

**Alaska Outer Continental
Shelf Region**

**Alaska Annual Studies Plan
Final FY 2009**

**U.S. Department of the Interior
Minerals Management Service
Alaska Outer Continental Shelf Region
Anchorage, Alaska
September 2008**

Prepared by
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September 2008

This document may be accessed electronically at <http://www.mms.gov/alaska/ess/index.htm>.
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United States Department of the Interior



MINERALS MANAGEMENT SERVICE
Alaska Outer Continental Shelf Region
3801 Centerpoint Drive, Suite 500
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September 15, 2008

Dear Stakeholder:

Thank you for your interest in the Environmental Studies Program of the Minerals Management Service. 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 *MMS Alaska Annual Studies Plan, Fiscal Year (FY) 2010*, which we are now beginning to formulate. For your convenient reference, we are providing the *Alaska Annual Studies Plan (ASP) Final FY 2009*, 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 MMS mission and decision needs (see Section 1.3). Comments or suggestions need to be received by us no later than November 15, 2008, to assure consideration for the 2010 fiscal year. Following revisions to the plan, we will issue a Final FY 2010 Alaska ASP in the autumn of 2009.

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



Minerals Management Service Alaska Environmental Studies Program

Proposed Study for FY 2010

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, MMS 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.]

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

Period of Performance: FY 2010-20XX

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. We encourage the use of lists (1, 2, 3, etc.).*

Date information is required: *Provide dates when products would be most useful, such as “Final report is needed by December 2012.” 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
ADF&G	Alaska Department of Fish and Game
AEWC	Alaska Eskimo Whaling Commission
AKMAP	Alaska Monitoring and Assessment Program
AMIS	Alaska Marine Information System
AMSRB	Acoustic Model Scientific Review Board
ANIMIDA	Arctic Nearshore Impact Monitoring in Development Area
AOOS	Alaska Ocean Observing System
BEST	Bering Sea Ecosystem Study
BLM	Bureau of Land Management
BPXA	British Petroleum Exploration Alaska
BRD	Biological Resources Division (USGS)
BSMP	Beaufort Sea Monitoring Program
BSPA	Beaufort Sea Planning Area
BWASP	Bowhead Whale Aerial Survey Project
CAB	Chemistry and Benthos
cANIMIDA	Continuation of Arctic Nearshore Impact Monitoring in Development Area
CMI	Coastal Marine Institute
COMIDA	Chukchi Offshore Monitoring in Drilling Area
CSPA	Chukchi Sea Planning Area
CTD	Conductivity, Temperature and Density Profiler
DFO	Canada Department of Fisheries Oceanography
DPP	Development and Production Plan
EAS	Environmental Assessment Section
EIS	Environmental Impact Statement
EP	Exploration Plan
EPA	Environmental Protection Agency
ESA	Endangered Species Act
ESP	Environmental Studies Program (refers to MMS national program)
ESS	Environmental Studies Section (refers to Alaska OCS Regional Program)
EVOS	<i>Exxon Valdez</i> Oil Spill
FY	Fiscal Year
GIS	Geographical Information Systems
GPS	Global Positioning System
HF	High Frequency
ITM	Information Transfer Meeting

IUM	Information Update Meeting
LiDAR	Light Detection and Ranging
MMPA	Marine Mammal Protection Act
MMS	Minerals Management Service
NAB	North Aleutian Basin
NASA	National Aeronautics and Space Administration
NEP	Net Ecosystem Production
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
NPPSD	North Pacific Pelagic Seabird Database
NPRB	North Pacific Research Board
NSB	North Slope Borough
NSSI	North Slope Science Initiative
NSF	National Science Foundation
NSL	National Studies List
OCS	Outer Continental Shelf
OCSEAP	Outer Continental Shelf Environmental Assessment Program
OCSLA	Outer Continental Shelf Lands Act
OGC	Open Geospatial Consortium
OSRA	Oil-Spill-Risk Analysis
OSU	Oregon State University
PAH	Polynuclear Aromatic Hydrocarbon
POP	Persistent Organic Pollutants
ROMS	Regional Ocean Modeling System
ROV	Remotely Operated Vehicle
SDI	Satellite Drilling Island
SINTEF	Foundation for Scientific and Industrial Resources of the Norwegian Institute of Technology [Norwegian acronym]
TAR	Technology Assessment and Research Program
TO	Task Order
TSS	Total Suspended Solids
UAF	University of Alaska-Fairbanks
ULS	Upward-Looking Sonar
URI	University of Rhode Island

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
VHF	Very High Frequency
WHOI	Woods Hole Oceanographic Institution

SECTION 1.0 PROGRAMMATIC OVERVIEW

1.1 Introduction to the Region

1.1.1 Background

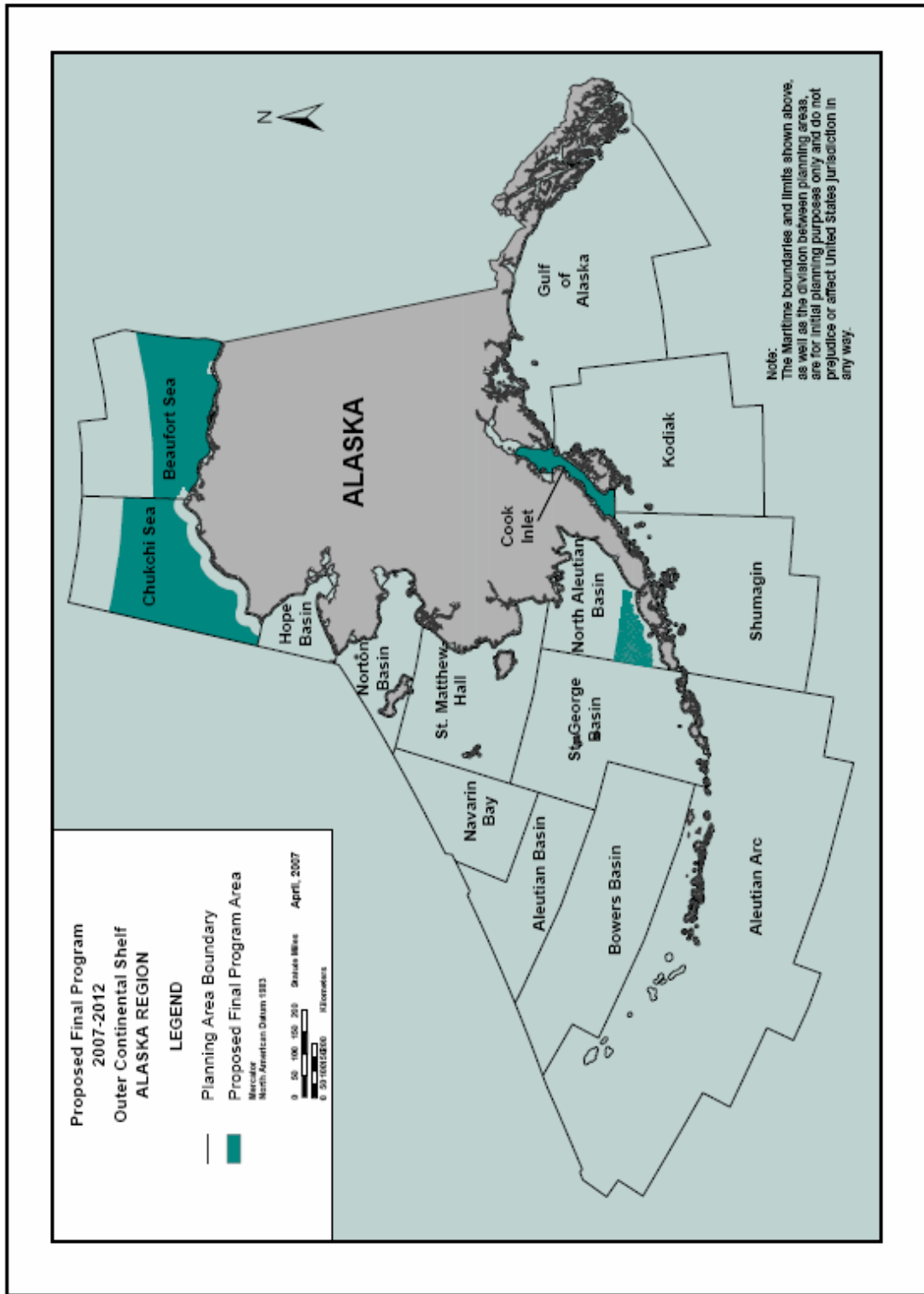
The MMS Environmental Studies Program (ESP) was established and funded by the United States Congress to support the offshore oil and gas leasing program of the Department of Interior in pursuit of national energy policies. Administered originally in 1973 by the Bureau of Land Management, then by the Minerals Management Service since 1982, the consistent mandate of the ESP has been to establish the information needed for assessment and management of potential impacts from oil and gas development on the Outer Continental Shelf and coastal environments. The Outer Continental Shelf (OCS) refers to 1.76 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 Outer Continental Shelf Lands Act (OCSLA) of 1953, as amended [Public Law 95-372, Section 20], provide guidelines for balancing orderly energy resource development with protection of the human, marine, and coastal environments. The basic agency mission is to expedite mineral resource exploration and development at fair market value in a safe and environmentally 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 MMS Environmental Studies Program 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. Since the ESP began, the Department of the Interior and the MMS have funded nationally more than \$800 million on environmental studies through fiscal year 2008. More than \$300 million of that amount has funded studies in Alaska across 15 planning areas in the Arctic, Bering Sea and Gulf of Alaska sub-regions (see Figure 1) to produce more than 400 different study reports. The ESP currently manages more than 50 ongoing study projects in Alaska 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://www.mms.gov/alaska/ref/AKPUBS.HTM>.

Early in the development of the program, the focus was on obtaining baseline information on the vast biological resources and physical characteristics of the Alaskan environment for pre-lease decision making. These studies included biological surveys of marine species, basic oceanography and meteorology, and geologic and sea ice phenomena. As a broader base of

Figure 1 Final Program 2007-2012 OCS Alaska Region



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 scenarios were developed to determine the most likely routes of transport and dispersion of oil that might affect the marine environment.

The use of computer modeling techniques has been implemented to aid in the assessment of potential oil spill and other pollutant risks to the environment and to key species such as fur seals, sea otters and endangered whales. Modeling has also been used in the ecosystem studies, especially where extrapolation to other areas provided valid analysis.

As study efforts collected and analyzed more disciplinary data, the importance of taking an integrated, interdisciplinary look at complete ecosystems in sensitive areas became apparent. During this time, the offshore leasing program was maturing. As a number of sales were held and exploration activities began, post-lease studies to monitor some of the possible effects of oil and gas activities on the environment and resources of these areas were initiated. The ESP provides information that is useful for development of the 5-year leasing schedule and for pre-lease and lease-related decisions, and develops monitoring information useful in post-lease management.

As studies information has been amassed, improved focus has required greater integration of various scientific disciplines. The MMS 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 MMS and other Federal and State agencies collect more pertinent information, the MMS 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 MMS decision needs.

In 2004, the U.S. Commission on Ocean Policy (USCOP) noted that “the MMS Environmental Studies Program (ESP) is a major source of information about the impacts of OCS oil and gas activities on the human, marine, and coastal environments” (USCOP, 2004). The ESP was evaluated by the U.S. Office of Management and Budget using the Administration’s Program Assessment Rating Tool. The review found that the program is “very effective in providing timely and peer reviewed environmental research to decision makers.” However, the Alaska ESP has been challenged to meet its mission in an increasingly conservative fiscal environment. Despite this challenging situation, the ESP, at the national level and in all the regions including Alaska, remains committed to attaining quality environmental information.

The *Alaska Annual Studies Plan Final FY 2009* complements and reinforces the goals of the *Environmental Studies Program National Strategic Plan 1998-2002* (USDOJ, MMS, ESP, 1998). Thus, the ESP is guided by several broad themes, which include the following:

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

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.

1.1.2 Issues To Be Addressed

At each step of the offshore leasing and development process, a variety of potential issues or resource-use conflicts may be encountered. This section forms a framework for the section titled “Identification of Information Needs.” As a result of issues characterized by uncertain information, we identify specific Information Needs. 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, possible lease sales, exploration activities and existing leases in the Beaufort Sea, Chukchi Sea and North Aleutian Basin Planning Areas.

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

- 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?
- What role will currents play in distribution of anthropogenic pollutants near development prospects?
- What are the current spatial and temporal use patterns of these planning areas by species that are potentially sensitive, such as bowhead whales, other marine mammals, fish, seabirds or other birds?
- What changes might occur in habitat use, distribution, abundance, movement or health of potentially sensitive key species such as bowhead whales, waterfowl, polar bears, other marine mammals or fish?

- What interactions between human activities and the physical environment have affected potentially sensitive species?
- What is the extent of endangered whale feeding in future proposed or potential lease sale areas?
- What changes might occur in socioeconomics and subsistence lifestyles of coastal Alaska communities?
- What are current subsistence harvest, distribution and consumption patterns and what changes might occur in key social indicators as a result of offshore exploration and development?
- 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 refinements are there to our knowledge of major oceanographic and meteorological processes and how they influence the human, marine and coastal environment?
- How do we improve our projection 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?
- How can we better integrate local and/or traditional knowledge into studies related to the Alaska ESP?

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

- What long-term change in anthropogenic hydrocarbon compounds has occurred in water and sediment?
- What refinements are there to our knowledge of major oceanographic and meteorological processes in the North Aleutian Basin and how do they influence the human, marine and coastal environment?
- How do we improve our prediction of the fate of potential oil spills?
- What long term changes related to past or future activities have occurred in marine food webs, especially regarding key fish, seabirds and sensitive marine mammals?

- What are the effects of offshore oil and gas exploration and development on important socioeconomic activities such as commercial fishing or existing community infrastructures?
- What are the near-term and long-term effects on key economic activities such as sport fisheries?
- What are current subsistence harvest patterns and what changes might occur in key social indicators as a result of offshore exploration and development?
- How can we better integrate local and/or traditional knowledge into conducting studies related to the Alaska ESP?

1.1.3 Planning Involvement

As proposals for exploration and development continue to evolve, Alaska's coastal communities are expecting increased involvement in project reviews and decisions that may affect their subsistence lifestyle. Since the people of Alaska's remote arctic and subarctic communities rely so heavily on subsistence resources of the marine environment, they are especially concerned about industrial activities that may directly or indirectly affect hunting success or the habitats of the species important to subsistence. The people proximate to the North Aleutian Basin are concerned about the potential effects of OCS activities on commercial fishing, marine subsistence resources and migratory waterfowl that use coastal lagoons. The people of Cook Inlet also have concerns about potential effects of OCS activities on commercial fishing, sport fishing and tourism. Many other related issues potentially could be affected by OCS activities, such as the well-being of marine mammals and threatened and endangered species. Coastal residents of Alaska have concerns about these resources, as do State and Federal agencies responsible for their management by law.

Over the years, the MMS ESP continues to involve Alaskans, State and Federal agencies and others in its research planning and execution in a number of ways. Solicitation of comments on the *Alaska Annual Studies Plan* has been practiced for years. The MMS ESP systematically seeks out and includes the knowledge of coastal community residents in planning. Another key source of input is discussion and advice from the OCS Scientific Committee, which meets on an annual basis. Other public involvement, such as participation on project-management review boards has assisted the MMS. In MMS field-oriented studies, researchers typically coordinate directly with local communities to discuss their plans, seek advice and assure that interested individuals learn about the project and its results. The MMS has incorporated local and traditional knowledge of Alaskan residents directly in the preparation of its study products, Environmental Impact Statements (EIS's), and decision documents.

The ESP utilizes a continuing process to synthesize information from many projects into a broader, multi-disciplinary view of research results. Of particular importance is the sharing of information among scientific fields. Efforts such as MMS-sponsored ITMs have helped the Alaska Region guide the design of future studies toward a more encompassing involvement of

local and traditional information with scientific activities. Local and traditional knowledge has been incorporated into specific study planning, fieldwork, and interpretation of results over the years of the ESP. 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.

1.1.4 Coordination and Collaboration

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 MMS, to assure optimal studies management and efficient use of funding resources
- Enhance utilization of existing information
- Enhance team approaches to interdisciplinary projects

Currently, a major portion of the Alaska ESP is conducted on a collaborative basis. In 1993, to take advantage of scientific expertise at the local level in addressing issues of mutual concern, the MMS developed the Coastal Marine Institute (CMI). The University of Alaska-Fairbanks (UAF) School of Fisheries and Ocean Sciences, nationally recognized for its coastal and marine expertise, administers the Alaska CMI. The Alaska CMI represents a unique cooperative effort between the MMS, the University of Alaska, and the State of Alaska to engage a diverse range of non-Federal entities in the joint pursuit of sound environmental scientific research. The collaborative and synergistic research effort enables the MMS to manage the information needs associated with development of offshore oil and gas resources in a more comprehensive and cost efficient manner over long-term horizons. Through the CMI, MMS stimulates important studies in a cost-saving one-to-one match structure. In its first 14 years of operation, the CMI match has come from 49 different organizations and has leveraged \$13 million of MMS funds into \$26 million worth of relevant marine-based research. During that time, the CMI program has also provided 117 years of graduate student support and completed over 54 studies. In 2008, the cooperative agreement was extended until 2013. Under the current 5-year agreement with CMI, MMS has committed \$750,000 per year with a dollar-for-dollar match arrangement.

The Alaska ESP also coordinates with other U.S. and local research entities such as the: National Oceanic and Atmospheric Administration (NOAA) and the National Marine Fisheries Service (NMFS) Alaska Fisheries Science Center; USGS-Biological Resources Division (BRD); U.S. Fish and Wildlife Service (USFWS); National Oceanographic Partnership Program (NOPP); 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; Polar Research Board; Alaska Ocean Observing System (AOOS); North Pacific Research Board (NPRB); Alaska Department of Fish and Game (ADF&G); North Slope Borough (NSB) Department of Wildlife Management; Alaska Eskimo Whaling Commission (AEWC); *Exxon Valdez* Oil

Spill Trustee Council research program; Cook Inlet Regional Citizens Advisory Council; academic institutions including: University of Alaska, Woods Hole Oceanographic Institution (WHOI), Oregon State University (OSU), University of Washington (UW), and University of Rhode Island (URI); industry programs; and others.

Additional international linkages with other arctic nations' research and regulatory entities have been established. 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 MMS. Further, the ESP identifies and facilitates specific studies that can coordinate and integrate with working group activities.

The polar regions play key roles in our global environment. Many interlinked research challenges involving both polar regions exist today. At its most fundamental level, the International Polar Year 2007-2008 is a coordinated campaign of polar observations, research and analysis that are multi-disciplinary in scope and global in reach. The International Polar Year (see <http://www.ipy.org>) is using today's research tools to better understand the key roles of the polar regions in global processes. The MMS has several studies that link with the International Polar Year activities.

1.2 Projected OCS Activities

1.2.1 Pre-lease Considerations

This *Alaska Annual Studies Plan Final FY 2009* reflects consideration of the proposed lease sales in the *Final Outer Continental Shelf Oil and Gas Leasing Program 2007-2012* (USDOJ, MMS, 2007). In a frontier region such as the Alaskan Arctic, planning lead-time is necessary to conduct adequate environmental studies. Challenges include: large and remote planning areas, diverse and extreme environmental conditions, still-evolving hydrocarbon extraction technology, and potential environmental hazards associated with offshore activities.

Three lease sales were held under the *Final Outer Continental Shelf Oil and Gas Leasing Program 2002-2007* (USDOJ, MMS, 2002), all of them in the Beaufort Sea Planning Area (see Figure 2). The last of these sales was held in April 2007. Other lease sales in that *Program* were postponed or were cancelled due to a lack of industry interest. The MMS issued the *Final Outer Continental Shelf Oil and Gas Leasing Program 2007-2012* in April 2007. The first lease sale under this *Program* was held in February 2008 in the Chukchi Sea Planning Area. The *Final Program* also proposes the following lease sales: two in the Beaufort Sea (2009 and 2011); two more sales in the Chukchi Sea (2010 and 2012) (see Figure 3); one in the North Aleutian Basin (2011) subject to restrictions (see Figure 4); and two in Cook Inlet (2009 and 2011) as special interest sales (see Figure 5). The Cook Inlet special interest sale or sales would be held only if industry shows interest in response to a request for nominations and comment.

