Alaska Outer Continental Shelf Region

Alaska Annual Studies Plan Final FY 2010

U.S. Department of the Interior
Minerals Management Service
Alaska Outer Continental Shelf Region
Anchorage, Alaska
September 2009

Prepared by
U.S. Department of the Interior
Minerals Management Service
Alaska Outer Continental Shelf Region
3801 Centerpoint Drive, Room 500
Anchorage, Alaska 99503-5823

September 2009

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

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

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United States Department of the Interior

MINERALS MANAGEMENT SERVICE
Alaska Outer Continental Shelf Region
3801 Centerpoint Drive, Suite 500
Anchorage, Alaska 99503-5823

September 8, 2009

Dear Stakeholder:

Thank you for your interest in the Environmental Studies Program of the Minerals Management Service. The agency assesses its information needs continuously and develops new study profiles systematically 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) 2011*, which we are now beginning to formulate. For your convenient reference, we are providing the *Alaska Annual Studies Plan (ASP) Final FY 2010*, 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, 2009, to assure consideration for the 2011 fiscal year. Following revisions to the plan, we will issue a Final FY 2011 Alaska ASP in the autumn of 2010.

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 Management Section

Minerals Management Service Alaska Environmental Studies Program

Proposed Study for FY 2011

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 2011-20*XX*

Description:

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

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

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

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

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Biology

Protected Species

ACRONYMS

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

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

SECTION 1.0 PROGRAMMATIC OVERVIEW

1.1 Introduction to the Region

1.1.1 Background

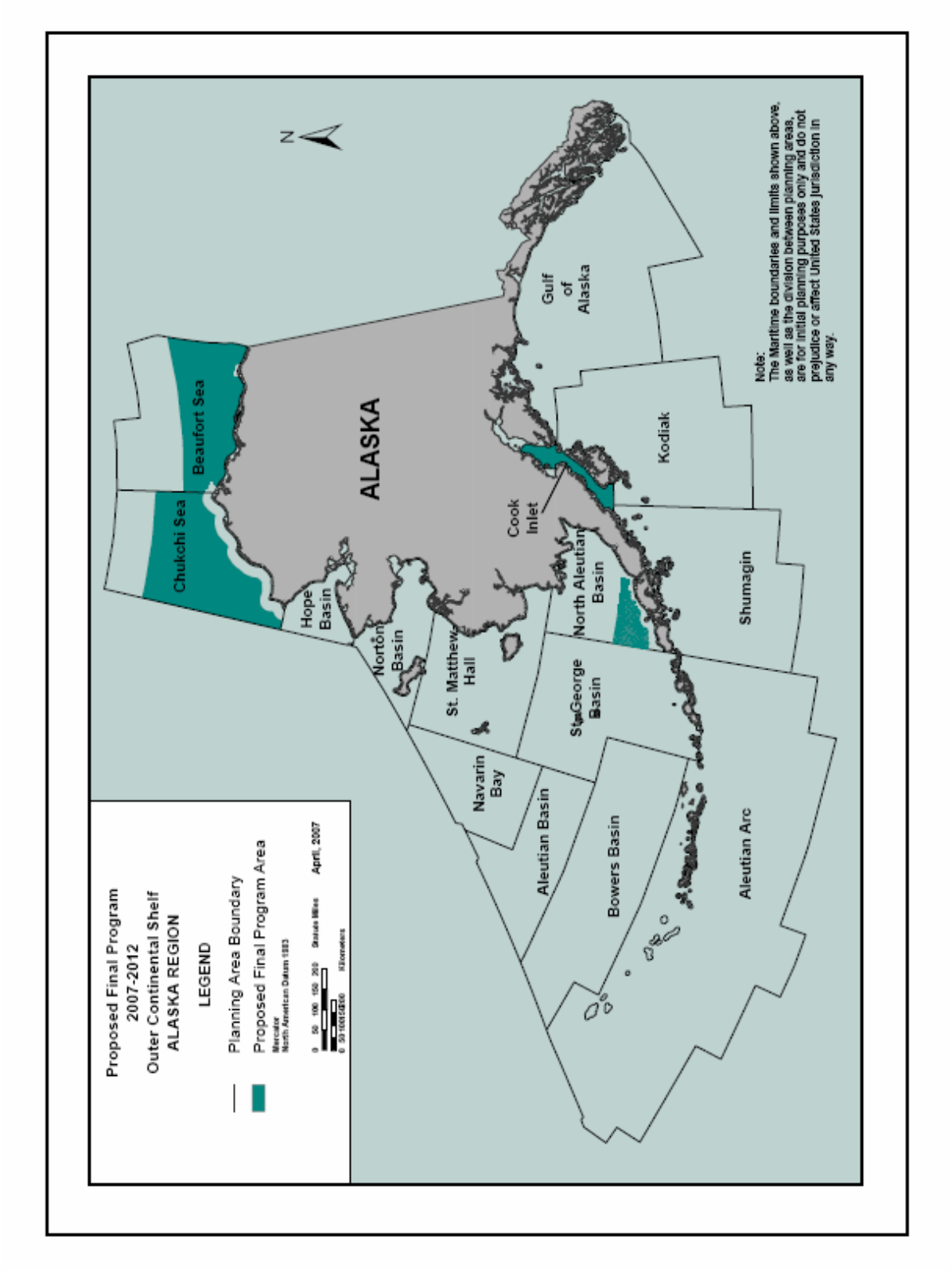
The Minerals Management Service Environmental Studies Program was established and funded by the United States Congress to support the offshore oil and gas leasing program of the U.S. Department of the Interior (USDOI) in pursuit of national energy policies. Administered originally in 1973 by the Bureau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

The Outer Continental Shelf Lands Act (OCSLA) of 1953, as amended (43 U.S.C. 1331 et seq.), provides guidelines for implementing an OCS oil and gas exploration and development program based on the need to balance orderly energy resource development with protection of the human, marine, and coastal environments. The basic MMS mission is to expedite mineral resource exploration and development at fair market value in an environmentally safe and responsible manner. Also, the National Environmental Policy Act (NEPA) of 1969 requires that all Federal Agencies use a systematic, interdisciplinary approach that will ensure the integrated use of the natural and social sciences in any planning and 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 Environmental Studies Program (ESP) operates on a national scale to assist in predicting, projecting, assessing and managing potential effects on the human, marine and coastal environments of the OCS that may be affected by oil and gas development. Lease-management decisions are enhanced when current, pertinent and timely information is available. Final reports from the ESP are most directly utilized by teams of NEPA analysts within the MMS Environmental Analysis Sections when they prepare and/or review Environmental Impact Statements (EISs), Environmental Assessments (EAs), Exploration Permits, and Development and Production Plans.

Since the ESP began, the USDOI and the MMS have funded nationally more than $850 million for environmental studies through fiscal year (FY) 2009. More than $320 million of that amount has funded studies in Alaska across 15 planning areas in the Arctic, Bering Sea and Gulf of Alaska sub-regions (see Figure 1) to produce more than 400 different study reports. The ESP manages ongoing study projects in Alaska (currently about 50) in disciplines such as physical oceanography, fate and effects of pollutants, protected and

Figure 1 Final Program 2007-2012 OCS Alaska Region



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

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

As studies information has been amassed, improved focus has required greater integration of various scientific disciplines. The 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. Of course, additional research coordination with groups external to MMS occurs continuously through a variety of institutional mechanisms, as discussed in the following section.

1.1.2 Scientific Studies Are Conducted in Partnership

The Alaska ESP, through its day-to-day operations and studies planning process, works to:

- Coordinate plans and studies with other ongoing programs and research projects, both internal and external to MMS, to assure optimal studies management and efficient use of funding resources.
- Enhance utilization of existing information.
- Enhance interdisciplinary approaches to project planning, data collection and data interpretation.

Currently, a major portion of the Alaska ESP is conducted on a collaborative basis with an extensive range of bilateral and multilateral partnerships. The Alaska ESP coordinates routinely on major projects with the following federal entities: National Oceanographic Partnership Program (NOPP); National Oceanic and Atmospheric Administration (NOAA) and the National Marine Fisheries Service (NMFS) Alaska Fisheries Science Center; NOAA's National Marine Mammal Laboratory (NMML); USGS-Alaska Science Center; U.S. Fish and Wildlife Service (USFWS); Bureau of Land Management (BLM) and the North Slope Science Initiative (NSSI); National Aeronautics and Space Administration (NASA); National Science Foundation (NSF); Arctic Research Commission; and the Polar Research Board.

The ESP also works directly on specific projects with the Alaska Ocean Observing System (AOOS); the North Pacific Research Board (NPRB); Alaska Department of Fish and Game (ADF&G); the North Slope Borough (NSB) Department of Wildlife Management; the Alaska Eskimo Whaling Commission (AEWC); and academic institutions including the University of Alaska, Woods Hole Oceanographic Institution (WHOI), Oregon State University (OSU), University of Washington (UW), Idaho State University, and University of Rhode Island (URI). The ESP also coordinates closely with active industry research and monitoring programs in Alaska as conducted by British Petroleum, Shell Offshore Inc., ConocoPhillips, and others.

In 1993, the University of Alaska Coastal Marine Institute (CMI) was created by a cooperative agreement between the University of Alaska and the MMS Alaska Region to study coastal topics associated with the development of natural gas, oil and minerals in Alaska's OCS. Under this arrangement, MMS taps the scientific expertise of regional and local experts through UAF/UAA to collect and disseminate environmental information about resource issues of mutual interest. Through the CMI, the MMS stimulates important studies in a cost-saving one-to-one match structure. In its first 15 years of operation, the CMI match has come from more than 50 different organizations and has leveraged over $14 million of MMS funds into $28 million worth of relevant marine-based research. During that time, the CMI program has also provided 117 years of graduate student support and completed 58 studies. In 2008, the cooperative agreement was extended until April 2013. Under the current 5-year agreement with the CMI, the MMS has committed $500,000 per year with a dollar-for-dollar match arrangement. More information can be found at http://www.sfos.uaf.edu/cmi.

Additional linkages have been established at an international level with other arctic nations' research and regulatory entities. The U.S. and seven other arctic nations voluntarily agreed to cooperate on an Arctic Environmental Protection Strategy, which evolved into the formation of the Arctic Council in 1996. The Alaska ESP has coordinated with Arctic Council activities, such as the Arctic Monitoring and Assessment Program, Conservation of Arctic Flora and Fauna, Arctic Climate Impact Assessment and others. The ESP provides information to these working groups through review of reports and plans and helps to inform participants of available information sponsored by MMS. Further, the ESP identifies and facilitates specific studies that can coordinate and integrate with working group activities.

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

Another key source of input derives from discussion and advice generated through the OCS Scientific Committee, an external advisory body that meets on an annual basis. Other involvement of external scientists occurs through forums such as participation on project-management review boards, which greatly facilitates MMS collaboration and coordination.

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

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

In 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 strives to assimilate local and traditional knowledge of Alaskan residents directly in the preparation of its study products and interpretation of results. The process of melding local and traditional knowledge varies from project to project, but the outcome of better information for decision making is a common goal.

1.1.3 Issues To Be Addressed

The *Alaska Annual Studies Plan FY 2010* complements and reinforces the goals of the Environmental Studies Program. The ESP is guided by several broad themes, which include the following:

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

To be responsive to ongoing leasing plans and changing offshore technologies, the Alaska OCS Region continually proposes new studies and pursues information needs in conjunction with ESP goals. Due to the great differences that exist between Alaskan environments and other OCS areas, the Alaska ESP remains especially flexible in planning and implementing needed studies.

At each step of the offshore leasing and development process, a variety of potential issues or resource-use conflicts may be encountered. Two questions are fundamental:

- What is the expected change in the human, marine and coastal environment due to offshore activity?

- Can undesirable change be minimized by mitigating measures?

Environmental studies are the primary means to provide information on these questions for use by decision-makers. Currently the Alaska ESP has primary focus on upcoming developments, possible lease sales, exploration activities and existing leases in the Beaufort Sea, Chukchi Sea and North Aleutian Basin Planning Areas.

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

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

- What role will currents play in distribution of anthropogenic pollutants near development prospects?

- What long-term changes in heavy metal and hydrocarbon levels may occur near Beaufort Sea development prospects, such as Liberty, or regionally along the Beaufort Sea coast?

- How do we improve our model predictions of the fate of potential oil spills?

- If oil is spilled in broken ice, what will its fate be?

- What effects might pipeline construction have on nearby marine communities or organisms?

- What changes might occur in sensitive benthic communities such as the Stefansson Sound "Boulder Patch," and other Beaufort Sea kelp communities or fish habitats?

- What are the current spatial and temporal use patterns of these planning areas by species that are potentially sensitive, such as bowhead whales, polar bears, other marine mammals, seabirds and other birds, or fish?

- What is the extent of endangered whale feeding in future proposed or potential lease sale areas?

- What changes might occur in habitat use, distribution, abundance, movement or health of potentially sensitive key species such as bowhead whales, polar bears, other marine mammals, seabirds and other birds, or fish?

- What interactions between human activities and the physical environment have affected potentially sensitive species?

- What changes might occur in socioeconomics and subsistence lifestyles of coastal Alaska communities?

- What are current patterns of subsistence harvest, distribution and consumption and what changes might occur in key social indicators as a result of offshore exploration and development?

- How can we continue to integrate local and/or traditional knowledge into studies related to the Alaska ESP?

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

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

- What long-term change in anthropogenic hydrocarbon compounds has occurred in water and sediment?

- How do we improve our model predictions of the fate of potential oil spills?

- What long term changes related to past or future activities have occurred in marine food webs, especially regarding key fish, seabirds and sensitive marine mammals?

- What are the effects of offshore oil and gas exploration and development on important socioeconomic activities such as commercial and sport fishing or existing community infrastructures?

- What are current subsistence harvest patterns and what changes might occur in key social indicators as a result of offshore exploration and development?

- How can we continue to integrate local and/or traditional knowledge into conducting studies related to the Alaska ESP?

1.2 Projected OCS Activities

1.2.1 Pre-lease Considerations

This *Alaska Annual Studies Plan FY 2010* reflects consideration of the proposed lease sales in the *Final Outer Continental Shelf Oil and Gas Leasing Program 2007-2012* (USDOI, 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* (USDOI, 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.

