of OCS activities.

- Projects which design or establish mechanisms or protocols for sharing data or scientific information regarding marine or coastal resources or human activities in order to support prudent management of oil, gas and marine mineral resources.
- Synthesis studies of scientific environmental or socioeconomic background information relevant to the OCS gas and oil program.

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

Revised Date: August 2010

ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2011

Region: Alaska

Planning Area(s): All Alaska Planning Areas

Title: Conference Management and Reports on BOEMRE Results
(AK-07-06)

BOEMRE Information Need(s) to be Addressed: This study will help to resolve environmental and technical issues for BOEMRE program managers and to increase public confidence in the data used by the OCS program. Workshops may be coordinated with future lease sales and for NEPA analysis and documentation focusing primarily on the Beaufort Sea, Chukchi Sea, and North Aleutian Basin areas.

Total Cost: \$200,000

Period of Performance: FY 2008-2011

Conducting Organization: BGES, Inc.

BOEMRE Contact: [Chief, Alaska Environmental Studies Section](#)

Description:

Background: The need for the transfer of studies information is ongoing and the Alaska Environmental Studies Program (ESP) has organized many meetings and workshops on environmental studies information with experts and interested parties on selected topics oriented to formulating concepts for new research projects and/or to address a study need. During the past decade the Alaska ESP has held Information Transfer Meetings (ITMs) and Information Update Meetings (IUMs) for the exchange of studies information among Principal Investigators and the general public.

Objectives: The objectives are to produce ITMs, IUMs, small workshops, and publications on OCS environmental studies information.

Methods: The primary method is to manage meetings and workshops and assist with preparation, coordination, logistics, program agenda, and invitation of speakers and participants.

Revised Date: August 2010

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ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2011

Region: Alaska

Planning Area(s): All Alaska OCS Planning Areas

Title: Alaska Marine Science Symposium (AK-10-03)

BOEMRE Information Need(s) to be Addressed: This symposium provides BOEMRE technical analysts and BOEMRE Principal Investigators for BOEMRE Alaska OCS Region studies a unique forum to share their research findings on the Alaska marine environment and to network with other scientists from around Alaska, the Pacific Northwest, and the nation. Since it is impossible for any one agency or group to conduct all of the needed research within the Alaska OCS Region, this forum provides marine scientists with the opportunity to gather information on other areas of similar research and foster important future collaborative efforts.

Total Cost: \$100,000

Period of Performance: FY 2010–2015

Conducting Organization: North Pacific Research Board (NPRB) / Alaska SeaLife Center

BOEMRE Contact: [Chief, Alaska Environmental Studies Section](#)

Description:

Background: The Alaska Marine Science Symposium is the largest and most comprehensive annual marine science conference within the State of Alaska (www.alaskamarinescience.org). The Alaska Marine Science Symposium is unique since it brings together government and non-government sponsored marine scientists within the State of Alaska, from around the nation, and from other nations in a forum to discuss their common interests in the dynamic and ever changing Alaska marine ecosystem. The symposium is organized into three large marine ecosystems of Alaska which includes the Arctic (Alaska Beaufort and Chukchi seas), the Bering Sea, and the Gulf of Alaska. The presentations, poster sessions, and workshops showcase the ocean research within these areas. Daily sessions are focused on the main components of the marine ecosystem including climate and oceanography, lower trophic level productivity, fish and fish habitat, seabirds, marine mammals, and human dimensions.

Over 500 people attended the most recent symposium, and many organizations pitched in to make it a success. The BOEMRE project investigators attended the symposium and provided important information on the Arctic and the Bering Sea from information collected under the Environmental Studies Program. The BOEMRE staff and sponsored scientists connected with other scientists that were conducting concurrent research in the Arctic and the Bering Sea regions.

Last year, in addition to daily presentations, there were evening sessions on bowhead whale feeding ecology, panel discussions on the beluga whale, and workshops on community involvement. In addition, there were other workshops on shipboard observation systems,

Alaska Ocean Observing System (AOOS), on communicating ocean science, and metadata standards. The symposium also encourages presentations on the Alaska marine environment from graduate students from local universities and from universities within the lower 48. The symposium presents awards to the best student poster and oral presentation at the meeting.