Figure 2 Beaufort Sea Oil and Gas Leasing Activity

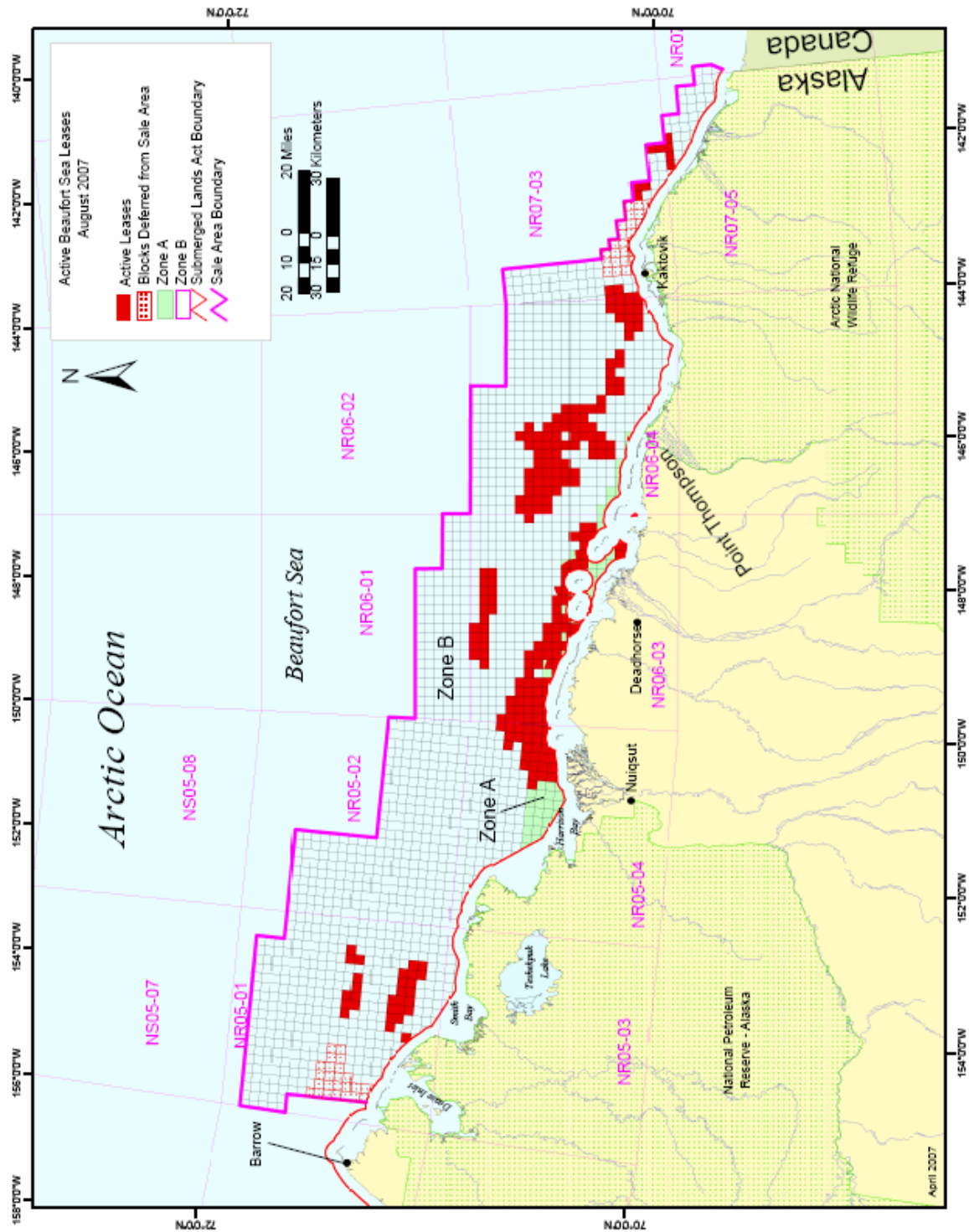


Figure 3 Chukchi Sea Planning and Program Areas

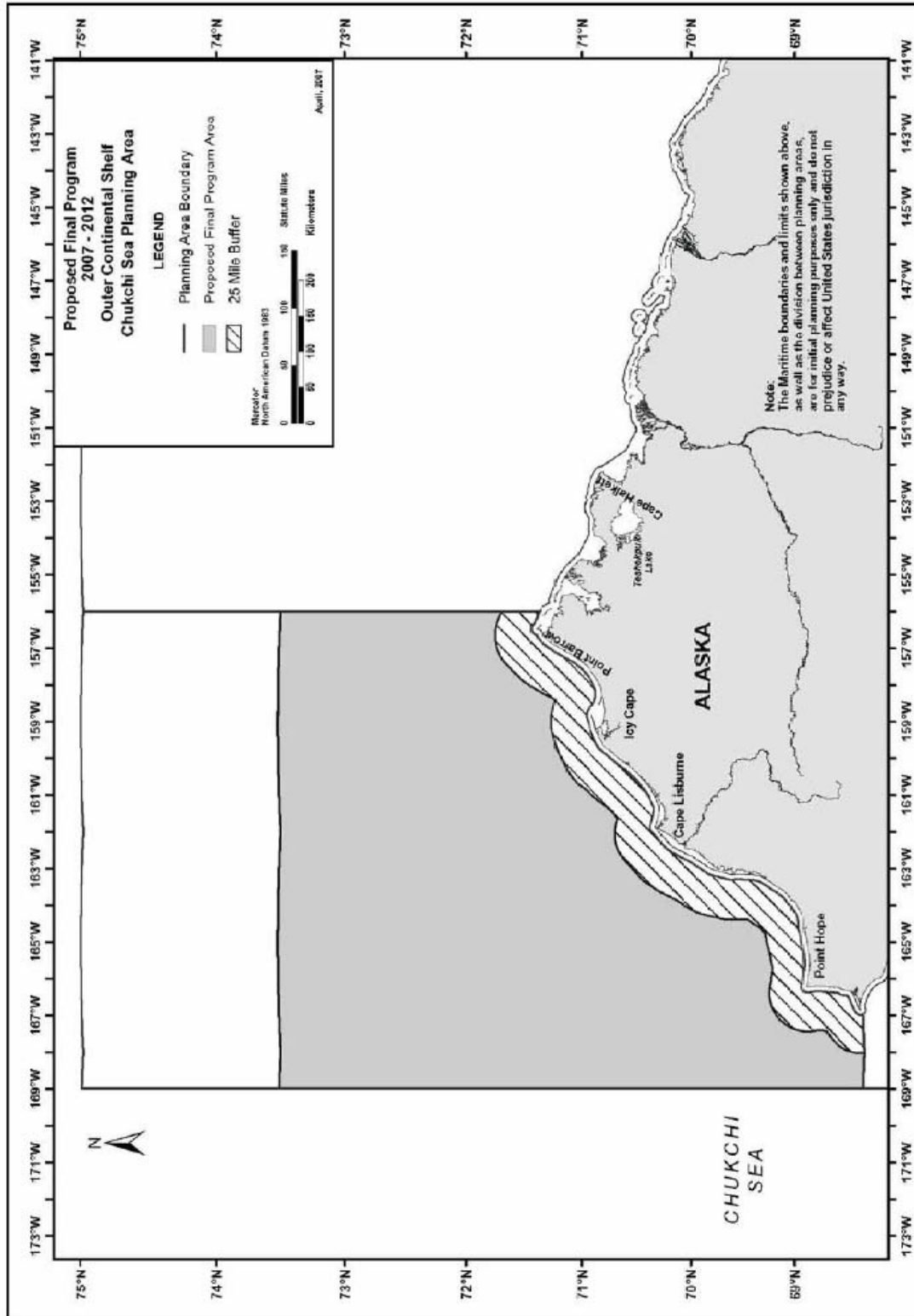


Figure 4 North Aleutian Basin Planning Area

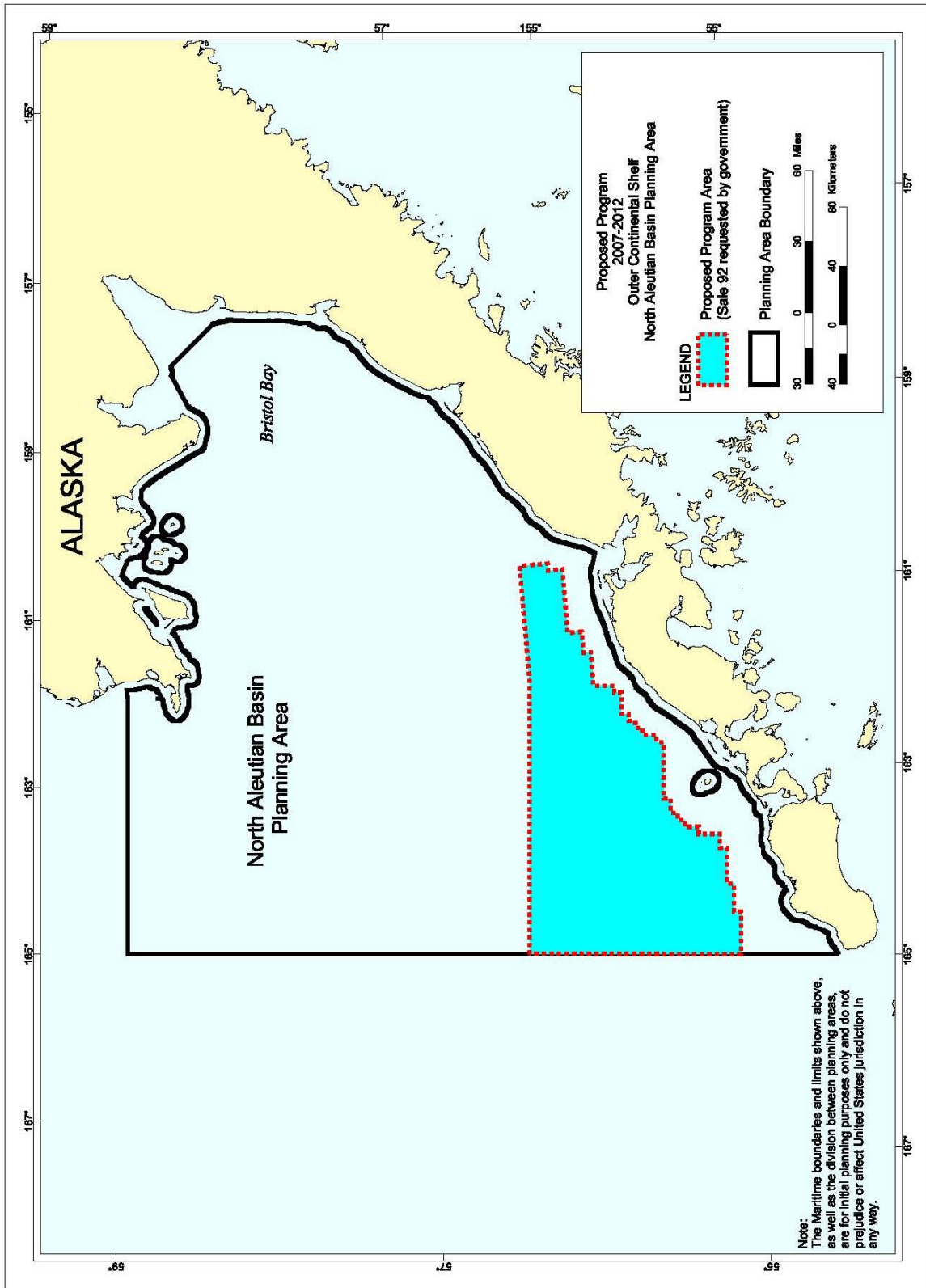
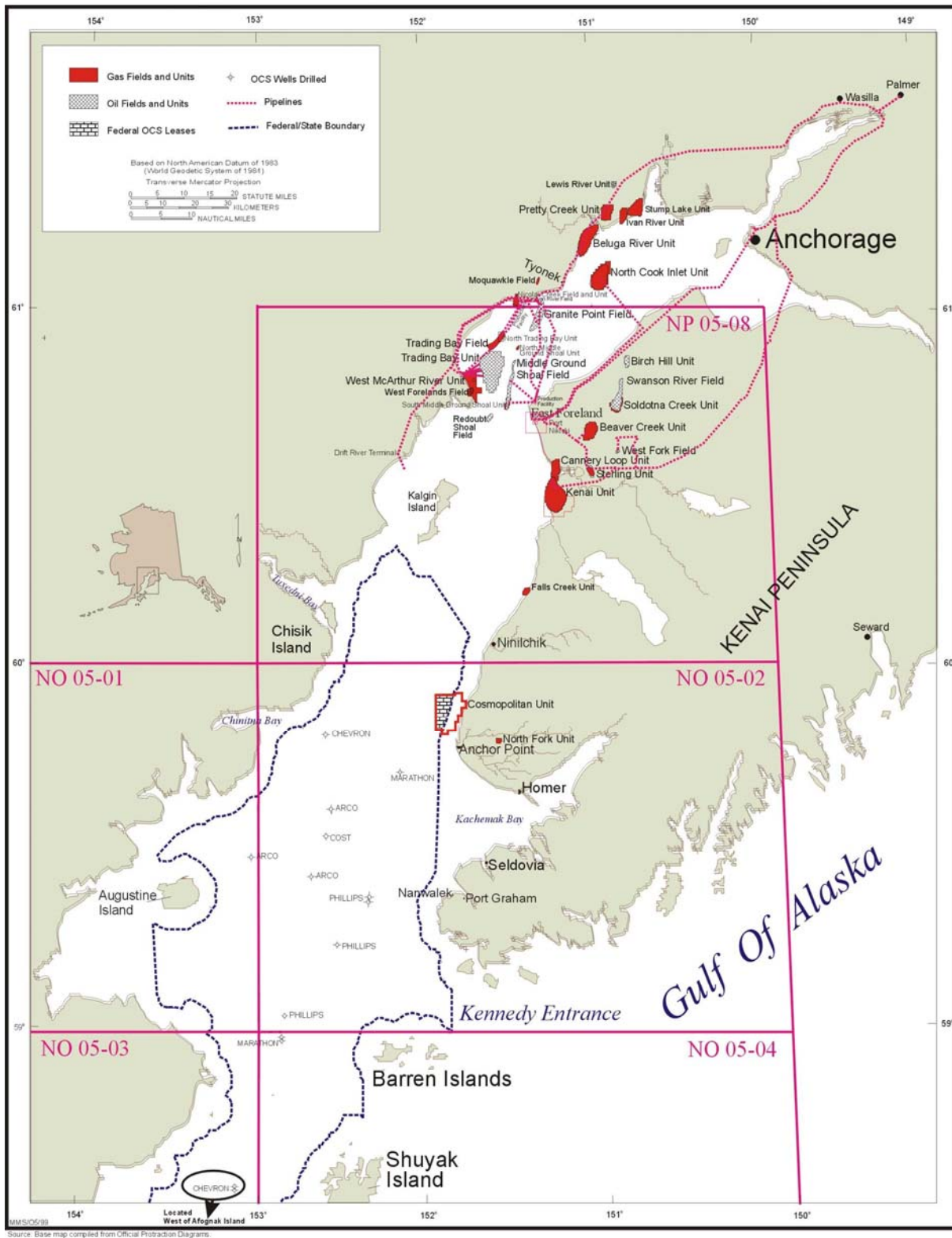


Figure 5 Cook Inlet Oil and Gas Leasing Activity



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

1.2.2 Post-lease Considerations

Prior to FY 1982, most studies of the Alaskan offshore were planned, conducted, and concluded before a sale was held in order to provide information for decision making and EIS's. However, not all needed information can be obtained prior to a sale. In accordance with mandates of Section 20 of the OCS Lands Act, as amended, post-lease studies are also needed to address environmental concerns and monitoring related to specific developments. The MMS 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 are:

- 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 abandonment)

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 2008, there are 261 active leases (see Figure 2) in the Beaufort federal offshore area. Lease Sale 195 in March 2005 accounts for 117 of the active Beaufort Sea leases, and Lease Sale 202 in April 2007 accounts for 90 of the active leases.

The British Petroleum Exploration Alaska (BPXA) Northstar development project (see Figure 6) is located about 10 miles north of Prudhoe Bay. This is the first development project to have production from the Alaska OCS. While the Northstar Island is in State waters, six to seven wells will be drilled into the Federal OCS. The project was approved by the U.S. Army Corps of Engineers in May 1999 and by the MMS in September 1999. Construction started in the winter of 2000 and production began the last day of October 2001. As of June 2008, the cumulative production for the Northstar State-Federal Unit totals 128 million barrels of oil from estimated recoverable reserves of 158 million barrels. Annual production peaked at 25 million barrels in 2004.

Figure 6 Northstar Island August 2000



A BPXA proposed project is the Liberty Unit in Foggy Island Bay, about 6 miles east of the State Endicott Project. The MMS released the *Draft Environmental Impact Statement for the Liberty Development and Production Plan* (USDOJ, MMS, Alaska OCS Region, 2001). In January 2002 BPXA put the Liberty project on hold. The MMS issued the *Final Environmental Impact Statement for the Liberty Development and Production Plan* (USDOJ, MMS, Alaska OCS Region, 2002) in May 2002. Recoverable reserves are estimated at 120 million barrels of oil. In April 2007, BPXA submitted a *DEVELOPMENT PROJECT: Development and Production Plan* to MMS on the Liberty Project (BPXA, 2007). On page 1-1, the document explains that “The Liberty Development Project design and scope have evolved from an offshore stand alone development in the Outer Continental Shelf (production/drilling island and subsea pipeline) . . . to use of existing infrastructure involving an expansion of the Endicott Satellite Drilling Island (SDI).” BPXA believes that this plan will require relatively few wells (up to six), resulting in a smaller environmental footprint and fewer impacts than the originally proposed offshore development. This plan was approved by MMS in January 2008.

Lease Sale 193 in February 2008 has resulted in 487 leases being issued in the Chukchi Sea Planning Area. The only other active leases are in the Cook Inlet/Shelikof Strait Planning Area. There are no active leases from previous lease sales in the Chukchi Sea or Hope Basin portions of the Arctic Subregion or in the Bering Sea or Gulf of Alaska Subregions (see Figure 1).

1.3 Identification of Information Needs

We distributed the *Alaska Annual Studies Plan Final FY 2008* (USDOJ, MMS, Alaska OCS Region, 2007a) to approximately 200 Federal, State, local, environmental, Native, industry, international and other stakeholders in September 2007. We also distributed a letter to the same stakeholders requesting suggestions for new studies for the FY 2009. We considered comments in response to that request and previous program reviews. In addition, we requested suggestions for new studies from all components of the Alaska OCS Region staff and considered their comments.

The ESP also relies heavily on information needs identified through solicitation of public comment and suggestions on how to enhance our information base at ITMs and other meetings. For example, the Alaska OCS Region has conducted ten ITMs. The tenth ITM was convened in Anchorage, Alaska, in March 2005 in Anchorage, Alaska. A Beaufort Sea IUM was also held in March 2005 in Barrow, Alaska. In addition, MMS 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 MMS 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 FY 2008 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, presented to and discussed by the workshop participants, and submitted to MMS for prioritization for inclusion in the COMIDA field effort. In total, the agency received 15 study profiles on the various topics discussed. As of August 2008, the study “Distribution and Relative Abundance of Marine Mammals: Aerial Surveys” is underway and both “Impact Monitoring for Offshore Subsistence Hunting” and “Chemistry and Benthos (CAB)” are expected to begin shortly. Two additional studies: “Physical Supporting Data for Chukchi Offshore Monitoring in Drilling Area” and “Spatial and Seasonal Distribution and Abundance of the Forage Fish Prey Resource of Chukchi Marine Mammals and Birds” are proposed for FY 2009 and FY 2010, respectively. The workshop report was published in April 2007 (USDOJ, MMS, Alaska OCS Region, 2007c).

The MMS also conducted a four day North Aleutian Basin (NAB) planning workshop from November 28-December 1, 2006, in Anchorage, AK. The research planning meeting participants included scientific experts and local, tribal, state and federal stakeholders to discuss potential studies focusing on Physical Oceanography/Fate and Effects of Oil Spills, Marine Mammals, Biology/Birds, Fish and Commercial Fisheries, Socioeconomics and Subsistence Activities of the North Aleutian Basin Area (see Figure 4). In total, the agency received 35 study profiles on the various topics discussed. The workshop report was published in June 2007 and is available on the MMS website (USDOJ, MMS, Alaska OCS Region, 2007b). Ongoing and proposed studies that developed from the NAB workshop include:

- Distribution, Abundance, and Habitat Use of North Pacific Right Whales
- Modeling of Circulation in the North Aleutian Basin
- Subsistence Study for North Aleutian Basin
- Juvenile and Maturing Salmon Use of the North Aleutian Basin Lease Area
- Spatial and Temporal Mapping of Nearshore Juvenile Fish and Larval Crab
- North Aleutian Basin Socio-economic Indicators
- Seasonal Habitat Use by Endangered Steller Sea Lions of the North Aleutian Basin Sale Area
- Occurrence and Distribution of Endangered Humpback and Fin Whales in the North Aleutian Basin (NAB) Area

Currently, a number of organizations and government agencies are sponsoring (along with the MMS) the *United States and Canada Northern Oil and Gas Research Forum: Current Status and Future Directions in the Beaufort Sea, North Slope and Mackenzie Delta*, to be held October 28-30, 2008. This forum will focus on oil and gas related research in the Beaufort Sea. It will provide an opportunity to share research, identify synergies and build on existing partnerships. Concurrent with this meeting, the MMS Alaska OCS Region is planning to hold its eleventh ITM.

Studies also address recommendations from programmatic reviews. 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).

1.3.1 Beaufort Sea General Information Needs

Long-Range Monitoring of Interdependent Physical, Biological and Social Processes: Both offshore and onshore oil and gas development and production activities are increasing across Alaska's North Slope. Residents of Nuiqsut, Kaktovik and Barrow are particularly concerned about long-term effects of offshore developments at Northstar and other possible developments, as well as long-term and cumulative effects of any exploration from OCS Beaufort Sea lease sales. Interagency reviews of related EIS's, EPs and DPPs are expected to lead to additional recommendations for monitoring impacts of Northstar and other possible developments. Key constituents have identified the need to monitor under ice currents, sedimentation and potential effects on social systems/subsistence in the vicinity of Northstar and Liberty. Related questions that need to be addressed are the characteristics of major oceanographic and meteorological processes and how they influence the human, marine and coastal environment.

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

- Hydrocarbon and metal characterization of sediments, bivalves and amphipods in the study area
- Annual assessment of subsistence whaling near Cross Island
- Identification of sources, concentrations, and dispersion pathways for suspended sediment
- Monitoring the Boulder Patch
- Characterization of anthropogenic contaminants in upper trophic biota
- Partitioning of potential contaminants between dissolved and particulate phases

Two of these studies are planned to extend beyond the cANIMIDA project. "Continuation of Impact Assessment for Cross Island Whaling Activities" is underway, and "cANIMIDA Monitoring of Boulder Patch Kelp During Liberty Development" is proposed for FY 2010.

Other keystone studies include:

- Beaufort Sea Nearshore Currents
- Surface Circulation Radar Mapping in Alaskan Coastal Waters: Field Study Beaufort Sea and Cook Inlet
- Sea Ice Modeling for Nearshore Beaufort and Chukchi Seas
- Beaufort Sea Mesoscale Meteorology

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, also known as BWASP (Bowhead Whale Aerial Survey Project)
- Bowhead Whale Feeding Variability in the Western Alaskan Beaufort Sea
- Population and Sources of Recruitment in Polar Bears

The study “Monitoring the Health of Bowhead Whales” was proposed for FY 2008, but has been deferred until FY 2009. Relevant studies proposed for FY 2009 include: “Passive Acoustic Detection and Monitoring of Endangered Whales in the Arctic” and “Demography and Behavior of Polar Bears Summering on Shore in Alaska.”

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

- Subsistence Mapping of Nuiqsut, Kaktovik and Barrow: Past and Present Comparison
- Study of Sharing Networks to Assess the Vulnerabilities of Local Communities to Oil and Gas Development Impacts in Arctic Alaska
- Continuation of Impact Assessment for Cross Island Whaling Activities

One additional study, “Aggregate Effects Research and Environmental Mitigation Monitoring of Oil Operations in the Vicinity of Nuiqsut,” that was included in the FY 2008 National Studies List (NSL) has been deferred until FY 2009.

Pollutants: North Slope villagers are concerned about potential effects on 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. Additional information on ocean currents and sea ice is necessary to fully address these concerns. Information on the fate (weathering) of oil spills is being obtained through participation with a joint industry consortium doing field experiments on cleanup, behavior, and weathering of oil in broken ice.

Small portions of the Beaufort Sea floor near the Liberty development unit have a special benthic environment referred to as the “kelp community” or the “Boulder Patch.” Sediments, pollutants, or disturbance associated with oil and gas-industry activities could negatively affect this unique environment.

National Oceanographic Partnership Program: The MMS also contributes to research in the Beaufort Sea conducted through NOPP, including:

- Circulation, Cross-Shelf Exchange, Sea Ice, and Marine Mammal Habitats on the Alaskan Beaufort Sea Shelf
- Toward a predictive model of Arctic coastal retreat in a warming climate, Beaufort Sea, Alaska
- Episodic Upwelling of Zooplankton within a Bowhead Whale Feeding Area near Barrow, AK

- Comprehensive Modeling Approach Towards Understanding and Prediction of the Alaskan Coastal System Response to Changes in an Ice diminished Arctic

1.3.2 Chukchi Sea General Information Needs

Native cultural activities that rely on subsistence, particularly on marine resources, predominate in these regions. The fundamental issues in the Chukchi Sea are very similar to the Beaufort Sea (see Section 1.3.1) although many species that regularly occur within the Chukchi Sea do not typically occur within the Beaufort Sea. One major difference is that 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 crucial 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.

Information needs for the Chukchi Sea will be addressed by a number of the studies listed above, as well as studies that sprang from the 2006 COMIDA workshop and several others:

- Distribution and Relative Abundance of Marine Mammals: Aerial Surveys
- Impact Monitoring for Offshore Subsistence Hunting
- Chemistry and Benthos (CAB)
- Pinniped Movements and Foraging
- Monitoring Marine Birds of Concern in the Eastern Chukchi Nearshore Area (Loons)
- Current and Historic Distribution and Ecology of Demersal Fishes in the Chukchi Sea Lease Area

New studies proposed for FY 2009 that will address issues in the Chukchi Sea include:

- Passive Acoustic Detection and Monitoring of Endangered Whales in the Arctic
- Migration and Habitat Use by Threatened Spectacled Eiders in the Eastern Chukchi Near and Offshore Environment
- Mapping and Characterization of Recurring Polynyas and Landfast Ice in the Chukchi Sea
- Surface Current Circulation High Frequency (HF) Radar Mapping in the Chukchi Sea

Two additional studies: “Physical Supporting Data for Chukchi Offshore Monitoring in Drilling Area” and “Spatial and Seasonal Distribution and Abundance of the Forage Fish Prey Resource of Chukchi Marine Mammals and Birds” are proposed for FY 2009 and FY 2010, respectively.

1.3.3 North Aleutian Basin General Information Needs

The *North Aleutian Basin Information Status and Research Planning Meeting* evaluated study concepts needed for describing the existing environment and forming a basis for assessing

potential environmental effects or needed monitoring in the North Aleutian Basin Program Area (see Figure 5). Attendees concluded that critical information needs include:

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

The multi-disciplinary study profiles developed at that planning meeting have become the blueprint for implementation of new MMS study efforts in the NAB since FY 2007. In 2007, MMS and the National Marine Fisheries Service began collaboration on “Distribution, Abundance, and Habitat Use of North Pacific Right Whales” in the NAB. The North Pacific right whale is a federally designated endangered species. The MMS has also contracted with Rutgers University, with the assistance of the University of Alaska-Fairbanks, to adapt an existing ice-ocean circulation model to the specific oceanographic conditions in Alaska’s Bristol Bay. “Modeling of Circulation in the North Aleutian Basin” will aid in determining environmentally sound actions that will need to be taken to protect the region. As of August 2008, “Subsistence Study for North Aleutian Basin” is in procurement. The results of this study will serve as community baselines to monitor and mitigate any significant future changes in subsistence activities over time. Two other studies that were approved for FY 2008 have been deferred until FY 2009: “Juvenile and Maturing Salmon Use of the North Aleutian Basin Lease Area” and “Spatial and Temporal Mapping of Nearshore Juvenile Fish and Larval Crab.”

1.3.4 Alternative Energy General Information Needs

Section 388 of the Energy Policy Act of 2005 amended the OCSLA to give discretionary authority to 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 makes available for alternative energy leasing are likely to be determined through a process that assesses different types of alternative energy resources, anticipated and potential environmental impacts, and other relevant information on a national, regional, or local basis.

Renewable energy resources, such as solar, wind, tidal and geothermal power, are gaining credence as a viable means to offset a portion of the nation’s dependence upon fossil fuels and reduce pollution emissions, as well as a means to reduce large international trade deficits, to improve national security, and to stimulate new prospects for economic expansion.

Alternative renewable energy supplies convey great promise for the future, but they must be imagined within the context of existing and developing socio-economic and political relations, with a watchful eye upon the potential environmental, social and cultural consequences of a significant technological transformation. The study “Alternative Energy Capacity Inventory in Coastal Alaska” has been proposed for FY 2010. The objectives of this study are to:

1) establish firm intellectual understanding over the range of options, processes, economic feasibility, and potential management strategies that are relevant to development prospects for renewable energy sources on the OCS of Alaska and 2) systematically collect a variety of technical and socio-economic data to produce a resource inventory database about the realistic prospects and related social impacts of specific alternative energy development scenarios for the Alaska region.

SECTION 2.0 STUDY PROFILES

2.1 Profiles of Ongoing Studies

Information about ongoing studies can be found at:

http://www.mms.gov/alaska/ess/ongoing_studies/ongoing_studies.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 all completed ESP Studies go to:

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

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ENVIRONMENTAL STUDIES PROGRAM: Annual Studies Plan FY 2009

Region: Alaska

Planning Area(s): North Aleutian Basin

Title: Modeling of Circulation in the North Aleutian Basin

MMS Information Need(s) to be Addressed: Oil-spill trajectory analysis for impact assessment is needed for the North Aleutian Basin Planning Area (NAB). The Department of Interior's *Final OCS Oil and Gas Leasing Program 2007-2012* considers a NAB oil and gas lease sale for 2011. Oil-Spill-Risk Analysis (OSRA) is a cornerstone 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 an up-to-date circulation model is essential to future OSRA-based EIS analyses

Total Cost: \$278,000

Period of Performance: FY 2007-2009

Conducting Organization: Rutgers University

Description:

Background: MMS proposes to lease within the NAB. Although MMS expects the leasing process to result primarily in exploration and production of gas for local use, this expectation does not preclude the need for Oil-Spill-Risk Analysis tools. The MMS does not have a functional oil-spill trajectory model for the NAB. Previous MMS contractors (RAND Corporation and Applied Science Associates) did develop circulation and oil-spill trajectory models for the northern Bering Sea in the late 1970s and 1980s, but these models are no longer functional, available to MMS, or state-of-the art. A phased effort is envisioned in which this study would be a first phase to provide needed EIS-applicable products prior to the next oil and gas lease sale. A more comprehensive post-sale model development and application would occur as a future second phase.

Objectives: Adapt and maximize the skill of an existing, coupled ice-ocean circulation model which includes the southeastern Bering Sea to represent the physical processes, especially circulation, within the NAB. Provide MMS with 10-20 years, gridded wind, surface water and ice velocity, ice cover; and limited other modeled fields to be determined.

Methods: This study will 1) modify existing coupled ice-ocean circulation model to maximize skill in the NAB; 2) conduct sensitivity testing and validation of modified model; 3) provide 3-hour gridded velocity fields (wind, surface water, ice), and ice cover to MMS in agreed format for 10-20 years hindcast simulation; 4) documentation through model manual, final report and submittal of a peer-reviewed journal article.

Revised Date: August 2008

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ENVIRONMENTAL STUDIES PROGRAM: Annual Studies Plan FY 2009

Region: Alaska
Planning Area(s): Beaufort Sea
Title: Beaufort Sea Nearshore Currents

MMS Information Need(s) to be Addressed: This study will be useful to MMS to validate the Oil-Spill-Risk Analysis model. It will provide understanding for oil-spill contingency planning in areas outside the barrier islands versus inside the barrier islands. This information will be used to evaluate oil-spill contingency plans for Liberty, if approved, and other developments. It would also be used for NEPA analysis and documentation for Beaufort Sea Lease Sales and DPPs.

Total Cost: \$605,000

Period of Performance: FY 2003-2009

Conducting Organization: UAF, Institute of Marine Science

Description:

Background: Understanding the under-ice and open water currents through a long term time series is a necessary precursor to estimating potential effects on sensitive resources from oil spills or in the landfast ice. A recent MMS study provided measurements from three locations within the barrier islands of Stefanson Sound near Northstar and Liberty for 1999-2000, 2000-2001, and 2001-2002; and from a fourth location just outside the barrier islands in 2001-2002. The ongoing study has provided the first current, temperature, and salinity data covering the entire freeze up, winter, and breakup periods in the nearshore Beaufort Sea. Preliminary evidence suggests that in the future, a single mooring would suffice in capturing the along-lagoon flow in this region of Stefanson Sound.

Other areas of the Beaufort Sea have different current regimes and have not been sampled for under-ice currents and only limited open water currents. Lagoons in the eastern Alaskan Beaufort Sea have narrower passes between the barrier islands, causing a pulsed circulation in and out of the lagoons. These passes are important due to their potential to funnel flow and oil spills into the lagoons. Camden Bay, also to the east, is not protected by barrier islands and represents a third type of coastal flow regime. The only current meter moorings for these eastern Beaufort Sea coastal regimes were a small oceanographic program in summer 1988 and 1989.

Objectives:

- Measure currents, temperature, and salinity hourly at three locations in the landfast ice zone; one in the vicinity of Liberty and Northstar and two in new locations with different flow characteristics.
- Quantify the magnitude of current variability and to describe the relationship between currents and local winds.

- Estimate the vertical structure of the currents throughout the water column and how the structure changes with the development of the landfast ice through the winter and in summer when the ice melts and rivers flood the inner shelf.
- Provide physical oceanographic data to the continuation of the Arctic Nearshore Impact Monitoring in Development Areas (ANIMIDA) study.

Methods: A 1200 kHz acoustic Doppler current profiler (ADCP) will be moored for one-year periods, recovered, and redeployed for total of 3 years. All three moorings will have conductivity temperature depth measuring devices (CTDs) and transmissometers. Local winds measured at Deadhorse, Northstar, Endicott, Oliktok and Badami and sea level data collected at the Waterflood facility will be collated for time-series comparison with mooring data. Standard physical oceanographic time-series analyses (e.g., univariate statistical descriptors and correlation in both time and frequency domains) and velocity shear calculations will be done.

Revised Date: August 2008

ENVIRONMENTAL STUDIES PROGRAM: Annual Studies Plan FY 2009

Region: Alaska

Planning Area(s): Beaufort Sea

Title: Feasibility and Study Design for Boundary Oceanography of the Beaufort Sea

MMS Information Need(s) to be Addressed: This study is needed by MMS to better understand the oceanography of Beaufort Sea and to insure that first-order oceanic physics are understood and appropriately represented in MMS circulation models and Oil-Spill-Risk Analyses. This information will be used to evaluate oil-spill contingency plans for Liberty, if approved, and other developments. It would also be used in NEPA analysis and documentation for proposed Beaufort Sea Lease Sales, EPs, and DPPs.

Total Cost: \$179,000

Period of Performance: FY 2006-2008

Conducting Organization: UAF

Description:

Background: MMS sponsored two international workshops designed to provide MMS with recommendations regarding future Arctic oceanographic research needs. The 2003 MMS/UAF CMI workshop on small sea ice and ocean modeling in the Beaufort and Chukchi seas reflects discussions of international sea ice modelers and observers who developed strategies to advance the state-of-art in Arctic ice modeling. Following recommendations from this workshop, MMS and NASA signed an IA in 2003 to research sea ice modeling in nearshore Beaufort and Chukchi Seas.

Also in 2003 MMS held a workshop on physical oceanography of the Beaufort Sea. The proceedings of that workshop reflect discussions of international experts in Arctic oceanography on state-of-knowledge of Beaufort Sea physical oceanography and recommend long-range goals for oceanographic research to meet MMS needs. Several of the recommendations articulate the need to better understand the coastal boundary (buoyancy-forced coastal circulation), lateral ocean boundaries, and the offshore boundary. Two MMS 2003 studies, on Beaufort Sea nearshore currents, an ADCP along coast mooring study, and on mapping and characterization of recurring spring leads and landfast ice in the Beaufort Sea, addressed a portion of these recommendations. However, other recommendations require more resources than MMS can provide alone. Thus, they are best suited for interagency, international partnerships.