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

1.2.2 Post-lease Considerations

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

Figure 2 Beaufort Sea Oil and Gas Leasing Activity

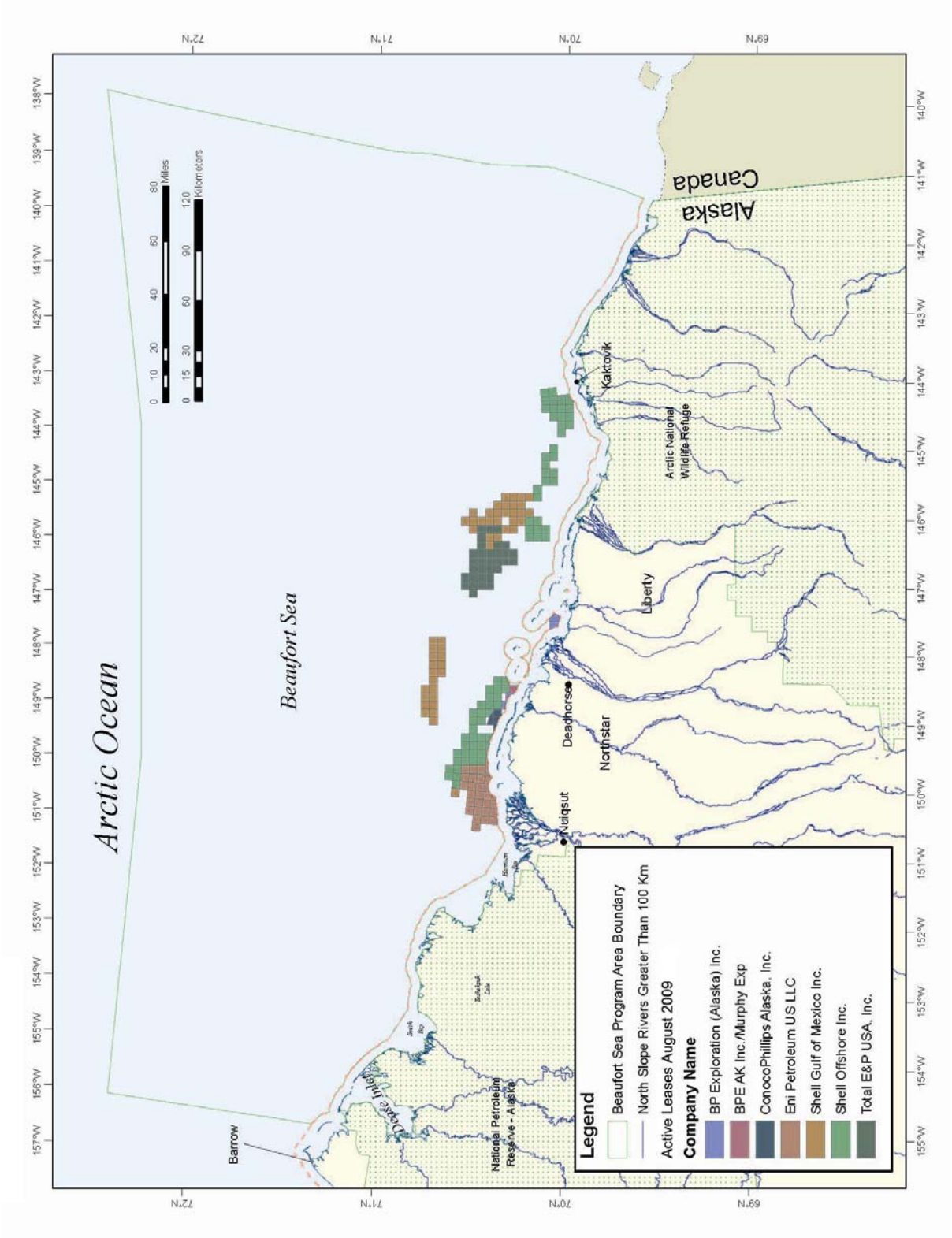


Figure 3 Chukchi Sea Oil and Gas Leasing Activity

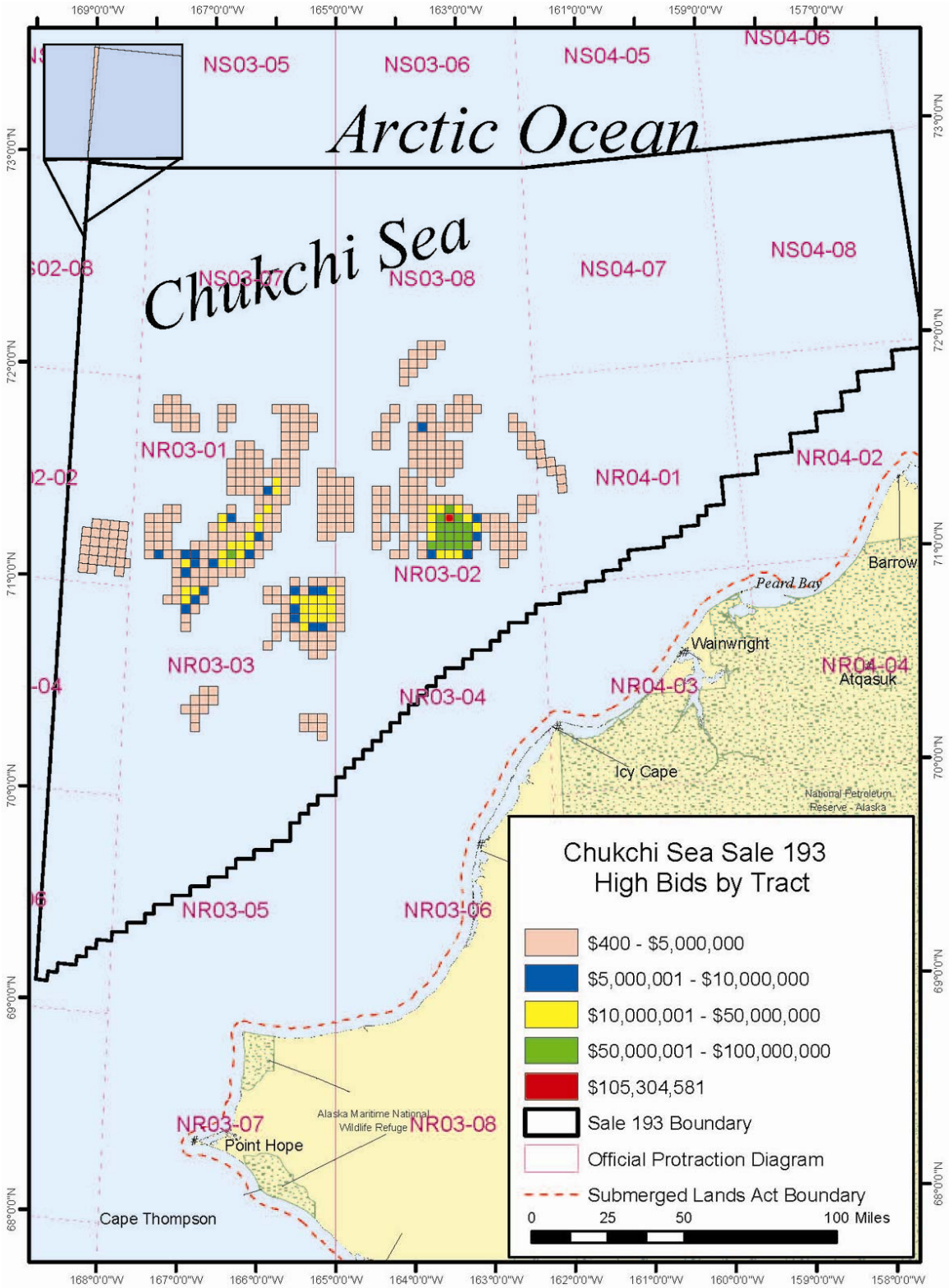


Figure 4 North Aleutian Basin Planning Area

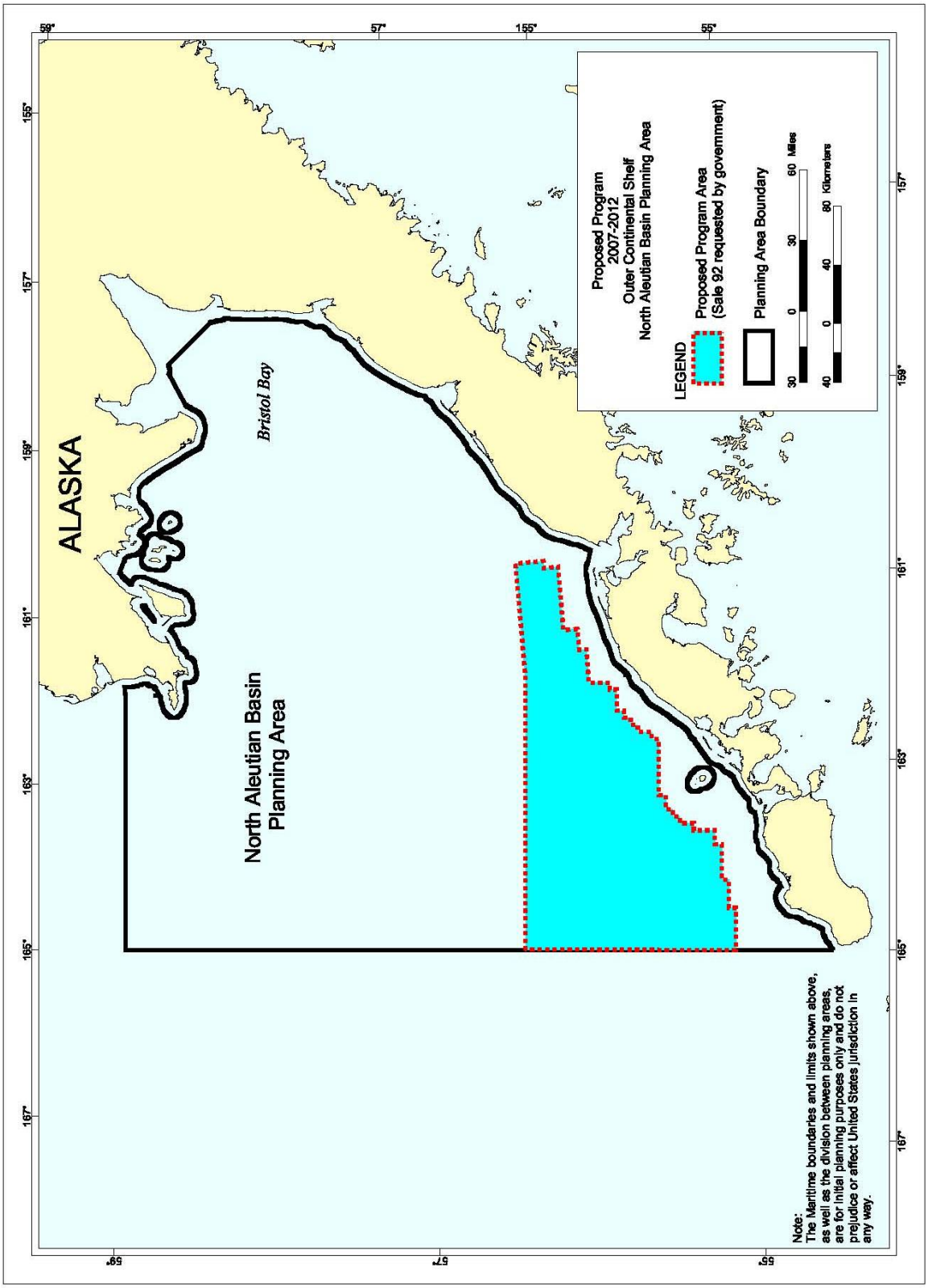
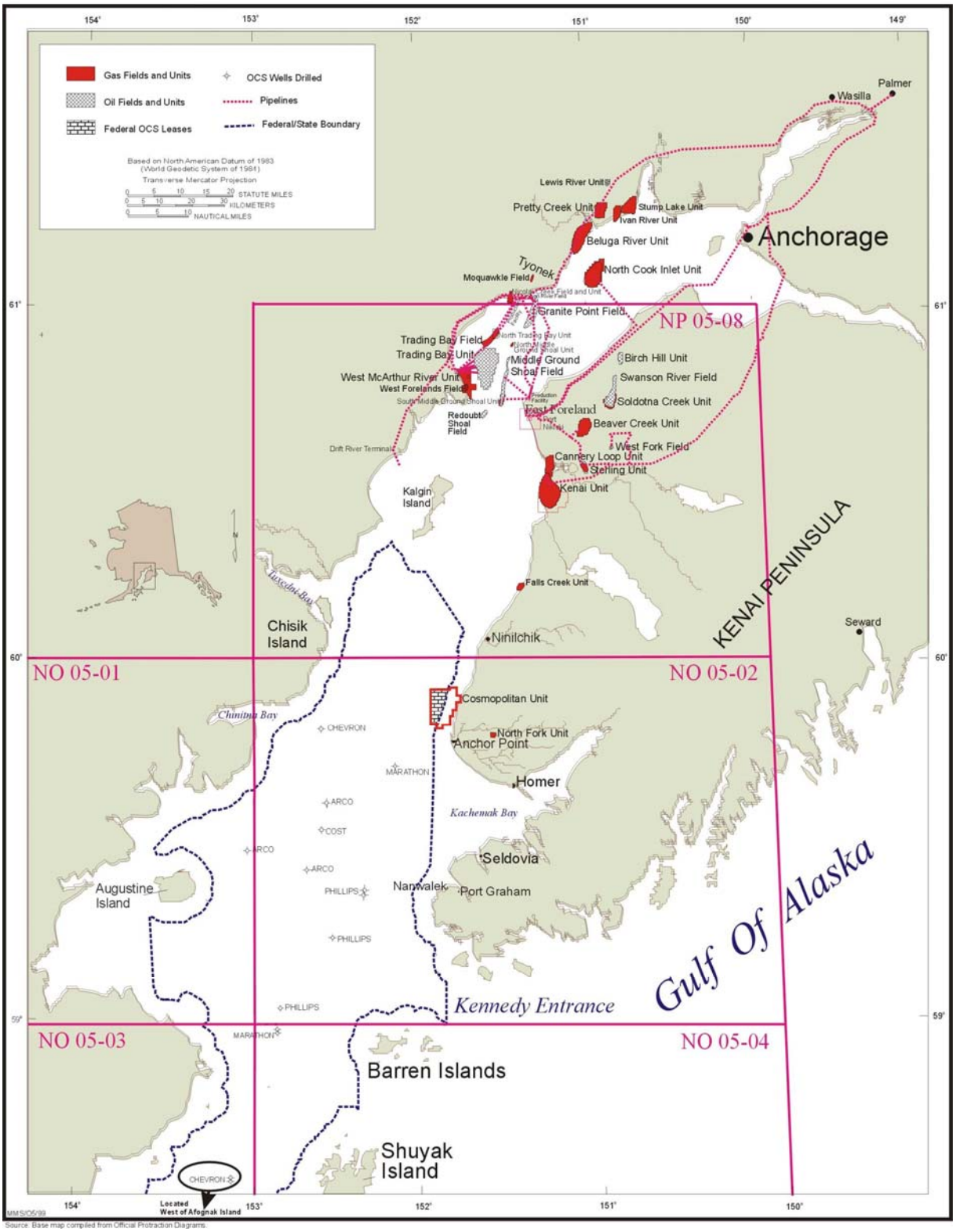


Figure 5 Cook Inlet Oil and Gas Leasing Activity



addition to those broader studies related to the pre-lease phase. As with the pre-lease phase, the wide range of environmental conditions from Cook Inlet to the Arctic is accounted for in the process of formulating new studies. Post-lease activities that require environmental data and assessment include:

- Geophysical surveys
- Preparation of Exploration Plans (EPs)
- Exploration drilling
- Preparation of Development and Production Plans (DPPs)
- Development, construction and production activities
- Oil transportation, including pipelines and tankers
- Lease termination or expiration (platform decommissioning)

In the Beaufort Sea Planning Area, there have been 929 tracts leased in ten OCS Lease Sales. Industry has drilled 31 exploratory wells and determined 11 to be producible. As of August, 2009, there are more than 180 active leases in the Beaufort federal offshore area.

The British Petroleum Exploration Alaska (BPXA) Northstar development project (see Figure 6) is located about 10 miles north of Prudhoe Bay. This is the first development project to have production from the Alaska OCS. While the Northstar Island is in State waters, six to seven wells will be drilled into the Federal OCS. The project was approved by the U.S. Army Corps of Engineers in May 1999 and by the MMS in September 1999. Construction started in the winter of 2000 and production began the last day of October 2001. The cumulative production for the Northstar State-Federal Unit through June 2009 totals 138 million barrels of oil from estimated recoverable reserves of 158 million barrels. Annual production peaked at 25 million barrels in 2004.

A BPXA proposed project is the Liberty Unit in Foggy Island Bay, about 6 miles east of the State Endicott Project. 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* (USDOI, 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 resulted in 487 leases being issued in the Chukchi Sea Planning Area. The only other active leases are in the Cook Inlet/Shelikof Strait Planning Area. There are no active leases from previous lease sales in the Chukchi Sea or Hope Basin portions of the Arctic Subregion or in the Bering Sea or Gulf of Alaska Subregions (see Figure 1).