Objectives:

- Produce a successful Alaska Marine Science Symposium which provides a forum for marine scientists, and local communities to present their information on the changing marine environment in Alaska.
- Provide a venue for BOEMRE, Alaska OCS Region environmental studies research for the Arctic and Bering Sea
- Provide a forum for Alaska OCS Region scientists and Principal Investigators to come together with other researchers that are conducting similar scientific studies within the Alaska OCS or adjoining areas of the Alaska marine ecosystem.

Methods: As a member of the Alaska Marine Science Symposium organizing committee with other scientists and officials from federal and state agencies, assist in producing a forum for BOEMRE staff and marine and coastal scientists, and local communities to present their findings on the changing marine environment in Alaska. Provide monetary support for scientists from within the State of Alaska and from around the nation to present their findings at the meeting. Provide abstracts and workshop discussions from the symposium to the general public for distribution.

Revised Date: August 2010

ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2011

Region: Alaska

Planning Area(s): All Alaska Planning Areas

Title: Management, Logistics, and Warehouse Storage of Oceanographic Equipment (AK-10-04)

BOEMRE Information Need(s) to be Addressed: Without funding of this program-support element, it would not be possible to maintain or deploy the 36-foot Launch 1273 that provides a mobile, cost-effective, and specialized research vessel for a variety of biological and oceanographic studies throughout the coastal waters of Alaska. Costs for certain studies would increase significantly if more expensive marine-support alternatives were chartered. Additionally, it would not be possible to maintain an equipment warehouse that allows us to re-use and share equipment effectively among projects and agencies. This is a fundamental program-support element related to studies that support all current leases.

Total Cost: \$200,000/year

Period of Performance: FY 2010–2012

Conducting Organization: Kinnetic Laboratories Inc.

BOEMRE Contact: [Chief, Alaska Environmental Studies Section](#)

Description:

Background: The BOEMRE Alaska OCS Region, has responsibility for equipment management and other storage needs in support of Alaska studies. In 1996 the General Services Administration (GSA) obtained a new storage facility for ESP use. Equipment is stored in a small warehouse in Anchorage, where it is maintained and made available for ongoing projects. The equipment includes off-season vessel safety and operating equipment, as well as equipment to support ongoing marine mammal and oceanographic studies. This support element also provides funds for maintenance of the BOEMRE Alaska Region Launch 1273, a small research vessel needed for various oceanographic studies, as well as funds for other equipment maintenance and shipping. Supported efforts include the Bowhead Whale Feeding Variability studies, the meteorological station at Cottle Island, and the cANIMIDA Boulder Patch monitoring project.

Objectives: The purpose of this program-support element is to efficiently manage and store oceanographic equipment and provide other support to ESP needs.

Methods: The GSA arranges for an appropriate warehouse facility for our use.

Launch 1273 was commissioned in 1983. The BOEMRE contractors use it for a number of oceanographic studies in the Arctic. We include the costs of operating Launch 1273 in the management costs listed above.

Revised Date: August 2010

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ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2011

Region: Alaska

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

Title: Alaska State-Wide Oceans Research and Studies Project Browser
Covering the Alaska Offshore and Coastal Areas (AK-10-14)

BOEMRE Information Need(s) to be Addressed: BOEMRE and other state-wide research efforts for the Chukchi, Beaufort and Bering seas, in addition to other areas of the Alaska outer continental shelf will be made available to the Environmental Studies Section, Environmental Analysis Section, and BOEMRE Management via an online web browser. A web-based visual display of ongoing, recently completed and possibly planned study efforts will assist BOEMRE in the writing of new study descriptions, Statements of Work, in preparation and planning for new meetings (e.g., North Aleutian, Chukchi, etc.); promoting collaboration with other agencies on similar projects; provide significant savings of funds; expand our research potential; and improve BOEMRE decision making in the writing of EISs, EAs and commenting on exploration and development plans for the OCS.