Objectives: Provide MMS with design and costs for research to meet the recommendations of the Beaufort Sea Workshop. These recommendations cover:

- Lateral Ocean Boundaries: develop better understanding of western and eastern boundary influences.
- Offshore Boundary: a) conduct shipboard and moored measurements of currents, sea ice drift, and hydrography across Beaufort Sea shelf; b) establish fate of Barrow Canyon outflow; c) establish the degree of infiltration of Mackenzie River plume into eastern Alaskan Beaufort Sea.
- Buoyancy-forced Coastal Circulation: a) gain better understanding of the processes which enhance or inhibit transport across the landfast/pack ice margin; b) gain better understanding of the behavior of the snowmelt freshwater plumes beneath landfast ice in spring; c) make better estimates of the freshwater discharge cycle for North Slope rivers; d) make observations of open water period 3-D circulation and thermohaline field associated with river discharge; e) develop geochemical discrimination techniques and apply to keying of low salinity to their freshwater sources.

Methods: This study will prioritize specific research objectives based on criteria including potential mutual interest (i.e. co-funding opportunities) and maximization of scientific gain and will provide as a final report a study design and cost estimate for research on the boundary oceanography of the Beaufort Sea that would address the stated objectives. The MMS would consider implementation of some or all components in future fiscal years. This project will consider results of the FY 2005 workshop on hydrological modeling for freshwater discharge from the Alaska arctic coast, and it will coordinate with other ongoing environmental studies, as appropriate.

Revised Date: August 2008

ENVIRONMENTAL STUDIES PROGRAM: Annual Studies Plan FY 2009

Region: Alaska

Planning Area(s): Beaufort Sea

Title: Beaufort Sea Mesoscale Meteorology

MMS Information Need(s) to be Addressed: The final modeled data will improve the predictive capabilities of the MMS oil-spill trajectory model and the Foundation for Scientific and Industrial Resources of the Norwegian Institute of Technology [Norwegian acronym] (SINTEF) 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: \$350,000

Period of Performance: FY 2006-2008

Conducting Organization: UAF, Geophysical Institute

Description:

Background: The 2003 MMS workshop on physical oceanography of the Beaufort Sea brought together international experts in Arctic oceanography to review the state-of-knowledge of Beaufort Sea processes and recommend long range goals for research to meet MMS needs. One recommendation was for improvements in understanding the mesoscale meteorology. Critical issues requiring study are the wind and surface stress fields established by mesoscale variations in regional meteorology and sea ice distribution and deformation fields. Accurate specification of the surface wind and stress field is essential to predicting ocean and ice circulation. The Beaufort Sea shelf is likely subject to substantial along and cross shore gradients in the surface wind velocity with these gradients possibly involving changes in both wind speed and direction. At present, wind gradients are not captured adequately by winds derived from synoptic pressure fields (typically prepared by weather forecasting and climate centers) and/or extrapolated from coastal meteorological stations, both of which are often used in estimating the shelf wind field. Oil-spill models that rely on winds measured from coastal stations or from synoptic pressure fields could be seriously biased.

Objectives:

- Evaluate existing mesoscale meteorology models that can predict along shore and cross-shelf wind speed and direction for the Beaufort Sea, Alaska.
- Determine the appropriate technical enhancements, funding levels and partnerships needed to build an enhanced mesoscale meteorological model for the Beaufort Sea that will optimize the prediction of spatial variability of winds, accounting for sea breeze and orographic effects.

Methods: Phase I will 1) identify potential interagency agreements or partnerships with other public, private, or international groups that are interested in cost or logistics sharing during; 2)

produce a Procite bibliographic database and report summary of potential mesoscale meteorological models and data collection efforts for the project study area; 3) conduct comparative data analysis and model evaluation; 4) based upon the comparative data analysis, and other analytical tools at the contractors discretion, describe how well the mesoscale meteorological model represents the observational data with regards to orographics steering effects, sea breeze affects, and along shore and cross shelf wind spatial coherence; 5) produce a Phase II plan to develop a mesoscale meteorological model for the Beaufort Sea that will meet MMS objectives.

Phase II will collect additional data as required for model implementation based upon the analysis of Phase I data, model priorities and cost, including: a) improved sea ice measurements; b) measurement of surface winds from portable, temporary meteorological stations, buoys, on the landfast ice, pack ice and other proposed meteorological stations on offshore islands or offshore oil platforms of opportunity; c) spatially varying surface variables such as soil moisture, canopy temperature and water content, terrain height, land roughness, land percentage etc.; d) other data. Phase II will also incorporate newly collected field data and develop preliminary model results that can predict the spatial and temporal variability of the along and cross shore surface wind and stress fields for the Beaufort Sea. An improved mesoscale meteorological model that meets MMS objectives will be produced.

Revised Date: August 2008

ENVIRONMENTAL STUDIES PROGRAM: Annual Studies Plan FY 2009

Region: Alaska

Planning Area(s): Beaufort Sea

Title: Mapping Sea Ice Overflood Using Remote Sensing from Smith Bay to Camden Bay

MMS Information Need(s) to be Addressed: This information is important to identify and characterize potential hazards, such as from strudel scour along the Beaufort Sea coast. In addition this information could be used to assist in the development of ice models and their performance during breakup in the landfast ice zone. The results will be used in NEPA analysis and documentation for Beaufort Sea Lease Sales, EPs, and DPPs.

Total Cost: \$475,000

Period of Performance: FY 2006-2009

Conducting Organization: D.F. Dickins Assoc., Ltd

Description:

Background: MMS has limited spatial and temporal information on rivers overflowing the nearshore sea ice in spring. The most recent work in 1999 focuses on overflow of the Sagavanirktok River in the vicinity of the proposed Liberty prospect. There are also 3 years of overflow data for the Kuparuk River in the vicinity of Northstar. Landsat imagery from projects in 1988 and 1993 has been collected and archived at the University of Alaska Geophysical Institute for the Beaufort Sea. With the advent of development in the Beaufort Sea this type of information is needed to address issues regarding pipeline routing and facility siting. Analysis of overflow and its implications for exploration and development requires information on both the temporal and spatial distribution of ice overflow from the breakup of North Slope rivers in the spring. This study would provide baseline data and improve the accuracy of information for environmental assessment and hazard mitigation. These observations would also be of value to the offshore industry for planning operations on the OCS.

Objectives:

- Compare the helicopter survey of the zone of overflowing for the Colville river delta against satellite imagery collected for the same time period.
- Utilizing satellite imagery, map the overflowed areas for the major North Slope river systems from 1997-2007.
- Compare overflow areas of the landfast ice to strudel scour locations.

Methods: This study will: 1) collect and synthesize existing Landsat/Radarsat/MODIS and other available remote sensing imagery; 2) quantify the spatial and temporal distribution of river overflow of the moderate size rivers on the North Slope of Alaska from Smith Bay to Camden Bay with a focus on mapping the maximum overflow extent; 3) compile Beaufort

Sea stream gauge data; 4) fly an aerial survey along the Colville River delta for one season to ground truth remote sensing data and quantify uncertainties of estimating the overflow from remotely sensed data; 5) collect hydrographic data for the Sagavanirktok and Kuparuk rivers and quantify any relationship between river runoff and aerial extent of overflow; 6) compile available spatial data on the location of strudel scours from existing surveys along the Beaufort Sea coast; 7) compile all of the overflow limits and available strudel scour data into a Geographic Information System (GIS) database; 8) provide a report that summarizes the spatial distribution of river overflow by year along the Beaufort Sea Coast, including individual years as well as minimum and maximum historical overflow extents from 1996-2007; 9) compare overflow extent to the location of strudel scours and other environmental variables.

Revised Date: August 2008

ENVIRONMENTAL STUDIES PROGRAM: Annual Studies Plan FY 2009

Region: Alaska

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

Title: Sea Ice Modeling for Nearshore Beaufort and Chukchi Seas

MMS Information Need(s) to be Addressed: The importance to the MMS is to increase the accuracy of estimates of oil-spill movement in ice in the Beaufort and Chukchi Seas. Current models are suspect inshore and have a resolution of 100-km to a few-km. This study will help resolve modeling issues for the Alaska OCS Region, increase confidence in the models used by the OCS Program, and help in review of oil-spill contingency plans. The information will also be used for NEPA analysis and documentation for Beaufort Lease Sales and DPPs.

Total Cost: \$1,000,000 plus Joint Funding **Period of Performance:** FY 2003-2008

Conducting Organization: NASA

Description:

Background: The MMS used the results of the FY 2002 sea ice modeling workshop to focus on what is needed from this next-generation effort addressing the specific problem of modeling fine scale ice/ocean and ice/ice interactions.

Most basin-scale dynamic-thermodynamic models use relatively simple thermodynamics and an ice thickness distribution that approximates the ice as slabs of one to a few meters mean thickness, plus open water. While sufficient as a first approximation of the arctic ice pack, such treatment lacks the ability to sufficiently resolve the observed spectrum of ice thickness from thin new ice to thick ridged ice to fast ice. The ice models in current state-of-the-art coupled ice/ocean models, including those current Rutgers and CMI models contracted by MMS, are based on empirical ice physics valid at a 100-km scale and extrapolated to smaller grid dimensions. Even at the larger scale, new satellite remote sensing data demonstrates that the first order physics of lead formation is not correctly depicted in existing ice models.

Development of this next-generation ice model is being jointly funded through an IA with NASA. Some aspects of the model are being developed under separate, additional funding by the National Science Foundation and Office of Naval Research. For MMS purposes, this new generation ice model would need to increase spatial resolution, improve modeling of fracture patterns and ice formation, better track observed ice interactions and lead toward better modeling of nearshore interactions.

Objectives: The objective of this study is to improve the state of the art in ice or ice/ocean modeling and to produce either a stand alone ice/ocean model or an improved ice model that

can be coupled to and or nested in the current MMS ice/ocean model. The existing or new model would be applied to the nearshore Beaufort and Chukchi Seas.

Methods: This study will 1) participate in interagency working group to co-fund new generation ice model; 2) develop new ice model based on smaller scale parameterization; 3) produce stand-alone ice/ocean model or couple the ice model to the current MMS ocean model; 4) run coupled model simulations; 5) conduct sensitivity testing and validation of the model results.

Revised Date: August 2008

ENVIRONMENTAL STUDIES PROGRAM: Annual Studies Plan FY 2009

Region: Alaska

Planning Area(s): North Slope, Beaufort Sea

Title: Support of the Collection of Meteorological Data on the North Slope and Beaufort Sea, Alaska

MMS Information Need(s) to be Addressed: The data and analysis from the collection of these meteorological data is invaluable to ongoing MMS 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 MMS 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); MMS field operations studies, and air quality measurements from offshore operations.

Total Cost: \$40,000

Period of Performance: FY 2007-2008

Conducting Organization: University of Alaska-Fairbanks

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 MMS final reports 2005-069 (Hoeffler Consulting Group, 2006) and 2007-011 (Hoeffler Consulting Group, 2007).

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 MMS 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 evapotranspiration 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: Update meteorological and communication equipment at three meteorological stations along the Beaufort Sea coast. Provide real time meteorological data to MMS via a server at the University of Alaska-Fairbanks. Provide annual data quality reports and an annual quality controlled database to MMS.

Revised Date: August 2008

MMS ENVIRONMENTAL STUDIES PROGRAM: ANNUAL STUDIES PLAN 2009

Region: Alaska

Planning Areas: Beaufort Sea, Cook Inlet

Title: Surface Circulation Radar Mapping in Alaskan Coastal Waters: Field Study Beaufort Sea and Cook Inlet

MMS Information Needs to be Addressed: The Oil-Spill-Risk Analysis (OSRA) is a cornerstone to regional EISs environmental assessments, and oil-spill-contingency planning. MMS is being tasked with providing circulation and oil-spill-trajectory information at higher resolution than feasible or justifiable by current modeling state-of-the-art or current-meter technology. Information from this study will be used in NEPA analysis and documentation for Beaufort Sea Lease Sales, Cook Inlet Lease Sales, DPPs, and oil-spill-contingency plans.

Total Cost: \$946,000

Period of Performance: FY 2006-2008

Conducting Organization: University of Alaska Fairbanks

Description:

Background: Over the past 25 years, oceanographic radar techniques have been developed and improved so that detailed, gridded, 2-dimensional maps of surface circulation can be provided and recorded in real time. Currents would play a critical role in the transport and fate of spilled oil, but there is paucity of direct circulation measurements in some areas of the Beaufort Sea and Cook Inlet. Current meters provide only data at specific points and not at the water surface, where the oil would be. These radar techniques provide a measured equivalent of a gridded circulation model and can be used as input to and validation for oil spill trajectory models.

Several entities, including MMS, NOAA, NOPP, IOOS, the University of Alaska Fairbanks, and oil industry have expressed interest in using circulation mapping radar techniques in Alaskan coastal waters. The radar units are expensive and cost and use-sharing rental agreements among multiple users is a preferred approach.

Objectives: This study's objectives are to field test the capability of the HF radar to collect near-real time surface current measurements in the Beaufort Sea from July (breakup of the landfast ice and opening of the offshore pack ice) through freeze-up and test the capability of the same units to collect surface currents in lower Cook Inlet for a period of a year. Analysis will compare surface currents to winds, subsurface currents, and ice concentration.

Methods: This study will: 1) deploy radar units to the Beaufort Sea during the 2005 and 2006 field seasons; 2) collect near real-time surface current measurements on an hourly basis over a publicly available internet connection from West Dock east to the Endicott causeway and as

far out on the continental shelf as technically feasible; 3) collect surface current measurements from the end of breakup (July) through the formation of landfast ice in October; 4) develop new routines to process the surface current measurements in ice covered waters of the Beaufort Sea; 5) analyze the processed surface current measurements against ice data, wind data collected from MMS meteorological stations on the North Slope and sub-surface currents collected from MMS Acoustic Doppler Current Profiler (ADCP) situated within the study area; 6) produce a field report for Beaufort Sea 2005 and 2006 field seasons; 7) demobilize HF radar units in the Beaufort Sea and deploy to lower Cook Inlet for a one year test in October 2006; 8) demobilize the units in Cook Inlet in November 2007; 9) process and analyze the data for Cook Inlet; 10) produce a final report for all years for the Beaufort Sea and Cook Inlet; 11) produce a final geospatial database of all of the surface current measurements

Revised Date: August 2008

ENVIRONMENTAL STUDIES PROGRAM: Annual Studies Plan FY 2009

Region: Alaska

Planning Area(s): Cook Inlet

Title: Water and Ice Dynamics of Cook Inlet

MMS Information Need(s) to be Addressed: This project will enable MMS to improve its oil-spill-risk modeling applied to Alaskan waters. This in turn will enhance the credibility of MMS Cook Inlet EIS's and related NEPA analysis and documentation. Public acceptance of OSRA results and analyses will be enhanced if accompanied by supporting drifter data for Alaskan waters.

Total Cost: \$940,000 plus Joint Funding

Period of Performance: FY 2002-2008

Conducting Organization: CMI, UAF

Description:

Background: The Cook Inlet tidal regime is among the most complex in the United States because of the large tidal range, extensive mud flats, strong currents, severe weather, and seasonal ice cover. Most physical oceanographic data supporting the model is derived from a comprehensive NOAA circulation survey of Cook Inlet carried out from 1973-1975. A few modest Lagrangian surface current studies have been performed in the Cook Inlet/Shelikof Strait. One study involved releasing drifters in and near Kachemak Bay as documented in 1977; another, released drifters from lower Cook Inlet, was documented in 1981; and another involved releasing drifters in the lower Shelikof Strait. The latter study released a small number of oil-spill simulating drifters for the purpose of testing how well these drifters would follow an actual oil spill, in this case the *Exxon Valdez* spill.

The MMS has used a variety of ocean models to estimate water and oil movement in Cook Inlet. Most recently, MMS has used an in-house version of the Princeton Ocean Model. In 1999 MMS co-sponsored a Cook Inlet oceanography workshop which recommended that Cook Inlet models be improved and validated in parallel with acquisition of improved observational data.

Objectives: The objective of this work is to successfully simulate the sea ice and water dynamics in Cook Inlet and validate the simulations with observational data.

Methods: A combination of 2-d and 3-d models, the Regional Ocean Model System (ROMS) will be used and compared to observational data because it has been configured to Cook Inlet. An improved Cook Inlet bathymetry needed for the modeling has been obtained from commercial and government sources. Scatterometer satellite observations will provide winds to the models. Drifters are a primary data source. These include oil-following drifters provided by MMS and water following drifters with combined Global Positioning System

(GPS) and Advanced Research and Global Observation Satellite (ARGOS) capabilities. Synthetic Aperture Radar (SAR) imagery is being obtained concurrent with drifter and other field measurements to obtain broad scale information on tide rips.

Revised Date: August 2008

ENVIRONMENTAL STUDIES PROGRAM: Annual Studies Plan FY 2009

Region: Alaska

Planning Area(s): Cook Inlet

Title: Seasonality of Biophysical Boundary Conditions for Cook Inlet, Alaska

MMS Information Need(s) to be Addressed: Information will be used for NEPA analyses and documentation for Cook Inlet Lease Sales and to enhance further circulation and trajectory models.

Total Cost: \$264,000 plus Joint Funding

Period of Performance: FY 2003-2008

Conducting Organization: CMI, UAF

Description:

Background: Improved understanding of density-driven and other circulation in Cook Inlet is needed for development of more sophisticated oil-spill models. Present oil-spill models for Cook Inlet are two dimensional and lack sufficient data in Cook Inlet to develop more useful three dimensional models. That is, they model only surface distribution of an oil spill. Developers of local numerical circulation/spill trajectory models and planners of Geographical Response Strategies need physical measurements by which their respective models and operational plans can be validated and improved.

Objectives:

- Measure Cook Inlet temperature, salinity, and hydrography from which the density-driven, geostrophic and other circulation within the inlet can be derived.
- Deploy drift cards whose deployment locations will be used as input to the CIRCAC numerical spill trajectory model for simulations of point source spills and whose recovery locations will then be compared to the grounding locations of the simulated spills.
- Involve local high school science classes in the reparation, field work/data acquisition and data analyses for temperature and salinity measurements.
- Measure seasonal changes in volume and property fluxes at the inflow and outflow boundaries in Cook Inlet.
- Continuously monitor freshwater signals in central and lower Cook Inlet by deploying moored conductivity-temperature-depth (CTD) sensors near the Forelands (in central Cook Inlet) and near Nanwalek in lower Cook Inlet.

Methods: This study will: 1) schedule spring and late summer sampling periods to correspond to period of increasing and diminishing fresh water runoff into Cook Inlet; 2) take CTD casts at 1-2 nautical mile spacing along ~20-40 km offshore transects located near participating high schools; 3) take additional CTD cast along the transect on each side of visible fronts; 4) plot cross-sections and surface maps of the temperature, salinity, density, and geostrophic velocity (dynamic topography) fields after the spring, summer and fall

hydrographic surveys; 5) acquire seasonal hydrographic and velocity measurements along transect lines crossing Kennedy Entrance, Stevenson Entrance, Shelikof Strait, Cook Inlet (Red River to Anchor Point), Kachemak Bay (Barabara Point to Bluff Point) and at the Forelands; 6) analyze data and report properties.

Revised Date: August 2008

ENVIRONMENTAL STUDIES PROGRAM: Annual Studies Plan FY 2009

Region: Alaska

Planning Area(s): Beaufort Sea

Title: Idealized Process Model Studies of Circulation in the Landfast Ice Zone of the Alaskan Beaufort Sea

MMS 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 2006-2009

Conducting Organization: CMI, UAF

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 2008

ENVIRONMENTAL STUDIES PROGRAM: Annual Studies Plan FY 2009

Region: Alaska

Planning Area(s): Chukchi Sea

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

MMS Information Needs 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 MMS 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: TBD

Period of Performance: FY 2008-2011

Conducting Organization: TBD

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 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 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: MMS 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 we anticipate sharing logistical platforms and samples. We anticipate adopting AKMAP stratified random design for chemical and biological sampling and sediment triad approach will be used.

For anthropogenic chemicals, the 2-year sampling strategy outlined in the proposal should collect surface sediments for the determination of standard sediment hydrocarbon parameters such as polynuclear 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 discussed above should be 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 will be a full Quality Assurance/Quality Control (QA/QC) program with inter-laboratory comparisons and reference standards. Normalization techniques developed in MMS Beaufort Sea monitoring will be adopted to minimize sample variability.

Pre-drilling activity baseline sampling will be conducted in 2008, emphasizing the area leased by industry in the proposed Chukchi Sea oil and gas lease sale scheduled for February, 2008. Additional adaptive sampling will occur in 2009, predicated on the findings and success in 2008 and locations of likely oil industry post-sale activities. For baseline and time trends, data-mining will be used to fine tune contaminant list, additional sampling locations, and sentinel benthic organisms. Dated sediment cores will be 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

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 will be part of initial study planning based on literature review and data-mining. Limited water and biota sampling will be 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 2008

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ENVIRONMENTAL STUDIES PROGRAM: Annual Studies Plan FY 2009

Region: Alaska

Planning Area(s): Beaufort Sea, Chukchi Sea

Title: Updates to the Fault Tree Approach to Oil-Spill Occurrence Estimators for the Chukchi and Beaufort Sea Planning Areas

MMS Information Need(s) to be Addressed: The Oil-Spill-Risk Analysis (OSRA) is a cornerstone to regional EIS's, environmental assessments, and oil-spill contingency planning. Oil-spill issues constitute a significant portion of public comments submitted on sale or development EIS's in the Alaska OCS Region. This study is necessary to incorporate fault-tree spill occurrence estimators into NEPA analyses for Beaufort Sea and Chukchi Sea oil and gas lease sales or development in the MMS 2007-2012, 5-Year Plan.

Total Cost: \$223,000

Period of Performance: FY 2005-2010

Conducting Organization: Bercha Group

Description:

Background: The OCS spill occurrence rates used in MMS NEPA analyses are based on historical platform and pipeline crude oil-spill rates, almost entirely from the Gulf of Mexico OCS. For the Alaska OCS Region Arctic planning areas, the MMS has recently incorporated a fault-tree approach which incorporates 1) differences in oil-spill occurrence factors between the Arctic and Gulf of Mexico OCS and 2) Arctic-specific factors. The first MMS-sponsored fault-tree study was finished in 2002. The second, ongoing, fault-tree study "Alternative Oil-Spill Estimators for the Beaufort and Chukchi Seas" primarily implements the MMS Scientific Committee recommendations to improve the fault tree application and statistics for Beaufort Sea spill occurrence rates. This second study is scheduled for completion in late 2005.

Objectives:

- Provide an updated fault tree spill occurrence rates and confidence intervals for NEPA analyses for Chukchi and Beaufort OCS Lease Sales or for oil and gas developments during the contract period of performance.
- Provide a PC program to provide MMS analysts the ability to calculate spill occurrence rates and confidence intervals subsequent to contract period of performance.

Methods: This study will: 1) review and assimilate oil-spill occurrence 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 setup the Monte Carlo fault tree model to run with these measures of variance; 3) update the Chukchi

Sea fault-tree analysis used in the MMS-sponsored study finished in 2002, incorporating the MMS Scientific Committee recommendations and a new MMS exploration and development scenario, and generate life-of-field occurrence indicators; 4) update the Beaufort Sea fault-tree analysis from the ongoing “Alternative Oil-Spill Estimators for the Beaufort and Chukchi Seas” study to match a new MMS exploration and development scenario and generate life-of-field occurrence indicators; 5) during the period of performance, provide up to two additional Chukchi Sea and up to two additional Beaufort Sea updated fault-tree analyses based on updated MMS exploration and development scenarios; 6) during the period of performance, 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 generate life-of-field occurrence indicators; 7) develop a PC program, manual and training necessary to provide MMS analysts the ability to calculate spill occurrence rates and confidence intervals from updated exploration and development scenarios for Chukchi and Beaufort Seas oil and gas lease sales subsequent to contract period of performance; 8) provide professional support to MMS in regard to statistical issues of occurrence rates and estimator(s) related to this study and its results.

Revised Date: August 2008

ENVIRONMENTAL STUDIES PROGRAM: Annual Studies Plan FY 2009

Region: Alaska

Planning Area(s): Beaufort Sea

Title: Assessment of the Direction and Rate of Alongshore Transport of Sand and Gravel in the Prudhoe Bay Region, North Arctic Alaska

MMS Information Need(s) to be Addressed: Information will be used for NEPA analysis and documentation for Beaufort Sea Lease Sales, oil-spill contingency plans, and DPPs.

Total Cost: \$268,000 plus Joint Funding

Period of Performance: FY 2005-2008

Conducting Organization: CMI, UAF

Description:

Background: In support of oil-related activities several coastal and offshore infrastructures have been built (e.g., docks, causeways, offshore production and exploration islands, submerged marine pipelines, extended-offshore-reach drilling pads on the shoreline). The possible cause-effect between the infrastructures and the natural nearshore hydrodynamic processes (wave, current, sea ice regimes, storm surges), coastal geomorphology, barrier island stability, shoreline erosion, and littoral sediment drift are not fully known, but are important to safe development.

Objectives:

- Comprehensive gray literature survey of past and ongoing investigations along the North Slope coast.
- Field determination of seasonal direction and volume of sand and gravel beach transport for Narwhal Island, a barrier island offshore of the Liberty prospect and Endicott causeway.
- Examine the impact of episodic storms on sediment drift.

Methods: The literature review will be conducted through internet and oil industry libraries. Beach transport will be determined by use of fluorescent dyed sand and tagged gravel using tiny Passive Integrated Transponder tags which transmit at 132.2 kHz. An existing Beaufort Sea storm surge model will be adapted to further examine the impact of episodic storms on sediment drift.

Revised Date: August 2008

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ENVIRONMENTAL STUDIES PROGRAM: Annual Studies Plan FY 2009

Region: Alaska

Planning Area(s): Beaufort Sea

Title: Synthesis of Time-Interval Changes in Trace Metals and Hydrocarbons in Nearshore Sediments of the Alaskan Beaufort Sea: A Statistical Analysis

MMS Information Need(s) to be Addressed: This study will consolidate and conduct statistical analyses of trace metal and hydrocarbon data in sediments along the Alaskan Beaufort Sea for monitoring potential effects of offshore oil and gas activities. Findings will increase knowledge of the mechanisms of environmental change. Study results will be used for NEPA analysis and documentation for the proposed Beaufort Sea Lease Sales and for DPPs.

Total Cost: \$82,184 plus Joint Funding

Period of Performance: FY 2008

Conducting Organization: CMI, UAF

Description:

Background: For comparison to OCS development areas, it is important to establish measurements of trace metals and hydrocarbons in sediments of the Alaskan Beaufort Sea. The marine sediments of the North Slope may be a sink for both organic and inorganic anthropogenic compounds. Sediments may serve as transfer pathways to higher trophic levels. Environmental accumulation is of particular concern in the Arctic where marine organisms, being lipid rich, with relatively simple and short food chains and low biodiversity, may be especially vulnerable to bioaccumulations.

Objectives: The primary objective of this study is to consolidate and statistically characterize the concentrations of 12 metals (vanadium, chromium, copper, nickel, zinc, arsenic, cadmium, lead, antimony, barium, iron and manganese) in the mud fractions (less than 63 micrometer [μm] size) and mercury and hydrocarbons in gross sediments sampled in the past several decades across the Beaufort Sea. This statistical analysis will help to develop criteria for detecting metal and hydrocarbon accumulation resulting from marine and other human activities in the Beaufort Lagoon region and elsewhere in the Alaskan Beaufort Sea.

Methods: This study will: consolidate data on a suite of trace metals and hydrocarbons that have been gathered by the authors on CMI/MMS and Outer Continental Shelf Environmental Assessment Program funded projects; conduct a statistical analysis on the data to characterize the distribution, sources (natural and anthropogenic), and regional differences; and detect site-specific time-interval differences and extent of contamination during the past 30 years.

Revised Date: August 2008

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ENVIRONMENTAL STUDIES PROGRAM: Annual Studies Plan FY 2009

Region: Alaska

Planning Area(s): North Aleutian Basin

Title: Juvenile and Maturing Salmon Use of the North Aleutian Basin Lease Area

MMS Information Need(s) to be Addressed: Local residents, highly dependent on salmon for both economic and subsistence livelihoods, are concerned about oilspill and other impacts on salmon in the lease area. Very little is known about how much of the ocean life cycle of salmon is spent in the proposed lease area. The MMS 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 NAB.

Total Cost: TBD

Period of Performance: FY 2009-2011

Conducting Organization: TBD

Description:

Background: It would be difficult to identify an area in the Bering Sea, or possibly anywhere in the world, that has greater fisheries use issues than the North Aleutian planning area. Bristol Bay includes eight major river systems that collectively support the largest commercial sockeye salmon fishery in the world. The Kvichak River is home to the single largest salmon run and the Nushagak River hosts the largest king salmon run in Alaska. Annual commercial catches average nearly 24 million sockeye salmon, 69,000 chinook, 971,000 chum, 133,000 coho, and 593,000 pinks. On average, individuals in Bristol Bay communities harvest 315 pounds per person, as their main source of food.