Figure 6 Northstar Island August 2000

1.3 Identification of Information Needs

We distributed the *Alaska Annual Studies Plan Final FY 2009* (USDOI, MMS, Alaska OCS Region, 2008) to more than 250 Federal, State, local, environmental, Native, industry, international and other stakeholders in September 2008. We also distributed a letter to the same stakeholders requesting suggestions for new studies for the FY 2010. 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 Information Transfer Meetings (ITMs) and other meetings. For example, the Alaska OCS Region has conducted eleven ITMs. The eleventh ITM was convened in October 2008 in Anchorage, Alaska. It was held in conjunction with the U.S. and Canada Northern Oil and Gas Research Forum that was sponsored by a number of organizations and government agencies, including the MMS. 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. The workshop report was published in April 2007 (MMS 2007-002 – USDOI, MMS, Alaska OCS Region, 2007c) and has become a useful planning tool that continues to influence our study priorities.

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

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

1.3.1 Beaufort Sea General Information Needs

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

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

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

The final study reports from cANIMIDA are in production and imminently available on our website of completed study reports. Two of these studies are planned to extend beyond the cANIMIDA project. "Continuation of Impact Assessment for Cross Island Whaling Activities" is underway. The study "cANIMIDA Monitoring of Boulder Patch Kelp During Liberty Development," proposed for FY 2011, would extend a long-term monitoring dataset for a special benthic environment known as the "kelp community" or the "Boulder Patch" that exists on small portions of the Beaufort Sea floor near the Liberty development unit. Sediments, pollutants, or disturbance associated with oil and gas-industry activities could negatively affect this unique environment.

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

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

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

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

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

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

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

Pollutants: North Slope villagers are concerned about potential contamination of their food supply. In the Beaufort Sea such foods include bowhead whales, seals, waterfowl and fish. Of particular concern are environmental effects of development on these biota, including those from potential oil spills. Related to these concerns, additional information is needed regarding currents that might carry oil under ice. 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 (Oil in Ice JIP [Joint Industry Project]) doing field experiments on cleanup, behavior, and weathering of oil in broken ice.

Information on Bowhead Whales and Other Wildlife: Iñupiat whale hunters rely heavily on bowhead whales for subsistence. The bowhead whale is central to village cultural and spiritual life. Whale hunters have reported that migrating bowhead whales deflect from their normal migratory route well upstream of active industry vessels and may divert their migration route. A concern is that deflection around oil and gas-industry activity (including drilling activity and associated icebreaker support) makes whales skittish and more difficult to hunt. Bowhead whales also feed along the fall migration route and information about bowhead feeding and habitat use is needed. Noise from industrial activity is a central concern. Additionally, Iñupiat whale hunters and the scientific community have raised concerns about potential cumulative impacts on bowhead whales. It is important to assess the factors that may be affecting the habitat use, health, population status and migration routes of bowhead whales.

The populations of bowhead whales, polar bears, beluga whales, spectacled eiders and other endangered species are an ongoing concern of environmental groups, Federal agencies and others. North Slope villages are also concerned about potential disturbance of ringed seals, waterfowl and other subsistence-wildlife species by oil industry activities such as helicopter overflights.

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

Monitoring the Distribution of Arctic Whales: The MMS has conducted aerial surveys of the fall migration of bowhead whales each year since 1987. Methods are comparable from year to year and based on similar monitoring dating to 1979. In partnership with the NMML, the Bowhead Whale Aerial Survey Project (BWASP) extends a long-term database of the distribution, relative abundance, habitat, and behaviors (especially feeding) of endangered bowhead whales through the bowhead-migration corridor across the Alaskan Beaufort Sea.

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

The addition of two field seasons to "Bowhead Whale Feeding Variability in the Western Alaskan Beaufort Sea" is proposed for FY 2010. When recommending added field seasons

for this study, the NMFS cited the importance of continued data collection for the purpose of informing management decisions. The North Slope Borough has also urged the MMS to continue ongoing long-term studies such as this.

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

Demography and Behavior of Polar Bears: In partnership with the USGS Alaska Science Center and USFWS Marine Mammals Management, MMS will collect data (beginning in 2009) to estimate the demographic composition and inter-annual patterns of use of coastal areas by the sub-population of polar bears summering on land in Alaska. The project will also evaluate the implications of extended summer use of land on polar bear health and nutrition, behavior, and population status.

Fish: Relatively little is known of fishes in the Beaufort and Chukchi Seas, although they fill an essential role in the Arctic ecosystem by consuming small prey and themselves providing a food resource for larger fishes, birds, marine mammals, and people. In addition, fish assemblages and populations in marine ecosystems off Alaska have undergone observable regime-shifts in diversity and abundance over the last 20-30 years. It is important to assess the distribution and abundance of fishes in these areas to distinguish between anthropogenic and natural effects.

Beaufort Sea Marine Fisheries Monitoring: In collaboration with the NMFS Alaska Fisheries Science Center, this study designs a long-term fish monitoring plan for the central Beaufort Sea and implements a survey to establish baseline knowledge of fish species, distribution and relative abundance in the region. A follow-on study is proposed for FY 2010.

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

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

- Social disruption and a change in cultural values through population shifts (immigration of large numbers of non-Iñupiat to the North Slope)
- Employment changes (potential effects on subsistence lifestyle by a cash economy)
- Cumulative effects of multiple industrial activities, alteration of subsistence-harvest patterns and displacement of hunters and subsistence resources

There is an ongoing need to monitor key indicators of socioeconomic and cultural changes on the North Slope. The Iñupiat rely on a wide variety of marine resources as significant sources of food. In addition, the harvesting, sharing and consuming of subsistence resources form an important part of the traditional Iñupiaq culture and spiritual life. People are concerned that a temporary or permanent elimination of primary subsistence foods would cause North Slope residents either to shift to less desired subsistence resources or to replace subsistence foods with expensive Western foods. The Iñupiat are concerned about mitigation, including compensation for potential losses. An anticipated decline in oil revenues to the NSB is an issue of concern also. Another concern is the use of local and traditional knowledge in analysis of potential environmental effects. We continue to seek and include firsthand knowledge of local subsistence hunters to augment the scientific knowledge base. Current, relevant studies that address these concerns include:

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

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

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

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

1.3.2 Chukchi Sea General Information Needs

Native cultural activities that rely on subsistence, particularly on marine resources, predominate in these regions. The fundamental issues in the Chukchi Sea are very similar to the Beaufort Sea (see Section 1.3.1) although many species that regularly occur within the Chukchi Sea do not typically occur within the Beaufort Sea. One major difference is that MMS placed less emphasis on studying the Chukchi Sea than the Beaufort Sea beginning in the mid-1990s in recognition of leasing priorities. Knowledge of the spatial and temporal variability of leads, polynyas and landfast ice is dated. This information is important for

determining the fate of spilled oil in this region and the impacts on biota associated with these systems. The status of many animal populations may also have changed since the earlier studies were conducted. Climate change may have triggered many spatial and temporal changes in the distribution of a variety of species.

Since 2007, MMS has developed a new suite of studies in the Chukchi Sea, leveraging more than $30 million (through FY2009, with another $10 million planned for FY10) to conduct interim baseline research and monitoring in all the following fields of interest: meteorology, ice dynamics and basic oceanography, benthic fauna and sedimentation, marine mammals (including whales, walrus, seals, and polar bear), fish, birds, and social systems. Most of the projects exhibit complex, multilateral collaborations, with explicit inter-disciplinary linkages between the physical and biological sciences, and many of them also provide a role for active participation by Native residents and input from sources of traditional knowledge. Most of them pursue multi-year data collection efforts on a regional scale, with careful attention to inter-annual variability and ecosystem processes. Some selected highlights of the new research projects underway are excerpted below:

Physical Oceanography

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

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

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

Ecosystem Observations in the Chukchi Sea: The oceanographic component of a new passive acoustic monitoring study utilizes biophysical moorings, hydrographic measurements, and numerical climate models to monitor the changing ecosystem of the Chukchi Sea. The moorings measure ocean temperature, salinity, nutrients, chlorophyll (a measure of phytoplankton abundance), oxygen, photosynthetic radiation, ice thickness, ocean circulation, and zooplankton abundance (volume). The study partners MMS with NOAA-Pacific Marine Environmental Lab and the Alaska Fisheries Science Center, National Marine Mammal Laboratory.

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

Protected Species and Fish

Distribution and Relative Abundance of Marine Mammals: Aerial Surveys: In collaboration with the National Marine Fisheries Service (NMFS), MMS collects aerial survey data on seasonal distribution, relative abundance, and habitat use of marine mammals in the Chukchi Sea. Observations from June to October are focused on bowhead whales, but also help to monitor gray whales, beluga whales, Pacific walrus, polar bears, bearded seals, and several other species of ice seals. All of these species are subject to changes in environmental variables such as oceanographic currents, sea temperature, sea ice cover, prey availability, and anthropogenic impacts.

Passive Acoustic Detection and Monitoring of Endangered Whales in the Arctic: A collaboration between NMFS and MMS documents (beginning in 2010) the general presence of bowhead, right, fin, gray, and other baleen whales in areas of potential seismic, drilling, construction, and production activities. Data will be useful for estimating temporal limits and formulating designs of mitigation for such activities. The study will fund the fabrication and deployment of arrays of long-term acoustic recorders that are capable of continuous year-round recording.

Demography and Behavior of Polar Bears: In partnership with the USGS Alaska Science Center and USFWS Marine Mammals Management, MMS will collect data (beginning in 2010) to estimate the demographic composition and inter-annual patterns of use of coastal areas by the sub-population of polar bears summering on land in Alaska. The project will also evaluate the implications of extended summer use of land on polar bear health and nutrition, behavior, and population status.

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

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

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

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

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

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

Social Systems

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

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

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

Economic Impact Modeling: This study upgrades and refines MMS procedures for estimating the onshore economic effects of OCS-related activities by updating and enhancing the current version of a modeling program known as MAG-PLAN. The model provides a tool to estimate employment, personal income, and OCS-specific "cost functions" to estimate the industry

expenditures required to complete a given activity, such as drilling an exploration well or operating a production facility.

1.3.3 North Aleutian Basin General Information Needs

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

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

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

In 2007, the MMS and the National Marine Fisheries Service began collaboration on a $2 million study entitled "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 also contracted with Rutgers University, in association with the University of Alaska-Fairbanks, to modify an existing ice-ocean circulation model to the specific oceanographic conditions in Alaska's Bristol Bay. "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.

In 2008, MMS and the Coastal Marine Institute at UAF started a cooperative million dollar study to measure ecosystem productivity in the North Aleutian Basin and to evaluate its vulnerability to climate change. The project involves three years of oceanographic sampling focused on measurements of dissolved organic and inorganic nutrients and carbon, total alkalinity, particulate organic matter, and pCO_2.

In 2009, MMS awarded an NAB subsistence study to Idaho State University. The results of this study will serve as community baselines to monitor and mitigate any significant future changes in subsistence activities over time, including trends in harvest and distribution networks. Other relevant social and subsistence data for the region is forthcoming in a final report from the MMS study initiated in 2003, "Social and Economic Assessment of Major Oil Spill Litigation Settlement for the Alaska OCS Region". In particular, that study developed a case study specifically focused on the spill event of the *Selendang Ayu* along the Aleutian

Chain and the implications of that event for nearby coastal communities. The report is forthcoming.

Two fishery studies were also awarded in 2009: "Juvenile and Maturing Salmon Use of the North Aleutian Basin Lease Area" to the NOAA/NMFS Alaska Fisheries Science Center's Auke Bay Laboratories and "Spatial and Temporal Mapping of Nearshore Juvenile Fish and Larval Crab" to the NOAA Earth System Research Laboratory. The salmon study involves two years of data collection of seasonal fish use and habitat assessment with a surface trawl in waters at least 20 meters deep in May and July to assess late winter and early summer fish characteristics. The juvenile fish and crab study maps the location and timing of larval nurseries, juvenile rearing, and crab settling areas through aerial digital imaging and Light Detection and Ranging (LiDAR).

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

1.3.4 Renewable Energy General Information Needs

Section 388 of the Energy Policy Act of 2005 amended the OCSLA to give discretionary authority to 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 "Renewable Energy Potential in Coastal Alaska" has been proposed for FY 2011. 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.

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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: Alaska Annual Studies Plan FY 2010

Region: Alaska

Planning Area(s): Chukchi Sea

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

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 EISs, environmental assessments (EAs), and oil-spill contingency planning. Information from this study will be used in NEPA analysis and documentation for Chukchi, DPPs, and oil-spill contingency plans.

Total Cost: $600,000 plus Joint Funding **Period of Performance:** FY 2009-2013

Conducting Organization: UAF

MMS Contact: Chief, Alaska Environmental Studies Section

Description:

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

The University of Alaska-Fairbanks, under contract to MMS successfully collected surface current measurements within the central Beaufort Sea Outer Continental Shelf out to 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 Dopper Current Profilers (ADCPs). 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) 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 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 ADCPs, surface drifters, wind data from coastal meteorological stations, and varying ice conditions from satellite imagery.
- For a specific period of time, combine surface current fields from HF radar with QuikSCAT currents to produce a best case current field for the entire Chukchi lease area.
- Provide an annual reports, final report, and spatial database.

Methods: This study will: 1) field test potential locations to deploy long and short range HF Doppler radar systems along the Chukchi Sea coast beginning near Barrow and extending down the Chukchi coast; 2) work with Alaska Native groups and scientific organizations on the North Slope to enhance their participation in the project; 3) select sites and collect surface current measurements on an hourly basis between the months of July and October for three to four field seasons; 4) collaborate with other agencies and industry to obtain needed data on subsurface currents and surface current parameters; 5) deploy instruments where needed to collect required data sets; 6) build geospatial database of surface and subsurface conditions for comparison to HF radar surface currents; 7) conduct analysis comparing available data on ice concentration, leads, moorings, drifters, sea surface temperature, salinity measurements, and wind data to surface current fields; 8) combine surface current fields from HF radar with QuikSCAT satellite observations; 9) provide spatial and temporal database along with final report; 10) provide surface current flow fields to modeling group for model validation; 11) provide final report of results.

Revised Date: August 2009

ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2010

Region: Alaska

Planning Area(s): Beaufort Sea, Chukchi Sea

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

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: $450,000 plus Joint Funding **Period of Performance:** FY 2009-2012

Conducting Organization: CMI, UAF

MMS Contact: Chief, Alaska Environmental Studies Section

Description:
Background: Polynyas in the Chukchi Sea reoccur every year to the west of Barrow. The size, frequency, and latitudinal extent of these polynyas are poorly defined south of Icy Cape along the U.S. eastern Chukchi coast and along the Russian Chukchi coast. A recently completed MMS study by Eicken et al. (MMS 2005-068) mapped and quantified the spatial and temporal extent of landfast ice and leads, including Polynyas along the Beaufort Sea coast and a portion of the Chukchi coast utilizing high resolution satellite imagery. Data from this completed study was incorporated into the 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.
- 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 Geographic Information System (GIS) database which quantifies the spatial and temporal distribution of spring leads in the Alaskan Chukchi Sea, in addition to updated information for the Beaufort Sea. Provide individual years as well as statistical representation of polynya/lead occurrence and distribution. Create a GIS database and statistical summaries showing the monthly distribution of the shoreward landfast ice line across the Chukchi Sea to the Russian Chukchi Coast at 174 W. Provide individual months per year as well as statistical representation of landfast ice occurrence and distribution. Analyze ice dynamics within the Beaufort and Chukchi seas. Provide relevant attributes to spatial data for use in a GIS. Provide a final report, database, and database documentation. Provide a project team web site.