Total Cost: TBD

Period of Performance: FY 2011–2014
(deferred in FY 10)

Conducting Organization: TBD

BOEMRE Contact: [Chief, Alaska Environmental Studies Section](#)

Description:

Background: BOEMRE places the digital copies of their final study reports online, but it's difficult to quickly access the study boundary, data collection efforts, or conclusions from multiple study efforts, without expending significant personal time and effort. In addition, it is a challenge for internal BOEMRE staff to remain current with all research in the OCS due to the quantity of government and industry activities conducted within these areas. The BOEMRE as well as other agencies (NPRB, AOOS, UAF, University of Alaska-Anchorage, USFWS, USGS-Alaska Science Center, NOAA, National Park Service, BLM, Alaska Department of Natural Resources, ADEC, Alaska Department of Transportation, ADF&G, Barrow Arctic Science Consortium, etc.) have identified a statewide need for a centralized database of past, present and future projects and associated observations and observing plans. Representatives from these agencies held a Data Integration Meeting in August of 2008 to plan how to integrate studies projects from these agencies into one unified project browser. A technical steering committee was formed among the participants. The technical steering committee succeeded in establishing the fields necessary to integrate the agency project information. The NPRB started the project browser several years ago with a focus on NPRB projects. This BOEMRE study shall design, develop, document, and implement a BOEMRE Internet Geospatial WEB Portal whereby BOEMRE project information and data from completed and ongoing BOEMRE Alaska OCS Region Environmental Studies can be queried and displayed by internal BOEMRE staff and other agencies.

Objectives:

- Develop a BOEMRE Environmental Studies (ES) project database that can be fully utilized to query, graphically display, and extract project specific information from all fields within the database.
- Develop programming tools that would allow internal BOEMRE staff and external non-BOEMRE users to query, display, and extract available spatial data sets collected from each study.
- Automate the updating of new studies project information: Develop programming tools that shall import new BOEMRE ES project information from newly completed or existing studies in a seamless manner. Specifically, a program that incorporates information from a technical summary and other sources to update the project database.
- Develop programming tools that can automatically search, retrieve, upload and merge project specific information and possibly data from other state, federal agencies, and industry into the BOEMRE project database and data directories.
- Develop a BOEMRE Geospatial Web Site User Interface and Graphical display whereby internal BOEMRE staff and other agencies can query, display, and extract project specific information, and display an extract BOEMRE environmental studies data sets covering Alaska OCS.
- Provide complete documentation on the database and user interface application.
- Provide a user manual and train internal staff on the use of BOEMRE Geospatial WEB Portal
- Provide online documentation for external users

Methods: Under this study, internal staff and contractors hired by BOEMRE will gather environmental studies project information and available data in a concerted effort to make the information readily available to BOEMRE staff and other agencies. This effort will centralize the function to collect, catalogue, and distribute BOEMRE environmental studies project information, associated project studies data, initially collecting studies project information and data going back to 2000. A BOEMRE web interface shall display maps of the project boundaries, links to the project specific information, data, metadata, and reports.

Revised Date: August 2010

National Oceanographic Partnership Program (NOPP)

Region: Alaska

Planning Area(s): Beaufort Sea

Title: Circulation, Cross-Shelf Exchange, Sea Ice, and Marine Mammal Habitats on the Alaskan Beaufort Sea Shelf (NOPP)

Total Cost: \$2,948,000 (MMS Share 32%) **Period of Performance:** FY 2007–2011

Partners: UAF, WHOI, NOAA-Alaska Fisheries Science Center, UW, Jet Propulsion Laboratory

Description:

The team proposes to carry out a joint physical/biological program to enhance the understanding of how the ABS atmosphere/ice/ocean/marine-mammal system works and what some of the consequences of a warming climate might be. They will focus on the related problems of how the wind-forced response due to storms and the cross-shelf exchange, including that due to rivers, will change under variable and changing ice conditions, and to understand the seasonal variations in marine mammal utilization of the ABS. The approach involves a retrospective examination of historical data, the synergistic application of recently developed technologies for measuring the ocean, ice, and marine mammal habitat utilization, and the use of novel techniques for interpreting satellite observations.

Revised Date: August 2010

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National Oceanographic Partnership Program (NOPP)

Region: Alaska

Planning Area(s): Beaufort Sea

Title: Toward a Predictive Model of Arctic Coastal Retreat in a Warming Climate, Beaufort Sea, Alaska (NOPP)

Total Cost: \$577,586 (MMS Share 32%) **Period of Performance:** FY 2007–2011

Partners: University of Colorado, Naval Postgraduate School, USDOl

Description:

The team proposes a three-year project to develop predictive models of coastal erosion and sediment transport along the Alaskan Beaufort Sea coast. This project has three distinct but complementary goals that include monitoring and modeling: 1) to quantify the rates and drivers of shoreline retreat through the past ~50 years using retrospective analyses of remotely sensed imagery, sea surface temperatures, ground temperatures, and meteorological records; 2) to characterize the processes driving coastal change in the Arctic via comprehensive monitoring of wave and thermal energy inputs, substrate properties, and inputs of water and sediment from fluvial systems; 3) to develop both descriptive and predictive models for coastal erosion in Alaska using both simplified physical models of individual processes, and models of suites of interrelated physical processes and hydrodynamics using DELFT3D.