Nearshore areas are seldom surveyed as fish habitat. While current fish surveys do sample within parts of the potential lease area during late summer and early fall, they do not sample during the late winter to early summer period nor in all parts of the proposed lease area.

A survey targeting the important sockeye, chinook, coho, pink, and chum salmon migratory from Bristol Bay watersheds in the nearshore and potential lease area, from late winter to early summer, is needed to fully evaluate the potential effects of offshore exploration and development. The survey would also sample the primary prey of salmon- young-of-the-year pollock and several similarly sized forage fish species (i.e., capelin, sand lance, sandfish, and rainbow smelt).

Objectives:

- Identify salmon use of the lease area during late winter and early summer and combine with existing information from other seasons.

- Combine information with nearshore fishes sampled with similar methods in the annual NMFS surveys in August – September (fall).
- Develop maps of seasonal and spatial distribution of juvenile and maturing salmon within the lease area for use in NEPA analysis, particularly oil-spill impact analysis.

Methods: Conduct two years of seasonal fish use and habitat assessment with a surface trawl (top 15 m of the water column) in waters 20 m depth or greater. This project would implement surveys in May and July to assess the late winter and early summer distribution, relative abundance, diet, energetics, and size of juvenile salmon, their prey, their predators, and other forage fish on the shelf (> 20 m to 100 m) of the NAB. The surveys will also document physical oceanographic and biological characteristics (age, diet, size, growth, habitat type) of salmon and make cost-efficient collections of other fish species (forage fish and pollock) incidentally caught.

Revised Date: August 2008

ENVIRONMENTAL STUDIES PROGRAM: Annual Studies Plan FY 2009

Region: Alaska

Planning Area(s): North Aleutian Basin

Title: Spatial and Temporal Mapping of Nearshore Juvenile Fish and Settling Crab in the North Aleutian Basin

MMS Information Need(s) to be Addressed: Information on seasonal distribution, abundance, and habitat use are necessary to assess oil-spill risks to sensitive lifestages of fish and crab for North Aleutian Basin NEPA analyses. The information from this study will be used for pre- and post-sale NEPA/EIS analysis and documentation, and by MMS analysts for mitigation of potential effects of OCS exploration and development in the NAB.

Total Cost: TBD

Period of Performance: FY 2009-2011

Conducting Organization: TBD

Description:

Background: It would be difficult to identify an area in the Bering Sea, or possibly anywhere in the world that has greater fisheries use issues than the North Aleutian planning area. Crab, a highly valued commercial fisheries and subsistence resource, are extremely sensitive to oil at very low concentrations. Furthermore, the juvenile and larval stages lifestages of fish and crab are the most vulnerable. Loss of a single juvenile year-class could affect future commercial fisheries and ecological productivity. However, information on spatial and temporal patterns of sensitive life stages in the nearshore North Aleutian Basin is lacking or out of date, especially in light of ecological changes that have occurred in recent decades.

The MMS-sponsored “North Aleutian Basin Information Status and Research Planning Meeting” recently identified studies that could provide useful information to upcoming National Environmental Policy Act (NEPA) Environmental Impact Statements (EIS), 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 pursuant to the proposed 5 year program.

Objectives:

- Identify spatial and seasonal location of larval and juvenile fish and crab larvae settling areas.
- Develop Geographical Information Systems (GIS) based maps and attribute tables of sensitive fish and crab lifestages for Oil-Spill-Risk Analysis.

- Identify high priority locations for mitigation or deferral areas under consideration in environmental assessments.

Methods: Geographically delineate the location and timing of larval nurseries, juvenile rearing, and crab settling areas through aerial digital imaging and Light Detection and Ranging (LiDAR). Perform ground truthing of digital imaging and LiDAR (a process similar to ground truthing acoustic fish surveys) through use of local fishing vessels. Provide GIS - mapped layers for EIS analysis of potential sensitive areas.

Revised Date: August 2008

ENVIRONMENTAL STUDIES PROGRAM: Annual Studies Plan FY 2009

Region: Alaska

Planning Area(s): North Aleutian Basin

Title: Biogeochemical Assessment of the North Aleutian Basin Ecosystem: Current Status and Vulnerability to Climate Change

MMS 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: \$490,000 plus Joint Funding

Period of Performance: FY 2008–2012

Conducting Organization: CMI, UAF

Description:

Background: The North Aleutian Basin in the southeastern Bering Sea is one of the most productive marine ecosystems in the world. 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.
- Determine the fate of NEP in North Aleutian Basin.

- Determine the effect of ocean acidification on the marine environment of the Bering Sea.

Methods: The Task will participate in spring and summer BEST cruises for three years. Dissolved organic and inorganic nutrients and carbon, total alkalinity, particulate organic matter, and pCO₂ measurements will be 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 determined.

Revised Date: August 2008

ENVIRONMENTAL STUDIES PROGRAM: Annual Studies Plan FY 2009

Region: Alaska

Planning Area(s): Chukchi Sea

Title: Current and Historic Distribution and Ecology of Demersal Fishes in the Chukchi Sea Lease Area

MMS 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 MMS analysts and decision makers will use the information from this study in NEPA analysis and documentation for Lease Sale(s), EP's and DPP's, 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 2007-2010

Conducting Organization: CMI, UAF

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 MMS 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.
- Determine physical and oceanographic feature (water mass) characteristics that define demersal fish habitat.
- Determine 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 MMS 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 MMS that will contain data on species presence and abundance from both past and present collections. This will expand the current MMS fish database and be suitable for GIS.

Revised Date: August 2008

ENVIRONMENTAL STUDIES PROGRAM: Annual Studies Plan FY 2009

Region: Alaska

Planning Area(s): Beaufort Sea, Chukchi Sea

Title: Arctic Fish Ecology Catalogue

MMS Information Need(s) to be Addressed: MMS 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 MMS decision making and mitigation. Also, study results will be used in similar pre-lease analyses and documentation for later Chukchi Sea Lease Sale(s) in the *Outer Continental Shelf Oil and Gas Leasing Program 2007-2012*.

Total Cost: \$475,000 plus Joint Funding

Period of Performance: FY 2008-2011

Conducting Organization: USGS

Description:

Background: A comprehensive synthesis of ecological and behavioral information concerning arctic fishes of Alaska is important to MMS 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 MMS 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 MMS NEPA analyst.

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 2008

ENVIRONMENTAL STUDIES PROGRAM: Annual Studies Plan FY 2009

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

MMS 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 2006–2009

Conducting Organization: USGS-BRD

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(s) 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 MMS in our responsibility to manage offshore development of oil and gas in the Beaufort Sea Planning area. This study will help determine 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 determine if it can test another hypothesis of local residents, that fish have grown thinner over recent years and determine whether 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.
- Determine the usefulness and rigor of selected nuclear microsatellite and mitochondrial DNA loci to determine 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 determine if 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 determine 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 are 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 2008

ENVIRONMENTAL STUDIES PROGRAM: Annual Studies Plan FY 2009

Region: Alaska

Planning Area(s): Beaufort Sea

Title: Beaufort Sea Marine Fish Monitoring: Pilot Survey and Test of Hypotheses

MMS Information Need(s) to be Addressed: Fish resources are important in the Beaufort Sea ecosystem and to the coastal communities. Study information will be used in NEPA analysis and documentation for Beaufort Sea Lease Sales, EPs, and DPPs.

Total Cost: \$997,000

Period of Performance: FY 2006-2009

Conducting Organization: NOAA-NMFS-Alaska Fisheries Science Center

Description:

Background: A consistent Beaufort Sea fish monitoring study is needed to obtain fundamental and current fish resource information. Data at the most basic level, e.g., fish 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, the delineation of important marine mating, spawning, rearing, feeding and migration habitats (pre or post regime-shift), is simply non-existent.

In addition to the need for basic distribution data, ecological information is necessary to assess potential effects of offshore development. However, Beaufort Sea life history strategies, foraging, population dynamics and other aspects of marine fish behavior and ecology are, for the most part, unknown. Because MMS is the principle agency proposing federal actions in the Alaskan Beaufort Sea, it is unlikely that other sources of applicable information will become available.

This study will begin to establish baseline knowledge of fish distribution in the Beaufort leasing area and assess interannual variation through monitoring. Concurrent collection of salinity, temperature and plankton data can establish basic ecological facts.

Objectives:

- Design a long-term fish monitoring plan for the Beaufort Sea OCS leasing area that includes ocean and lower trophic data essential to understanding fish dynamics.
- Implement the first survey covering 1/5th of the Beaufort Sea OCS (roughly a 40 by 130 mile area). Repeat at the appropriate interval in the remaining areas of the Beaufort Sea OCS to establish a long term monitoring baseline.

Methods: In Phase I: Design, the study will review and adapt marine fish survey design methods to specific MMS information needs and Beaufort Sea conditions; design survey methods for long-term comparability, cost-effectiveness and incorporation of future technological and remote sensing advances; monitor demersal and pelagic fishes at all life history stages and across depths and habitats; include active *in situ* fish sampling with concurrent collection of plankton and ocean conditions.

In Phase II: Implementation, the study will conduct the first survey based on results of the design phase; analyze samples for basic ecological information; summarize information on fish distribution, relative abundance, locations of critical or sensitive life history stage habitats, and trophic structure in GIS and report format; provide intermediate results for NEPA analyses; incorporate lessons learned into recommendations for the next 5-year survey in another section of the Beaufort Sea OCS; archive environmental data and specimens to provide a cost effective means of future hypothesis testing by MMS and other agencies.

Revised Date: August 2008

ENVIRONMENTAL STUDIES PROGRAM: Annual Studies Plan FY 2009

Region: Alaska

Planning Area(s): Beaufort Sea

Title: Evaluating the Potential Relict Arctic Invertebrate and Algal Community on the West Side of Cook Inlet

MMS Information Need(s) to be Addressed: An evaluation of the lower western Cook Inlet intertidal and subtidal invertebrates and algae will potentially lead to a better understanding of the potential effects of offshore oil and gas, or other mineral, exploration and extraction on the outer continental shelf. New information will support NEPA analysis and documentation for future Cook Inlet Lease Sales, DPPs, and monitoring.

Total Cost: \$60,000 plus Joint Funding **Period of Performance:** FY 2005-2008

Conducting Organization: CMI, UAF

Description:

Background: This study is based on previous work conducted on the lower west side of Cook Inlet when taxonomic identifications of epifaunal invertebrates collected in the 1970s for the OCS Environmental Assessment Program bore a striking resemblance to species reported for the Alaskan Arctic. Additional information provided by other historical invertebrate collections in the area indicate that these west side species and assemblages more closely matched Arctic species and assemblages than those on Cook Inlet's east side or in other areas of the Gulf of Alaska. Few studies have been conducted in the Bering or Chukchi Seas or Norton Sound, making it difficult to conduct a suitable comparison of species between Cook Inlet and the Arctic. From the limited comparisons, though, it is possible that many of the species do not occur nearer to the populations in western Cook Inlet than the Beaufort Sea, effectively isolating these species from similar species or genera. Based on its duration, it is possible that geographic isolation has allowed some species to become genetically distinct, to the point of evolving into separate subspecies or species. Thus, this assemblage is very interesting in evolutionary terms.

While defining biogeographical regions in coastal Alaska, scientists have placed upper Cook Inlet in the sub polar Beringian Province rather than the Aleutian Province with the adjacent Gulf of Alaska. This classification was based on fish assemblages, the occurrence of an isolated population of beluga whales, and water column characteristics (i.e., water temperature and salinity). They noted that this apparently unique region "is not represented in the system of marine protected areas in the United States." Given their potential isolation, these western Cook Inlet populations could be at risk of significant habitat perturbation and may prove to be sensitive indicators of climate change or other ecological shifts. Monitoring their distributions and abundance could provide "early-warning" signals.

Objectives:

- Develop a more complete comprehension of the species composition of the intertidal and subtidal benthic assemblages on the west side of Cook Inlet.
- Evaluate the degree of geographic isolation for each potential relict Arctic species.
- Determine the taxonomic status of the species observed on the west side of Cook Inlet.

Methods: Conduct a survey from previously archived specimens from the west side of Cook Inlet. Review species lists from previous studies conducted on the east side of Cook Inlet, the Alaska Peninsula, Kodiak, and in Shelikof Strait and the Bering Sea. Conduct detailed taxonomic evaluations on a wide variety of algae and invertebrates, including those in previous collections that have been preserved and archived to conduct comparisons of species between Cook Inlet and the Arctic area.

Revised Date: August 2008

ENVIRONMENTAL STUDIES PROGRAM: Annual Studies Plan FY 2009

Region: Alaska

Planning Area(s): Beaufort Sea

Title: Foraging Ecology of Common Ravens on Alaska's Coastal Plain

MMS Information Need(s) to be Addressed: This study, which is a collaboration amongst MMS, the University of Alaska-Fairbanks/CMI, the North Slope Borough and Phillips Petroleum, will help MMS assess and potentially mitigate, possible indirect impacts of MMS actions that may occur as a result of enhancement of raven habitat on the North Slope resulting from the presence of human structures. If data indicate that structures, pipelines or other factors related to oil or gas development enhance raven predation, MMS may need to design mitigation to reduce such impacts on natural fauna. Information from this study will also be useful for analysis of the cumulative effects of offshore development on the fauna of the OCS and Alaskan Coastal Plain. Information will be used for NEPA analysis and documentation for Beaufort Sea Lease Sales and DPPs.

Total Cost: \$205,000 plus Joint Funding

Period of Performance: FY 2003-2008

Conducting Organization: CMI, UAF

Description:

Background: The impact of avian predators, including the common raven, on the North Slope has often been assumed to be higher in areas with oil development or human habitation due to increased availability of food and nest sites associated with human-made structures. Predator management on the Alaska North Slope is an issue that has arisen in many contexts. For example, the Steller's Eider Recovery Team has recommended killing ravens in Barrow to benefit the threatened Steller's eider (*Polysticta stelleri*), and this recommendation has been implemented to a limited extent. More generally, the U.S. Fish and Wildlife Service has attempted to reduce predator access to human food waste in the oilfields and villages through its authorities under the Clean Water Act.

It is clear that common ravens (*Corvus corax*) on the North Slope are utilizing human-related facilities both as nesting sites and to obtain sufficient food to overwinter on the outer arctic coastal plain. However, the associated impact of raven predation on other tundra-nesting birds has not been studied. Data on summer diet and raven productivity are needed to assess whether increased raven numbers pose a threat to other species, particularly the threatened spectacled (*Somateria fischeri*) and Steller's eiders.

Objectives: The objective of this study is to document summer foraging ecology, and distribution and abundance of ravens nesting within areas of oil development, in and near villages, and in semi-natural habitat (DEW Line sites) on Alaska's North Slope.

Methods: This study will 1) use biological surveys and obtain anecdotal information from local residents to document the distribution and abundance of ravens breeding in the oil fields, in and near villages, and in semi-natural sites using surveys and local knowledge; 2) produce a GIS map showing the locations of nests and/or breeding pairs; 3) document the summer diet of nestling ravens using video camera monitoring stations, direct observation at nests, examination of pellets and/or fecal remains and collection of prey remains at nests; 4) monitor nests to assess fledging and nest success of ravens in and outside of the oil fields; 5) use very high frequency (VHF) and satellite telemetry to document the movements of ravens from nesting sites to foraging areas and between breeding and non-breeding seasons on Alaska's North Slope.

Revised Date: August 2008

ENVIRONMENTAL STUDIES PROGRAM: Annual Studies Plan FY 2009

Region: Alaska

Planning Area(s): Beaufort Sea, Chukchi Sea

Title: Monitoring the Health of Bowhead Whales

MMS Information Need(s) to be Addressed: This monitoring study of bowhead whales taken in subsistence hunts, or found stranded or beach-cast will provide time-series data that can be used for comparisons of general health before, during, and after offshore industry activities in the Alaskan OCS. Data from this study will also be potentially useful for evaluating the status of the bowhead population relative to carrying capacity. 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.

Total Cost: TBD

Period of Performance: FY 2009-2014

Conducting Organization: TBD

Description:

Background: The bowhead whale population of the Bering, Chukchi, and Beaufort Seas, while endangered, has been slowly recovering since the cessation of commercial whaling in 1910. There is concern, though, about potential effects of factors acting on bowhead whales and the subsistence communities that rely on them culturally and nutritionally. For example, rapid change in human activities (e.g., oil- and gas-related exploration and development) and other environmental parameters (e.g., reduction in sea ice) in the Arctic could cause a highly specialized species such as the bowhead whale to have difficulty adjusting, competing and surviving. Relatedly, environmental change could facilitate the appearance of zoonotic diseases in the Arctic because the warming environment could be beneficial to the spread of a disease agent or its vectors. New diseases could affect whales and subsistence users alike. Thus, even in the face of a growing bowhead population, it is logical to sustain a program to monitor the body condition, general health, and presence of zoonoses and environmental pollutants in bowhead whales. The bowhead whale may be a useful sentinel of environmental change and by proactively monitoring bowhead health; problems may be detected and possibly mitigated before a crisis stage is reached.

Objectives: Monitor the health of subsistence-harvested, stranded, and beach-cast bowhead whales.

Methods:

1. Establish partnerships with Federal and State agencies and other organizations, especially Iñupiat hunters and other local leaders, to provide an efficient, sustainable

- and cost-effective means by which to conduct a long-term bowhead whale health-monitoring program. Establish a network to obtain information on harvested, beach-cast, and stranded bowheads in Alaska and Canada. Although the primary activities of the study will be staged out of Barrow, individuals in other whaling communities, potentially including Gambell, Savoonga, Wainwright, Point Hope, Kaktovik, Nuiqsuit, and various Canadian villages, shall be encouraged to participate when feasible.
2. Take morphological measurements on each individual whale. Also, collect and archive appropriate tissues for analysis of persistent organic pollutants (POP) and EPA significant trace metals. Take appropriate biological samples and conduct screening for zoonotic diseases. Analyze samples and data using standard field and laboratory protocols. Assess body condition and health of bowhead whales using carcasses from subsistence whaling and compare with data taken from stranded and beach-cast specimens. If possible conduct collect baseline data on body length, body condition, and gestational age estimates of any unborn calves carried by harvested bowhead females.
 3. Develop a plan to accomplish comprehensive analysis of POPs and trace metals for implementation during the 5th year of the study.
 4. Develop appropriate hypotheses, an experimental design, and methodology for collections of tissues from bowhead whale ears and related supporting analyses of effects of noise on hearing by whales in several demographic classes. To advance our understanding of how hearing and noise sensitivity may change with age, ears should also be collected from near-term fetuses. As possible, these tissues should be collected in concert with supporting samples that permit age estimation.
 5. Develop additional hypotheses, experimental design, and methodology for collections of fecal material and urine from harvested bowheads and related supporting analyses to study levels of glucocorticoids and other stress-sensitive hormones (or their metabolites) in bowheads, following a key recommendation of the National Research Council (2005. Marine Populations and Ocean Noise: Determining When Noise Causes Biologically Significant Effects).
 6. Work closely with educators to involve students in this monitoring study and to develop culturally appropriate outreach programs to inform communities of the results of project monitoring and the possible implications for human health.

Revised Date: August 2008

ENVIRONMENTAL STUDIES PROGRAM: Annual Studies Plan FY 2009

Region: Alaska

Planning Area(s): Chukchi Sea

Title: COMIDA: Distribution and Relative Abundance of Marine Mammals: Aerial Surveys

MMS 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 monitoring described in this study profile needs to be initiated as soon as possible with results to be available in annual reports and a final report in 2011. The MMS 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: \$3,000,000 plus Joint Funding **Period of Performance:** FY 2008-2011

Conducting Organization: NMML

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 MMS Bowhead Whale Aerial Survey Project so that data are comparable with earlier surveys in the Chukchi Sea.

Revised Date: August 2008

ENVIRONMENTAL STUDIES PROGRAM: Annual Studies Plan FY 2009

Region: Alaska

Planning Area(s): Chukchi Sea

Title: Satellite Tracking of Walruses in the Chukchi Sea: The Planning Phase

MMS 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. This study explores the feasibility of conducting a cooperative project involving various state and federal agencies, and Native Alaskan subsistence hunters to study the movements and habitat use of walruses in the Chukchi Sea.

Total Cost: \$10,000 plus Joint Funding

Period of Performance: FY 2008-2009

Conducting Organization: Alaska Department of Fish and Game

Description:

Background: Walruses are an important species for subsistence communities along the Bering and Chukchi Sea coastlines. Walrus meat is used for food, hides are used for boat skins, and ivory is used for artwork that provides cash for fuel, ammunition, and other needs. In recent years, spring sea ice, that is an important component of walrus habitat, has retreated more rapidly and to a greater extent in this region. Female walruses give birth in spring as they move northward with the ice. They use the sea ice as a platform for resting between feeding bouts and it is important for calves to be able to rest on ice near good shallow-water feeding areas for the females and sub-adults. With the changes in the extent and duration of the sea ice in summer the distribution of females and sub-adults may also be changing. Females with young calves may need to remain close to beaches where they can haul out and rest. During 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 located offshore and northwest of the villages of Wainwright and Point Lay, 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.

Objectives:

- Determine the feasibility of and develop a consensus for cooperative study of the movements and habitat use of selected walrus in the Chukchi Sea Planning area.
- Develop recommendations for logistical approaches and technology to be used in studying movement and habitat use by walrus.

Methods: This study is modeled on a cooperative study of bowhead whale distribution and movements that is currently supported by MMS. Review literature and existing data to make recommendations about logistics and technology that could support a walrus study. Meet with walrus experts in federal agencies, state agencies, and local communities to discuss potential cooperation and approaches. Hold discussions with Native walrus subsistence hunters in communities along the Chukchi Sea coastline to gauge and encourage interest in active involvement in undertaking a multi-year study of walrus movements and habitat use employing state of the art technology.

Revised Date: August 2008

ENVIRONMENTAL STUDIES PROGRAM: Annual Studies Plan FY 2009

Region: Alaska

Planning Area(s): North Aleutian Basin

Title: Distribution, Abundance, and Habitat Use of North Pacific Right Whales

MMS Information Need(s) to be Addressed: The *Final Outer Continental Shelf Oil and Gas Leasing Program 2007-2012* (USDOJ, 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: \$3,000,000 plus Joint Funding **Period of Performance:** FY 2007-2010

Conducting Organization: NMFS, NMML

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 2008

ENVIRONMENTAL STUDIES PROGRAM: Annual Studies Plan FY 2009

Region: Alaska

Planning Area(s): Beaufort Sea, Chukchi Sea

Title: Monitoring the Distribution of Arctic Whales

MMS Information Need(s) to be Addressed: This continuing MMS study is needed for decisions on environmental assessment and exploration monitoring for past and upcoming OCS activity in the Beaufort Sea. It analyses behavioral information needed to identify areas of interest to feeding bowhead whales. In years with active offshore seismic-vessel or drilling operations, the BWASP provides real-time data to MMS and NMFS on each fall migration of bowhead whales across the Alaskan Beaufort Sea for implementing overall limitations on offshore drilling and geological and/or geophysical exploration. Project information is used to ensure that planned activities will not have an immitigable adverse effect on the availability of the bowhead whale to meet subsistence needs by causing whales to abandon or avoid hunting areas. Information is needed each year to monitor the migration of bowhead whales past active seismic, drilling, construction, and production operations. Information from this study also will be needed to support NEPA analysis and documentation for Beaufort Sea Lease Sales, DPPs, and monitoring of Northstar.

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

Conducting Organization: MMS, NOAA AOC and NMFS NMML

Description:

Background: The MMS 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. Real-time data are used to implement overall seasonal restrictions and limitations on geological and geophysical exploration. 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 MMS and the NMFS on the general progress of the fall migration of bowhead whales across the Alaskan Beaufort Sea for use in protection of this Endangered Species.
- 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. The MMS staff will continue to prepare an annual report concerning the axis of the bowhead migration. Aircraft operations will be managed by the NOAA AOC.

Revised Date: August 2008

ENVIRONMENTAL STUDIES PROGRAM: Annual Studies Plan FY 2009

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

MMS 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 MMS 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: \$1,499,995 plus Joint Funding **Period of Performance:** FY 2005-2010

Conducting Organization: ADF&G

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 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 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, MMS 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, MMS 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 2008

ENVIRONMENTAL STUDIES PROGRAM: Annual Studies Plan FY 2009

Region: Alaska

Planning Area(s): Beaufort Sea, Chukchi Sea

Title: Bowhead Whale Feeding Variability in the Western Alaskan Beaufort Sea: Oceanography and Feeding

MMS 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 MMS 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: \$5,187,320 plus Joint Funding **Period of Performance:** FY 2006-2012

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

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 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 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, MMS 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 between whaling captains, AEW, NSB, ADF&G, NMFS, MMS and other interested parties to resolve roles in 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 MMS *Bowhead Whale Aerial Survey Project*. The study would be carefully coordinated with the AEW 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 2008

ENVIRONMENTAL STUDIES PROGRAM: Annual Studies Plan FY 2009

Region: Alaska

Planning Area(s): Beaufort Sea

Title: Aerial Photography of Bowhead Whales to Estimate the Size of the Bering-Chukchi-Beaufort Population

MMS Information Need(s) to be Addressed: Information from the study will be used for ESA and NEPA analysis and documentation for Beaufort Sea Lease Sales and DPPs.

Total Cost: \$166,000 plus Joint Funding

Period of Performance: FY 2004-2007

Conducting Organization: NMFS, NSB

Description:

Background: An aerial photographic survey of bowhead whales was conducted during the spring of 2003 based out of Barrow, Alaska. This survey was very successful with >750 photographs having been obtained. Analysis of the photographs is expected to be useful toward an improved population size estimate using mark and recapture methods. This project is envisioned as a jointly funded effort, including but not limited to NMFS, NSB, and MMS. Additional funding sources may be involved as needed to seek additional population dynamics information.

Biological information about the status of endangered bowhead whale stocks is useful for OCS management and to maintenance of the centuries-old subsistence lifestyle along the north coast of Alaska. Two of the most important statistics are current population size and population trends. Population estimates are typically generated via ice-based censuses at Barrow; however, few (if any) data exist to confirm the apparent population increases indicated by these counts. Credible confirmation of population size would help evaluate whether the Bering-Chukchi-Beaufort bowhead whale population should be down-listed to the threatened species list. Other life history parameters (migration timing, etc.) obtained from the study would likewise be useful for management of offshore activities.

Objectives: The primary goal of the survey is to estimate the size of the bowhead whale population using photogrammetric mark-recapture methods and data collected during 2003 and 2004. Specific objectives for accomplishing this goal include:

- conducting an aerial photographic survey of bowhead whales in the spring of 2004;
- analyzing the 2004 photographs to identify the recurrence of individual whales previously photographed in 2003;
- using mark-recapture methods and calculations to estimate the population of bowhead whales;
- developing and testing a computer program that will increase efficiency of the search for matches among whale images collected in different years.

Methods: This jointly-funded study would be conducted using methods already developed in 2003 by NMFS and NSB. Required permits for low-level photography will be obtained as needed. The draft final report to MMS would include full description of the aerial survey protocol, mark-recapture methods used, analysis of collected data, and discussion of findings relative to population estimation. Other ancillary population dynamics parameters obtained on growth rates, survival rates, migration timing, calving intervals and population structure (length-frequency distribution) may be included. The study will develop and test a computer program that will increase the efficiency of the search for matches among whale images collected in different years by prioritizing images for comparison.

Revised Date: August 2008

ENVIRONMENTAL STUDIES PROGRAM: Annual Studies Plan FY 2009

Region: Alaska

Planning Area(s): Beaufort Sea, Chukchi Sea

Title: Populations and Sources of Recruitment of Polar Bears

MMS Information Need(s) to be Addressed: The study will enhance MMS 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 2005-2011

Conducting Organization: University of Alberta, Canada

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 2008

ENVIRONMENTAL STUDIES PROGRAM: Annual Studies Plan FY 2009

Region: Alaska

Planning Area(s): Beaufort Sea, Chukchi Sea

Title: Radio-Frequency Identification Tags for Grizzly and Polar Bear Research

MMS Information Need(s) to be Addressed: This jointly-funded study will develop and test new technology for application in population studies of polar bears on the Alaskan OCS. Such studies provide useful information on the Southern Beaufort Sea polar bear stock and specifically on the rapidly increasing 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, DPPs, and monitoring. Data will also be useful for MMPA permitting and development of related mitigation.

Total Cost: \$257,000 plus Joint Funding **Period of Performance:** FY 2005-2008

Conducting Organization: UAF-CMI, ADF&G, USGS-BRD

Description:

Background: Grizzly bears (*Ursus arctos*) and polar bears (*Ursus maritimus*) are important species for subsistence communities along the Beaufort Sea coast for food, fur and for their cultural importance. Much of our current knowledge about bear populations, habitat use, movements, and interactions with oil and gas activities on the North Slope has been the result of repeated observations of radio-collared or satellite-collared female and sub-adult bears. Unfortunately, adult male bears have a low retention rate for collars due to their large necks. Application of existing and emerging radio frequency identification technology, currently used for military and commerce, has the potential to significantly increase the sample size of marked bears by decreasing the cost of marking and allowing male bears to be marked. A system contains two major components: tags and a reader. The tags are currently capable of transmitting 100 m under laboratory conditions when interrogated by the reader. Neither the current generation of readers (receivers) nor the tags has been tested with large mammals under arctic environmental conditions where aircraft are used extensively.