Revised Date: August 2009

ENVIRONMENTAL STUDIES PROGRAM: Annual Studies Plan FY 2011

Region: Alaska

Planning Area(s): Chukchi Sea

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

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. In addition, this study will provide information necessary for ground-truthing and tuning of the numerical models, particularly the climate models and oil trajectory models.

Total Cost: $1,618,928 plus Joint Funding **Period of Performance:** FY 2009-2014

Conducting Organization: NOAA_Pacific Marine Environmental Laboratory

MMS Contact: Chief, Alaska Environmental Studies Section

Description:

Background: During the last three decades there has been a northward shift of some fish species in the eastern Bering Sea. It is hypothesized that these changes are a result of global climate change and the loss of sea ice. The western Arctic physical climate is rapidly changing. The summer minimum sea ice extent in 2007 and 2008 covered an area which was 37% less that the areal coverage of two decades ago and 20% less than the previous minimum coverage in 2005. The rapidity of these changes was unexpected, as the consensus of the climate research community just a few years ago was that such changes would not be seen for another 30 years, as expected from the CO_2 anthropogenic contribution alone. This reduction in sea ice area opens up vast new regions of the Arctic Ocean to increased absorption of sunlight and storage of heat. This heat is returned to the atmosphere in the following autumn resulting in increased Arctic temperatures of more than 5° C, extending the sea ice free season into November, and causing changes in wind patterns. Such Arctic changes appear to be

irreversible. As the sea ice that has lasted for several years melts away and extra heat is stored in the ocean during autumn, potential future periods of colder than normal air temperatures may not be sufficient to rebuild the summer sea ice cover. Previous sea ice and climate analyses and projections for the Chukchi Sea are out of date.

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

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

Objectives:

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

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

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

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

Revised Date: August 2009

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ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2010

Region: Alaska

Planning Area(s): North Aleutian Basin

Title: Modeling of Circulation in the North Aleutian Basin (AK-07-x14)

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

MMS Contact: Chief, Alaska Environmental Studies Section

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) provide documentation through model manual, final report and submittal of a peer-reviewed journal article.

Revised Date: August 2009

ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2010

Region: Alaska

Planning Area(s): Beaufort Sea

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

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 2007-2009

Conducting Organization: UAF

MMS Contact: Chief, Alaska Environmental Studies Section

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

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

observing network in the Arctic. The Network approach is also consistent with the major recommendations of key variables needing long-term monitoring for an Arctic Observing Network (National Research Council, 2006).

Objectives: The collection of meteorological data along the North Slope and nearshore Beaufort Sea in support of other 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 evapo-transpiration in the network region.
- Provide data on the Internet in hourly updates to benefit field operations, traveler weather information, and emergency response.
- Provide data for National Weather Service forecasting use to help improve daily forecasts in network region.

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

Revised Date: August 2009

ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2010

Region: Alaska

Planning Area(s): Beaufort Sea

Title: Feasibility and Study Design for Boundary Oceanography of the Beaufort Sea (AK-06-03)

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 2006-2009

Conducting Organization: UAF

MMS Contact: Chief, Alaska Environmental Studies Section

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 2009

ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2010

Region: Alaska

Planning Area(s): Beaufort Sea

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

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 (SINTEF [Norwegian acronym]) weathering model for the Beaufort Sea. Information will be used in NEPA analysis and documentation for Beaufort Sea Lease Sales, Exploration Plans (EPs), and Development and Production Plan (DPPs).

Total Cost: $1,750,000 **Period of Performance:** FY 2006-2012

Conducting Organization: UAF Geophysical Institute

MMS Contact: Chief, Alaska Environmental Studies Section

Description:

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

Objectives:

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

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

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

Revised Date: August 2009

ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2010

Region: Alaska

Planning Area(s): Beaufort Sea, Cook Inlet

Title: Surface Circulation Radar Mapping in Alaskan Coastal Waters: Field Study Beaufort Sea and Cook Inlet (AK-04-08)

MMS Information Need(s) to be Addressed: The Oil-Spill-Risk Analysis (OSRA) is a cornerstone to regional EISs, EAs, 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 2006-2009

Conducting Organization: UAF

MMS Contact: Chief, Alaska Environmental Studies Section

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 2009

ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2010

Region: Alaska

Planning Area(s): Beaufort Sea

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

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

MMS Contact: Chief, Alaska Environmental Studies Section

Description:
Background: Winds and river runoff influence the dynamics and circulation pathways over the innermost portion (water depths ~<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 2009

ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2010

Region: Alaska

Planning Area(s): Chukchi Sea

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

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 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: $2,560,000 **Period of Performance:** FY 2008-2012

Conducting Organization: University of Texas at Austin

MMS Contact: Chief, Alaska Environmental Studies Section

Description:
Background: The November 2006 COMIDA workshop described the importance of benthos and chemical monitoring to evaluate the health of the Chukchi ecosystem. The MMS 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 1970's and early 1990's. 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 polycyclic aromatic hydrocarbon (PAH), relevant metals, including the Environmental Protection Agency (EPA) priority metals [total iron (Fe), manganese (Mn), aluminum (Al), barium (Ba), chromium (Cr), vanadium (V), lead (Pb), copper (Cu), cadmium (Cd), nickel (Ni), arsenic (As), silver (Ag), mercury (Hg), selenium (Se), beryllium (Be), thallium (Tl), tin (Sn), antimony (Sb), and zinc (Zn)]; supporting/normalizing parameters such as grain size, organic carbon or organic matter, etc.; and sourcing parameters such as diagnostic hydrocarbon ratios. The biological sampling 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 2009

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ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2010

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 (AK-05-x12)

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

MMS Contact: Chief, Alaska Environmental Studies Section

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 2009

ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2010

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 (AK-93-48-64)

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

MMS Contact: Chief, Alaska Environmental Studies Section

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 2009

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ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2010

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 (AK-93-48-61)

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

MMS Contact: Chief, Alaska Environmental Studies Section

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 2009

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ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2010

Region: Alaska

Planning Area(s): North Aleutian Basin

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

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

MMS Contact: Chief, Alaska Environmental Studies Section

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 2009

ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2010

Region: Alaska

Planning Area(s): North Aleutian Basin

Title: Juvenile and Maturing Salmon Use of the North Aleutian Basin Lease Area (AK-08-07)

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: $650,000 plus Joint Funding **Period of Performance:** FY 2009-2011

Conducting Organization: NOAA-NMFS-Alaska Fisheries Science Center

MMS Contact: Chief, Alaska Environmental Studies Section

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 2009

ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2010

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 (AK-08-08)

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: $532,000 plus Joint Funding **Period of Performance:** FY 2009-2011

Conducting Organization: NOAA-Earth System Research Laboratory

MMS Contact: Chief, Alaska Environmental Studies Section

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 (EISs), 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 2009

ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2010

Region: Alaska

Planning Area(s): Beaufort Sea & Chukchi Sea

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

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

Total Cost: $120,000 plus Joint Funding **Period of Performance:** FY 2009-2011

Conducting Organization: CMI, UAF

MMS Contact: Chief, Alaska Environmental Studies Section

Description:

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

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

This study will utilize genetic tools to investigate population structure in snow crabs, *C. opilio*, in the N Bering, Chukchi and Beaufort Seas, and the degrees of genetic exchange

between these regions. This information will also aid in defining the general distribution for crab species Essential Fish Habitats (EFH).

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

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

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

Revised Date: August 2009

ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2010

Region: Alaska

Planning Area(s): Chukchi Sea

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

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

Total Cost: $532,000 plus Joint Funding **Period of Performance:** FY 2009-2013

Conducting Organization: CMI, UAF

MMS Contact: Chief, Alaska Environmental Studies Section

Description:

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

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

record minima were recorded in both 2007 and 2008. The loss of habitat for ice seals has resulted in three species being considered for listing under the Endanger Species Act. Dietary differences among forage fishes in the Lease Sale area may propagate into higher trophic levels such as ice seals. Thus, it is essential to evaluate fishes as prey resources, or "forage," for marine mammals. The study design aligns fish, prey and seals sampled in the Chukchi Sea, not only across both diet and isotopic signals, but also matched over three recent and consecutive years to provide an essential measure of interannual variability. The proposed study will produce a more comprehensive picture of forage fishes in the Chukchi Sea and then trophically relate fishes and their prey to ice seals and their diets in the Chukchi Sea to provide an essential new understanding of the ecosystem. The resulting increase in basic knowledge of the Chukchi Sea ecosystem will facilitate good stewardship by the oil and gas industry.

Objectives:

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

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

Revised Date: August 2009

ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2010

Region: Alaska

Planning Area(s): Beaufort Sea

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

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

Total Cost: $123,000 plus Joint Funding **Period of Performance:** FY 2008-2012

Conducting Organization: CMI, UAF

MMS Contact: Chief, Alaska Environmental Studies Section

Description:

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

Objectives:

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

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

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ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2010

Region: Alaska

Planning Area(s): Beaufort Sea

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

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 2006–2010

Conducting Organization: USGS-BRD

MMS Contact: Chief, Alaska Environmental Studies Section

Description:
Background: The lowest harvest rates ever occurred in the critical subsistence resource, Colville River arctic cisco, raised urgent concerns about the possible effects of offshore oil and gas development in the early 2000s. A 2003 Arctic Cisco Workshop conducted in Nuiqsut with both scientific and local arctic cisco experts identified the highest priority information needs with regard to the Colville River arctic cisco subsistence population. Identification of the source populations of arctic cisco recruits and their movement along the North Slope is a question of considerable importance to the native people in this area, and their subsistence harvest. The recent declines in the number and size of fish in the subsistence harvest have made this question a high priority for 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 is extracted from fin, gill or muscle tissue from the sample areas. These samples will be tested and analyzed for nuclear microsatellite DNA markers, mitochondrial DNA, and otolith microchemistry. Highly polymorphic microsatellite molecular markers will be produced from a Colville River arctic cisco DNA library for populations scale analysis. Otoliths will be tested for the range and rigor available from micro chemical analyses to address migration patterns to and from freshwater habitats.

Revised Date: August 2009

ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2010

Region: Alaska

Planning Area(s): Beaufort Sea, Chukchi Sea

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

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

MMS Contact: Chief, Alaska Environmental Studies Section

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 2009

ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2010

Region: Alaska

Planning Area(s): Beaufort Sea

Title: Beaufort Sea Marine Fish Monitoring: Pilot Survey and Test of Hypotheses (AK-06-04)

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

MMS Contact: Chief, Alaska Environmental Studies Section

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 2009

ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2010

Region: Alaska

Planning Area(s): Chukchi Sea

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

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), EPs and DPPs, and in post-sale and post-exploration decision making, mitigation, and monitoring in the Chukchi Sea.

Total Cost: $342,810 plus Joint Funding **Period of Performance:** FY 2007-2010

Conducting Organization: CMI, UAF

MMS Contact: Chief, Alaska Environmental Studies Section

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

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

This project will assemble data into a searchable database and collect additional field data to meet 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 2009

ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2010

Region: Alaska

Planning Area(s): Beaufort Sea

Title: Evaluating the Potential Relict Arctic Invertebrate and Algal Community on the West Side of Cook Inlet (AK-93-48-60)

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

MMS Contact: Chief, Alaska Environmental Studies Section

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 2009

ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2010

Region: Alaska

Planning Area(s): Chukchi Sea

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

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: $1,529,000 **Period of Performance:** FY 2009-2013

Conducting Organization: ADF&G

MMS Contact: Chief, Alaska Environmental Studies Section

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

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

The Burger Prospect has potentially strong renewed interest for oil and gas exploration and development and is located just south of Hanna Shoal. It is thus situated between winter habitat and potentially important summer feeding habitat on, and around, Hanna Shoal. Plans for geophysical exploration, field delineation, and development of production facilities and pipelines in that region are being developed and such activities may have consequences for pinniped movements and habitat utilization, which in turn could further alter the availability of walruses 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 walruses 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 walruses 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 walruses. Involve local Natives in shore-based monitoring of walruses 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 2009

ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2010

Region: Alaska

Planning Area(s): Beaufort Sea, Chukchi Sea

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

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. Study results may be useful for estimating temporal limits and formulating designs of mitigation for such activities. Findings may be used for evaluating potential deferral areas and other potential limitations on offshore leasing and development. This study will provide useful information needed to support NEPA analysis and documentation for Beaufort and Chukchi Sea Lease Sales, DPPs, and monitoring. Results will support ESA consultations, MMPA permitting, and preparation of Biological Evaluations and Biological Opinions.

Total Cost: $4,304,300 plus Joint Funding **Period of Performance:** FY 2009-2014

Conducting Organization: NOAA, NMML

MMS Contact: Chief, Alaska Environmental Studies Section

Description:

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

Passive acoustic detection and tracking is a proven tool for assessment of large whales in Alaskan seas. Specifically, acoustic detection has proven a key addition to the census of bowhead whales (*Balaena mysticetus*) during their spring migration past Barrow, and in relation to oil and gas development activities offshore Prudhoe Bay. More recently, gray whale calls have been detected year-round near Barrow on long-term recorders deployed in

collaboration with the NSF/Shelf-Basin Interaction Study. Other data have been obtained on North Pacific right, humpback, and fin whales in the southern Bering Sea.

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

Objectives:

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

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

Revised Date: August 2009

ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2010

Region: Alaska

Planning Area(s): Beaufort Sea, Chukchi Sea

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

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: $919,000 **Period of Performance:** FY 2009-2013

Conducting Organization: USGS

MMS Contact: Chief, Alaska Environmental Studies Section

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

Objectives:

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

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

Revised Date: August 2009

ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2010

Region: Alaska

Planning Area(s): Beaufort Sea, Chukchi Sea

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

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

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

MMS Contact: Chief, Alaska Environmental Studies Section

Description:

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

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

observed near Barter Island, Cross Island, and Barrow. Industrial operators in the Prudhoe Bay area report an increasing trend in the numbers, frequency, and duration of polar bear use during the open water period.

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

Objectives:

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

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

Revised Date: August 2009

ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2010

Region: Alaska

Planning Area(s): Chukchi Sea

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

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: NMFS NMML

MMS Contact: Chief, Alaska Environmental Studies Section

Description:

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

available for comparison with new data to assess whether changes in distribution or abundance have occurred since the earlier surveys were completed.

Objectives:

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

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

Revised Date: August 2009

ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2010

Region: Alaska

Planning Area(s): North Aleutian Basin

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

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

Total Cost: $3,950,000 plus Joint Funding **Period of Performance:** FY 2007-2010

Conducting Organization: NMFS, NMML

MMS Contact: Chief, Alaska Environmental Studies Section

Description:

Background: The eastern population of the North Pacific right whale (*Eubalaena japonica*) is arguably the rarest stock of whales anywhere in the world. Right whales throughout the North Pacific were drastically reduced by commercial whaling beginning in 1835, and the remnant eastern population was almost wiped out by illegal Soviet catches in the 1960's. 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 International Union for Conservation of Nature), 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 2009

ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2010

Region: Alaska

Planning Area(s): Beaufort Sea, Chukchi Sea

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

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 supplements behavioral information needed to identify areas of interest to feeding bowhead whales. Information from this study also will be needed to support NEPA analysis and documentation for Beaufort Sea Lease Sales, DPPs, and monitoring of production at Northstar and Liberty.

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

Conducting Organization: MMS, NOAA AOC and NMFS NMML

MMS Contact: Chief, Alaska Environmental Studies Section

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. 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 status of the fall migration of bowhead whales across the Alaskan Beaufort Sea for use in protection of this Endangered Species, if needed.
- Provide an objective area-wide context for management interpretation of bowhead migrations and site-specific study results.