Revised Date: August 2010

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2.2 Profiles of Studies Proposed for FY 2011 NSL

Table 1 Alaska OCS Region Studies Proposed for the FY 2011 NSL

Page No.	Discipline	Title	Ranking
127	FE	Updates to the Fault Tree for Oil-Spill Occurrence Estimators needed under the forthcoming BOEMRE 2012-2017, 5-Year Program	1
129	SS/FE	Oil Spill Occurrence Estimators for Onshore Alaska and Canada North Slope Crude and Refined Oil Spills	2
131	PO	Hanna Shoal Ecosystem Study	3
133	IM	Synthesis Report Generation: Technical Support for Environmental Analyses on Select Regional Topics	4
135	MM/PO	Marine Mammal/Physical Oceanography Synthesis	5
137	MM	Monitoring the Distribution of Arctic Whales (BWASP Extension)	6
139	IM	ShoreZone–Shoreline Mapping of the North Slope of Alaska	7
141	HE	Distribution of Fish, Crab and Lower Trophic Communities in the Chukchi Sea Lease Area	8
143	SS	Social Indicators in Coastal Alaska: Arctic Communities	9
145	HE	Shorebirds and Infaunal Abundance and Distribution on Delta Mudflats along the Beaufort Sea	10
147	IM	Workshop—Interagency Protocols for Immediate On-Scene Arctic Oil Spill Impact Science	11
149	FE	Maximum Credible Blowout Occurrence and Size Estimators for the Alaska OCS	12
151	IM	Oilspill Lessons Learned Workshop	13
153	HE	Arctic Cod Pilot Genomics and Toxicity Study	14
155	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			

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ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2011

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: TBD

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 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. OCS Study MMS 2006-033. Prepared by Bercha Group, Calgary, Alberta, for MMS 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. OCS Study MMS 2008-025. Prepared by Bercha Group, Calgary, Alberta, for MMS Alaska OCS Region, Anchorage, AK.
- Bercha, F. G. 2008. Alternative Oil Spill Occurrence Estimators and Their Variability for the Beaufort Sea - Fault Tree Method. OCS Study MMS 2008-035. Prepared by Bercha Group, Calgary, Alberta, for MMS Alaska OCS Region, Anchorage, AK.
- Bercha, F. G. 2008. Alternative Oil Spill Occurrence Estimators and Their Variability for the Chukchi Sea - Fault Tree Method. OCS Study MMS 2008-036. Prepared by Bercha Group, Calgary, Alberta, for MMS 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: August 2010

ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2011

Region: Alaska

Planning Area(s): Beaufort Sea, Chukchi Sea

Title: 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: TBD

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 MMS last collated and analyzed Alaska North Slope small spill data in 2000. More than a decade has passed since a comprehensive analysis of Alaska North Slope crude and refined small spills has been completed by MMS/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 the 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 MMS/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 MMS/BOEMRE in the past because of limited data availability.

The MMS/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: Investigators will conduct a preliminary meeting to discuss acceptable statistical methods. This will require an understanding of historical statistical approaches, BOEMRE rationales for estimating oil spill occurrence rates, and possible sources of variance. 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: August 2010

ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2011

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: TBD

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 down current 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 coupled 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 high 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:

- Document surface and 3-D circulation and density fields in and around Hanna Shoal.
- Document 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 assess causes of water column and benthic primary and secondary productivity and biomass.
- Integrate these data with Hanna Shoal portions of 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 Acoustic Doppler Current Profilers (ADCPs), 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: August 2010

ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2011

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: TBD

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 literature search to facilitate the future study effort “Enclave Development: Alternative Approaches for Housing Transient Workers in Rural Alaska” with a special emphasis on identification of industrial housing policies in the past in Alaska.
- 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: September 2010

ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2011

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: TBD

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 MMS/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) 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. 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. Deliverables from this study will include multiple workshop proceedings and summary recommendation reports, as well as multiple peer-review journal publications.