Objectives: The objective of this study is to modify the radio frequency identification system and test its feasibility for use on grizzly and polar bear research and management.

Methods: This study will 1) modify an existing tag design so tags can be attached to bear ears; 2) modify existing readers for use in aircraft and land vehicles; 3) build 50 tags and 4 readers for use on the project; 4) test the radio frequency identification system initially on 40

grizzly bears marked during the ADF&G “Oilfield Grizzly Bear Project” and, if successful, expand the test to include 10 polar bears.

Revised Date: August 2008

ENVIRONMENTAL STUDIES PROGRAM: Annual Studies Plan FY 2009

Region: Alaska

Planning Area(s): Chukchi Sea

Title: Pinniped Movements and Foraging

MMS 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 MMS decision making and mitigation. Also, study results will be used in similar pre-lease analyses and documentation for later Chukchi Sea Lease Sale(s) in the *Outer Continental Shelf Oil and Gas Leasing Program 2007-2012*.

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

Conducting Organization: NMFS NMML

Description:

Background: As winter pack ice recedes; walrus, bearded seals, and other pinnipeds follow the ice edge from wintering areas to its northern margin. For example, large numbers of walrus migrate 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 walrus move along coastal leads between Point Hope and Point Barrow and are hunted by Natives. Ice seals may be present in the Chukchi Sea throughout the year. Seasonal movements likely occur to offshore areas having high resources near Hanna Shoal.

Concern has been expressed by Native hunters that in recent summers, sea ice is receding faster and further to the north, making walrus less available to the communities that depend on them. Very little information is available on how walrus move through this region and where they forage. The same concerns exist over the affect changes in sea ice are having on distribution of ice 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. The MMS portion shown above is approximately 50% for FY 2007 and 67% of the estimated total joint funding of the total cost to accomplish all objectives. If joint funding from other sources, e.g. NMFS, USFWS, ADF&G, is not achieved, target species will be limited.

Objectives:

- Develop a phased cooperative project to deploy satellite transmitters to study the movements and habitat use of selected pinnipeds in the Chukchi Sea Planning area.
- Model this study on a cooperative study of bowhead whale distribution and movements which MMS currently supports.

Methods: Phases I & II will both 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 existing 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 to the extent possible will be encouraged.

Revised Date: August 2008

ENVIRONMENTAL STUDIES PROGRAM: Annual Studies Plan FY 2009

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

MMS Information Need(s) to be Addressed: This study will assist MMS 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

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 Iñupiat 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 2008

ENVIRONMENTAL STUDIES PROGRAM: Annual Studies Plan FY 2009

Region: Alaska

Planning Area(s): Beaufort Sea

Title: Pre-migratory Movements and Physiology of Shorebirds Staging on Beaufort Sea Littoral Zone

MMS Information Need(s) to be Addressed: MMS will use results on shorebird distribution and abundance from this study, and related studies cited within, to estimate the effects of various oil-spill scenarios on the Beaufort Sea breeding and staging shorebird population. The MMS will also use information on habitat-use, and peaks in staging and turn-over times to improve NEPA assessments of potential impacts of oil development, and potentially to develop mitigation measures for future OCS activity, and supporting onshore development. This work will compliment other ongoing research on tundra breeding shorebirds, and allow a more complete evaluation of the potential effects of oil and gas development. The MMS will utilize information obtained from this study for NEPA analysis and documentation for Beaufort Sea Lease Sales, post-sale mitigation, exploration plan reviews, and DPPs.

Total Cost: \$270,208 plus Joint Funding **Period of Performance:** FY 2004-2009

Conducting Organization: CMI, UAF

Description:

Background: Preliminary work conducted during the 1970s near Barrow, Alaska, indicated that shorebirds breeding along Alaska's North Slope use the Beaufort Sea littoral zone extensively for nutrient acquisition prior to migration to wintering areas in Asia and the Americas. However, little information exists on the seasonal distribution and abundance of pre-migratory shorebirds that use littoral zones along the entire Beaufort Sea and what factors may influence the duration and timing of use. This information is important given increased interest in oil and gas exploration and other development across the Arctic coastal plain.

Shorebirds are granted protection under the Migratory Bird Treaty Act, and several species that breed and stage along the Beaufort Sea (Dunlin, American Golden-plover, Bar-tailed Godwit, and Whimbrel) appear on the USFWS list of birds of conservation concern. A better understanding of the ecology of staging shorebirds across the Beaufort Sea littoral zone could be useful for assessment of potential effects from current and future industrial activity, including possible contamination of brooding and staging habitats from oil or gas spills, human disturbance, or increased rates of predation by species (e.g., gulls and ravens) whose populations have increased through anthropogenic changes in the area.

Objectives:

- Assess the species composition, distribution, abundance, and habitat use of pre-migratory shorebirds staging along Beaufort Sea coastline.
- Examine factors affecting shorebird use of littoral zones near Barrow, Alaska, as a reference site for the remaining portions of the Beaufort Sea coastline.

Methods: A single aerial survey for staging shorebirds along the Beaufort coast from Point Lay to Demarcation Point on the Canadian border will be conducted during August and September 2005 and 2006. Four teams of biologists will be stationed on the ground along the aerial flight line to identify species using the area and correct aerial survey data. Littoral transects around Barrow will be located and monitored to determine species-specific habitat preference, turnover times, and movements between local staging sites. Mist-netting and blood-sampling of birds will occur at littoral staging sites in the Barrow vicinity to examine differences in fattening rates (measured by plasma fat metabolite levels) and physiological stress levels (measured by blood corticosterone concentrations). This information will provide information about the physiological mechanism behind the timing and duration of pre-migratory shorebird use of Beaufort Sea littoral zones.

Revised Date: August 2008

ENVIRONMENTAL STUDIES PROGRAM: Annual Studies Plan FY 2009

Region: Alaska

Planning Area(s): Cook Inlet

Title: Distribution and Abundance of Harbor Seals in Cook Inlet

MMS Information Need(s) to be Addressed: This study will provide a sound, scientific protocol for aerial surveys to evaluate harbor seals in the Cook Inlet/Shelikof Strait area. This study will provide information for NEPA analysis and documentation for proposed Cook Inlet lease sales and other NEPA reviews.

Total Cost: \$813,000 plus Joint Funding **Period of Performance:** FY 2003-2007

Conducting Organization: National Marine Mammal Laboratory

Description:

Background: Harbor seals have been identified as a “keystone” species in the Cook Inlet and Gulf of Alaska marine environment. They represent a top-level predator in the food chain and an abundant species that occurs on the OCS year-around. The western Gulf of Alaska/Cook Inlet population of harbor seals has declined drastically since 1976 (Pitcher, 1990). Any perturbations that might be associated with Cook Inlet oil and gas activities could threaten this population. Information on the current trend in the population is needed to adequately assess potential effects of oil and gas activities. Harbor seal distribution could be affected by operations, and their abundance probably could be affected by a substantial oil spill.

Objectives: To develop and use a sound, scientific protocol to conduct a multi-year/season series of aerial surveys to estimate the distribution and abundance of harbor seals in the Cook Inlet Area, and to identify factors contributing to variation in those estimates.

Methods: This study will: 1) review and refine the previously established protocol for harbor seals by aerial surveys including information gleaned from *Exxon Valdez* oil spill (EVOS) Prince William Sound harbor seal surveys; 2) estimate relative abundance and density of hauled out harbor seals along the coast of Cook Inlet, and associated islands; 3) correlate harbor seal densities along the coast with environmental parameters; 4) develop and deploy remote camera systems for year-around use to identify factors that impact the haul-out behavior of harbor seals at various sites in Cook Inlet and quantify the relationship between haul-out patterns and these factors; 5) integrate findings of this study with those of the concurrent MMS satellite-tagging study “Movements and habitat use Harbor Seals in Cook Inlet”, in order to broaden the geographic extent of the data available to estimate the proportion of seals missed because they are in the water during aircraft surveys.

Revised Date: August 2008

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ENVIRONMENTAL STUDIES PROGRAM: Annual Studies Plan FY 2009

Region: Alaska

Planning Area(s): Cook Inlet

Title: Movements and Habitat Use of Harbor Seals in Cook Inlet

MMS Information Need(s) to be Addressed: This study will provide valuable information about a harbor seal population (or populations) that is exhibiting a trend toward seriously declining abundance. The study will provide information that addresses public concerns raised during MMS outreach. Information on distribution, abundance and behavior will be used in pre- and post-assessments and could form the basis for post-development monitoring if oil or gas related development is undertaken in the MMS Cook Inlet Planning Area. Information will be useful for assessments and monitoring for proposed Cook Inlet lease sales.

Total Cost: \$1,328,000 plus Joint Funding **Period of Performance:** FY 2004-2007

Conducting Organization: National Marine Mammal Laboratory

Description:

Background: In recent decades, the abundance of harbor seals has declined at several Alaskan locations. For example: counts of harbor seals at Tugidak Island declined 85% between 1976 and 1988 in Bristol Bay; the north side of the Alaska Peninsula; seal counts declined 42% between 1975 and 2003; and trend site counts in Prince William Sound suggest declines in harbor seal populations of approximately 63% between 1984 and 1997. The significance and causes of these declines are unknown, but concern is rising about the present and future status of Alaska harbor seal populations, most notably in the Gulf of Alaska. Because of the proximity of the declining populations to Cook Inlet, and the inherent vulnerability of harbor seals to spilled oil, it is particularly important to assess the potential impacts of oil and gas activities on the harbor seal population in the Cook Inlet Region.

In Alaska, aerial surveys have generally been conducted during the molt period (August-September) when the number of seals hauled out is thought to be highest and the weather conditions are likely to be most favorable for flying. Haul-out patterns at other times of the year are not well known. Since any seal's activity budget includes a significant time away from haul outs, information is also needed about at-sea behaviors for oil-spill-risk assessment. This study would result in a coordinated benefit to ongoing MMS-funded aerial surveys of harbor seals by estimating a correction of survey counts for the numbers of animals missed when they are not hauled out. It augments the ongoing MMS study entitled, "Distribution and Abundance of Harbor Seals" by providing a correction factor and other information on the distribution and behavior of seals away from established haul-outs.

Objectives: The general goal of this study is to employ satellite telemetry to document the movements, foraging behavior, and habitat use of harbor seals in Cook Inlet.

Specific objectives are to:

- Enhance estimates of harbor seal abundance in Cook Inlet by determining and applying a correction factor to survey counts of harbor seals from concurrent aerial surveys at haul outs in Cook Inlet.
- Obtain Cook Inlet-wide information on harbor seal relative abundance, distribution and behavior with emphasis on habitat other than major haul outs.
- Identify and prioritize any specific habitat areas that are or particular importance to the Cook Inlet harbor seal population(s) for specific activities such as feeding, breeding, pup rearing, wintering, etc.
- Conduct a comprehensive evaluation of whether individual populations (or stocks) exist in the MMS Cook Inlet planning area.

Methods: This study will capture and instrument 30 seals in each of 3 successive years (N = 90) with Argos satellite-linked time-depth recorders. Seals to be instrumented would include approximately equal proportions of juveniles, adult females and adult males each year. Seals would be captured from locations throughout Cook Inlet, in relative numbers that are proportionate to local abundance. Necessary statistical analyses or statistical models will be developed to produce a correction factor for harbor seal abundance derived from aerial surveys at haul outs. Movement and behavioral data from this study will be used with any existing published results or other data in a comprehensive analysis of harbor seal distribution and habitat use in, or adjacent to, the MMS Cook Inlet Planning Area. Text, maps, photographs or other data summaries will be used to portray harbor seal distribution and habitat use in Cook Inlet for use in Oil-Spill-Risk Analysis. A synthesis of movement data and other existing evidence (e.g., genetic analyses or tagging studies) will be produced to evaluate whether individual populations (or stocks) exist in the MMS Cook Inlet planning area. Tissue samples obtained from instrumented seals will be used for supplemental genetic analyses, if needed.

Revised Date: August 2008

ENVIRONMENTAL STUDIES PROGRAM: Annual Studies Plan FY 2009

Region: Alaska

Planning Area(s): Chukchi Sea

Title: Monitoring Marine Birds of Concern in the Eastern Chukchi Nearshore Area (Loons)

MMS 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 (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 Lisburn. 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 later Chukchi Sea Lease Sale(s) in the *Outer Continental Shelf Oil and Gas Leasing Program 2007-2012*.

Total Cost: \$750,000 plus Joint Funding **Period of Performance:** FY 2007-2011

Conducting Organization: USGS-BRD

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 MMS. 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 MMS 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 2008

ENVIRONMENTAL STUDIES PROGRAM: Annual Studies Plan FY 2009

Region: Alaska

Planning Area(s): Beaufort Sea

Title: Aggregate Effects Research and Environmental Mitigation Monitoring of Oil Industry Operations in the Vicinity of Nuiqsut

MMS 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 MMS 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: TBD

Period of Performance: FY 2009-2011

Conducting Organization: TBD

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 effecting 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 2008

ENVIRONMENTAL STUDIES PROGRAM: Annual Studies Plan FY 2009

Region: Alaska

Planning Area(s): Chukchi Sea

Title: COMIDA: Impact Monitoring for Offshore Subsistence Hunting

MMS 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 MMS 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 MMS 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: TBD

Period of Performance: FY 2008-2011

Conducting Organization: TBD

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 MMS 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 Hypotheses 1: Offshore subsistence hunting patterns in the vicinity of Wainwright and Point Lay do not vary significantly from year to year.
- Monitoring Hypotheses 2: Variation 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 2008

ENVIRONMENTAL STUDIES PROGRAM: Annual Studies Plan FY 2009

Region: Alaska

Planning Area(s): North Aleutian Basin

Title: Subsistence Study for North Aleutian Basin

MMS 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: TBD

Period of Performance: FY 2009-2010

Conducting Organization: TBD

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 MMS 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 2008

ENVIRONMENTAL STUDIES PROGRAM: Annual Studies Plan FY 2009

Region: Alaska

Planning Area(s): Beaufort Sea

Title: Continuation of Impact Assessment for Cross Island Whaling Activities

MMS 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

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 MMS 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: a) number of whales taken; b) GPS location of whale strikes, with direction and distance from Cross Island; c) number of crews, composition of crews, total number of crew; d) periodic "census" of whaling participants on Cross Island, 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

collection on a) non-whaling subsistence activities on and near Cross Island; b) 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 Cross Island.

Revised Date: August 2008

ENVIRONMENTAL STUDIES PROGRAM: Annual Studies Plan FY 2009

Region: Alaska

Planning Area(s): Chukchi Sea

Title: Traditional Knowledge Regarding Bowhead Whales in the Chukchi Sea

MMS Information Need(s) to be Addressed: The bowhead whale, an endangered species and a critical subsistence resource for Alaska Native residents, is known to occupy and to pass through the Chukchi Sea. Bowhead whales may be affected in a variety of ways during all stages of oil and gas exploration, development, and production. The MMS analysts and decision-makers need to use the best available information to comply with National Environmental Protection Act (NEPA) requirements in the preparation of environmental impact statements, environmental assessments, and other documents. Traditional knowledge regarding these whales, including potential predictions of migration timing and feeding areas, has great value in helping to analyze the potential impacts of oil and gas activities in the Chukchi Sea. Study findings will be used in post-sale NEPA analysis, review of exploration plans, development and production plans, and other reviews for post-sale and post-exploration MMS decision-making and mitigation. Also, study results will be used in similar pre-lease analyses and documentation for later Chukchi Sea Lease Sale(s).

Total Cost: \$50,000 plus Joint Funding

Period of Performance: FY 2007-2008

Conducting Organization: CMI, UAF

Description:

Background: The Minerals Management Service has funded a five-year project to place satellite transmitters on up to 25 bowhead whales per year to learn more about migratory patterns, seasonal habitat use, and other aspects of the distribution and movements of bowhead whales in the Bering, Chukchi, and Beaufort Seas. In response to plans for this project, the Alaska Eskimo Whaling Commission (AEWC) and the North Slope Borough requested that a traditional knowledge component be added to make sure that relevant knowledge accumulated by generations of Iñupiaq and Yup'ik whalers be included along with the results from the transmitters. ConocoPhillips has funded this work in two Beaufort Sea whaling villages, Barrow and Kaktovik, beginning in October 2006. This current study is for a traditional knowledge effort involving the Chukchi Sea whaling village of Wainwright.

Objectives: The goal of this project is to gather traditional knowledge about bowhead movements, distribution, and long-term changes in size composition and abundance. The traditional knowledge will then be incorporated into the annual and final reports to MMS for

the bowhead whale satellite-tracking study, and documents will be prepared that compile the information for each village.

- Gather traditional knowledge about bowhead movements, distribution, and long-term changes in size composition and abundance in the Chukchi region and prepare a document compiling that information for Wainwright. This document will be co-authored by a whaler from the region.
- Hold a workshop to discuss tag data along with traditional knowledge that will be incorporated into the annual and final reports to MMS for the bowhead whale satellite-tracking study.

Methods: Work with the Wainwright Whaling Captains' Association to identify key individuals for guided discussions. The discussions will document local knowledge of bowhead whale migratory behavior and timing, possible segregation of the population during migration, and changes in abundance and size composition, plus other related information. A focus group will consist of discussions about bowhead movements and behavior by using a map of the area with Mylar overlays on which information can be recorded. A draft report will be provided to each participant for review and correction as necessary. A final report will be sent to the participants, the Wainwright Whaling Captains' Association, and AEWG for approval. After they approve the report, it will be available to others.

A workshop will be held in Wainwright that will include a discussion of the traditional knowledge report under review and data from the bowhead satellite-tracking study. The workshop will provide an opportunity for whalers to discuss how the tracking data relate to their knowledge of what bowheads do in their region.

Revised Date: August 2008

ENVIRONMENTAL STUDIES PROGRAM: Annual Studies Plan FY 2009

Region: Alaska

Planning Area(s): Beaufort Sea

Title: Subsistence Mapping at Nuiqsut, Kaktovik, Barrow, and Wainwright:
Past and Present Comparison

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

Total Cost: \$400,000

Period of Performance: FY 2002-2008

Conducting Organization: Stephen A. Braund and Associates

Description:

Background: MMS conducted studies providing detailed mapping of a wide range of subsistence activities for Nuiqsut, Kaktovik, and Barrow about 1990. Information is available from recent subsistence scientific, private, and government sources. For example, ADF&G has done some detailed mapping of subsistence activities for these three North Slope villages since 1990 but the mapping needs to be put in usable form. The MMS assesses cumulative effects in EIS's and, therefore, needs documentation on more current subsistence patterns for comparison between 1990 and the present. Exploration on the offshore, including the OCS, and much onshore development has taken place since 1990. Much oil and gas infrastructure has been built onshore since 1990. Northstar is the first offshore oil development connecting to the onshore developments centered at Prudhoe Bay and it began production in 2001. This study will coordinate with the documentation of subsistence activities at Cross Island, which is part of the ongoing "Arctic Nearshore Impact Monitoring In Development Areas" (ANIMIDA) study and continuation of that study. It will utilize information from the MMS-sponsored study which compiled GIS overlays of oil-industry and other human activities for the 1979-1998 period in the Beaufort Sea.

Objectives: Develop a Geographic Information System (GIS) to map and analyze changes in and potential interactions between subsistence activities and oil industry activities.

Methods:

1. Consult with key organizations to refine the scope of work for the study and to plan for conduct of the study. Such organizations may include the NSB Planning and Wildlife Management Departments, AEWC, Iñupiat Community of the Arctic Slope, the Native Villages of Barrow, Nuiqsut, and Kaktovik, and ADF&G Subsistence Division, and others as appropriate.
2. Compile information regarding subsistence geospatial patterns from MMS sponsored and other studies conducted in Nuiqsut, Kaktovik, Barrow, and Wainwright during the 1990s. Assess the quality of existing geo-spatial data and convert to GIS format where possible.

3. Compile current information on subsistence activities and use of resources for Nuiqsut, Kaktovik, Barrow, and Wainwright as available from recent work conducted by scientific, private, and government entities. Gather primary source data regarding current subsistence effort, and use of resources from knowledgeable key informants resident in Nuiqsut, Kaktovik, and Barrow. The data collection effort will coordinate with other relevant MMS studies.
4. Generate maps depicting where subsistence activities are currently taking place and at what level of intensity. Products will show potential changes in harvests, access to resources, competition for resources, costs, effort, and levels of risk.
5. For each subsistence activity map, provide context describing in standardized and specific terms the nature and source of the data.
6. Develop overlay maps depicting changes in subsistence activities and changes in oil and gas activities. Develop analysis to address potential cumulative-effect dynamics occurring between subsistence and oil and gas activities. Develop descriptive context to augment the analysis.
7. Review and evaluate effectiveness of current federal and state mitigation associated with oil and gas activity regarding potential displacement of subsistence resources and resource users.
8. Review graphic and written analysis with key informants and key organizations including but not limited to those identified in 1 above. Disseminate ongoing and final products of study to local residents through village workshops and integrate workshop feedback into the final analysis.
9. Input all final spatial information on subsistence and industry activity into a GIS format.
10. Make resulting information available to the public on CD-ROM.

Revised Date: August 2008

ENVIRONMENTAL STUDIES PROGRAM: Annual Studies Plan FY 2009

Region: Alaska

Planning Area(s): Beaufort Sea and Lower Cook Inlet

Title: Researching Technical Dialogue with Alaskan Coastal Communities: Analysis of the Social, Cultural, Linguistic, and Institutional Parameters of Public/Agency Communication Patterns

MMS Information Need(s) to be Addressed: Since MMS primarily communicates to a diverse public through the preparation of regulatory measures, EIS's, and other documents, an analytic investigation of alternative communication processes and their effects on key constituents is needed. This study will evaluate the effectiveness of various communication strategies, explore prospects for altering future communication efforts, and seek to make agency communication more effective in the Alaska region. By reducing miscommunication with stakeholders, this study will enhance the ability of the public to participate more fully in the NEPA process.

Total Cost: \$300,000

Period of Performance: FY 2004-2008

Conducting Organization: EDAW, Inc.

Description:

Background: Technical dialogue plays an important role in shaping OCS decisions, yet relatively little research has been devoted to investigate the communication processes between technical professionals and citizen stakeholders. Some research of this nature has been done, but not in Alaska, where distinctive resource management issues and distinctive social, cultural, linguistic, and institutional differences exist. Previous social research indicates that differing knowledge bases and paradigms routinely complicate the communication efforts of federal institutions in Alaskan coastal communities. Some agencies have already made significant progress in efforts to assess and improve the effectiveness of their written communication methods with the public.

The proposed research would specifically investigate the effects of MMS written communication efforts in selected coastal communities and try to improve communication processes with local stakeholder groups. It would systematically identify and analyze potential communication obstacles and then pursue remedies through pilot-testing a series of experimental "newsletters" on targeted focus groups. Is MMS successfully communicating the messages that it intends to communicate? Does a particular communication have any measurable effect on relevant local understandings? Are unintended messages being communicated? Can MMS improve communication techniques through cost efficient measures? Can issues of public trust be addressed through a more effective written communication process? If specific written communication problems can be identified

through controlled testing, the study would then seek to provide both a rationale and a method to explore potential changes in future agency communication strategies with regard to:

- message content
- mechanisms of message delivery
- timeliness of communication
- availability and use of supporting materials and information.

Objectives:

- Assess the measurable effectiveness of MMS written communication methods with various communities of coastal Alaska.
- Identify potential obstacles in MMS written communication efforts and develop a strategy for their amelioration.
- Generate specific recommendations for improved written communication methods and for their implementation in agency processes.
- Improve prospects for public/agency communication and collaboration in resource management issues of the Alaskan OCS.

Methods:

1. Analyze and catalogue the record of public comments from Cook Inlet and the Beaufort Sea to assess the scope and character of manifest communication issues and regional opinions about offshore oil development and MMS regulatory processes.
2. Conduct a literature search to assess alternative federal agency written communication efforts with local populations that are relevant to MMS goals and processes.
3. Identify appropriate samples of study participants in communities on the North Slope and the Kenai Peninsula.
4. Devise a cost effective procedure to create focus groups to assess public knowledge and attitudes about the OCS regulatory environment, the communication of scientific and technical information, and key agency messages.
5. Work with MMS management and staff to prepare new (theory-driven) textual materials to disseminate agency statements under controlled and variable circumstances, including the preparation and distribution of various “newsletters” to compare their effectiveness as measured across a range of key variables.
6. Monitor changes in understanding, perceptions of OCS management, and durability of opinions among study participants because of pilot-test materials.
7. Continue to test and monitor communication efforts in a limited and controlled newsletter format until a model based upon “lessons learned” can be implemented.
8. Coordinate communication processes with other relevant MMS studies.

Revised Date: August 2008

ENVIRONMENTAL STUDIES PROGRAM: Annual Studies Plan FY 2009

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

MMS 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 2007-2010

Conducting Organization: UAF, Resilience and Adaptation Program

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 2008

ENVIRONMENTAL STUDIES PROGRAM: Annual Studies Plan FY 2009

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

MMS 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 MMS information needs to be addressed: Alaska OCS Region. This study will be used in EAs and EIS's 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 2003-2008

Conducting Organization: Impact Assessment, Inc.

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 2008

ENVIRONMENTAL STUDIES PROGRAM: Annual Studies Plan FY 2009

Region: Alaska

Planning Area(s): Beaufort Sea

Title: Continuation of Arctic Nearshore Impact Monitoring in Development Area (cANIMIDA): Core Contractor Program Management, Logistics, Data Management and Reporting

MMS Information Need(s) to be Addressed: Northstar construction started during the ANIMIDA study and production started in November 2001. Liberty, if initiated, could start construction sometime during the period of cANIMIDA. Interagency reviews of related EIS's and Development and Production Plans recommend monitoring effects of Northstar and the possible Liberty development. There is a continuing, ongoing need for this monitoring information during the performance period of the study, which will coincide with production from Northstar and possible Liberty construction. The information will be used for NEPA analysis and documentation for Beaufort Sea Lease Sales and DPPs.

Total Cost: \$1,801,000

Period of Performance: FY 2003-2009

Conducting Organization: Battelle

Description:

Background: The Arctic Nearshore Impact Monitoring in Development Area (ANIMIDA), a five-year study started in 1999, has provided baseline data and monitoring results for chemical contamination, turbidity, and subsistence whaling in the vicinity of Northstar and Liberty development sites. Northstar is in State waters, but includes production of some OCS oil through directional drilling. Liberty, if approved, will be the first offshore OCS development project in the Beaufort Sea or elsewhere in the Alaska OCS. ANIMIDA monitoring for Northstar includes pre-construction, and construction, and early production periods. The last field sampling for ANIMIDA occurred in 2003. This study started field work in FY 04, with this Core Contractor task funded and procured under FY 03 appropriations.

Objectives: This task provides overall management, logistical support, database management, and review of products for all cANIMIDA science tasks. The cANIMIDA projects will gather long term monitoring data which will 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. Currently, these site-specific areas include the Northstar and Liberty areas, other prospects would be included if proposed for development.

Methods: Field logistics for both phases include helicopter support and small vessel (e.g., MMS Launch 1273) support in the "open" water season and snow machine support in

winter/spring. Samples will be collected from construction gravel pits, artificial islands, rivers, barrier islands, and sediment from ANIMIDA offshore stations and along the proposed Liberty pipeline route.

Turbidity, total suspended sediment, current velocity measurements are being made in the vicinity of construction, spoils dumps and other sites including local rivers and the Boulder Patch. Sediment and suspended sediment samples will be analyzed for PAH, trace metals, and supporting chemistry using methods consistent with prior ANIMIDA analyses. Biota sampling (species and contaminants measured) will be based on results and recommendations from ANIMIDA. Kelp productivity will be monitored in the Boulder Patch and will use the inherent optical properties of the ice and water to evaluate the effect of sediment resuspension on kelp productivity. Optical-related measurements will include spectral irradiance, light scattering coefficients, and total suspended solids. The reporting program for Cross Island whaling, which records information on whaling locations, success, and whaler perceptions, will be supported. Field programs were conducted in 2003-2006 for contaminant tasks and 2003-2007 for Boulder Patch and Cross Island Whaling tasks.