Methods: Aerial surveys, based out of Deadhorse, Alaska, during September and October, monitor the fall bowhead migration between 140° W. and 157° W. longitude, south of 72° N. latitude. Particular emphasis is placed on regional randomized transects, statistical tests, and

power analyses to assess fine scale shifts in the migration axis of bowhead whales across the Beaufort Sea, and on the coordination of effort and management of data necessary to support seasonal offshore drilling regulations. The project analyzes migration timing, distribution, relative abundance, habitat associations, swim directions, water depths, and behaviors (especially potential feeding) of whales, as well as ice type and percentage at bowhead sightings. Belugas, gray whales, and polar bears are regularly recorded along with incidental sightings of other marine mammals. Data are also shared with site-specific studies to define bowhead responses to individual oil-industry activities. Incidental oceanographic observations are shared with the National Ice Center and National Weather Service to ground-truth satellite imagery.

Field work will be conducted and various analyses and reports will be prepared by the NMFS, NMML. Survey results will be available after each survey flight on a website maintained by the NMML. A comprehensive master database, with metadata, will also be available on the website. Aircraft operations will be managed by the NOAA AOC.

Revised Date: August 2009

ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2010

Region: Alaska

Planning Area(s): Chukchi Sea

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

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

MMS Contact: Chief, Alaska Environmental Studies Section

Description:

Background: Specific areas identified for study in this profile are very important Chukchi Sea coastal lagoons and embayments where waterfowl seasonally concentrate. These locations are vulnerable to industrial disturbance or oil spills potentially associated with offshore oil and gas exploration and development. Scientists have identified the lagoons, bays, and barrier islands along the Alaskan coast of the Chukchi Sea as important feeding, staging, and molting areas for relatively large numbers and a diverse assemblage of water birds breeding in both Alaska and Canada. Peard and Ledyard Bays and Kasegaluk Lagoon, in particular, appear to represent important staging and/or molting habitat for a variety of shorebirds, seabirds (nesting colonies at

Point Hope, Cape Lewis, Cape Lisburne, Point Lay, Icy Cape, and Cape Thompson), and waterfowl. In particular, it is critical to identify high-use areas by threatened Spectacled Eiders. Also, the USFWS was petitioned in 2004 to list the Yellow-billed Loon under the ESA and thus this species is of concern to 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 2009

MMS ENVIRONMENTAL STUDIES PROGRAM: ONGOING STUDIES

Region: Alaska

Planning Area(s): Chukchi Sea

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

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 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

MMS Contact: Chief, Alaska Environmental Studies Section

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

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

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

Objectives:

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

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

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

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

Revised Date: January 2009

ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2010

Region: Alaska

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

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

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

MMS Contact: Chief, Alaska Environmental Studies Section

Description:

Background: A previous MMS study estimated the extent to which the bowhead whale population utilizes OCS areas in the eastern Alaskan Beaufort Sea for feeding, as well as that area's importance to individual whales. Additional research on this subject has been requested particularly at locations other than those included in the previous study. In a 2001 Arctic Region Biological Opinion NMFS made a Conservation Recommendation that MMS 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 2009

ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2010

Region: Alaska

Planning Area(s): Beaufort Sea, Chukchi Sea

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

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

MMS Contact: Chief, Alaska Environmental Studies Section

Description:

Background: A previous MMS study estimated the extent to which the bowhead whale population utilizes OCS areas in the eastern Alaskan Beaufort Sea for feeding, as well as that area's importance to individual whales. Additional research on this subject has been requested particularly at locations other than those included in the previous study. In a 2001 Arctic Region Biological Opinion NMFS made a Conservation Recommendation that MMS 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 among whaling captains, AEWC, NSB, ADF&G, NMFS, MMS and other interested parties to clarify roles in research permitting, co-sponsorship and implementation. Based on preliminary observations of locations of bowhead feeding having high potential for more comprehensive study and analysis, project planning and research would be initiated using logistics and field methods including, but not limited to, those similar to those used to accomplish the previous eastern Alaskan Beaufort Sea bowhead feeding study. These could include placement of permanent moorings for passive acoustic and sea-water current, temperature and salinity monitoring, fieldwork such as analyses of stomach contents at Barrow and Cross Island, behavioral observations by aircraft, bowhead tagging from Native operated boats, plankton tows by small vessel, stable isotope ratios in baleen layers, fatty acid comparisons, recording of traditional knowledge, and computer modeling of feeding information. Real-time distribution of whales in the Beaufort Sea, as well as historic information on bowhead whale feeding activity in the study area, would also be provided by the ongoing MMS *Bowhead Whale Aerial Survey Project*. The study would be carefully coordinated with the AEWC and Whaling Captains Associations in Barrow, Nuiqsut and Kaktovik to avoid interference with fall subsistence hunts and, where feasible, to involve whaling communities in the conduct of the study.

Revised Date: August 2009

ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2010

Region: Alaska

Planning Area(s): Beaufort Sea

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

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

MMS Contact: Chief, Alaska Environmental Studies Section

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

The health and condition of ringed seals in the Beaufort Sea are important to biologists, hunters and managers for several reasons. They have been proven to be useful indicators of the physical and biological environment. As ubiquitous and important prey, they are critical to the well being of polar bears. Also, they are valued as a subsistence resource by the 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 the1970s 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 2009

ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2010

Region: Alaska

Planning Area(s): Cook Inlet

Title: Distribution and Abundance of Harbor Seals in Cook Inlet (AK-03-10)

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

MMS Contact: Chief, Alaska Environmental Studies Section

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. 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 2009

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ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2010

Region: Alaska

Planning Area(s): Cook Inlet

Title: Movements and Habitat Use of Harbor Seals in Cook Inlet (AK-04-07)

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 2004-2008

Conducting Organization: National Marine Mammal Laboratory

MMS Contact: Chief, Alaska Environmental Studies Section

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 2009

ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2010

Region: Alaska

Planning Area(s): Beaufort Sea, Chukchi Sea

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

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

MMS Contact: Chief, Alaska Environmental Studies Section

Description:

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

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

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

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

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

Revised Date: August 2009

ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2010

Region: Alaska

Planning Area(s): Beaufort Sea

Title: Pre-migratory Movements and Physiology of Shorebirds Staging on Beaufort Sea Littoral Zone (AK-93-48-56)

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

MMS Contact: Chief, Alaska Environmental Studies Section

Description:

Background: Preliminary work conducted during the 1970's 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 2009

ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2010

Region: Alaska

Planning Area(s): Beaufort Sea

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

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: $350,000 **Period of Performance:** FY 2009-2011

Conducting Organization: Stephen A. Braund and Associates

MMS Contact: Chief, Alaska Environmental Studies Section

Description:

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

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

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

The study is intended to pilot-test the prospects for a more comprehensive future undertaking by limiting the initial scope of research to a few recent exploration and development projects. The projects to review would likely include Northstar, McCovey, Endicott, Alpine and satellites, NPR-A exploration, and the most recent fields in Kuparuk (Meltwater and Tarn). The most substantial topics would likely derive from mitigation efforts 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 2009

ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2010

Region: Alaska

Planning Area(s): Beaufort Sea

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

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

MMS Contact: Chief, Alaska Environmental Studies Section

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

Objectives: This study will gather long-term monitoring data to help the 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: 1) number of whales taken; 2) Global Positioning System (GPS) location of whale strikes, with direction and distance from Cross Island; 3) number of crews, composition of crews, total number of crew; 4) periodic “census” of

whaling participants on Cross Island, 5) duration of whaling season by active days; 6) timing of whaling; 7) length of trips and area searched while whaling; 8) records of catch per unit effort; and 9) observations of whaling participants. The study will also record systematic and observational/interview data collection on 1) non-whaling subsistence activities on and near Cross Island; 2) observations of local subsistence users. Hard copy maps will be appended as necessary for clarification of location information. The recorded data will be presented in an annual report using tabular information on harvest levels and locations of subsistence resources taken on or near Cross Island.

Revised Date: August 2009

ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2010

Region: Alaska

Planning Area(s): Chukchi Sea

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

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: $785,000 **Period of Performance:** FY 2009-2011

Conducting Organization: Stephen A. Braund and Associates

MMS Contact: Chief, Alaska Environmental Studies Section

Description:

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

Objectives: This study will gather long-term monitoring data to allow the 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 Hypothesis 1: Offshore subsistence hunting patterns in the vicinity of Wainwright and Point Lay do not vary significantly from year to year.

- Monitoring Hypothesis 2: 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 2009

ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2010

Region: Alaska

Planning Area(s): All Alaska

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

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

Total Cost: TBD **Period of Performance:** FY 2009-2011

Conducting Organization: TBD

MMS Contact: Chief, Alaska Environmental Studies Section

Description:

Background: MMS maintains two versions of an OCS Economic Impact Model (EIM) called MAG-PLAN to provide a consistent bureau-wide approach to estimating employment, personal income, and similar results of OCS activities. Each version is a Microsoft Access-based, 2-stage model that uses OCS-specific "cost functions" to estimate the industry expenditures required to complete a given activity, such as drilling an exploration well or operating a production facility. The second stage uses region-specific economic multipliers from the commercial economic modeling system IMPLAN to forecast employment, personal income, and other variables resulting from the initial industry expenditures.

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

First, MMS employees used MAG-PLAN for the latest round of 5-year program and EIS analyses and identified certain problems in the model. Users resolved most of these problems by work-arounds, but some important model weaknesses remain, and it's possible that there are additional problems that have not yet been identified. Among the remaining problems is file instability—the same file cannot be used for successive runs, resulting in wasted employee time and disk space, as well as increased opportunity for user error, as employees create duplicates of the huge base file and re-create all settings for each run.

Second, almost all model data came from engineering cost estimates (extrapolating from onshore and State-waters projects) developed for two studies (Arctic IMPAK and Sub-Arctic IMPAK) about a decade ago. MAG-PLAN Alaska adjusts this data, primarily from 1998 and 1999, to account for inflation, but that adjustment does fully account for changes that have occurred over the interim. Since 1998 and 1999, technology has advanced, the first Alaska OCS production (North Star) commenced, preparations for a second Alaska OCS project (Liberty) have progressed, Alaska has developed some manufacturing support for offshore oil and gas operations, and companies have invested large amounts to explore and prepare for projects on the Alaska OCS (e.g., the Chukchi Sea), potentially creating a new pool of available information.

Third, much of the supporting model data is inadequate for the Chukchi Sea and North Aleutian Basin planning areas, both of which have attracted far more industry interest than was apparent when earlier model planning decisions were made. Due to earlier attempts to focus the spending of limited funds on the planning areas deemed most likely to be developed, all MAG-PLAN Alaska data is based on estimated costs/expenditures for projects in the Beaufort Sea and Cook Inlet/Shelikof Strait planning areas; rules of thumb were used to extrapolate the data for use with other Alaska planning areas. The Chukchi Sea and North Aleutian Basin are sufficiently different from the Beaufort Sea and Cook Inlet, respectively, that more targeted data and revised cost functions are needed.

Fourth, the internal sector-allocation equations in the model will have to be changed to make MAG-PLAN compatible with recent changes in the IMPLAN industry sectoring scheme.

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

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

Methods: This project will involve coordinating five linked but separate research efforts: 1) testing and streamlining MAG-PLAN functionality; 2) identifying and collecting industry expenditure data; 3) creating better "Offshore Modeling Area" data and model structure for Chukchi and N. Aleutian Basin; 4) revising industry sector codes to match current IMPLAN sectoring scheme and incorporating the new codes into MAG-PLAN equations; and 5) documenting all efforts.

Revised Date: August 2009

ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2010

Region: Alaska

Planning Area(s): Beaufort Sea

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

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

Total Cost: $119,500 plus Joint Funding **Period of Performance:** FY 2009-2011

Conducting Organization: CMI, UAF

MMS Contact: Chief, Alaska Environmental Studies Section

Description:

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

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

Objectives:

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

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

Revised Date: August 2009

ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2010

Region: Alaska

Planning Area(s): North Aleutian Basin

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

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: $339,793 **Period of Performance:** FY 2009-2011

Conducting Organization: Idaho State University

MMS Contact: Chief, Alaska Environmental Studies Section

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

broader regional baseline, as potential exploration or development in the NAB achieve greater definition.

Objectives:

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

Methods: All phases of this study shall be conducted in close collaboration with the 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 2009

ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2010

Region: Alaska

Planning Area(s): Beaufort Sea, Chukchi Sea

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

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

MMS Contact: Chief, Alaska Environmental Studies Section

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

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

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

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

Methods:

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

Revised Date: August 2009

ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2010

Region: Alaska

Planning Area(s): Beaufort Sea

Title: Subsistence Mapping at Nuiqsut, Kaktovik, Barrow, and Wainwright: Past and Present Comparison (AK-02-07)

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

MMS Contact: Chief, Alaska Environmental Studies Section

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 EISs 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 2009

ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2010

Region: Alaska

Planning Area(s): All Alaska Planning Areas

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

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 EISs for predicting and mitigating social effects potentially resulting from major oil spills and resulting oil-spill litigation. This information will be used for NEPA analysis and documentation for Beaufort Sea Lease Sales, Cook Inlet Lease Sales, Chukchi/Hope Basin Lease Sales, and DPPs.

Total Cost: $252,000 **Period of Performance:** FY 2003-2008

Conducting Organization: Impact Assessment, Inc.

MMS Contact: Chief, Alaska Environmental Studies Section

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

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

Objectives: Analyses of data collected in spill-affected communities soon after the EVOS event report that existing social problems were heightened in relation to the influx of spill clean-up monies and resources, particularly in rural-Native communities where access to

subsistence resources was limited. Subsequent analyses suggest that larger communities have benefited from opportunities such as eco-tourism that were not extant before the spill. It may be hypothesized that spill clean-up and restoration monies and resources served to amplify social, demographic, and economic trends and attributes of the awardees in all cases at individual, familial, and community levels of analysis. The objective of this study is to test this hypothesis given potential future influx of monies and resources via final litigation settlement.

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

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

Revised Date: August 2009

ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2010

Region: Alaska

Planning Area(s): Chukchi Sea

Title: Traditional Knowledge Regarding Bowhead Whales in the Chukchi Sea (AK-93-48-68)

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 EISs, EAs, 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 2007-2009

Conducting Organization: CMI, UAF

MMS Contact: Chief, Alaska Environmental Studies Section

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 AEWC 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 2009

ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2010

Region: Alaska

Planning Area(s): All Alaska Planning Areas

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

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: $800,000 plus Joint Funding **Period of Performance:** FY 2008-2013

Conducting Organization: CMI, UAF

MMS Contact: Chief, Alaska Environmental Studies Section

Description:

Background: This study provides management of a large ongoing program of scientific research into framework issues related to 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 2009

ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2010

Region: Alaska

Planning Area(s): All Alaska Planning Areas

Title: Management, Logistics, and Warehouse Storage of Oceanographic Equipment (AK-07-02)

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.

MMS Contact: Chief, Alaska Environmental Studies Section

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 supports 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 2009

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ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2010

Region: Alaska

Planning Area(s): All Alaska Planning Areas

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

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 2008-2013

Conducting Organization: BGES, Inc.

MMS Contact: Chief, Alaska Environmental Studies Section

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

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

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

Revised Date: August 2009

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ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2010

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

MMS Contact: Chief, Alaska Environmental Studies Section

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

Over 500 people attended the most recent symposium, and many organizations pitched in to make it a success. The 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 comingle 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 with 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 2009

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, USDOI

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.