Revised Date: September 2010

ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2011

Region: Alaska

Planning Area(s): Beaufort Sea, Chukchi Sea

Title: Monitoring the Distribution of Arctic Whales (BWASP Extension)

BOEMRE Information Need(s) to be Addressed: This continuing 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: TBD

Period of Performance: FY 2011-2013

Description:

Background: The MMS/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: August 2010

ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2011

Region: Alaska

Planning Area(s): Beaufort Sea, Chukchi Sea

Title: ShoreZone–Shoreline 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 shoreline mapping information for identifying high priority fish and wildlife habitats in NEPA and ESA (Endangered Species Act) analyses and documentation for Lease Sales, EPPs 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; and a value added benefit from more accurately append the current Environmental Sensitivity Indices (ESI).

Cost Range: TBD

Period of Performance: FY 2011-2013

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 now 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 an MMS 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 may be suitable for ShoreZone mapping. The USGS has also collected topographical imagery (LIDAR) in the Arctic in 2009-2010 for shoreline change that can be applied to morphological changes of the tundra. These imagery sets will be described, cataloged, and summarized for historical perspective for BOEMRE use. This project will provide an

additional imagery necessary, combined with a ground verification component through a series of shore stations, to describe the shoreline and the physical and biological features of the intertidal zone, nearshore, and estuarine environments.

Objectives:

- Summarize existing historic coastal video imagery.
- Assess the use of USGS topographic LIDAR for research on shoreline change and how it can apply to coastal inundation of slopes for spill scenarios and shoreline position change of the barrier islands.
- Conduct new video imagery along the Arctic Coast of Alaska.
- Groundtruth imagery with shore stations to verify geomorphic features. Map video imagery using the ShoreZone methodology.
- Develop 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>).
- Assess the feasibility of extending the project to include a bathymetric LIDAR component.

Methods: The *ShoreZone Coastal Habitat Mapping Protocol for the Gulf of Alaska* will be used to map the imagery collected in the North Slope, Alaska. (http://www.fakr.noaa.gov/habitat/shorezone/goa_protocol.pdf).

Groundtruthing will occur with a series of shore stations over many separate habitat types (i.e. Inside Lagoons, Lagoon Passes, Barrier Islands) along the Arctic Coast. Across-shore profiles will be measured to describe the geomorphic features at each shore station. Data will provide site-specific details of slope, substrate, and widths on the ground, and help with confirming assumptions made in mapping features observed from the air.

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: September 2010

ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2011

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 project continues collection of marine fish baseline in the Chukchi Sea, and 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 MMS-sponsored “Chukchi Sea Information Status and Research Planning Meeting” to provide useful information to upcoming NEPA reviews and post sale needs.

Cost Range: TBD

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 2009 study “Chukchi Sea Offshore Monitoring in Drilling Area (COMIDA): Chemistry and Benthos (CAB).” This will also complement the 2010 LGL component of COMIDA CAB that undertook midwater and benthic fishery samples at 20 sites within the COMIDA CAB sample design. This study would utilize these data and create a similar survey design such that data sets were compatible, comparable, and extend the time series. This study would contribute to further knowledge 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. This study will coordinate with the BOEMRE central Beaufort Sea Fish Survey for under-ice pilot survey which will occur near Barrow, Alaska, and examine the potential for using icebreakers for fish samples in the ice-covered season. The pilot under-ice marine survey will implement a design outlined in the 2007 MMS “Under-Ice Sampling Workshop.”

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 MMS 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 for the open water season.
- Estimate the geographic range of fish, invertebrates, and lower trophic biomass in the lease area by comparing recent and historic fishery databases.
- 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.
- Assess utilizing icebreakers to undertake sampling during the winter for the iced-covered season.
- Provide GIS based maps and attribute tables of marine fish and lower trophics for OSRA and NEPA analysis.

Methods: Conduct a one-two year field study with fisheries and lower trophic survey in the Chukchi Sea region to obtain baseline data on the structure and function of these ecosystems and on the ecology of important fish species. Samples locations will be determined such that it compliments and extends recent work in the COMIDA CAB, and could provide for collaboration with the logistics and project goals of the Arctic Ecosystem Integrated Survey scheduled for 2012 in the northeastern Bering Sea to the southern portion of the Chukchi Sea. 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 historic surveys conducted by COMIDA CAB, RUSALCA, Conoco/Shell, 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 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: September 2010

ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2011

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: TBD

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: Alaska Annual Studies Plan FY 2011

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 as well as the chemical factors that determine their distribution. 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: TBD

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 and the biochemistry that influences these relationships. 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. Additionally understanding the chemical factors that determine the distribution of these microfauna and meiofauna is necessary.