Revised Date: August 2008

ENVIRONMENTAL STUDIES PROGRAM: Annual Studies Plan FY 2009

Region: Alaska

Planning Area(s): Beaufort Sea

Title: Continuation of Arctic Nearshore Impact Monitoring in Development Area (cANIMIDA): Hydrocarbon and Metal Characterization of Sediments in the cANIMIDA Study Area

MMS Information Need(s) to be Addressed: Northstar construction started during the ANIMIDA study and production started in November 2001. Liberty, if initiated, could start construction sometime during the period of cANIMIDA. Interagency reviews of related EIS's and Development and Production Plans recommend monitoring effects of Northstar and the possible Liberty development. There is a continuing, ongoing need for this monitoring information during the performance period of the study, which will coincide with production from Northstar and possible Liberty construction. The information will be used for NEPA analysis and documentation for Beaufort Sea Lease Sales and DPPs.

Total Cost: \$616,000

Period of Performance: FY 2004-2009

Conducting Organization: Battelle

Description:

Background: MMS initiated an environmental monitoring program in the Beaufort Sea in 1984 to assess the potential area wide or cumulative effects of gas and oil exploration and development. The program is designed to detect and quantify long-term changes in the concentrations of metals and hydrocarbons in sediments and animal tissues. Its design is based on recommendations from a workshop conducted by the MMS and the NOAA in 1983. The initial phase of the monitoring study was a 3-year program with field sampling and analyses taking place in 1984, 1985, and 1986. Subsequent sampling was recommended for every third year but took place only in 1989. The Arctic Nearshore Impact Monitoring in Development Area (ANIMIDA), a five-year study started in 1999, has provided baseline data and monitoring results for chemical contamination, turbidity, and subsistence whaling in the vicinity of Northstar and Liberty development sites. Northstar is in State waters, but includes production of some OCS oil through directional drilling. Liberty, if approved, will be the first offshore OCS development project in the Beaufort Sea or elsewhere in the Alaska OCS. ANIMIDA monitoring for Northstar includes pre-construction, and construction, and early production periods. The last field sampling for ANIMIDA occurred in 2003. This study started field work in FY 04, with an initial planning phase and Core Contractor funded and procured under FY 03 appropriations.

The sensitivity of the development area, and the highly variable and complex environmental conditions, make further monitoring necessary. Because current practice is to not discharge

muds, cuttings, and formation waters during development and production, environmental concerns are shifting toward gravel-construction effects such as may have occurred at Endicott and to pre-potential spill baselines. During ANIMIDA Phase I, chemistry measurements were made during the open water season near the Northstar and Liberty sites, and at Beaufort Sea Monitoring Program stations. A winter sampling program was also conducted under Phase I to collect data under ice-covered conditions. During ANIMIDA Phase II, the sediment chemistry stations from Phase I were resampled in 2000 and 2002. Sediment cores from the study area were dated and analyzed in 2001. In addition to sediment chemistry in 2002, caged mussels and semi-permeable membrane devices (SPDM) were also deployed.

Objectives: This study will gather long term monitoring data which will 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. Currently, these site-specific areas include the Northstar and Liberty areas, other prospects would be included if proposed for development. This Task will continue the ANIMIDA sediment chemistry program from Task Order (TO) 2, “Hydrocarbon and Metal Characterization of Sediments, Bivalves and Amphipods in the ANIMIDA Study Area.” Biota sampling and tissues chemistry will now be the responsibility of cANIMIDA TO 5, but will be closely coordinated with this TO’s sediment monitoring program. The specific objectives of the chemistry monitoring program include:

Methods: Field logistics for both phases include helicopter support and small vessel (e.g., MMS Launch 1273) support in the “open” water season and snow machine support in winter/spring. Samples will be collected from construction gravel pits, artificial islands, rivers, barrier islands, and sediment from ANIMIDA offshore stations and along the proposed Liberty pipeline route.

In summer 2004, this TO will repeat the field monitoring of sediment chemistry program conducted in 1999, 2000, and 2002 for ANIMIDA, focusing on potential impacts from the Northstar and potential Liberty development. Bivalve and amphipod samples will be collected at sediment stations for cANIMIDA TO 5. Offerors should discuss any needed reconfiguration of stations and rationale in their proposals. In 2005, 2006, and 2007, alternative summer sampling programs will be considered. Whether the alternative sampling programs will be substituted will depend on the degree of agreement of cANIMIDA with ANIMIDA data and on proposed development activities in the nearshore Beaufort Sea. Such alternative sampling programs shall be designed to improve scientific context of TO 2. For example, an return to the full suite of Beaufort Sea Monitoring Program (BSMP) stations or extension of sampling, especially sediment coring and geochronology, into outer shelf waters through non-cANIMIDA ice breaker support are potential substitutions.

Revised Date: August 2008

ENVIRONMENTAL STUDIES PROGRAM: Annual Studies Plan FY 2009

Region: Alaska

Planning Area(s): Beaufort Sea

Title: Continuation of Arctic Nearshore Impact Monitoring in Development Area (cANIMIDA): Sources, Concentrations, and Dispersion Pathways for Suspended Sediment in the cANIMIDA Study Area

MMS Information Need(s) to be Addressed: Northstar construction started during the ANIMIDA study and production started in November 2001. Liberty, if initiated, could start construction sometime during the period of cANIMIDA. Interagency reviews of related EIS's and Development and Production Plans recommend monitoring effects of Northstar and the possible Liberty development. There is a continuing, ongoing need for this monitoring information during the performance period of the study, which will coincide with production from Northstar and possible Liberty construction. The information will be used for NEPA analysis and documentation for Beaufort Sea Lease Sales and DPPs.

Total Cost: \$319,000

Period of Performance: FY 2004-2009

Conducting Organization: Battelle

Description:

Background: The Arctic Nearshore Impact Monitoring in Development Area (ANIMIDA), a five-year study started in 1999, has provided baseline data and monitoring results for chemical contamination, turbidity, and subsistence whaling in the vicinity of Northstar and Liberty development sites. Northstar is in State waters, but includes production of some OCS oil through directional drilling. Liberty, if approved, will be the first offshore OCS development project in the Beaufort Sea or elsewhere in the Alaska OCS. ANIMIDA monitoring for Northstar includes pre-construction, and construction, and early production periods. The last field sampling for ANIMIDA occurred in 2003. This study started field work in FY 04, with an initial planning phase and Core Contractor funded and procured under FY 03 appropriations.

In ANIMIDA, turbidity and distribution of total suspended solids (TSS) was found to be dependent on ice cover and sea state. Under ice, prior to river breakup TSS levels are low at a few tenths of a milligram per liter or lower. During the brief open-water period, concentrations of TSS were directly related to sea state, to the strength and duration of winds.

Concentrations of trace metals were determined for suspended matter samples collected during 1999-2002 from the coastal Beaufort Sea. The fine-grained aluminosilicates suspended in the water column were enriched in trace metals; however, concentrations of the Fe, Ba, Cr, As and other metals plot within the 99% prediction intervals prepared from the

data for bottom sediment. The ANIMIDA area appeared to be a net erosional environment for sediment. Much of the large sediment load of the rivers may be carried across the nearshore environment during spring on the freshwater channel under the ice or with summer storms to be deposited in deeper waters of the Beaufort Sea.

Objectives: This study will gather long term monitoring data which will 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. Currently, these site-specific areas include the Northstar and Liberty areas, other prospects would be included if proposed for development. The specific objectives for this task are the following: improve the ANIMIDA conceptual model of suspended sediment interactions, loading, and export from the cANIMIDA 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 in the cANIMIDA area, expand the chemical analyses of suspended sediments to include hydrocarbon composition, investigate the contribution of shoreline erosion to suspended sediment load and composition, and determine the contribution of plankton/larvae to suspended sediment, including under ice and open water.

Methods: Field logistics for both phases include helicopter support and small vessel (e.g., MMS Launch 1273) support in the “open” water season and snow machine support in winter/spring. Samples will be collected from construction gravel pits, artificial islands, rivers, barrier islands, and sediment from ANIMIDA offshore stations and along the proposed Liberty pipeline route.

Field surveys should occur in the open-water period, during breakup with high river flow, and at least once during the ice-covered season. Hydrocarbon analysis of suspended sediments will require large volume water samples (100 liter) from rivers and the nearshore study area with adsorption of filtrate to isolate the dissolved fraction.

This task will use chemical fingerprinting 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.

Revised Date: August 2008

ENVIRONMENTAL STUDIES PROGRAM: Annual Studies Plan FY 2009

Region: Alaska

Planning Area(s): Beaufort Sea

Title: Continuation of Arctic Nearshore Impact Monitoring in Development Area (cANIMIDA): Partitioning of Potential Contaminants between Dissolved and Particulate Phases in the cANIMIDA Study Area

MMS Information Need(s) to be Addressed: Northstar construction started during the ANIMIDA study and production started in November 2001. Liberty, if initiated, could start construction sometime during the period of cANIMIDA. Interagency reviews of related EIS's and Development and Production Plans recommend monitoring effects of Northstar and the possible Liberty development. There is a continuing, ongoing need for this monitoring information during the performance period of the study, which will coincide with production from Northstar and possible Liberty construction. The information will be used for NEPA analysis and documentation for Beaufort Sea Lease Sales and DPPs.

Total Cost: \$188,000

Period of Performance: FY 2004-2009

Conducting Organization: Battelle

Description:

Background: The Arctic Nearshore Impact Monitoring in Development Area (ANIMIDA), a five-year study started in 1999, has provided baseline data and monitoring results for chemical contamination, turbidity, and subsistence whaling in the vicinity of Northstar and Liberty development sites. Northstar is in State waters, but includes production of some OCS oil through directional drilling. Liberty, if approved, will be the first offshore OCS development project in the Beaufort Sea or elsewhere in the Alaska OCS. ANIMIDA monitoring for Northstar includes pre-construction, and construction, and early production periods. The last field sampling for ANIMIDA occurred in 2003. This study started field work in FY 04, with an initial planning phase and Core Contractor funded and procured under FY 03 appropriations.

Concentrations of dissolved and particulate metals (As, Ba, Ca, Cu, Fe, K, Mg, Mn, Na, Ni, Pb and Zn), particulate Al and dissolved and particulate organic carbon (DOC and POC) were determined for three ANIMIDA area rivers during June to August 2001 and 2002.

Concentrations of dissolved trace metals were low, but different among the three rivers. For example, in the Sagavanirktok River, the following average concentrations of dissolved metals were determined: Pb at 15 ng/L, Cu at 0.6 µg/L and Ba at 32 µg/L whereas in the Colville River these three metals were found at concentrations of 60 ng/L, 2 µg/L and 50 µg/L, respectively.

Concentrations of dissolved trace metals in the saline waters of the coastal Beaufort Sea were generally lower than found in the rivers with the following observations: Pb at 4-7 ng/L, Cu at 0.5 µg/L and Ba at 13 µg/L. Concentrations of total Hg in the coastal Beaufort Sea were low at about 0.5-0.8 ng/L. The last field sampling for ANIMIDA occurred in 2003. This cANIMIDA task started field work in FY 04, with an initial planning phase and Core Contractor funded and procured under FY 03 appropriations.

Objectives: This study will gather long term monitoring data which will 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. Currently, these site-specific areas include the Northstar and Liberty areas, other prospects would be included if proposed for development. Specific objectives are to continue to delineate trace element distribution by water mass type from rivers to offshore, full salinity water in the cANIMIDA area., determine the reactions/mixing during freshwater/seawater mixing, better define the adsorption/desorption of petroleum hydrocarbons and selected metals under ice, low total-suspended-sediment water and in the well-stratified waters after spring melt, and examine the uptake of dissolved contaminants into the food chain in coordination the cANIMIDA bioaccumulation task.

Methods: Field logistics for both phases include helicopter support and small vessel (e.g., MMS Launch 1273) support in the “open” water season and snow machine support in winter/spring. Samples will be collected from construction gravel pits, artificial islands, rivers, barrier islands, and sediment from ANIMIDA offshore stations and along the proposed Liberty pipeline route.

Turbidity, total suspended sediment, current velocity measurements are being made in the vicinity of construction, spoils dumps and other sites including local rivers and the Boulder Patch. Sediment and suspended sediment samples will be analyzed for PAH, trace metals, and supporting chemistry using methods consistent with prior ANIMIDA analyses. Biota sampling (species and contaminants measured) will be based on results and recommendations from ANIMIDA.

Revised Date: August 2008

ENVIRONMENTAL STUDIES PROGRAM: Annual Studies Plan FY 2009

Region: Alaska

Planning Area(s): Beaufort Sea

Title: Continuation of Arctic Nearshore Impact Monitoring in Development Area (cANIMIDA): Integrated Biomonitoring and Bioaccumulation of Potential Anthropogenic Contaminants in Biota of the cANIMIDA Study Area

MMS Information Need(s) to be Addressed: Northstar construction started during the ANIMIDA study and production started in November 2001. Liberty, if initiated, could start construction sometime during the period of cANIMIDA. Interagency reviews of related EIS's and Development and Production Plans recommend monitoring effects of Northstar and the possible Liberty development. There is a continuing, ongoing need for this monitoring information during the performance period of the study, which will coincide with production from Northstar and possible Liberty construction. The information will be used for NEPA analysis and documentation for Beaufort Sea Lease Sales and DPPs.

Total Cost: \$545,000

Period of Performance: FY 2004-2009

Conducting Organization: Battelle

Description:

Background: The Arctic Nearshore Impact Monitoring in Development Area (ANIMIDA), a five-year study started in 1999, has provided baseline data and monitoring results for chemical contamination, turbidity, and subsistence whaling in the vicinity of Northstar and Liberty development sites. Northstar is in State waters, but includes production of some OCS oil through directional drilling. Liberty, if approved, will be the first offshore OCS development project in the Beaufort Sea or elsewhere in the Alaska OCS. ANIMIDA monitoring for Northstar includes pre-construction, and construction, and early production periods. The last field sampling for ANIMIDA occurred in 2003. This study started field work in FY 04, with an initial planning phase and Core Contractor funded and procured under FY 03 appropriations.

Objectives: This study will gather long term monitoring data which will 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. Currently, these site-specific areas include the Northstar and Liberty areas, other prospects would be included if proposed for development. Specific objectives includes development of a conceptual model of bioaccumulation and trophic interaction in cANIMIDA biota., monitor bioaccumulation of contaminants in selected species, and continue ANIMIDA contaminant monitoring program for amphipod and bivalve samples.

Methods: Field logistics include small vessel (e.g., MMS Launch 1273) support in the “open” water season. Biota sampling (species and contaminants measured) are based on results and recommendations from ANIMDIA. The 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 4 species of fish (minimum). Emphasis is on resident species. Caged bivalves at Northstar and reference locations will be used as contaminant integrators.

Revised Date: August 2008

ENVIRONMENTAL STUDIES PROGRAM: Annual Studies Plan FY 2009

Region: Alaska

Planning Area(s): Beaufort Sea

Title: Continuation of Arctic Nearshore Impact Monitoring in Development Area (cANIMIDA): Monitoring the 'Boulder Patch' as part of the cANIMIDA Program

MMS Information Needs to be Addressed: Northstar construction started during the ANIMIDA study and production started in November 2001. Liberty, if initiated, could start construction sometime during the period of cANIMIDA. Interagency reviews of related EIS's and Development and Production Plans recommend monitoring effects of Northstar and the possible Liberty development. There is a continuing, ongoing need for this monitoring information during the performance period of the study, which will coincide with production from Northstar and possible Liberty construction. The information will be used for NEPA analysis and documentation for Beaufort Sea Lease Sales and DPPs.

Total Cost: \$572,000

Period of Performance: FY 2004-2009

Conducting Organization: LGL Alaska Research Associates

Description:

Background: The Arctic Nearshore Impact Monitoring in Development Area (ANIMIDA), a five-year study started in 1999, has provided baseline data and monitoring results for chemical contamination, turbidity, and subsistence whaling in the vicinity of Northstar and Liberty development sites. Northstar is in State waters, but includes production of some OCS oil through directional drilling. Liberty, if approved, will be the first offshore OCS development project in the Beaufort Sea or elsewhere in the Alaska OCS. ANIMIDA monitoring for Northstar includes pre-construction, and construction, and early production periods. The last field sampling for ANIMIDA occurred in 2003. This study started field work in FY 04, with an initial planning phase and Core Contractor funded and procured under FY 03 appropriations.

The "Boulder Patch" area in Stefansson Sound is characterized by a diverse arctic kelp community in patchy areas where boulder cover greater than 10 percent is found. Any nearby oil development, such as possible for the Liberty prospect, would increase the potential for impacts and effects on this biological community.

Objectives: This study will gather long term monitoring data which will 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. Currently, these site-specific areas include the Northstar and Liberty areas, other prospects would be included

if proposed for development. This study continues to monitor the potential effects of offshore development on the Boulder Patch community. Monitoring measures include kelp production and biomass, ambient light intensity and total suspended solids at the water surface and at depths in areas where turbidity could be affected by development, and diversity of benthic community in Boulder Patch.

Methods: Field logistics are based on small vessel sampling. Kelp productivity will be monitored in the Boulder Patch and will use the inherent optical properties of the ice and water to evaluate the effect of sediment resuspension on kelp productivity. Optical-related measurements will include spectral irradiance, light scattering coefficients, and total suspended solids. Diversity measurements will be compatible with prior measurements in the in Boulder Patch, including revisiting Endicott diversity stations [Martin and Galloway, 1994. The Effects of the Endicott Development Project on the Boulder Patch, an Arctic Kelp Community in Stefansson Sound, Alaska. *Arctic* 47(1): 54-64]. The available Boulder Patch datasets will be combined into a longer term record. Appropriate measures will be taken to develop correct factors for differences in measurement methodology.

Revised Date: August 2008

ENVIRONMENTAL STUDIES PROGRAM: Annual Studies Plan FY 2009

Region: Alaska

Planning Area(s): Beaufort Sea

Title: Continuation of Arctic Nearshore Impact Monitoring in Development Area (cANIMIDA): Continuation of Annual Assessment of Subsistence Bowhead Whaling near Cross Island and part of the cANIMIDA Project

MMS Information Needs to be Addressed: Northstar construction started during the ANIMIDA study and production started in November 2001. Liberty, if initiated, could start construction sometime during the period of cANIMIDA. Interagency reviews of related EIS's and Development and Production Plans recommend monitoring effects of Northstar and the possible Liberty development. There is a continuing, ongoing need for this monitoring information during the performance period of the study, which will coincide with production from Northstar and possible Liberty construction. The information will be used for NEPA analysis and documentation for Beaufort Sea Lease Sales and DPPs.

Total Cost: \$193,000

Period of Performance: FY 2004-2009

Conducting Organization: Applied Sociocultural Research

Description:

Background: The Arctic Nearshore Impact Monitoring in Development Area (ANIMIDA), a five-year study started in 1999, has provided baseline data and monitoring results for chemical contamination, turbidity, and subsistence whaling in the vicinity of Northstar and Liberty development sites. Northstar is in State waters, but includes production of some OCS oil through directional drilling. Liberty, if approved, will be the first offshore OCS development project in the Beaufort Sea or elsewhere in the Alaska OCS. ANIMIDA monitoring for Northstar includes pre-construction, and construction, and early production periods. Effects of nearshore Beaufort oil development on subsistence activities, particularly bowhead whaling at and near Cross Island are of primary concern to the Village of Nuiqsut. The ANIMIDA program conducted this monitoring program during fall whaling in 2001-2003. This cANIMIDA study started field work in 2004, with an initial planning phase and Core Contractor funded and procured under FY 03 appropriations.

Objectives: This study will gather long term monitoring data which will 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. Currently, these site-specific areas include the Northstar and Liberty areas, other prospects would be included if proposed for development. Priority monitoring issues will be established through public and interagency comment, and coordinated with lessees and other organizations. This

cANIMIDA task continues the ANIMIDA objectives for the Annual Assessment of Subsistence Whaling near Cross Island:

- Secure continued cooperation of the Nuiqsut Whaling Association/crews in this task.
- Continue the Annual Assessment of Subsistence Bowhead Whaling near Cross Island started by ANIMIDA.
- Continue collation and archiving of Global Positioning System (GPS) data for each whaling vessel.
- Continue completion, collation, and annual reporting of standard data collection forms.
- Continue annual narrative report showing the subsistence bowhead whaling activities, resources, and harvest on and near offshore Cross Island.
- Installation and operation of a Cross Island weather station during the whaling season.
- Compare and summarize significant results from 2001-2007 annual reports on Cross Island Whaling.

Methods: Each whaling crew is provided with a handheld GPS. A dedicated individual on Cross Island ensures hunters go out with properly charged GPS and downloads the data to get location of each bowhead harvest and strike. The dedicated individual also collects other data, using the form developed in ANIMIDA. These data include the number of whaling boats and crews using Cross Island, weather and ice conditions, time allocation of crews, the hunters' perception of any bowhead displacement (if any), the hunters' perception of any access issues (if any), the hunters' perception of increased effort, physical risk, or cost due to bowhead displacement (if any). The Contractor prepares an annual report in coordination with the Alaska Eskimo Whaling Commission.

Note: This research will be continued by the FY 2008 study "Continuation of Impact Assessment for Cross Island Whaling Activities."

Revised Date: August 2008

ENVIRONMENTAL STUDIES PROGRAM: Annual Studies Plan FY 2009

Region: Alaska

Planning Area(s): All Alaska Planning Areas

Title: Minerals Management Service/University of Alaska-Fairbanks/State of Alaska/Coastal Marine Institute – Management

MMS 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: \$4,500,000 plus Joint Funding **Period of Performance:** FY 2008-2013

Conducting Organization: CMI, UAF

Description:

Background: This study provides management of a large ongoing program of scientific research into framework issues related to lease sales identified in the MMS *Final Outer Continental Shelf Oil and Gas Leasing Program 2007-2012*. It is a cooperative program between MMS 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 MMS contribution of \$750,000 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 MMS 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 2008

ENVIRONMENTAL STUDIES PROGRAM: Annual Studies Plan FY 2009

Region: Alaska

Planning Area(s): All Alaska OCS Planning Areas

Title: Alaska Marine Science Symposium

MMS Information Need(s) to be Addressed: This symposium provides MMS scientists and MMS Principal Investigators for MMS 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 2009–2014

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

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 MMS 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 MMS 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 MMS, 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 MMS and other 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 2008

ENVIRONMENTAL STUDIES PROGRAM: Annual Studies Plan FY 2009

Region: Alaska

Planning Area(s): All Alaska Planning Areas

Title: Management, Logistics, and Warehouse Storage of Oceanographic Equipment

MMS 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 MMS 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 critical program-support element related to studies that support all current leases.

Total Cost: \$450,000

Period of Performance: FY 2007-2009

Conducting Organization: Kinnetic Laboratories, Inc.

Description:

Background: The MMS, Alaska OCS Region, has responsibility for equipment management in support of Alaska studies. In 1996 the General Services Administration (GSA) obtained a new storage facility for ESP use. The equipment is stored in a small warehouse in Anchorage, where it is maintained and made available for ongoing projects. This support element also provides funds for maintenance of the MMS Alaska Region Launch 1273, a small research vessel needed for various oceanographic studies, as well as funds for other equipment maintenance and shipping. Also under this project, MMS will support Alaska ESP equipment management and other storage needs.

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 General Services Administration arranges for an appropriate warehouse facility for our use.

Launch 1273 was commissioned in 1983. The MMS 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 2008

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ENVIRONMENTAL STUDIES PROGRAM: Annual Studies Plan FY 2009

Region: Alaska

Planning Area(s): All Alaska Planning Areas

Title: Conference Management and Reports on MMS Results

MMS Information Need(s) to be Addressed: This study will help to resolve environmental and technical issues for MMS 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.

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 main priorities have been small workshops for resolution of environmental issues and Information Transfer Meetings (ITMs) for the exchange of studies information among Principal Investigators and the general public. The Alaska ESP has also organized small meetings on a limited range of topics called Information Update Meetings (IUMs).

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

Methods: The primary method is to coordinate meetings and workshops and assist with preparation of publications. Coordination includes organizing appropriate speakers and participants and logistics. FY 2008-2011 components may include an ITM in late 2008.

Revised Date: August 2008

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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 2007–2009

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 2008

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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 2007–2009

Partners: University of Colorado, Naval Postgraduate School, USDOJ

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 2008

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National Oceanographic Partnership Program (NOPP)

Region: Alaska

Planning Area(s): Beaufort Sea, Chukchi Sea

Title: Episodic Upwelling of Zooplankton within a Bowhead Whale Feeding Area near Barrow, AK (NOPP)

Total Cost: \$732,683 (MMS Share 32%) **Period of Performance:** FY 2007–2009

Partners: WHOI, UAF, URI, UW

Description:

The proposed work will expand upon 2005-2006 field studies to explicitly identify and document the occurrence, frequency, and persistence of wind-driven shelf-slope exchange events at the Barrow Canyon and the Beaufort shelf breaks during the summer and early fall in association with the presence of ice cover, water column stratification, and the presence of bowhead whales. The investigators will employ a combination of moorings, field validation using boat-based oceanographic sampling, and analyses of whale prey based on stomach contents from harvested whales. In so doing, the proposed work will lead to a greater understanding of the shelf environment, of the bowhead whale feeding environment, and of the potential impact of climate change on this Arctic shelf ecosystem.

Revised Date: August 2008

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National Oceanographic Partnership Program (NOPP)

Region: Alaska

Planning Area(s): Beaufort Sea, Chukchi Sea

Title: Comprehensive Modeling Approach Towards Understanding and Prediction of the Alaskan Coastal System Response to Changes in an Ice diminished Arctic (NOPP)

Total Cost: \$1 **Period of Performance:** FY 2007–2009

Partners: Naval Postgraduate School, Univ. of Colorado, Univ. of South Florida

Description:

The proposed research combines state-of-the-art regional modeling of sea ice, ocean, atmosphere and ecosystem to provide a system approach to advance the knowledge and predictive capability of the diverse impacts of changing sea ice cover on the bio-physical marine environment of coastal Alaska and over the larger region of the western Arctic Ocean. The focus of this project on seasonally ice-free Alaskan coasts and shelves is in direct support of NOPP Topic 4A: ‘Coastal Effects of a Diminished-ice Arctic Ocean’ and of littoral studies of interest to the U.S. Navy.

Revised Date: August 2008

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2.2 Profiles of Studies Proposed for FY 2009 NSL*

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

Table 1 Alaska OCS Region New Studies Proposed for the FY 2009 NSL

Page No.	Discipline	Title
157	FE PO	Adaptation of NOPP Arctic Circulation Model to Meet OSRA Needs
159	MM	Pinniped Movements and Foraging: Walrus Habitat Use in the Potential Drilling Area
161	MM	Passive Acoustic Detection and Monitoring of Endangered Whales in the Arctic
163	MM	Migration and Habitat Use by Threatened Spectacled Eiders in the Eastern Chukchi Near and Offshore Environment (BRD)
165	PO FE	Mapping and Characterization of Recurring Polynyas and Landfast Ice in the Chukchi Sea (Joint Funding)
167	SS	North Aleutian Basin Socio-economic Indicators
169	MM	Seasonal Habitat Use by Endangered Steller Sea Lions of the North Aleutian Basin Sale Area
171	MM	Demography and Behavior of Polar Bears Summering on Shore in Alaska (BRD)
173	MM	Occurrence and distribution of endangered humpback and fin whales in the NAB area
175	PO FE	Surface Current Circulation High Frequency (HF) Radar Mapping in the Chukchi Sea (Joint Funding)
177	IM	Alaska State Wide Oceans Research and Studies Project Browser covering the Alaska Offshore and Coastal Areas
179	HE	Seabird Distribution and Abundance in the Offshore Environment
181	PO	Physical Supporting Data for Chukchi Offshore Monitoring in Drilling Area (COMIDA)
AQ = Air Quality FE = Fates & Effects MM = Marine Mammals and IM = Information Management SS = Social Sciences Protected Species PO = Physical Oceanography HE = Habitat & Ecology		

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ENVIRONMENTAL STUDIES PROGRAM: Annual Studies Plan FY 2009

Region: Alaska

Planning Area(s): Beaufort Sea, Chukchi Sea

Title: Adaptation of NOPP Arctic Circulation Model to Meet OSRA Needs

MMS 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: TBD

Period of Performance: FY 2009

Description:

Background: MMS proposes to lease within the Beaufort and Chukchi Sea Planning Areas. To maintain its state-of-the-art in Oil-Spill-Risk Analysis, MMS 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, as part of the study: A Comprehensive Modeling Approach Towards Understanding and Prediction of the Alaskan Coastal System Response to Changes in an Ice-diminished Arctic, Dr. Maslowski, Principal Investigator. The study will develop an eddy resolving (1/96°) coupled sea-ice/ocean model of the Beaufort and Chukchi Seas. With some additional adaptation, this new modeling effort can be modified and expanded to capture provide multi-year circulation, ice, and forcing fields for use in MMS 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 MMS 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 MMS.