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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 2009

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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: $1,200,367 (MMS Share 32%) **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 2009

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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 2009

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2.2 Profiles of Studies Proposed for FY 2010 NSL

Table 1 Alaska OCS Region Studies Proposed for the FY 2010 NSL*

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

Page No.	Discipline	Title
151	MM	Bowhead Whale Feeding Variability in the Western Alaskan Beaufort Sea: Satellite Tracking of Bowhead Whales (Extension)
153	MM	Bowhead Whale Feeding Variability in the Western Alaskan Beaufort Sea: Oceanography and Feeding (Extension)
155	IM	Alaska Marine Science Symposium
157	IM	Management, Logistics, and Warehouse Storage of Oceanographic Equipment
159	MM	COMIDA: Distribution and Relative Abundance of Marine Mammals: Aerial Surveys (Extension)
161	HE	Beaufort Sea Marine Fish Monitoring Survey in the Central Beaufort Sea
163	PO	Evaluation of the Use of Hindcast Model Data for OSRA in a Period of Rapidly Changing Conditions (Workshop)
165	HE	North Aleutian Basin Monitoring in Drilling Area (NABMIDA): Nearshore Benthic Biota Habitat Baseline & Community Based Long-Term Monitoring
167	HE	Joint Funding Opportunities in Existing Marine Fish Studies
169	HE	Seabird Distribution and Abundance in the Offshore Environment
171	SS	North Aleutian Basin Socio-economic Indicators
173	MM	Seasonal Habitat Use by Endangered Steller Sea Lions of the North Aleutian Basin Sale Area
175	MM	Occurrence and Distribution of Endangered Humpback and Fin Whales in the NAB Area
177	IM	Alaska State-Wide Oceans Research and Studies Project Browser Covering the Alaska Offshore and Coastal Areas

AQ = Air Quality	FE = Fates & Effects	MM = Marine Mammals and Protected Species
IM = Information Management	SS = Social Systems	
PO = Physical Oceanography	HE = Habitat & Ecology	REN = Renewable Energy

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ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2010

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 (Extension)

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

Cost Range: (in thousands) TBD **Period of Performance:** FY 2010-2012

Description:

Background: This study extends the existing bowhead whale feeding study AK-05-01 with two additional field seasons. The North Slope Borough (NSB) has stated that "it is critical that MMS continue ongoing long-term studies." The NMFS has also recommended that this project be strengthened by adding field seasons, emphasizing the importance of continued data collection for the purpose of informing management decisions.

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 in 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 MMS may use this information to evaluate potential effects of oil and gas-related activities on bowheads and their populations.

This study has progressed well with over 30 bowhead whales tagged in Alaska and Canada with assistance from Native whalers. Study results, methods and other description can be found on the Alaska Department of Fish and Game (ADF&G) website at: http://wildlife.alaska.gov/index.cfm?adfg=marinemammals.bowhead.

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 among whaling captains, Alaska Eskimo Whaling Commission (AEWC), NSB, ADF&G, NMFS, MMS and other interested parties to clarify roles in research 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 will 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. Draft and final technical reports will be produced.

Revised Date: August 2009

ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2010

Region: Alaska

Planning Area(s): Beaufort Sea, Chukchi Sea

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

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

Cost Range: (in thousands) TBD **Period of Performance:** FY 2010-2012

Description:

Background: This study extends the existing bowhead whale feeding study AK-05-01 with two additional field seasons. The North Slope Borough has stated that "it is critical that MMS continue ongoing long-term studies." The NMFS has also recommended that this project be strengthened by adding field seasons, emphasizing the importance of continued data collection for the purpose of informing management decisions.

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 extension, 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 in 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, MMS may use this information to evaluate potential effects of oil and gas-related activities on bowheads and their populations.

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

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

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

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

Revised Date: August 2009

ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2010

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 technical analysts 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.

Cost Range: (in thousands) TBD **Period of Performance:** FY 2010–2015

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 comingle 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 staff and marine and coastal scientists, and local communities to present their findings on the changing marine environment in Alaska. Provide monetary support for scientists from with 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 2009

ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2010

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

Cost Range: (in thousands) TBD **Period of Performance:** FY 2010-2012

Description:

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

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

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

Launch 1273 was commissioned in 1983. The 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 2009

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ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2010

Region: Alaska

Planning Area(s): Chukchi Sea

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

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 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.

Cost Range: (in thousands) TBD **Period of Performance:** FY 2012-2013

Description:

Background: This study extends the existing marine mammal aerial survey project AK-08-02 with two additional field seasons. 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.
- Acquire hangar space in Barrow, Alaska

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 MMS-sponsored surveys in the Chukchi Sea.

Revised Date: August 2009

ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2010

Region: Alaska

Planning Area(s): Beaufort Sea

Title: Beaufort Sea Marine Fish Monitoring Survey in the Central Beaufort Sea

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

Cost Range: (in thousands) TBD **Period of Performance:** FY 2010-2013

Description:

Background: Enhanced marine fish information is needed for Beaufort Sea NEPA analyses. Data at the most basic level—e.g., fish species presence/absence and distribution data—are not only spotty, but also outdated. Fish assemblages and populations in other marine ecosystems off Alaska have undergone observable regime-shifts in diversity and abundance over the last 20-30 years. While the same is likely true of the Beaufort Sea, it is unconfirmed because the scant distribution and abundance data available are pre-regime-shift. Furthermore, important marine mating, spawning, rearing, feeding, and migration habitats (pre or post regime-shift) is yet to be delineated. A baseline of fish species, distribution, relative abundance, and the locations of critical or sensitive life history stage habitats in this central lease area remains a very high-priority information need for NEPA analyses. The original central Beaufort target area remains the region of most intense industry interest and thus the region of greatest MMS information need.

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

The addition of bird and marine mammal observers and zooplankton sampling will provide transect data in offshore areas where data for those species is as sparse as for fish species. The contemporaneous collection will also enable first-time correlations between fish, zooplankton, birds and marine mammal species in this area.

Objectives:

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

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

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

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

Revised Date: August 2009

ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2010

Region: Alaska

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

Title: Evaluation of the Use of Hindcast Model Data for OSRA in a Period of Rapidly Changing Conditions (Workshop)

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

Cost Range: (in thousands) TBD **Period of Performance:** FY 2010

Description:

Background: The pace at which conditions are changing and sea ice is being lost in the Arctic raises several questions, including: How might the ocean circulation be changing? Do the hindcasts continue to adequately represent current patterns in the region? Does MMS need to switch to a 20-40 year forecast-modeling mode? Oceanic current patterns in the Arctic, especially in nearshore regions, are strongly influenced by climatological factors such as winds, river runoff and sea ice coverage. The rapid changes in each of these factors that are now occurring could lead to drastic alterations of the surface current fields. Most datasets of modeled surface currents now used in OSRA are more than 10 years old—pre-dating the period of most rapid change.

Objectives:

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

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

Revised Date: August 2009

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ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2010

Region: Alaska

Planning Area(s): North Aleutian Basin

Title: North Aleutian Basin Monitoring in Drilling Area (NABMIDA): Nearshore Benthic Biota Habitat Baseline & Community Based Long-Term Monitoring

MMS Information Need(s) to be Addressed: This study will address key environmental assessments of the North Aleutian Basin (NAB) needed for Lease Sale 214 (proposed for 2011) in response to local stakeholder input and public comment during scoping meetings. The results will contribute information useful for developing ongoing monitoring of hydrocarbons to reduce potential impacts from proposed oil and gas exploration and development on nearshore benthic environments. The information from this study will be used for NEPA analysis and documentation for the NAB prior to gas exploration and development in that region.

Cost Range: (in thousands) TBD **Period of Performance:** FY 2010-2012

Description:

Background: The NAB planning area includes more than 2,412 kilometers of shoreline with diverse, abundant, and environmentally sensitive resources. Communities along the Alaska Peninsula and other areas near the proposed lease area rely on its natural resources (e.g., commercial and subsistence fish and shellfish species) for their sustenance and livelihood. Local communities use nearshore and intertidal resources including chitons, clams, squid, and octopus as a part of their subsistence food gathering. Due to the large commercial fisheries in the area, much of the offshore southeast Bering Sea has assessments for marine fish distribution and abundance information, but similar information is lacking for shallow nearshore waters along most of the Alaska Peninsula. The EVOS studies have demonstrated that oil impacts are greatest in the nearshore zone and that oil persists in this zone for decades. Nearshore waters between 5m-20m are some of most productive habitats in Alaska and many commercial species use nearshore habitats at some point in their life cycle.

This study provides a nearshore assessment to quantify abundance and diversity of key species (including chitons, clams, squid, forage fish, and octopus) in known subsistence areas. Physical habitat characteristics of these nearshore subsistence areas will be identified and compared to similar habitats identified using the ShoreZone mapping database. Sites within subsistence areas and additional locations within the lease area, identified through ShoreZone, will be sampled to determine if there is low-level PAH (polycyclic aromatic hydrocarbon) contamination and identify potential sources. Samples will utilize consistent techniques established for continued oil monitoring. The study will also develop the locations and protocol for a regional program to monitor for oil in the environment that could impact subsistence resources following a successful North Aleutian Oil and Gas Lease Sale. A

subsequent follow-up study would expand benthic monitoring to the leased area and enact a more expansive quantification of benthic biota and sediment chemicals of concern, hydrocarbons and EPA priority metals.

Objectives: The study will provide information on nearshore benthic biota of concern to assess potential impacts of oil and gas exploration and development. Results will provide abundance and distribution data for key species that will be useful for sale or exploration analysis. Hydrocarbon sampling will provide a baseline to help identify the PAH loads and sources to analyze potential spill events in areas where subsistence use is significant. These goals will be accomplished with the following tasks:

- Identify subsistence use locations for key benthic biota through stakeholders.
- Complete mapping from video imagery following ShoreZone protocol to provide a comprehensive region-wide database of nearshore habitat and physical habitats.
- Describe the physical environment in the nearshore areas of the NAB planning area.
- Conduct a nearshore boat survey to sample herring (and other forage fish), acoustics, and other biological and oceanographic information (plankton, CTD).
- Conduct nearshore beach seine surveys in shallow water (<5m deep).
- Evaluate status of hydrocarbon contamination in the nearshore areas.
- Document locations and map abundance, distribution and health of common subsistence species including chitons, clams, and octopus in nearshore habitats.
- Describe dominant infauna and epifauna communities and habitats that are ideal for subsistence use in northern and southern areas of the NAB.
- Develop a monitoring program with local communities.
- Use habitat and species distribution data, as well as spatial and temporal comparisons, to build predictive models of habitat selection and utilization by species.

Methods: Sampling for benthic infauna and epifauna will occur in nearshore areas within a subset of the NAB Planning Area from the shoreline to 20 meters in depth and will cover a variety of habitat types (e.g., sand/gravel beaches, eelgrass). Sampling locations will include subsistence areas as well as high use areas at each general location. A grid of transects will cover a range of depths, with replicate samples. Similar transects will collect nearshore fishes in spring, summer, and fall with a variety of gear types (e.g., beach seine, small boat trawling, purse seine, jigging, or ROV). All species will be identified and counted, and a subsample of individuals will be catalogued for voucher specimens and biological tissue samples.

Nearshore sediments will be collected and analyzed for hydrocarbons following established protocols used in other areas of Alaska. The ShoreZone coastal habitat mapping will also be used to map the 2,412 kilometers of shoreline imagery collected in Bristol Bay. At each site, habitat characteristics following ShoreZone database fields will be documented to build predictive models of habitat selection and utilization by fishes other key benthic biota.

To be consistent for a longer term monitoring program, passive hydrocarbon samplers (low-density polyethylene) will be deployed monthly at several sites near the villages of False Pass, Nelson Lagoon, Port Moller, and Port Heiden and other areas of the Aleutians East Borough.

Revised Date: August 2009

ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2010

Region: Alaska

Planning Area(s): Beaufort Sea, Chukchi Sea

Title: Joint Funding Opportunities in Existing Marine Fish Studies

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

Cost Range: (in thousands) TBD **Period of Performance:** FY 2010-2012

Description:

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

Additional baseline data for fish species in the Chukchi and Beaufort Seas will help explain effects of climate change. Such information will help to distinguish between anthropogenic and natural effects of change without a basis of comparison. Thus it is important to assess the distribution and abundance of fishes in the Chukchi Sea prior to oil exploration, and oil extraction in the Beaufort. Current research focuses on current and historic distribution and ecology of demersal fishes in the Chukchi Sea Lease Area for small bottom fishes. Those collections enhance the NOAA-funded joint US-Russian RUSALCA program that collects fishes further north, south, and west. However, sampling of fishes in Lease Sale 193, especially in the vicinity of the leases, is lacking. Additionally opportunistic sampling within

the Beaufort Sea areas is also needed. There remains a paucity of data for demersal fishes in these areas and information for pelagic fishes is lacking entirely. Filling these needs will be valuable for addressing impacts from oil and gas exploration.

Objectives:

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

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

Revised Date: August 2009

ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2010

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

Cost Range: (in thousands) TBD **Period of Performance:** FY 2010-2013

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 survey data, but most of these data were collected in the 1970s-80s. Since then, many seabird species have declined and changes have occurred in ocean ecosystems. These changes may have affected the foraging patterns of seabirds. Further changes due to predicted Arctic climate change are anticipated. To address these needs, this project will build off of a recently established at-sea survey program, to collect distribution data on seabirds via partnership and collaboration among the USFWS, NOAA-Fisheries and other vessel-based programs.

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

The results of this study will complement recent and on-going surveys of marine birds which are partially funded by the North Pacific Research Board (NPRB) and the USFWS. In 2006-2007, NPRB project placed 637 seabird observers on NOAA and NSF-funded vessel-based projects. During those two years, USFWS seabird observers joined 27 cruises and surveyed in excess of 42,000 km. Data on more than 547,000 birds were added to the NPPSD. However, only two of those cruises covered waters in the Chukchi or NAB areas. The at-sea survey program recently received additional funding from NPRB for 2008-2011, as part of the Bering Sea Ecosystem Integrated Research Program. Again, the funded surveys do not adequately provide coverage of the Chukchi or 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 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 2009

ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2010

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.

Cost Range: (in thousands) TBD **Period of Performance:** FY 2010–2012

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 NAB lease sale area. Any former socioeconomic study of the area was performed over 20 years ago and is obsolete because the dynamics of the economy for the entire region has changed. 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 participants identified information needs and priorities in the NAB Planning Area for future Environmental Impact Statements, analysis of potential mitigation of impacts, and post-sale needs, such as NEPA reviews of exploration or development plans. This social indicator study has been identified by the Alaska OCS Region as meeting a highly time-sensitive information need. There is no overlap between this work and the BEST-BSIERP study funded by the NSF.

Objectives: The objective of this study is to identify and describe the socioeconomic characteristics of the communities in the North Aleutian Basin through accomplishing the following categories of analysis:

- 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 likely to accompany oil and gas exploration and development.
- Identify regional socio-economic aspirations and values.

Methods: This study will conduct community consultations in all targeted locations to ensure local interest in study participation. The contractor will 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 will 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. The contractor will compile data and identify any key types of information that are unavailable from existing data sources. The study will involve conducting focus groups for qualitative data collection and, as possible, obtain data unavailable from existing sources. The study will also entail conducting basic data analysis (baseline description) and prepare a report describing the socio-economic characteristics of the area. Finally, it an important element will be to conduct community consultations to present data analysis and baseline description to the communities for their review and comments.

Revised Date: August 2009

ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2010

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 an Alaska 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 beneficial for ensuring 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.

Cost Range: (in thousands) TBD **Period of Performance:** FY 2010–2013

Description:

Background: The North Aleutian Basin Sale Area includes habitat used by the endangered western stock of Steller sea lions. However, research is needed on 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 beneficial for ensuring an enhanced NEPA analysis. 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:

- Estimate seasonal distribution of Steller sea lions in the Sale Area. Evaluate 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 near 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). Draft and final technical reports will be produced.