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 chemical analysis, 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 USFWS Arctic Refuge- at 3 sites associated with the coastal lagoons at the Jago, Okpilak, and Canning Rivers.
- Assess the chemical footprint to characterize the sources of the suspended sediments.
- 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 and sediment dispersion that can be used to assess available foraging habitat for shorebirds.
- Assess whether shorebirds respond physiologically to a greater abundance in food resources through body condition measurements and increased triglyceride levels.
- 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 USFWS 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 USFWS Arctic Refuge and two years data collection has been funded by USFWS. The USGS/BOEMRE partnership would collect data on a few sites intensively within the USFWS 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, chemical footprint, 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: September 2010

ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2011

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: TBD

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 oilspill 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

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ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2011

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: TBD

Period of Performance: FY 2011-2012

Description:

Background: The MMS/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 MMS 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 probability 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: Alaska Annual Studies Plan FY 2011

Region: Alaska

Planning Area(s): Beaufort Sea, Chukchi Sea

Title: Oilspill Lessons Learned Workshop

BOEMRE Information Need(s) to be Addressed: BOEMRE needs to reassess potential oilspill impacts and mitigation measures in Arctic waters to incorporate lessons learned from the April 2010 Gulf of Mexico *Deepwater Horizon* blowout and other historical oilspills. This reassessment will better inform analysis under the National Environmental Policy Act and formulation of additional mitigation measures.

Cost Range: TBD

Period of Performance: FY 2011-2012

Description:

Background: The April 2010 Gulf of Mexico *Deepwater Horizon* well blowout radically changes the statistics of historical oilspills on the OCS. As a result of this exploration phase oilspill, 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 oilspill 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 oilspills 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 oilspills.
- 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 oilspills would apply to OCS waters in the arctic.

Revised Date: August 2010

ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2011

Region: Alaska

Planning Area(s): Beaufort Sea, Chukchi Sea

Title: Arctic Cod Pilot 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 oilspill response and monitoring protocols.

Cost Range: TBD

Period of Performance: FY 2011-2013

Description:

Background:

Arctic cod is a key species in Arctic food webs and occupies nearly all depths during its life cycle. Whether 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.

The genomics pilot and toxicity testing feasibility analysis will benefit from close association with an ongoing BOEMRE study and an ongoing international Joint Industry Program (JIP) Arctic species toxicity study. The pilot genomics study has ties to the ongoing Central Beaufort Fish Survey under ice and open water survey (NSL 10-09). Opportunistic samples from an international Chukchi Sea fish survey in September 2010 have been committed for the pilot BOEMRE genomic survey. The genomic study also has ties to an ongoing Canadian Department of Fisheries and Oceans (DFO) Arctic cod genetic study to assess genetic differentiation of the Arctic cod population and provide international collaboration.

A workshop held in Anchorage in March 2008 facilitated the discussion on the research gap on the effects of dispersed oil specific to the Beaufort and Chukchi Seas on two Arctic species, Arctic Cod and a copepod (*Calanus glacialis*). The workshop was followed by fieldwork in both 2009 and 2010. Reports from this study are anticipated late in 2010. The results of the Joint Industry Program study of toxicity to Arctic species at surface pressures can parlay an assessment of what broader research may prove beneficial in terms of assessing

depth, additional Arctic cod life stages in the base year. Under Option 1, the anticipated research on Arctic Cod Toxicity would commence based on the feasibility analysis.

The effects of subsurface blowouts are receiving renewed focus following the *Deepwater Horizon* explosion and subsequent oil and gas release in the Gulf of Mexico. 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 under the conditions unique to the U.S. Arctic. Assumptions and practices from different geographic locations may not accurately transfer to the U.S. Arctic. Under Option 1 a 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 will help analysts respond to basic questions under NEPA review that address 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 oilspill effects on and the responses of Arctic cod vary in relation to a complex of different oil/gas/dispersant mixtures, different life stages, different body mass, different temperatures and different depths typical of the US Arctic waters? How do the toxicity test results at depth compare to results of ongoing JIP toxicity study at surface pressure?