Methods: The NOPP 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 MMS in agreed format for a ten-to-twenty year hindcast simulation. Sensitivity testing and validation of the model and results will be conducted. The MMS 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 2008

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ENVIRONMENTAL STUDIES PROGRAM: Annual Studies Plan FY 2009

Region: Alaska

Planning Area(s): Chukchi Sea

Title: Pinniped Movements and Foraging: Walrus Habitat Use in the Potential Drilling Area

MMS 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 MMS decision-making and mitigation.

Total Cost: TBD

Period of Performance: FY 2009-2013

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 MMS. 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 2008

ENVIRONMENTAL STUDIES PROGRAM: Annual Studies Plan FY 2009

Region: Alaska

Planning Area(s): Beaufort Sea, Chukchi Sea

Title: Passive Acoustic Detection and Monitoring of Endangered Whales in the Arctic

MMS 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. Data will 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. Data will support ESA consultations, MMPA permitting, and preparation of Biological Evaluations and Biological Opinions.

Total Cost: TBD

Period of Performance: FY 2009-2013

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 occupying 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.

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 2008

ENVIRONMENTAL STUDIES PROGRAM: Annual Studies Plan FY 2009

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

MMS 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: TBD plus Joint Funding (BRD) **Period of Performance:** FY 2009-2013

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 2008

ENVIRONMENTAL STUDIES PROGRAM: Annual Studies Plan FY 2009

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

MMS 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: TBD plus Joint Funding

Period of Performance: FY 2009-2012

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 MMS study by Eicken et al. (2006) 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 MMS 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 MMS OCS study 2005-068 (Eicken et al., 2006).
- 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.
- 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 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 Geographic Information System (GIS). Provide a final report, database, and database documentation. Provide a project team web site.

Revised Date: August 2008

ENVIRONMENTAL STUDIES PROGRAM: Annual Studies Plan FY 2009

Region: Alaska

Planning Area(s): North Aleutian Basin

Title: North Aleutian Basin Socio-economic Indicators

MMS 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 key socio-economic baseline data for analysis 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: TBD

Period of Performance: FY 2009–2011

Description:

Background: This study is intended to initiate new socio-economic data collection in coastal communities along the Alaska Peninsula most proximate to the proposed North Aleutian Basin lease sale area. There is high priority for baseline information from the communities of Nelson Lagoon, Sand Point, Cold Bay, False Pass, King Cove, and related Community Development Quota groups. Later phases of the study are anticipated that will increase the range of surveyed communities to establish a broader regional baseline, as potential exploration or development in the NAB achieves greater definition. In November 2006, the MMS sponsored the “North Aleutian Basin Information Status and Research Planning Meeting” to solicit input from a broad range of scientific experts and regional stakeholders that could assist with the creation of research planning strategies. The meeting identified more than 30 studies that could provide useful information for future 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 social indicator study has been identified by the Alaska OCS Region as meeting a highly time-sensitive information need.

Objectives:

- Synthesize a broad range of existing socio-economic data for identified communities.
- Collect new data on key socio-economic indicator variables.
- Identify existing community infrastructure and public services, and local capacity to incorporate change that would likely accompany oil and gas exploration and development.
- Identify regional socio-economic aspirations and values.

Methods: Conduct community consultations in all targeted locations to ensure local interest in study participation. Identify key sources, scope, and quality of data from known sources:

Census data, Aleutians East Borough, Aleut Corporation, Aleutian-Pribilof Islands Association, Eastern Aleutian Tribes, key communities, other pertinent boroughs, Community Development Quota groups, tribal governments and village corporations. This information would include past and present demographic data, basic data on the economic structure and activities in the region, an assessment of labor resources in the region, and an assessment of educational and training opportunities for local residents. Compile data and identify any key types of information that are unavailable from existing data sources. Conduct focus groups for qualitative data collection and, as possible, obtain data unavailable from existing sources. Conduct basic data analysis (baseline description) and prepare a report describing the socio-economic characteristics of the area. Conduct community consultations to present data analysis and baseline description to the communities for their review and comments.

Revised Date: August 2008

ENVIRONMENTAL STUDIES PROGRAM: Annual Studies Plan FY 2009

Region: Alaska

Planning Area(s): North Aleutian Basin

Title: Seasonal Habitat Use by Endangered Steller Sea Lions of the North Aleutian Basin Sale Area

MMS Information Need(s) to be Addressed: The Steller sea lion is listed as endangered under the ESA and as a species of concern in the North Aleutian Basin. Information on use of terrestrial and marine habitats by Steller sea lions in the southeastern Bering Sea, including the Sale Area, is necessary to ensure that oil and gas lease and development activities do not delay the species' recovery. Study findings will be required in NEPA analyses, ESA Section 7 consultations, and other reviews of pre- and post-sale and pre- and post-exploration decision making and mitigation.

Total Cost: TBD

Period of Performance: FY 2009–2012

Description:

Background: The North Aleutian Basin Sale Area includes habitat used by the endangered western stock of Steller sea lions. However, nothing is currently known regarding how this area is used by this species on a seasonal basis and which portions of the Sale Area are of critical importance to this species for foraging. Information on use of terrestrial and marine habitats by Steller sea lions in the southeastern Bering Sea, including the Sale Area, is necessary to ensure that oil and gas lease and development activities do not delay the species' recovery. Telemetry studies in the eastern Steller sea lion stock have shown that animals use haulouts as a central place from which foraging trips are made. The close proximity of the Steller sea lion haulouts and rookery sites at Amak Island, Cape Newenham, Round Island, Akun, Akutan, and Ugamak to the NAB Planning Area suggests that this area may be used as a foraging location.

Objectives:

- Determine seasonal distribution of Steller sea lions in the Sale Area. Determine the extent to which regions within the Basin are utilized by Steller sea lions for foraging, and the extent to which activities in the area could affect foraging efficiency.
- Capture Steller sea lions using a variety of on-land or at-sea techniques and attach satellite-linked telemetry devices that record and transmit foraging depths and location.
- Highlight areas of critical importance through kernel home range analysis.
- Identify dispersal (migration) through the area to other haul outs surrounding the Sale Area.
- Monitor the health and condition of each captured animal.
- Permanently mark individual animals captured so they may be included in population dynamic research in the area in the future.

Methods: During a 3-year period, two trips will be conducted during spring (April or May) and two during autumn (October or November) to capture and instrument (SMRU tags) Steller sea lions among Unimak Pass and Amak Island/Sea Lion Rock areas, or other haulout locations within the Sale Area. By deploying instruments at two different times throughout the year, information on the habitat use of Steller sea lions throughout the annual cycle will be gained. Steller sea lions will be captured using a variety of on-land and at-sea techniques and immobilized with isoflurane gas anesthesia. Satellite telemetry transmitters will be attached and measurements of health and condition collected according to standard procedures developed at National Marine Mammal Laboratory (NMML), ADF&G, and Alaska SeaLife Center. A licensed veterinarian will be present at all times when isoflurane is being administered. Dive depth data are stored by the telemetry device and transmitted when dry (e.g., when the sea lion is at the surface or hauled out on land) to Argos satellites. Locations are estimated by Argos and variance in location estimate is based on quality of received signals. At-sea distribution and habitat use will be determined through analysis of location and dive data by sea lion age and sex through the use of GIS, animal movement software, and new habitat use models being developed at NMML. All physiological tissues collected will be archived for future contaminants, disease, and diet assessments to provide baseline data in the event of catastrophic events (e.g., oil spill).

Revised Date: August 2008

ENVIRONMENTAL STUDIES PROGRAM: Annual Studies Plan FY 2009

Region: Alaska

Planning Area(s): Beaufort Sea, Chukchi Sea

Title: Demography and Behavior of Polar Bears Summering on Shore in Alaska

MMS 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 2009-2013

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 are likely to increase because areas of importance to significant numbers of 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 a draft mitigation plan 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 2008

ENVIRONMENTAL STUDIES PROGRAM: Annual Studies Plan FY 2009

Region: Alaska

Planning Area(s): North Aleutian Basin

Title: Occurrence and Distribution of Endangered Humpback and Fin Whales in the North Aleutian Basin (NAB) Area

MMS Information Need(s) to be Addressed: At least nine species of cetaceans are known to occur in the North Aleutian Basin lease-sale area. In addition to the North Pacific right whale (*Eubalaena japonica*) (already the subject of a NMFS-MMS inter-agency agreement), other species listed as threatened and/or endangered are known to, or potentially could, occur in areas that may be affected by oil and gas activities within the NAB. These include, but are not limited to the humpback whale (*Megaptera novaeangliae*) and the fin whale (*Balaenoptera physalus*), both of which are listed as endangered, and both of which are known to feed in areas within or adjacent to the NAB lease sale area. Under the National Environmental Policy Act (NEPA), and under the ESA, MMS will be required to evaluate if and how federal actions associated with oil and gas development may affect these whales. The occurrence, distribution and habitat use of these species in the area may play an important role in determining where and when exploration or access to petroleum reserves may be conducted.

Total Cost: TBD

Period of Performance: FY 2009-2011

Description:

Background: Humpback and fin whales both feed in the southeastern Bering Sea, including the NAB area. The population identity of humpback whales that frequent the area was recently studied using photo-identification. Analyses from these efforts are currently underway. However, while longer-distance migratory matches have been made for some whales, little is known about the temporal and spatial patterns of their use of the NAB, their use of specific areas for feeding or other biologically significant behaviors, or the types of whales that use specific areas. Virtually nothing is known about the extent to which the region is important for fin whales.

Because some basic humpback and fin whale information will be collected during the course of the study of the North Pacific right whale, the objectives of this particular study are designed to complement data that will be collected during aerial surveys and passive acoustic monitoring that will occur during that ongoing study.

Objectives: To characterize and understand the spatial and temporal use of habitats by humpback and fin whales within, and adjacent to, those areas in the NAB in which oil and gas exploration, development, and production and associated activities may occur in the near future.

Methods: Satellite tags will be attached to humpback and fin whales, and their movements monitored through the Argos system. Since this work will dovetail with the existing NMFS-MMS right whale studies, this study will not require additional field staff or ship time during the first field season while that study is ongoing; initially, the only costs for this work will be tags and satellite time, as well as some analysis expenses. Up to 16 tags for both species (total) would be deployed for each of two years.

Revised Date: August 2008

ENVIRONMENTAL STUDIES PROGRAM: Annual Studies Plan FY 2009

Region: Alaska

Planning Area(s): Chukchi Sea

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

MMS Information Need(s) to be Addressed: The collection of surface current data will be used to validate the MMS ocean circulation model for the Chukchi Sea. These data will support the MMS Oil-Spill-Risk Analysis (OSRA). OSRA is a cornerstone to regional EIS's environmental assessments, 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: TBD plus Joint Funding

Period of Performance: FY 2009-2013

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 70Km, covering an area over 2500 Kilometers. 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 along northeastern coast of the Alaskan Chukchi Sea through the deployment of coastal HF radar systems and offshore bottom mounted Acoustic Doppler Current Profilers. Top to bottom current circulation fields will be collected along the northeastern Chukchi coast beginning in July when the major northeast oriented lead system begins to breakup seaward of the landfast ice zone. Data collection will continue throughout the open water season until landfast begins to form along the coast. Data collection from HF radar systems will be attempted simultaneously from three separate sites. Surface current circulation fields will be collected utilizing shorter range switchable (13 and 25 Mhz) High Frequency (HF) radar and possibly a longer range 5 Mhz

HF radar system. Surface current fields will be collected on an hourly basis out to 150 Km from shore from three coastal locations. Data collection will be attempted in near-real time. Bottom mounted Acoustic Doppler Current Profilers (ADCPs) will be deployed to capture the sub surface circulation fields, including temperature and salinity. 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 Acoustic Doppler Current Profilers (ADCP), 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: Field test potential locations to deploy long and short range HF Doppler radar systems along the Chukchi Sea coast beginning near Barrow and extending down the Chukchi coast. Work with Alaska Native groups and scientific organizations on the North Slope to enhance their participation in the project. Select sites and collect surface current measurements on an hourly basis between the months of July and October for three to four field seasons. Collaborate with other agencies and industry to obtain needed data on subsurface currents and surface current parameters. Deploy instruments where needed to collect required data sets. Build geospatial database of surface and subsurface conditions for comparison to HF radar surface currents. Conduct analysis comparing available data on ice concentration, leads, moorings, drifters, sea surface temperature, salinity measurements, and wind data to surface current fields. Combine surface current fields from HF radar with QuikSCAT satellite observations. Provide spatial and temporal database along with final report. Provide surface current flow fields to modeling group for model validation. Provide final report of results.

Revised Date: August 2008

ENVIRONMENTAL STUDIES PROGRAM: Annual Studies Plan FY 2009

Region: Alaska

Planning Area(s): All ocean areas of Alaska: Gulf of Alaska, Bering Sea, Chukchi Sea, Beaufort Sea, Cook Inlet, Prince William Sound, etc.

Title: Alaska State-Wide Oceans Research and Studies Project Browser
Covering the Alaska Offshore and Coastal Areas

MMS Information Need(s) to be Addressed: MMS 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 (ESS), Environmental Assessment Section (EAS) Analysts, and MMS Management via an online web browser centralized at the University of Alaska-Fairbanks. A web-based visual display of ongoing, recently completed and possibly planned study efforts will assist MMS 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 MMS decision making in the writing of EIS's, EAs and commenting on exploration and development plans for the OCS.

Total Cost: TBD

Period of Performance: FY 2009-2013

Description:

Background: The Minerals Management Service (MMS) as well as other agencies (NPRB, AOOS, UAF, University of Alaska-Anchorage USFW, BRD, BLM, etc.) have identified a statewide need for a centralized database of past, present and future projects and associated observations and observing plans. NPRB started this project several years ago with a focus on NPRB projects. In fiscal year 2007, NPRB tasked the Alaska Ocean Observing System (AOOS) to build a project database that will initially include NPRB and AOOS projects. AOOS has spent several months re-designing a Project Browser by expanding on the original NPRB browser in order to meet the needs of the broader agency and science community. This new MMS cooperative effort will piggy back on existing efforts by including MMS' ongoing and recently completed study boundaries, study summaries, and pertinent observation platforms in an online spatial database. Through the use of online maps, the user could search any recently completed or ongoing study efforts within a specific boundary of the OCS.

MMS places the digital copies of the final study reports online, but it is very difficult to quickly access the 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 MMS staff to remain current with all of the research in the OCS due to the large

volume of government and industry activities conducted within these areas. This effort will centralize the function of collecting and storing the study summaries, study boundaries, and any observation platforms within AOOS and the University of Alaska-Fairbanks. The information will be made available for public access through the AOOS web site.

Objectives: Develop and implement web-based online visual Geographic Information System (GIS) display of ongoing and recently completed MMS, NPRB, AOOS, and other agency and industry study efforts for the Beaufort, Chukchi, and Bering Seas.

Methods: Develop processes to incorporate essential information from ongoing MMS studies into WEB based mapping system. Integrate recently completed MMS study efforts into a web based system through the incorporation of spatially referenced study boundaries and study information derived from technical summaries and links to MMS full reports and databases (Phase II). Assess TIMS/CORIS Geobibliography standards for possible inclusion. Integrate older select historical MMS studies into a database. Combine above information with project information and include funded sensor deployments and past sensor deployments that were specifically funded by MMS, AOOS and other agencies (NSF, etc.). Work with other agencies (NOAA, USGS, USFWS, and NSF) to include their studies information. Work with industry to integrate critical information. The MMS will be able to access the aggregated project database using one of several methods: the AOOS/AMIS (Alaska Marine Information System) web portal (on-line visualization/query interface); or Open Geospatial Consortium's (OGC) Web Mapping Service; or OGC Web Feature Service.

Revised Date: August 2008

ENVIRONMENTAL STUDIES PROGRAM: Annual Studies Plan FY 2009

Region: Alaska

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

Title: Seabird Distribution and Abundance in the Offshore Environment

MMS Information Need(s) to be Addressed: Information on the distribution and timing of use by marine birds and mammals, including listed and candidate species under the ESA (Spectacled Eider, Steller's Eider, Short-Tailed Albatross, Kittlitz's Murrelet) will be potentially useful for planning for lease sales in the Chukchi Sea Planning Area in 2010 and 2012, and potentially for the North Aleutian Basin. Data on the distribution of marine birds and mammals will be potentially useful for ESA, Section 7 consultations and NEPA analyses, DPPs and other documentation. The information obtained from these surveys will potentially contribute to development of mitigation measures and strategies to reduce potential impacts.

Total Cost: TBD

Period of Performance: FY 2009-2012

Description:

Background: Basic information on timing and duration of use within designated (Chukchi Sea) and potential (North Aleutian Basin) 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 and mammal 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 this data gap, this project will build off of a recently established at-sea survey program, to collect distribution data on seabirds (and to some extent, marine mammals) 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 data gaps will be essential to mitigating impacts from oil and gas exploration.

The results of this study will complement recent and on-going surveys of marine birds and mammals 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 and over 70 marine mammal species 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 NAB 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 and mammals 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 NAB planning areas. 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 2008

ENVIRONMENTAL STUDIES PROGRAM: Annual Studies Plan FY 2009

Region: Alaska

Planning Area(s): Chukchi Sea

Title: Physical Supporting Data for Chukchi Offshore Monitoring in Drilling Area (COMIDA)

MMS Information Need(s) to be Addressed: MMS 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 being used for Chukchi and Beaufort Sea Lease sales scheduled in the MMS 2007-2012 5-year plan. The data would also be used for post-lease, site-specific modeling of circulation in oil-spill contingency planning and NPDES permitting.

Total Cost: TBD

Period of Performance: FY 2009-2012

Description:

Background: Our understanding of circulation in NE Chukchi Sea should be verified with better data. We suspect it is an area of recirculation but we know it has high interannual and seasonal variability. We know that ice regime—duration, seasonality, location of the ice edge, and ice thickness are being affected and changed by global warming. Monitoring the oceanographic conditions during other monitoring activities may be necessary to separate effects of oil and gas activities from those specific to the state of the physical environment. Other Chukchi Offshore Monitoring in Drilling Area (COMIDA) studies: marine mammals, anthropogenic chemicals, benthic biota, and subsistence were initiated in fiscal year 2008.

We anticipate coordinating this COMIDA task with the proposed “Passive Acoustic Detection and Monitoring of Endangered Whales in the Arctic” which will operate in the western Beaufort and Chukchi Sea. The COMIDA and North Aleutian Basin workshops discussed the potential for and recommended co-located moorings for passive acoustics and physical oceanography as a cost savings. The statement of work for this study will integrate recommendations from the COMIDA workshop and from early oceanographic successes of the ongoing NOPP study “Circulation, Cross-shelf Exchange, and Marine Mammal Habitats on the Alaskan Beaufort Sea Shelf.”

Objectives:

- Provide context for other COMIDA tasks.
- Resolve temporal and spatial variability of physical and chemical processes.
- Resolve circulation features.

Methods: The study will provide year round mooring deployments (with ADCPs with bottom tracking, arctic winch (Conductivity, Temperature and Density Profiler, CTD), ice thickness (Upward-Looking Sonar, ULS). Deployments would be made for two years. Other sensors and equipment such as sediment traps, turbidity sensors, passive acoustics monitors, and chemical sensors could be deployed in collaboration with other COMIDA tasks, but would require multiple moorings at each site. Full hydrographic surveys upon mooring deployment will be conducted for mooring parameters. Shipboard ADCP transect data will be obtained.

Revised Date: August 2008

2.3 Profiles of Studies Proposed for FY 2010 NSL

Table 2 Alaska OCS Region Studies Proposed for the Fiscal Year 2010 NSL

Page No.	Discipline	Title
185	HE	Field Experiments of Seismic Effects on Commercial Fish and Crab in the North Aleutian Basin
187	MM	Noise Propagation Modeling and Field Testing for the Beaufort and Chukchi Seas
189	HE	Under-Ice Marine Fish Survey: Pilot Survey in the Beaufort Sea
191	HE	COMIDA Phase I: Spatial and Seasonal Distribution and Abundance of the Forage Fish Prey Resource of Chukchi Marine Mammals and Birds
193	PO SS	Determining Archaeological Potential of Buried Terrestrial Landforms in the Beaufort Sea, Phase II
195	FE PO	A Comparison of Modern and Historical Ice Gouge Characteristics and Recurrence Rates in the Alaskan Chukchi Sea
197	HE	cANIMIDA Monitoring of Boulder Patch Kelp During Liberty Development
199	SS	Alternative Energy Capacity Inventory in Coastal Alaska*
AQ = Air Quality		FE = Fates & Effects
IM = Information Management		MM = Marine Mammals and Protected Species
PO = Physical Oceanography		SS = Social Sciences
		HE = Habitat & Ecology

* Alternative Energy Program

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ENVIRONMENTAL STUDIES PROGRAM: Annual Studies Plan FY 2009

Region: Alaska

Planning Area(s): North Aleutian Basin

Title: Field Experiments of Seismic Effects on Commercial Fish and Crab in the North Aleutian Basin

MMS Information Need(s) to be Addressed: This study will provide new and region specific information to EAS fisheries analysts who need to assess potential effects of seismic activity on high value commercial fisheries and the ecosystem functions of the affected fisheries resources. The information needed to address this issue does not exist for many of the region's fish species.

Total Cost: TBD

Period of Performance: FY 2010–2012

Description:

Background: There are growing expressions of concern from residents in the North Aleutian Basin and from stakeholders in the region's commercial fisheries about the potential effects of seismic activity on the area's fish and shellfish resources. These concerns have been voiced by both public comments letters and the Aleutians East Borough at public meetings, including the MMS North Aleutian Basin Information Status and Research Planning Meeting and the Sea Grant Energy and Fisheries Workshop. While a growing body of literature covering impacts of seismic activity exists worldwide, we have no clear understanding of seismic activity effects on the distribution, migration, behavior or health of the Northern Aleutians regions numerous commercially important fish and shellfish species. Many concerns about negative effects of seismic activity also reference the trophic relationship between whales and fish.

A limited body of literature indicates that seismic activity can affect commercial fisheries catch rates. For instance, Norwegian trawl catch of Atlantic cod (similar to Pacific cod, which is one of the most abundant species in the NMFS Aleutian Island survey) was reduced by about 60% in the area of seismic shooting, with significant effects measured in the entire study area of 40 x 40 nautical miles (Engås et al, 1996). The longline catch for cod declined by 45% in the exploration area, but the decline was smaller with increasing distance from the exploration area, with no reduction in catch at distances of 16 to 18 nautical miles. Catch rates did not recover during the five-day period after the airguns stopped. It should be noted that Gausland (2003) has refuted the results of Engås et al. (1996) by examining catch results at tighter time intervals and concluding that there were no sudden changes in catches when the seismic noise commenced and thus the longer term decreases in catch were due to other (probably natural) causes. There are vast differences in the hearing capabilities of different species of fish, such that exposure of seismic signals will vary from study to study based on fish species and location (McCauley et al., 2000).

Furthermore, recent laboratory research is documenting more subtle and non-lethal impacts resulting from exposure to intense seismic activity (McCauley et al., 2003). For instance, recent research has documented seismic effects on fish sensory organs. Preliminary research by Christian et al. (2003) has also shown significant ovary and liver damage in snow crab placed under a seismic testing area. These effects included hemorrhaging, membrane detachment and dilation in the ovaries of the female snow crab; abnormal cellular structure, swelling and stress in the livers; and retarded development of eggs. The problems persisted for at least five months. Interruptions in the reproductive biology can impart especially long term effects on a population. If these effects occur in snow crabs, similar effects might be expected to also occur in economically important king crab. In order to evaluate the potential for mitigation, a better understanding is needed about how the region's important species respond to seismic activity, as well as the timing, magnitude, proximity, and duration of seismic activity levels. An overview of seismic literature shows varying results between regions and species. Therefore, there is a definitive need within the North Aleutian Basin for studies of individually important commercial fish and shellfish.

Objectives: Estimate effects of seismic activity on North Aleutian Basin fishery catch rates for commercially important fish and shellfish species through field experiments. Evaluate effects on commercially important species.

Methods: Conduct typical commercial fisheries fishing activity to compare catch rates before, during and after seismic activities. Conduct biomass surveys of these species before and after seismic activity. Conduct an in-situ test of seismic effects on captive individuals of king crab, tanner crab, scallops, walleye pollock, herring, salmon, Pacific cod, and squid placed in cages (or tagged) in the path of seismic exploration vessels and in control areas. Include commercially important species such as yellowfin sole, Rock sole, flathead sole, pollock, halibut, and other opportunistically available species where practical. Assess effects immediately after, and at 1 month, 6 months and 12 months after exposure to seismic activity. Relate results to possible fishery, population, and ecosystem effects.

Revised Date: August 2008

ENVIRONMENTAL STUDIES PROGRAM: Annual Studies Plan FY 2009

Region: Alaska

Planning Area(s): Beaufort Sea, Chukchi Sea

Title: Noise Propagation Modeling and Field Testing for the Beaufort and Chukchi Seas

MMS Information Need(s) to be Addressed: Documenting the human activities and sound source propagation levels emanating from human activities in the Alaska Beaufort and Chukchi Seas is essential for cumulative effects analysis and mitigating effects on bowhead whales and the people who rely on them for subsistence. Marine mammals that are using a given area may be exposed simultaneously, sequentially throughout the season, or over a period of years to various sources of human-related noise. Models of the acoustic fields to which they are exposed, coupled with available data about the habitat use of select species, could add considerably to scientific understanding and operational mitigation of noise effects from industrial activities. The results of this study will support and enhance the analytical work required for NEPA and ESA consultations.

Total Cost: TBD

Period of Performance: FY 2010-2014

Description:

Background: Bowhead whales (*Balaena mysticetus*) are the most important subsistence resource for many coastal villages adjacent to the Chukchi and Beaufort Seas. Bowheads are important to these communities for fulfillment of cultural and nutritional needs. The MMPA protects the subsistence hunt from “unmitigable adverse impacts”. Subsistence communities are concerned that whales may shift migration and movement patterns primarily due to industrial or other anthropogenic activities, making hunting more difficult and less productive.

Recent industry-sponsored field studies in the Beaufort Sea have shown that bowheads may react at substantial distance from nearshore industry activities (i.e. greater than 20 kilometers). Multiple sound sources may cause whales to shift areas of use or other behavioral change, making the whales more difficult to hunt or retrieve when harvested. With increasing interest in potential offshore oil and gas development in the Chukchi and Beaufort seas, other increased domestic vessel traffic, and possible future international shipping routes through the range of bowhead whales, there is a continued need to further document anthropogenic marine activities and acoustic exposure for cumulative effects assessments and analysis.

MMS collected spatial and temporal data on available historical oil-industry exploration and development activities (1979-1998) in the Beaufort Sea (Wainwright, 2002). We found that even with a high level of oil and gas activity information available to us, we did not fully understand the sound sources emanating from those activities or the acoustic propagation

levels and transmission lose levels with the adjacent marine environment. The absence of these measurements, and the incompleteness of the database, present challenges in the assessment of overall impacts on the surrounding environment from these activities. In this new study effort, field tested measurements from ongoing activities will be collected, compared and tested against existing acoustic models to obtain a range of values that could be used to improve assessment of effects from these activities on the marine environment.

Objectives:

- Use an iterative process to develop a noise propagation model for the Beaufort and Chukchi seas which will provide estimates of the acoustic travel paths and spatial extents of sound sources and levels during periods of ambient and anthropogenic activities.
- Create a database that contains sound source levels and distances during ambient and anthropogenic activities for future use in acoustic model testing and evaluation.
- Provide an estimate of marine mammal responses from human activity acoustic sources during field testing.
- Support and enhance the analytical work for NEPA and ESA consultation.

Methods: This study will occur in two phases: Phase I (one year) will select an expert Acoustic Model Scientific Review Board (AMSRB), conduct a literature search, and summarize the information for the AMSRB. The AMSRB will propose a study design to the Principal Investigator. The PI will seek other agency, industry partnerships and field support. Phase II will implement the plan set forth within Phase I over a four year period. Phase II will involve a wide range of tasks, including: acoustic model selection and testing; site selection of areas of the Beaufort and Chukchi Seas where industry plans to conduct exploration and development activities; site-specific data collection on human activities within a fifty mile radius of a central sound source; model testing and validation; acquisition of empirical data for acoustic model runs; acoustic model site specific comparisons; marine mammal data collection; data analysis; and project reporting. The project will take empirical measurements of key sources and within the key locations during industrial activities to ground-truth/verify estimates of acoustic dosage and revise models as appropriate with new sound source, animal distribution and behavior information. The model will be subjected to peer-review to guide further refinement and to obtain final models for the four areas.