Revised Date: August 2009

ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2010

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: The humpback whale (*Megaptera novaeangliae*) and the fin whale (*Balaenoptera physalus*) are known to occur in the North Aleutian Basin lease-sale area. Both species are listed as endangered, and both are known to feed in areas within or adjacent to the NAB lease sale area. Information from this study will be used to support NEPA and ESA-related analyses for Lease Sale 214. 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.

Cost Range: (in thousands) TBD **Period of Performance:** FY 2010-2012

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.

Some basic humpback and fin whale information will be collected during the course of the NMML study of the North Pacific right whale (MMS study number AK-05-x13). 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. Royal Dutch Shell, Incorporated, is not conducting research on these, or any other whale species, in this area.

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. Project description and methods for the supporting, concurrent study on right whales (AK-05-x13) can be found at the NMML websites:
http://www.afsc.noaa.gov/nmml/cetacean/research/caepresearch.php?url=nmmlcaep0808 and
http://www.afsc.noaa.gov/Quarterly/jas2008/divrptsNMML3.htm.

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ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2010

Region: Alaska

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

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

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 Analysis Section (EAS), 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 EISs, EAs and commenting on exploration and development plans for the OCS.

Cost Range: (in thousands) TBD **Period of Performance:** FY 2010-2013

Description:

Background: MMS places the digital copies of their final study reports online, but it's difficult to quickly access the study boundary, data collection efforts, or conclusions from multiple study efforts, without expending significant personal time and effort. In addition, it is a challenge for internal MMS staff to remain current with all research in the OCS due to the quantity of government and industry activities conducted within these areas. The Minerals Management Service (MMS) as well as other agencies (NPRB, AOOS, UAF, University of Alaska-Anchorage, USFWS, USGS-Alaska Science Center, NOAA, National Park Service, BLM, Alaska Department of Natural Resources, ADEC, Alaska Department of Transportation, ADF&G, Barrow Arctic Science Consortium, etc.) have identified a statewide need for a centralized database of past, present and future projects and associated observations and observing plans. Representatives from these agencies held a Data Integration Meeting in August of 2008 to plan how to integrate studies projects from these agencies into one unified project browser. A technical steering committee was formed among the participants. The technical steering committee succeeded in establishing the fields necessary to integrate the agency project information. A computer form has been developed by AOOS to input the project information from multiple agencies. The NPRB started the project browser several years ago with a focus on NPRB projects. In fiscal year 2007, NPRB tasked AOOS to build a project database that will initially include NPRB and AOOS projects. The 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. As a secondary focus, MMS will support the integration of other agency and industry data for this browser.

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. AOOS has agreed to provide a form which will be used by MMS staff to input MMS studies data and report information that can be easily incorporated into the AOOS project browser. The information will be made available for public access through the AOOS web site.

Objectives: Provide funding support to AOOS to coordinate and integrate ocean research project information from MMS, other agencies, and industry in the development a web-based online visual Geographic Information System (GIS) project browser that will meet MMS needs for the Alaska Outer Continental Shelf (OCS).

Methods: Under phase I, MMS will provide their project information from ongoing MMS studies to the Alaska Ocean Observing System (AOOS) through a standardized input form developed by AOOS. AOOS will incorporate the project information into a WEB based mapping system, incorporating spatially referenced study boundaries, project objectives, and other pertinent information. AOOS will make the project browser and database available on the web. The MMS project funds will be provided to AOOS so that they can develop and maintain the web site and browser and integrate MMS data and summary information with other similar industry and agency information. Within phase II, MMS will continue to 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. 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.

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2.3 Profiles of Studies Proposed for FY 2011 NSL

Table 2 Alaska OCS Region Studies Proposed for the Fiscal Year 2011 NSL*

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

Page No.	Discipline	Title
181	HE	cANIMIDA Monitoring of Boulder Patch Kelp During Liberty Development
183	SS	Baseline Nutritional Survey: Inventory and Content Analysis of Subsistence and Market Foods as Consumed by North Slope Communities
185	HE	Current Distribution of Pelagic Fish, Demersal Fish, and Invertebrate Communities in the Chukchi Sea Lease Area
187	MM	Use of the Chukchi, Beaufort and Bering Seas by Endangered Humpback and Fin Whales
189	HE	Field Experiments of Seismic Effects on Arctic Fish and Field Measurements of Seismic Acoustic Characteristics
191	PO	A Comparison of Modern and Historical Ice Gouge Characteristics and Recurrence Rates in the Alaskan Chukchi Sea
193	PO	High-Resolution Digital Elevation Model for the Greater Alaskan Waters
195	SS	Report of Multivariate Statistical Analysis from Beaufort Sea Community Data
197	REN	Renewable Energy Potential in Coastal Alaska

AQ = Air Quality	FE = Fates & Effects	MM = Marine Mammals and Protected Species
IM = Information Management	SS = Social Systems	
PO = Physical Oceanography	HE = Habitat & Ecology	REN = Renewable Energy

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ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2010

Region: Alaska

Planning Area(s): Beaufort Sea

Title: cANIMIDA Monitoring of Boulder Patch Kelp During Liberty Development

MMS Information Need(s) to be Addressed: The Boulder Patch is the northern-most kelp community in the western Arctic. Monitoring would focus upon protecting the continued health of the nearby Boulder Patch during development and possibly into initial production of the Liberty prospect.

Cost Range: (in thousands) TBD **Period of Performance:** FY 2011-2015

Description:

Background: MMS has approved a development plan for the Liberty prospect that would use directional drilling from an enlarged Satellite Drilling Island (SDI) at the east end of the Endicott Causeway. The rate of coastal erosion in the coastal Beaufort Sea is predicted to continue to increase with decreases in the summer ice cover. There has been documented increase in the coastal erosion rate along the Beaufort coast over the last half century, attributed in the literature to a combination of increased temperature, increased fetch as summer ice cover decreases, and increased storminess. A continued Boulder Patch monitoring would help distinguish the past natural rate of kelp growth with the rate with projected increases in coastal erosion, and any effect from the expansion of to the Satellite Drilling Island (SDI) at the east end of the Endicott Causeway.

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. 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.

MMS and industry studies in over thirty years of monitoring have demonstrated that the kelp are extremely vulnerable to any increase in background suspended sediment levels. Kelp production in a summer can be measured by the following winter's linear growth. The low in situ light levels in the Boulder Patch limit kelp production and there is high interannual variability of light as function of varying storminess and resultant resuspended sediment levels.

The ANIMIDA and cANIMIDA projects in 2000-2007 demonstrated elevated suspended sediment levels near the existing Endicott Causeway, including the SDI. This appears 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. The ANIMIDA project also demonstrated the effect of wind in resuspending sediments and in maintaining elevated suspended sediments levels in the water column. Water column photosynthetically active light levels were found to be directly proportionate to both turbidly and suspended sediment levels. Kelp production in turn could be quantitatively estimated from the modeled relationship between light level and kelp growth.

Objectives: The objective of this study is evaluate the impact from additional activities at the Liberty prospect on the Boulder Patch kelp community.

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

Revised Date: August 2009

ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2010

Region: Alaska

Planning Area(s): Beaufort Sea, Chukchi Sea

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

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

Cost Range: (in thousands) TBD **Period of Performance:** FY 2011-2012

Description:

Background: Many previous MMS studies have documented various aspects of Native subsistence production, distribution, and consumption in coastal Alaskan communities over the last three decades. However, research has not yet analyzed the nutritional composition of representative dietary patterns for various resident groups on the North Slope. This study will involve a nutritional survey and analysis of subsistence and market foods as actually consumed, using standard methods of nutritional epidemiology to characterize the mixed and changing nutritional system of three villages, preferably Wainwright, Point Lay, and Kaktovik. Key sampling variables for each community would likely include ethnicity, gender, age group, and lifestyle attributes, especially level of subsistence effort.

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

The study is envisioned as a collaborative, inter-agency effort, with the State of Alaska Department of Health and Human Services assuming the lead role with assistance from MMS. Other cooperative funding institutions may include NSSI, BLM, USFWS, the U.S. Department of Agriculture, and/or the State of Alaska, and private industry.

Objectives:
This study will investigate if any emergent pathologies are attributable to incremental subsistence sector disruptions that may be reasonably associated with oil and gas activities to assess if there is a direct or indirect causal relationship between oil and gas activities and food choices through examining the following:

- Improve understanding of contemporary patterns of food consumption within each sampled community
- Analyze representative food consumption patterns and portions for nutritional value and potential contaminants
- Estimate the percentage and dosage of food energy derived from subsistence and market sources for sampled subgroups in each community.
- Link nutritional data to existing subsistence surveys and sharing network studies to enhance analysis of potential health impacts from oil and gas development

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

Revised Date: August 2009

ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2010

Region: Alaska

Planning Area(s): Chukchi Sea

Title: Current Distribution of Pelagic Fish, Demersal Fish, and Invertebrate Communities in the Chukchi Sea Lease Area

MMS Information Need(s) to be addressed: This study will provide a baseline for fish and invertebrates to use in evaluating natural and anthropogenic changes through a comprehensive assessment of pelagic fishes combined with a series of bottom trawls to document demersal fish and invertebrates in the Chukchi Sea lease area post lease sale 193. This study will provide new information on the abundance and distribution of pelagic and demersal fish and invertebrate communities that is needed to evaluate and mitigate the effects of offshore oil and gas development.

Cost Range: (in thousands) TBD **Period of Performance:** FY 2011-2013

Description:

Background: This study proposes to develop a comprehensive understanding of fish and invertebrate communities over the offshore lease area by concurrent sampling of the pelagic and demersal fish, as well as invertebrate assemblages. Fisheries information is needed from the Chukchi Sea lease sale area. Interim results from a current MMS funded CMI project, 'Current and Historic Distribution and Ecology of Demersal Fish in the Chukchi Sea Planning Area,' have identified temporal, seasonal, and spatial gaps in data on fish in the Chukchi Sea in particular to sampling on or near the lease areas. This proposal was designed specifically to fill these information needs.

The Alaska OCS Region identified a need for continued fish and invertebrate baseline monitoring during the 2007 MMS-sponsored "Chukchi Sea Information Status and Research Planning Meeting" to provide useful information to upcoming NEPA reviews and post sale needs. The recent surge in interest in Arctic oil leases combined with climatic changes has elevated this information need. Data from this study will provide key abundance and distribution information for NEPA analysis (e.g. writing existing environment and environmental consequences sections, and environmental resource areas for subsequent OSRA analysis) on fish and invertebrate species.

In the well-studied Bering Sea, it is apparent that the distribution and community composition of fish has changed in recent decades and many species are shifting their distributions northward. A MMS funded NOAA Beaufort Sea fish survey in 2008 indicated presence of walleye Pollock and dense aggregations of snow crab in the western Beaufort Sea. These species are likely to be present in the adjacent Chukchi Sea also, and this study will increase information for a post-sale lease area (Sale 193) and provide a baseline for further studies linking species distributions between the Bering and Beaufort Seas.

The demersal fish and invertebrate community of the Chukchi Sea is thought to be less dense and diverse than in the Bering Sea and the area does not support major commercial fisheries, but it is critical to the existence of many species of marine mammals and birds, and locally important to coastal native villages. Although the Chukchi has historically been considered a benthic dominated system, the data that are available indicate that there is a large biomass of pelagic fish in the area that has not been adequately sampled. This pelagic fish community seems to be dominated by forage fish, including Arctic cod, sand lance and capelin. These species serve as an important mechanism of energy transfer to top predators such as birds, ice-dependent seals, and cetaceans.

Objectives: To document, characterize and understand the distribution of pelagic and demersal fish and invertebrate communities in Chukchi Sea lease 193. Specifically, the investigators will:

- Estimate the pelagic fish and invertebrate biomass in the lease area.
- Document species presence, abundance, distribution, and diversity to document geographic range of fishes and invertebrates.
- Describe physical and oceanographic feature (water mass) characteristics of pelagic and demersal fish habitat.
- Evaluate the similarity or variations between samples with those of the historic collections and ongoing synthesis of fishes in the Chukchi Sea.
- Provide a basis for monitoring of fishes in the Chukchi Sea following oil and gas exploration and development.
- Describe large scale spatial trends in species composition, abundance and distribution by comparing the data from the Chukchi Survey to that from the Bering Sea survey and the recently completed Beaufort Sea Survey.
- Provide GIS based maps and attribute tables of forage fish for Oil-Spill-Risk Analysis and impact monitoring.

Methods: A comprehensive acoustic survey of Chukchi Sea lease 193 area will be conducted using a chartered commercial fishing vessel. The abundance of pelagic fish, jellyfish, and large zooplankton (e.g., euphausiids) will be estimated with a multi-frequency echo-sounder and ground-truthed using a large pelagic trawl and a smaller frame trawl. The results will be directly comparable to pelagic surveys conducted by NOAA's Alaska Fisheries Science Center on the eastern Bering Sea shelf, which will allow them to be placed into a broader latitudinal context. A series of coordinated bottom trawls would use the same survey methodology as that used by the annual Bering Sea surveys conducted by the Alaska Fisheries Science Center, 1990/1991 Chukchi Sea Survey, and the 2008 Beaufort Sea survey. The demersal portion of the work will extend the time series (2004, 2007, 2008) and build upon early surveys (1990, 1991) of demersal fish and invertebrate communities. To interpret the distribution of fishes and their importance as prey, water column properties (temperature, salinity, light level, chlorophyll fluorescence) will be measured at all trawl stations.

Revised Date: August 2009

ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2010

Region: Alaska

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

Title: Use of the Chukchi, Beaufort and Bering Seas by Endangered Humpback and Fin Whales

MMS Information Need(s) to be Addressed: At least nine species of cetaceans are known to occur in the North Aleutian Basin (NAB) 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. In addition, recent sightings of both humpback and fin whales further north, including in the Chukchi and/or Beaufort Seas, indicate a possible range expansion by one or both species. Under the National Environmental Policy Act (NEPA), and under the ESA, MMS will 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 areas concerned may play an important role in determining where and when exploration or access to petroleum reserves may be conducted.

Cost Range: (in thousands) TBD **Period of Performance:** FY 2011-2015

Description:

Background: In recent years, humpback whales have been observed in the Chukchi and Beaufort Seas, and fin whales have been sighted in the former area. Given the retreat of sea ice and the known high-latitude range of these species in other oceans, it is possible that the recent sightings represent a climate-related range expansion that will continue in future years. The extent to which this is occurring, and therefore the potential impact of resource extraction activities on these species in the Chukchi and Beaufort, is currently unknown. Nothing is known about the population identity of the animals observed there. In the case of the humpback whales, it is possible that they are part of the small western North Pacific stock.

Humpback and fin whales both feed in the Bering Sea, NAB and adjacent areas. The population identity of humpback whales that frequent this region was recently studied using photo-identification; analyses from these efforts are currently underway. However, while longer-distance migratory matches have been made for some humpback whales, little is known about the temporal and spatial patterns of their use of those regions, or their use of

specific areas for feeding or other biologically significant behaviors. Virtually nothing is known about the extent to which those regions are important for fin whales.

Because some basic humpback and fin whale information will be collected in the southeastern Bering Sea during the course of the study of the North Pacific right whale, some of the objectives of the work proposed here will be designed to complement data that will be collected during aerial surveys and passive acoustic monitoring that will occur during that ongoing study. Additional work to investigate the occurrence of these two species in the Chukchi Sea is also required, specifically acoustic and survey effort to study the occurrence, movements and population identity of large whales in the region.

Objectives:

- Estimate spatial and temporal patterns of use of the Chukchi and Bering Seas by endangered fin and humpback whales.
- Assess population structure and origin of animals in both regions.

Methods:

Bering Sea/North Aleutian Basin. Satellite tags will be attached to humpback and fin whales, and their movements monitored through the Argos system. No fin whales have ever been satellite tagged in this region. Up to 30 tags for both species (total, including in the Chukchi Sea) would be deployed for each of three years. Population structure and origin will be assessed by genetic analysis of biopsy samples.