Objectives:

- Assess feasibility of genomics to assess the ice dependency of Arctic cod.
- Participate in pan-arctic genetic stock separation study of Arctic cod.
- Base year: Conduct a feasibility analysis for project design based on the results of the JIP study of toxicity to Arctic species at surface pressures. The analysis will provide recommendations to conduct further research under Option 1 to assess the affects of Arctic cod toxicity test to broader life stages and add a depth component.
- Option 1: Assess the effects on Arctic cod (and perhaps other species) of accidental subsurface release of oil/gas and the effects of dispersants at low temperatures and at pressures and oceanographic conditions typical of the U.S. Arctic OCS.

Methods: 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 results to resolution from international collaborators conducting genetic DNA micro-satellite studies of Arctic cod population separation. Develop recommendations for further genomics study and incorporate results into planning of future joint US/Canada fisheries surveys and Arctic cod ecology studies. Obtain results of the JIP toxicity study and conduct a feasibility analysis to design and conduct controlled laboratory studies to test the toxicity effects of gas/oil/dispersant mixtures on Arctic cod at critical lifestages, and at a range of temperatures and depths (pressures) typical of the U.S. Arctic OCS.

Revised Date: September 2010

ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2011

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: TBD

Period of Performance: FY 2011-2013

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. In 2008, the MMS 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 also submitted an exploration plan to MMS 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 proposed for future work 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.

The surveys would be repeated at regular intervals (perhaps every five years).

Revised Date: September 2010

2.3 Profiles of Studies Proposed for FY 2012 NSL

Table 2 Alaska OCS Region Studies Proposed for the Fiscal Year 2012 NSL

Page No.	Discipline	Title
159	SS	Impact Assessment for Kaktovik Whaling Activities
161	MM	Cape Lisburne Seabird Colony Productivity and Foraging Areas
163	HE	Eastern Beaufort Sea Marine Fish and Lower Trophic Survey
165	PO	Physical Oceanography of the Chukchi Sea Oil and Gas Lease Areas (Extension of AK-09-06)
167	PO	Eastern Boundary Oceanography of the Beaufort Sea
169	MM	Field Evaluation of an Unmanned Aircraft System (UAS) for Studying Cetacean Distribution, Density, and Habitat Use in the Arctic
171	SS	Baseline Nutritional Survey: Inventory and Content Analysis of Subsistence and Market Foods as Consumed by North Slope Communities
173	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		

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ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2011

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: TBD

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. In 2008, the MMS 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 also has submitted an exploration plan 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: August 2010

ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2011

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: TBD

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 MMS 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 MMS-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: August 2010

ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2011

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. The approval of an Exploration Plan (EP) for Camden Bay highlights 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: TBD

Period of Performance: FY 2012-2016

Description:

Background:

The 2009 International Arctic Fisheries Symposium highlighted the need for 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 MMS 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 MMS/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: August 2010

ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2011

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: TBD

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. MMS/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 Acoustic Doppler Current Profilers (ADCPs), Autonomous Underwater Vehicles (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 ADCPs and 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 ADCPs and AUVs 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: August 2010

ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2011

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: TBD

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 MMS/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 MMS Beaufort Sea Oceanography Workshop (<http://alaska.boemre.gov/reports/2003rpts/2003-045.pdf>). The feasibility and study design for this project are addressed in the report "Recommended Physical Oceanographic Studies in the Alaskan Beaufort Sea" (http://alaska.boemre.gov/reports/2010rpts/2010_018.pdf).

Objectives:

- Document large scale surface and 3-D circulation and density fields and their interannual variation.
- Assess 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.
- Estimate the relative contributions of heat and freshwater fluxes to variations in stratification.
- Estimate 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 (ADCPs) (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 assess the effect of water column structure on dispersal of potential contaminants.

Revised Date: August 2010

ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2011

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: TBD

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: August 2010

ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2011

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: TBD

Period of Performance: FY 2012-2014

Description:

Background: Many previous MMS/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: August 2010

ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2011

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 MMS/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: TBD

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: August 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, the *Preliminary Revised Program Outer Continental Shelf Oil and Gas Leasing Program 2007-2012* (USDOl, MMS, 2007), issued in March 2010, pointed to a need for more environmental research in the Arctic before additional leasing occurs. 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 cetaceans, polar bears, pinnipeds and other marine mammals are expected to continue into 2011 and beyond. Additional studies may be brought online which address fish and migratory waterfowl. Future studies will include those aimed at determining spatial and temporal habitat use patterns, habitat description and monitoring and evaluations of health over time. Studies aimed at understanding potential impacts to subsistence species and subsistence practices will continue to be important. Additional studies of the physical environment, such as current regimes and ice characteristics, will be proposed to support interpretation of data from living resource investigations and to provide a better understanding of the fate and dispersion of OCS discharges.