Revised Date: August 2008

ENVIRONMENTAL STUDIES PROGRAM: Annual Studies Plan FY 2009

Region: Alaska

Planning Area(s): Beaufort Sea

Title: Under-Ice Marine Fish Survey: Pilot Survey in the Beaufort Sea

MMS Information Need(s) to be Addressed: An MMS study jointly-funded by industry and the Canada Department of Fisheries Oceanography (DFO) could address information needs on the marine fish presence in areas of increasing oil and gas activities along the Alaskan Arctic coastline in the ice-covered season. New information will support NEPA analysis and documentation for the 2011 Beaufort Sea Lease Sale, Draft Production Plans, permitting, and development of related mitigation.

Total Cost: TBD

Period of Performance: FY 2010-2013

Description:

Background: A 2007 MMS sponsored “Under-Ice Marine Fish Sampling Workshop” recommended a 2009 under-ice survey to replicate summer/fall sample locations of the 2008 open water season survey.

Scientists from both Alaska and Canada must evaluate the potential effects of oil and gas development activity, including oil spills, on Beaufort Sea marine fish. These activities include initial exploration, development of infrastructure, production, transportation of oil and gas, and analysis of possible oil spills. Beaufort Sea marine fish surveys must obtain fundamental and current fish resource information necessary to regulate environmentally sound offshore oil and gas development. Data at the most basic level in the Beaufort Sea, e.g., fish 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. Furthermore, the delineation of important marine spawning, rearing, feeding and migration habitats in the Beaufort Sea is simply non-existent. Additionally, little is known about the biology and ecology of many marine fish species inhabiting the area. The highest priority information needs are thus the most basic: what species are present and their abundance and distribution.

In addition to needing basic fish distribution data, environmental information is also necessary to assess potential effects of offshore development. Beaufort Sea life history strategies, foraging, population dynamics and other aspects of marine fish behavior and ecology are largely unknown. To address these information needs, a survey will be conducted from ice-based camps off shore of the bottom-fast ice in the central Beaufort Sea between 147° and 150° W. longitude and in the Canadian Beaufort Sea 50 miles northwest of the Mackenzie River delta.

Due to the logistical and cost considerations, a Beaufort Sea marine fish survey must be especially cognizant of efficient methodology. Remote sensing and other recent technology promise both efficiency and new capabilities. Industry has expressed interest in co-sponsoring the study. Considerable potential also exists for synergies with ongoing studies and cooperative funding, including: ongoing MMS Beaufort open water survey and Canada DFO Mackenzie delta surveys; DIDSON sonar equipment and possibly acoustic technicians through the ADF&G and the USFWS; National Underwater Research Program grant program; and NOPP.

Given the predicted increase in marine transportation across the Arctic Ocean as a result of longer ice-free seasons, these investigations will have relevance beyond offshore oil and gas development in the Beaufort Sea.

Objectives:

- Characterize the under-ice marine fish survey of Alaskan and Canadian Beaufort Sea areas likely to experience offshore oil and gas development. The study will provide a more complete data set that encompasses all the seasons in the Beaufort Sea including ice covered seasons. Such a data set will allow MMS to support environmentally sound offshore oil and gas exploration and development decisions.
- The study will serve as a proto-type fisheries component of future MMS or other ocean observing systems by providing time-series and data trend information to support environmentally sound offshore oil and gas exploration and development decision..

Methods: The under-ice marine survey will occur in three stages. Initially, local residents in Beaufort Sea villages will be interviewed on their knowledge of marine fish species types and distribution to identify species seasonality and habitats. The species abundance and distribution information will be cataloged. The second component will provide spatial and temporal patterns of fish abundance by placing time lapsed cameras on existing stationary Beaufort Sea moorings. Lastly, an under-ice survey will be designed such that an evaluation of three under-ice habitats will be documented. These surveys will be performed by a research vessel collecting DIDSON sonar information, a remotely operated vehicle (ROV) and shallow-water scuba transects. Each survey component will collect physical, chemical, biological and other environmental data necessary to evaluate and test the significance of independent variables that potentially affect fish presence and distribution. Once the under-ice habitat has been evaluated, estimates of predominant species (i.e. Arctic cod) will be calculated. 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 analysis.

Revised Date: August 2008

ENVIRONMENTAL STUDIES PROGRAM: Annual Studies Plan FY 2009

Region: Alaska

Planning Area(s): Chukchi Sea

Title: COMIDA: Spatial and Seasonal Distribution and Abundance of the Forage Fish Prey Resource of Chukchi Marine Mammals and Birds.

MMS Information Need(s) to be Addressed: Understanding key ecological transfer events and other forage fish factors that cascade to higher trophic level predators are necessary to assess oil-spill risks. Results from this study will provide information for lease sale MMPA authorizations, ESA consultations, Essential Fish Habitat and NEPA analyses. The results will also contribute information 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: TBD

Period of Performance: FY 2010-2012

Description:

Background: Having a good understanding of the seasonal distribution, abundance, and habitat use of forage fish in the Chukchi Sea is fundamentally important to monitoring the potential upper trophic level environmental impacts associated with offshore development. However, information on the forage fish resource and its relation to apex predators in the Chukchi Sea is lacking or out of date, especially in light of ecological changes that have occurred in recent decades. Without a reliable current baseline, effects from other anthropogenic activities or other natural causes cannot be ruled out from possible oil and gas development impacts.

This prey resource information was identified as highly time-sensitive and important decision-applicable information that should be initiated as soon as possible by MMS-sponsored “Chukchi Sea Information Status and Research Planning Meeting” attendees and the Alaska OCS Region to assure availability of critical mission related information.

Higher trophic level marine mammals, birds and fish are highly dependent on forage fish concentrations for energy. Forage fish migration and spawning are also the basis of transient but key energy transfer events during critical seasons of apex predator life history cycles such as molting, calving, pupping, and feeding. Collapse of forage fish can result in collapse of whole year classes or populations of the apex predators. For example, the failure of a forage fish spawning event can result in the complete failure of chicks for the year.

Thus, impacts to key forage fish species are likely to cascade throughout the foodweb in a complex way, further exacerbating direct effects on higher trophic level marine mammals and birds. Monitoring key forage fish species and their key ecological events (e.g. peak

migration, spawning, nursery and settling periods) will provide information critical to accurately assessing and mitigating the ecological effects that cannot be adequately captured without a better understanding of this bottle neck resource.

Understandings gained from the survey, including forage fish abundance and distribution and the transfer of energy to higher trophic levels during key ecological events, will contribute to the basic ecological knowledge necessary for estimating oil-spill impacts. It will also contribute information useful for developing mitigation strategies to reduce impacts to the forage fish and their marine mammal and bird predator populations from proposed oil and gas exploration and development activities.

Collaboration and integration with marine mammal and bird research activities will provide maximum ecological characterization and take advantage of existing logistical investments and operations including providing information on important zooplankton prey as well as forage fish prey.

This study also benefits monetarily and logistically by being contemporaneous with a similar study in the North Aleutian Basin.

Objectives:

- Identify spatial and seasonal location of forage fish and key transfer events contributing energy to apex predators.
- Provide GIS based maps and attribute tables of forage fish for Oil-Spill-Risk Analysis.
- Identify high priority locations for mitigation or deferral areas under consideration in environmental assessments.

Methods: Geographically delineate the location and timing of forage fish concentrations through aerial, digital imaging and Light Detection and Ranging (LiDAR). Coordinate with on-going marine mammal and bird surveys to evaluate forage fish availability in the vicinity of fish, bird, and marine mammal ‘hot spots.’ Perform ground truthing through use of local fishing vessels. Develop GIS map layers for EIS analysis of potential sensitive areas.

Revised Date: August 2008

ENVIRONMENTAL STUDIES PROGRAM: Annual Studies Plan FY 2009

Region: Alaska

Planning Area(s): Beaufort Sea

Title: Determining Archaeological Potential of Buried Terrestrial Landforms in the Beaufort Sea: Phase II Collection and Radiocarbon Dating of Cores and Shallow Seismic Data in the Beaufort Sea

MMS Information Need(s) to be Addressed: The MMS is required under the National Historic Preservation Act to evaluate the potential effects of our permitted activities on significant archaeological resources. To fulfill this legal mandate, the MMS conducts archaeological baseline studies to identify general areas of the OCS that have potential for prehistoric archaeological deposits. Prior to permitting bottom-disturbing activities within these broad areas, the MMS requires review of geological and geophysical data to identify specific locations having potential for preserved prehistoric archaeological site deposits. The MMS does not have a comprehensive Archaeological Baseline Study for the Beaufort Sea OCS area to draw upon in preparing NEPA analyses, or in instituting archaeological survey and mitigation requirements for permitting decisions (i.e., exploration, development, and production plans and pipeline rights-of-way). This proposed study will provide more definitive information on the prehistoric site potential of the Beaufort Sea OCS in general, and of specific geomorphic features identified during previous geophysical surveys.

Total Cost: TBD

Period of Performance: FY 2010-2011

Description:

Background: The results of OCS Study MMS 2007-004 (Northern Land Use Research, Inc., 2007), which was designed to assess the prehistoric archaeological potential for shallow water paleo-terrestrial features in the Beaufort Sea, indicate that buried and drowned terrestrial sediments and associated landforms are less than 10,000 years old. This means that these features may have seen human occupation and have potential for archaeological resources. OCS Study MMS 2007-004 further identified areas for follow-up data collection to verify its results—this forms the basis for the current proposal--Phase II. OCS Study MMS 2007-004 also determined new and very significant relative sea level information for the Arctic indicating a rapid rise in pulses over the last 11,000 years, and this important information would also be verified with the proposed follow-up study. The results of OCS Study MMS 2007-004, though useful and important, are based on very limited data, and the results warrant a more thorough study, as outline in Phase I.

Objectives: OCS Study MMS 2007-004 showed that from a few decades-old USGS cores, radiocarbon age-dates of less than 10,000 years correspond to paleo-landforms identified from

OCS geophysical surveys. These age-dates are few, and in some cases equivocal, and require new targeted cores and limited high resolution seismic data so that the age of these features and their terrestrial affinity may be verified, as envisioned in Phase I. Samples and age-dates obtained through this study will also verify and refine the relative sea level history for the Beaufort and Chukchi Seas that has been reported in OCS Study MMS 2007-004. Refining the relative sea-level history is important in establishing the extent of the OCS that was subaerially exposed during known human occupation of the region, and will also contribute to our understanding of the dynamics and effects of past global climate changes. The objectives of this study are to determine the age of relict terrestrial landforms observed at, and just beneath the seafloor, in the Beaufort Sea and to verify the results of Phase I of this proposed study, OCS Study MMS 2007-004. The final objective is to write an “Archaeological Baseline Study for the Beaufort Sea Area.” The baseline study will synthesize all existing geologic, paleo-environmental, and archaeological data for the Beaufort Sea area to:

- define the maximum extent of the Beaufort Sea OCS that was subaerially exposed during known human occupation of the region;
- more clearly define the relationship of prehistoric human populations to the prehistoric landscape;
- define the size, type, and ages of sites to be anticipated in the offshore area; and
- define how site densities fall off with increasing distance from the various types of landforms.

Methods: Collect and analyze marine high-resolution seismic profiles along transects identified in the Phase I study. Collect new cores in the areas identified in the Phase I study using a vibracore and/or rotary drilling rig mounted in a marine vessel or over-ice vehicle. Perform preliminary analysis onboard and place samples into cold storage. Perform laboratory analysis of collected cores to extract samples for: radiocarbon or other isotopic dating, paleo-environmental analyses, and archaeological analyses (if macroscopic indicators of a site such as charcoal; charred vegetal material, bone or shell; or lithic material are present). Determine the age of observed shallow offshore terrestrial landforms and, if data are adequate, establish a new relative late Wisconsinan sea-level curve for the Beaufort Sea. Write an Archaeological Baseline Study.

Revised Date: August 2008

ENVIRONMENTAL STUDIES PROGRAM: Annual Studies Plan FY 2009

Region: Alaska

Planning Area(s): Chukchi Sea

Title: A Comparison of Modern and Historical Ice Gouge Characteristics and Recurrence Rates in the Alaskan Chukchi Sea

MMS Information Need(s) to be Addressed: This study will enhance knowledge of ice gouging characteristics and recurrence rates in the Chukchi Sea for those areas where sub-sea bed pipelines may be buried or lie at the surface. Information will be necessary to evaluate any Development Production Plans that propose to use sub sea bed pipelines or surface pipelines for the Chukchi Sea. Data can be used with future MMS Fault Tree Analysis for the Chukchi Sea as these data will better define the risks associated with pipeline emplacement with any proposed future development scenario.

Total Cost: TBD

Period of Performance: FY 2010-2013

Description:

Background: A recently completed Technology Assessment and Research Program (TAR) study “Design Options for Offshore Pipelines in the U.S. Beaufort and Chukchi Sea” stated a strong need for “increased regional coverage of repetitive mapping of the U.S. Beaufort and Chukchi seas.” This study was unable to ascertain the impact of ice gouges on pipelines for the Chukchi Sea since there was insufficient data to predict the age, occurrence, extent, and magnitude of ice gouging on the Chukchi Shelf since only single year surveys were done in sighting the exploration wells during the late 1980s and early 1990s. Therefore the age and recurrence rates of the gouges found within the survey area could not be ascertained. Some gouges identified during these site surveys were as deep as two meters. Ice gouges of this magnitude can cause severe damage to any pipeline and possibly cause a major oil-spill. Data sets clarifying the magnitude and recurrence rates of ice gouging are critical for establishing guidelines for burial of oil production pipelines that cross the shelf. The most common mitigation strategy for reducing ice gouge impacts on sub-sea pipelines--burial beneath the zone of sea floor disturbance--requires knowledge of ice gouge recurrence rates and depth of seabed disturbance.

Approximately nine site specific surveys collected ice gouge data at nine different proposed exploration sites in the Chukchi Sea during the late 1980s. The paper copies of these data are available in the MMS internal vault. Analysis of ice gouge characteristics including ice gouge recurrence rates, gouge depths, gouge widths, gouge densities (number of gouges per track-line km), gouge orientations, gouge distribution on the shelf, and flanking ridge heights will be conducted and the data recorded in a database. Since the last site surveys were collected, there has been significant reduction in both the extent and thickness of Arctic sea ice. Collecting new, contemporary data coincident with the old survey lines will extend the

site survey data sets to the present. Collection and analysis of several years of contemporary ice gouge data will allow determination of present ice gouge characteristics and recurrence rates for this area of the Chukchi Shelf. This new data could be directly comparable to the site survey data. Comparison of these two data sets will show whether ice gouge characteristics are changing with sea ice conditions, and assess the burial depth for any proposed potential future development plans for the Chukchi Sea.

Objectives:

- Conduct a regional repetitive ice gouge survey on the Chukchi Outer Continental Shelf to assess characteristics and severity of contemporary ice gouges along historic site survey lines and within those areas of high potential for oil and gas development.
- Analyze similar data from lines collected during site-specific surveys in the Chukchi Sea during the late 1980s and early 1990s.
- Correlate gouge characteristics with location on the shelf and water depth.
- Compare contemporary gouge data to historical site survey data to determine if ice gouge characteristics and frequency and occurrence have changed with changing sea ice conditions.
- Document the recurrence rate, ice gouge incision depth, and other physical characteristics of ice gouging for the surveyed areas over multiple years.
- Incorporate the data into a GIS geospatial database.
- Access the risk to pipelines emplacement and incorporate data into MMS Fault Tree Analysis for Oil-Spill-Risk Assessment.

Methods: Contemporary gouge data will be collected from a vessel for a minimum of two summers (2010 and 2011) using standard marine geophysical techniques, including side scanning sonar, swath bathymetry, and precision GPS navigation. Contemporary data will be put into a digitized format and will be analyzed. In addition to using published analyses of the historical data to correlate historical and contemporary gouge characteristics, the original site-specific survey analog records will be compared to the new data sets. A geo-referenced GIS database of contemporary ice gouge characteristics and recurrence rates will be compiled. A final report will discuss the results of this research and assess the pipeline risk to ice gouging. Final results will be published in scientific journals.

Revised Date: August 2008

ENVIRONMENTAL STUDIES PROGRAM: Annual Studies Plan FY 2009

Region: Alaska

Planning Area(s): Beaufort Sea

Title: cANIMIDA Monitoring of Boulder Patch Kelp During Liberty Development

MMS Information Need(s) to be Addressed: In December 2007, MMS completed an Environmental Assessment (EA) of proposed Liberty development that would use directional drilling from an enlarged Satellite Drilling Island (SDI) at the east end of the Endicott Causeway. Monitoring would focus upon securing the continued health of the nearby Boulder Patch during development and possibly into initial production. The rate of coastal erosion in the coastal Beaufort Sea is predicted to increase with decreases in the summer ice cover. Continued Boulder Patch monitoring would help distinguish 1) the past natural rate of kelp growth, 2) the rate with projected increases in coastal erosion, and (3) any addition to the SDI.

Total Cost: TBD

Period of Performance: FY 2010-2014

Description:

Background: The Boulder Patch is the northern-most kelp community in the western Arctic. The Boulder Patch, long identified by MMS and the scientific community as an area of special biological concern, is between the SDI and Liberty Unit leases. The combination of water depth, relic cobble and boulder bottom, and barrier-island protection from ice gouging has allowed development and persistence of a unique and distinct kelp community. Over thirty years of monitoring have demonstrated both strong limitation of low in situ light levels on kelp production and of high interannual variability of light as function of storminess and resultant resuspended sediment levels. The kelp are extremely vulnerable to any increase in background suspended sediment levels.

Suspended sediment levels are elevated near the existing Endicott Causeway, including the SDI. This appears to be an effect of the disruption of longshore transport of sediments from the Sagavanirktok River, resultant shoaling of waters near the causeway, and resuspension of near-causeway sediments by summer waves and storms. Because of the significance of Boulder Patch, the MMS Scientific Committee recommended addition of Boulder Patch monitoring task be added to the MMS Arctic Nearshore Monitoring in Development Area (ANIMIDA) and continuation of ANIMIDA (cANIMIDA) projects in 2000-2007. Those monitoring projects have completed their monitoring just as development of Liberty is anticipated.

Objectives: Conduct a project to monitor the potential effects of Liberty development on the Boulder Patch Community.

Methods: Measure kelp production using established or compatible techniques. Monitor ambient light intensity and total suspended solids using established or compatible techniques. Combine with an existing long-term dataset.

Revised Date: August 2008

ENVIRONMENTAL STUDIES PROGRAM: Annual Studies Plan FY 2009

Region: Alaska

Planning Area(s): All

Title: Alternative Energy Capacity Inventory in Coastal Alaska

MMS Information Need(s) to be Addressed: The Energy Act of 2005 delegated regulatory authority to MMS over renewable energy resources on the OCS. The new mandate requires fresh research about the range of opportunities, environmental implications, and potential social effects of renewable energy projects on a national, regional, and local scale. This study is designed to provide an initial inventory of plausible development opportunities and potential socio-economic consequences for residents of Alaska and select coastal communities. The information is needed for timely agency planning of the new regulatory authority.

Total Cost: TBD

Period of Performance: FY 2010-2012

Description:

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

Some of the paramount initial social questions must consider optimal opportunity for alternative energy development. Which regions of coastal Alaska are best poised to capitalize on opportunities from new technologies in the development of renewable energy? What are the predictable implications of tidal energy production in a specific region, such as Cook Inlet? What are the major parameters that will determine the economic feasibility of alternative energy projects in various regions of coastal Alaska? Will alternative energy technologies provide a wide range of socially desirable benefits to match the presumed environmental benefits? In what specific ways should government regulatory authorities attempt to manage a nascent development project in order to optimize positive social impacts and minimize any adverse implications?

Objectives: The objectives of this study are to: 1) establish firm intellectual understanding over the range of options, processes, economic feasibility, and potential management strategies that are relevant to development prospects for renewable energy sources on the OCS of Alaska and 2) systematically collect a variety of technical and socio-economic data to

produce a resource inventory database about the realistic prospects and related social impacts of specific alternative energy development scenarios for the Alaska region.

Methods: Conduct a systematic review of feasibility studies and project proposal scenarios for development of alternative energy resources in the State of Alaska. Conduct a literature review on social implications of alternative energy development. Identify and interview key experts from industry to document relevant technical details about the minimum thresholds necessary to achieve economic feasibility for specific project scenarios. Conduct a series of focus group sessions with relevant stakeholder representatives to explore and document the range of social perspectives about various alternative energy development scenarios and anticipated benefits and impacts. Produce a realistic development model and summary report to demonstrate lessons learned from the study.

Revised Date: August 2008

SECTION 3.0 TOPICAL AREAS FOR FY 2011

This section presents a general forecast of significant topical issues and concerns to be addressed by studies to be proposed for FY 2010 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 MMS 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.

Many of the studies proposed for FY 2009 and FY 2010 address the topical areas described below. These will be re-assessed as part of the FY 2010 planning process.

As noted in Section 1.2.1 of this document, MMS released its *Final Outer Continental Shelf Oil and Gas Leasing Program 2007-2012* in April 2007 (USDOJ, MMS, 2007). This program includes proposed lease sales in four planning areas within Alaska, two of which (the Chukchi Sea Planning Area and the North Aleutian Basin Planning Area) exhibit particularly acute information needs. It will also be important for MMS 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. Additionally, many studies of other sensitive marine mammals, including North Pacific right whales, polar bears, pinnipeds and other marine mammals will continue into 2010. Additional studies may be brought online which address fish and migratory waterfowl. Studies will include those aimed at determining spatial and temporal habitat use patterns, habitat description and monitoring and evaluations of health over time. Studies aimed at understanding potential impacts to subsistence species and subsistence practices will continue to be important. Additional studies of the physical environment, such as current regimes and ice characteristics, will be proposed to support interpretation of data from living resource investigations and to provide a better understanding of the fate and dispersion of OCS discharges.

3.1 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 for the nearshore portions of the Beaufort Sea. Development and application of state-of-the-art circulation models is essential to future OSRA-based EIS analyses. The MMS has partnered with NOPP and with Rutgers University to produce high-resolution circulation models covering Arctic OCS waters and the NAB Planning Area, respectively.

Improvements are also needed in sea ice aspects of the modeling. The resolution of ice models and ice data needs to be increased to address the propagation of fine scale non-random interactions across hundreds of miles of pack ice in the case of ice leads, as evidenced by recent improvements in satellite oceanography. The MMS and NASA have partnered with an international, industry/academic team to create a new state-of-the-art ice model, sufficient to

resolve the spectrum of ice thickness, evolution, and motion in transition from thin new ice to thick ridged ice to landfast ice.

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. The MMS studies 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. The MMS recently completed a study on leads and landfast ice which updated our information for the Beaufort Sea and a portion of the Chukchi Sea.

3.2 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 will continue as a new FY 2008 start and the cANIMIDA task of monitoring the Boulder Patch is proposed to continue as a new FY 2010 study. Because of lack of observed effects, other cANIMIDA monitoring tasks will undergo approximately a 5-year hiatus prior to reconsideration, unless new, post-Liberty Beaufort Sea OCS development occurs sooner. As of January 2008, BPXA’s Development and Production Plan to develop the Liberty Prospect using ultra-extended reach directional drilling from the Endicott Satellite Drilling Island was approved by MMS. Future development of other prospects in the Beaufort Sea OCS is possible.

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).

3.3 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 MMS also anticipates the continuation of vital region-wide monitoring of the fall migration by the Bowhead Whale Aerial Survey Project and additional knowledge it obtains on bowhead feeding patterns. The MMS 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.

3.4 Potential Effects on Unique Marine Benthic Communities

Pipeline construction and other activities may generate sediment plumes that could potentially impact the unique "Boulder Patch" benthic community that is known to cover an extensive area to the northwest of the Liberty site in Stefansson Sound. This is a boulder-strewn seabed area with a kelp-dominated community. Similar areas are known to exist to the east in Camden Bay. Some kelp plants in the Boulder Patch are up to 40 years old. One of the ongoing studies in the cANIMIDA project focuses on kelp productivity and will use inherent optical properties of ice and water to estimate the potential effect of sediment resuspension on kelp productivity. Optical-related measurements will include spectral irradiance, light scattering coefficients and total suspended solids. Results of this work will be used to formulate future information needs related to this issue. Research on invertebrate and vertebrate components of this community and refined development of monitoring protocols are anticipated for the future.

3.5 Marine Fish Migrations, Recruitment and Essential Fish Habitat

The MMS needs information to assess and manage the potential environmental effects of offshore development on marine fish. Little is known about the biology and ecology of many marine fish species inhabiting the Alaska lease areas. The highest priority MMS information needs include species presence, distribution, abundance and potential effects of oil spills, particularly during periods when ice is present. As offshore oil development interest expands to deeper and more widespread areas, additional fisheries information is required.

As a result of the Magnuson Fishery Conservation and Management Act, effects on Essential Fish Habitat must be evaluated in NEPA analyses. The Bering Sea and the North Aleutian Basin support the most important commercial fisheries in the U.S. More information is required to evaluate Essential Fish Habitats in the Chukchi Sea as commercial fish species

move northward. Beaufort waters are also considered Essential Fish Habitat for salmon, and future research on salmonid reproduction in Beaufort Sea drainages is indicated to clarify environmental assessment and mitigation needs.

Residents and non-residents dependent on commercial fisheries are concerned about development activities interfering with those fisheries. Even the simple public perception of tainting of commercial fish could cause detrimental effects on commercial 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.

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 at all trophic levels.

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 Kaktovik, Nuiqsut and Barrow. Consideration of cumulative impacts is an increasingly important issue for MMS 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 addressed by additional research.

There is also, related to the long-term study of the cumulative effects of oil industry on subsistence, a broader set of issues concerning how the Iñupiat society has been potentially affected. Relevant issues include a broad 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 cumulative impacts.

3.7 North Aleutian Basin

The North Aleutian Basin Program Area contains significant ecological and natural resources. The area supports important habitat for a wide variety of species and globally significant habitat for commercial fish, birds and marine mammals, including many federally listed species. Villages and communities of the Alaska Peninsula and other areas bordering or near the Basin rely on its natural resources (especially commercial and subsistence fishing) for much of their sustenance and livelihood. The offshore area of the NAB is considered to have important hydrocarbon reserves, especially natural gas.

Scientific staff at Argonne National Laboratory were contracted to assist the MMS Alaska OCS Region in identifying and prioritizing information needs related to the NAB Planning Area and potential future oil and gas leasing and development activities. The overall approach focused on three related but separate tasks: 1) identification and gathering of relevant literature; 2) synthesis and summary of the literature; and 3) identification and prioritization of information needs. To assist in gathering this information, MMS convened the North Aleutian Basin Information Status and Research Planning Meeting, held in Anchorage, Alaska, from November 28 through December 1, 2006 (USDOJ, MMS, Alaska OCS Region, 2007c). This meeting was the primary method used to gather input from stakeholders and identify information needs and priorities for future inventory, monitoring and research related to potential leasing and oil and gas developments in the NAB.

The 113 meeting participants represented a broad mix of research scientists, public agency managers, and stakeholders from local government, commercial fishing, subsistence organizations, tribal organizations and environmental organizations, including regional institutions such as: the Aleutians East Borough, Bristol Bay Borough, Lake and Peninsula Borough, Bristol Bay Native Association, Aleutian Pribilof Islands Association, Friends of Bristol Bay, and the Bering Sea Fishermen's Association. Plenary speakers and meeting participants emphasized the critical importance of resources in the NAB including human subsistence resources, commercial fisheries and internationally important bird and marine mammal populations and habitats. Meeting participants broke into five working groups: 1) oceanography, ecosystems, and fate and effects of oil spills; 2) socioeconomics and subsistence; 3) fish and fisheries; 4) birds; and 5) marine mammals. The objectives of each working group were: to review the status of existing information; to identify information needs to support future environmental assessment activities in the Basin; to prioritize those information needs; and to develop proposed study profiles to fill high priority information needs. Thirty-five study profiles were developed at the meeting, representing the highest priority studies identified by the working groups.

3.8 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.

Socio-economic issues 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. The MMS needs to project how climate change effects will interact with OCS activities in the Arctic over the next 25-50 years.

3.9 Alternative Energy

With the passage of the Energy Policy Act of 2005, the MMS acquired responsibilities for alternative energy activities on the Outer Continental Shelf. In the future, MMS will conduct detailed environmental analyses of projects proposed for development. The potential direct, indirect and cumulative impacts on the human, coastal and marine environments must be evaluated in order for MMS to make environmentally sound decisions about managing alternative energy activities and developing mitigation measures to avoid, minimize, rectify, eliminate or compensate for impacts.

Topical areas of potential environmental concerns for alternative energy development include continued collection of baseline data in frontier areas; monitoring of potential projects during construction and operation; future environmental concerns for specific technologies; and cross-cutting issues that apply to any development on the OCS. Topical areas also include overarching themes such as global climate change and the benefits of OCS energy development. Baseline information for key species of marine mammals, fish, birds, and invertebrates, as well as physical oceanographic data, are important to obtain in areas of interest.

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