3.1 Climate Change

Climate change is accelerating in the Arctic, leading to a rare but true baseline environmental change. In recent years, the extent of summer ice cover is decreasing more rapidly than was predicted by most global change models. The extent, duration, and thickness of summer ice cover in the Arctic region have decreased to record historical lows. The loss of ice cover is causing changes to both physical oceanography and ecosystem productivity and has significant ramifications for marine mammals, bird and fish species that live on, below, or near the ice.

Climate change will also lead to altered water chemistry. In particular, the average pH of the surface ocean is projected to decrease by as much as 0.5 pH units by 2100 due to the uptake of excess carbon dioxide (Sigler et al., 2008). In addition, higher water temperatures can result in increased biological production and decomposition.

Oceanic current patterns in the Arctic, especially in nearshore regions, are strongly influenced by climatological factors such as winds, river runoff and sea ice coverage. The rapid changes in each of these factors that are now occurring could lead to drastic alterations of the surface current fields. Oil-spill trajectory analyses performed by BOEMRE are based on surface current data derived from ocean circulation hindcast models. As climate change continues, oil-spill trajectory modeling may need to incorporate forecast data.

Climate change also entrains many socio-economic issues. Some immediate concerns include: increased shoreline erosion and permafrost melt that threatens arctic villages and infrastructure; changes in distribution and availability of hunted subsistence species; and potential changes in commercial and subsistence fisheries as commercial species such as salmon move north. In consideration of such basic transition, scientists are challenged to project how climate change effects will interact with OCS activities in the Arctic over the next 25-50 years.

3.2 Physical Oceanography

An ongoing challenge in the Alaska OCS Region is the need for better, finer scale circulation and oil-spill models and higher resolution data. This need is underscored by the rapidly changing conditions in the Arctic. Continued development and application of state-of the-art circulation models is important for future OSRA-based EIS analyses.

Improvements are also needed in sea ice aspects of the modeling. The resolution of ice models and ice data needs to be increased to address the propagation of fine scale non-random interactions across hundreds of miles of pack ice in the case of ice leads, as evidenced by recent improvements in satellite oceanography.

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 MMS/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 Fate and Effects

The Region has collected baseline biological and chemical monitoring data in the vicinity of the Liberty Prospect and Northstar since 1999, as part of the studies “Arctic Nearshore Impact Monitoring in the Development Area (ANIMIDA)” and “Continuation of Arctic Nearshore Impact Monitoring in the Development Area (cANIMIDA).” The summer of 2007 was the last field season for the 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 to delineate discoveries in the Sivulliq and Torpedo prospects.

In addition to site-specific monitoring, ANIMIDA and cANIMIDA re-examined the regional sediment quality in the nearshore U.S. Beaufort Sea. The MMS set up the Beaufort Sea Monitoring Project (BSMP) in the 1980s to monitor sediment quality. The BSMP monitored trace metal and hydrocarbon levels in sediments and benthic biota at specific locations on a regional basis. The ANIMIDA and cANIMIDA projects have resampled many of the BSMP stations from Harrison Bay to Camden Bay and Coastal Marine Institute studies resampled BSMP areas further west (Point Barrow) and east (Beaufort Lagoon). The need for additional monitoring will continue to be re-evaluated as oil and gas development in the Alaska Region OCS evolves.

3.4 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. In the Bering and Chukchi Seas, more information is needed to evaluate Essential Fish Habitats in the Chukchi Sea as commercial fish species move northward from the Bering Sea. Beaufort waters are also considered Essential Fish Habitat for salmon, and future research on salmonid reproduction in Beaufort Sea drainages is indicated to clarify environmental assessment and mitigation needs.

Seismic exploration and its effects on fish is becoming a high-priority issue for arctic residents. More information regarding the effects of seismic exploration on the health, behavior, distribution, and migration of the numerous important fish species of the Beaufort and Chukchi seas would be valuable for NEPA analyses.

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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