Chukchi Sea/Bering Strait. In the Chukchi Sea, arrays of listening devices will be deployed in the Bering Strait and near Wainwright, Alaska, with the intention of monitoring the occurrence and movements of large whales transiting through the area. The study proposed here will also permit a full visual and acoustic survey to be conducted between Dutch Harbor and the Bering Strait/Wainwright. In addition, photo-id, biopsy sampling and satellite tagging will be attempted if humpback and fin whales are found en route. If significant numbers of humpback or fin whales are found in waters north of the Bering Strait, cruises will be organized to extend similar research activities to those areas during years 3-4 of the study.

In both areas, analysis of acoustic data from new and existing recording packages will investigate the occurrence of humpback and fin whales on a year-round basis. Draft and final technical reports will be produced.

Revised Date: August 2009

ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2010

Region: Alaska

Planning Area(s): Beaufort Sea, Chukchi Sea

Title: Field Experiments of Seismic Effects on Arctic Fish and Field Measurements of Seismic Acoustic Characteristics

MMS Information Need(s) to be Addressed: Concerns about seismic exploration effects on fish are increasing. This study will provide new and region-specific information for NEPA analysts who need to assess potential effects of seismic activity on fisheries and the ecosystem functions of the affected fish resources. The information is needed to address this issue for the region's fish species.

Cost Range: (in thousands) TBD **Period of Performance:** FY 2011–2013

Description:

Background:

Effects of seismic exploration activity on fish are still highly debated and it is recognized that effects vary with the species, life stage and environment of the fish. Seismic exploration and its effects on fish is becoming a high-priority issue for arctic residents who increasingly demand studies on local species.

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 damage to fish sensory organs. Preliminary research by Fisheries and Oceans Canada has shown ovary and liver damage in snow crab in both lab experiments and in in-situ with caged animals held in a seismic testing area of low-level seismic energy (132 hours of survey time, low-volume 1,310 in^3 air-gun array). Effects included ovary hemorrhaging, oocyte dilation, abnormal hepatopancreas cellular structure, delayed embryo development and smaller larvae with differing body proportions. Some problems persisted for at least five months. Interruptions in the reproductive biology can impart especially long term effects on a population.

An overview of seismic literature shows varying results between regions and species. A better understanding of how the region's important species respond to seismic activity, as well as the timing, magnitude, proximity, and duration of seismic activity levels is required in order to evaluate the potential for both effects on fish and for potential mitigation. More information regarding effects of seismic activity on the health, behavior, distribution, and migration of the numerous important fish species of the Beaufort and Chukchi Seas is becoming ever more needed for NEPA analyses.

The physics of acoustic propagation and transmission loss and how they vary with substrate, water depth, water chemistry and water density in the marine environment is not well enough

understood to develop forecasting models. Measurements of the actual seismic acoustic variations in a specific environment will increase fundamental understanding of seismic noise propagation that will contribute to possible future models.

Objectives:

- Coordinate between MMS and industry operators to prepare appropriate field tests.
- Define and measure acoustic propagation levels and transmission loss level in specific marine environments.
- Evaluate effects of seismic sound waves on important Arctic fish and shellfish species through field experiments during industry seismic operations.

Methods: Successful field tests will require advance preparation and planning for the next permitted arctic seismic operation. Planning for the field study will be coordinated by MMS management as a part of permitting.

Acoustic measurements will consist of actual measurement in known development areas to assess propagation levels and transmission loss in those specific marine environments. Relevant physical and oceanographic parameters will be measured to further understand acoustic conditions. Measurements will provide estimates of acoustic travel paths and spatial extend of sound sources and levels during periods of both ambient conditions and during seismic firing. Draft and final technical reports will be produced.

Effects of the seismic energy on fish species will be assessed by conducting in-situ tests of seismic effects on tagged or captive adults, juveniles, and eggs/larvae of important fish and shellfish species in the path of seismic exploration vessels and in control areas. Fish and shellfish would be tagged or pre-located in pens in the expected seismic pathway. Immediate effects would be assessed both behaviorally and through dissection immediately following the seismic operations. Animals would also be held in the lab for assessment at 1 month, 6 months, and 12 months after exposure to seismic activity. Relationships to possible fishery, population, and ecosystem effects will be explored. Species selected for the field test will represent a range of sensory organs, species closely related to those tested in other regions, species inhabiting various portions of the water column, and species considered particularly vulnerable to seismic waves.

Fish surveys before, during and after seismic exploration activities will evaluate the distance and duration of displacement of fish.

Revised Date: August 2009

ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2010

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-seabed pipelines may be buried or lie at the surface. This information will be of use to evaluate any Development Production Plans that propose to use sub-seabed 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.

Cost Range: (in thousands) TBD **Period of Performance:** FY 2011-2014

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 is 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. Chukchi site surveys located ice gouges in water depths between 30 and 45 meters. The Burger, Crackerjack, and Popcorn surveys had the highest density of gouging. 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 very important 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.

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, multibeam bathymetry, and precision GPS (global positioning system) navigation. Ice gouge, bathymetry, and bottom sediment type along with any other features found from the survey efforts will be incorporated into a geospatial database. The original site-specific survey analog records will scanned, georeferenced, and compared to the new survey 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 2009

ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2010

Region: Alaska

Planning Area(s): All planning areas with particular focus on the Chukchi Sea and North Aleutian Basin

Title: High-Resolution Digital Elevation Model for the Greater Alaskan Waters

MMS Information Need(s) to be Addressed: MMS has funded many oceanic numerical model simulations (e.g., Curchitser and Hedstrom; Maslowski; Wang) used in NEPA analyses. The foundations of these simulations are all based upon bathymetric digital elevation models (DEMs) that represent the ocean floor topography. Through the continuity equation, a numerical model's DEM is intimately connected with the simulation of surface currents and sea surface elevation. Construction of a more accurate and higher resolution DEM will enable more accurate simulations.

Cost Range: (in thousands) TBD **Period of Performance:** FY 2011-2012

Description:

Background: There exist only three modern, publicly available large-scale DEMs that cover significant portions of the greater Alaskan waters, and all three have horizontal resolution of 1 minute (~2 km): the International Bathymetric Chart of the Arctic Ocean (IBCAO); the General Bathymetric Chart of the Oceans (GEBCO); and the Smith-Sandwell satellite gravimetrics derived DEM. The Smith-Sandwell grid does not well represent the bathymetry over broad shallow shelves such as found in the Bering and Chukchi seas: the gravimetric anomalies result in an overly "rough" bathymetry. The GEBCO grid suffers from being too "smooth" – canyon bottoms are too shallow and banks are too deep. Both the IBCAO and GEBCO grids suffer from having incorporated digitized contours from nautical charts. These contours lead to a "terracing" effect in the DEMs that assigns too much ocean area to each of the contour levels. These problems are all well known and documented in the greater literature base (e.g., Marks, K.M. & W.H.F. Smith, 2006)

Over the course of 2008-2009 researchers at UAF have assembled what they believe to be one of the most complete sets of publicly available bathymetric soundings for the greater Alaskan region and have also attained access to some proprietary soundings. They have created a high resolution (1-km) gridded DEM derived from these soundings. They have excluded the use of digitized contours in order to avoid the terracing effect. In Russian waters, where shipboard sounding data is sparse, they have undertaken the digitization of point soundings from Russian nautical charts. To date, nearly 150 charts have been digitized. Through partnership with Canadian colleagues they have received many soundings from the Canadian Hydrographic Service (CHS). Soundings in US waters come from the National Ocean Service hydrographic trackline database, NOAA Electronic Navigational Chart (ENC) point

soundings, other various US trackline and multibeam data archives and miscellaneous research cruises conducted by UAF and other oceanographic institutions.

Oceanographic studies that seek to understand the marine environment require accurate depictions of the ocean's bathymetry. Because ocean circulation and the other components of the climate system do not recognize national boundaries, it is necessary to assemble datasets from beyond our national borders and integrate them into a coherent product. For example, the tidal amplitudes and tidal circulations in the North Aleutian Basin (NAB) region are both dependant upon the tide waves that propagate into the Bering Sea over Russian Exclusive Economic Zone (EEZ) waters and across the deep basin. The grid spans 130°E to 120°W and 45°N to 75°N. Two MMS workshops, Small-Scale Sea-Ice and Ocean Modeling (SIOM) in the Nearshore Beaufort and Chukchi Seas (MMS2003-043) and Physical Oceanography for the Beaufort Sea (MMS2003-045) have both identified need for better bathymetry data as high priority.

A number of ocean researchers have already adopted the new grid or requested it for use within their numerical models (Curchitser, Hedstrom and Maslowski, for example). The current version of the grid is publicly available for viewing and downloading at the Alaska Ocean Observing System (AOOS) web page (http://www.aoos.org) and at the DEM project web page (http://mather.sfos.uaf.edu/~seth/bathy/).

Objectives: To further improve the AOOS bathymetric DEM through 1) acquiring additional soundings, 2) processing soundings that have already been obtained but not yet incorporated into the DEM and 3) continued development of error-checking and gridding schemes.

Methods: This study will complete the digitization of Russian nautical chart point soundings, greatly improving the resolution in the Chukchi Sea and parts of the western Bering Sea. Additional in-hand sounding data that lie within the NAB planning region and over the greater Bering Sea shelf will be processed as well. These underway vessel trackline soundings are in a raw format taken directly from various vessel data acquisition systems; the total volume of data is over 300 MB compressed and represents many thousands of trackline kilometers. Also, the study will locate and obtain additional soundings, particularly soundings located within foreign oceanographic/hydrographic databases or private industry archives; improve the data quality control error-checking algorithm; and re-grid the entire dataset with the new soundings incorporated and with improved error-checking.

Revised Date: August 2009

ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2010

Region: Alaska

Planning Area(s): Beaufort Sea

Title: Report of Multivariate Statistical Analysis from Beaufort Sea Community Data

MMS Information Need(s) to be Addressed: Through multivariate analysis of existing social data sets, this study will foster improved information about Beaufort Sea communities to better address OCSLA requirements; assist in NEPA analysis and documentation for Lease Sales, EPs and DPPs; and prepare effective mitigation and monitoring measures. The study will strengthen MMS compliance with Executive Order 12898 on Environmental Justice and will facilitate MMS research coordination with other agencies.

Cost Range: (in thousands) TBD **Period of Performance:** FY 2011-2012

Description:

Background: Previous MMS social research has generated data sets that have residual value for further statistical analysis. For example, an early prominent data set was generated by Dr. Jack Kruse in the 1980s. Another prominent data set was produced for the study *Quantitative Description of Potential Impacts of OCS Activities on Bowhead Whale Hunting and Subsistence Activities in the Beaufort Sea* (MMS 2007-062). Through that project, household level data was obtained from random samples throughout Barrow, Nuiqsut, and Kaktovik.

The proposed new study effort will supplement analytical findings from previous data collection efforts, using existing data sets. The current information is insufficient, but allows for additional multivariate analysis. Specific data sets are as yet to be determined through the procurement process. This study will contribute to a better understanding of the social complexities in North Slope communities to help explore the strength of hypothetical correlations and to predict changes that may be reasonably associated with oil and gas activities.

Objectives: The objective is to analyze existing data sets to provide more in-depth information on Barrow, Nuiqsut, and Kaktovik households to gain better understanding through the following:

- Assess variability to survey response within the study population by residence, age, gender, ethnicity, and other demographic variables.
- Analyze differences between Beaufort Sea communities and explore correlations to test hypotheses.

- Conduct univariate and bivariate analysis to generate valid and reliable descriptive information for inclusion in summary tables and graphs, and to provide quantitative-oriented but readily understandable explanatory discussion in the draft and final report.
- Conduct multivariate analysis of relationships among key variables to predict relationships regarding oil and gas development.

Methods: This study will: 1) analyze existing datasets and develop themes within categories regarding existing socio-economic conditions; and 2) pursue multivariate statistical analysis techniques to examine the data for developing hypotheses about relationships among modernization, oil and gas development, participation in traditional institutions—especially whale hunting, and other socio-economic attributes. Final deliverables will include a report and technical summaries. Special care will be made to use graphics and charts to present findings and to explain the technical analyses to lay people. GIS mapping may be used to illustrate relationships among socioeconomic data and findings. All documents will be prepared for community-based understanding as well as for technical audiences.

Revised Date: August 2009

ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2010

Region: Alaska

Planning Area(s): All

Title: Renewable Energy Potential 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 2011-2013

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) identify synergies with other ongoing research on renewable energy research in coastal Alaska; 2) 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 3) 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 market analysis. 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. Conduct an analysis of economics of infrastructure/grid analysis. Conduct a stakeholder analysis with an eye toward identifying winners and losers. Produce a realistic development model and summary report to demonstrate lessons learned from the study.

Revised Date: August 2009

SECTION 3.0 TOPICAL AREAS FOR FY 2012

This section presents a general forecast of significant topical issues and concerns to be addressed by studies to be proposed for FY 2012 and beyond. In general, these topics conform with the research themes of the ESP. Due to the great differences existing between Alaskan environments and other OCS areas, the uniqueness of issues in Alaska has dictated the need to anticipate new topical areas for implementation within the Alaska ESP. These projects will focus on 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, as well as the release of the next five-year *Oil and Gas Leasing Program*.

Many of the studies proposed for FY 2010 and FY 2011 address the topical areas described below. These will be re-assessed as part of the FY 2011 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 (USDOI, 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. Many studies of other sensitive marine mammals, including North Pacific right whales, polar bears, pinnipeds and other marine mammals may continue into 2011 and beyond. Additional studies may be brought online which address fish and migratory waterfowl. Studies will include those aimed at determining spatial and temporal habitat use patterns, habitat description and monitoring and evaluations of health over time. Studies aimed at understanding potential impacts to subsistence species and subsistence practices will continue to be important. Additional studies of the physical environment, such as current regimes and ice characteristics, will be proposed to support interpretation of data from living resource investigations and to provide a better understanding of the fate and dispersion of OCS discharges.

3.1 Climate Change

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

Climate change will also lead to altered water chemistry. In particular, the average pH of the surface ocean is projected to decrease by as much as 0.5 pH units by 2100 due to the uptake

of excess carbon dioxide (Sigler et al., 2008). In addition, higher water temperatures can result in increased biological production and decomposition.

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

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

3.2 Physical Oceanography

An ongoing challenge in the Alaska OCS Region is the need for better, finer scale circulation and oil-spill models and higher resolution data. This need is underscored by the rapidly changing conditions in the Arctic. Development and application of state-of the-art circulation models is important for future OSRA-based EIS analyses. The MMS has recently partnered with NOPP and with Rutgers University to produce high-resolution circulation models covering Arctic OCS waters and the NAB Planning Area, respectively.

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

The accuracy of surface wind fields, ocean currents, and information regarding the spatial and temporal variability of polynyas, leads, and landfast ice are important for determining the fate of spilled oil in this region and the impacts on biota associated with these systems. Studies conducted by the MMS have demonstrated that landfast ice completely blocks wind forcing of under-ice waters. Thus water moves differently under landfast ice than adjoining open or pack ice waters. It becomes very important to know locations of and seasonal changes in the distribution of landfast ice.

3.3 Fate and Effects

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

last field season for the current cANIMIDA project. The cANIMIDA task of monitoring of Cross Island whaling has been continued, and the cANIMIDA task of monitoring the Boulder Patch is proposed to continue as a new FY 2011 study. Because of lack of observed effects, other cANIMIDA monitoring tasks will undergo approximately a 5-year hiatus prior to reconsideration.

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

3.4 Endangered and Protected Species

Production at the Northstar site and at other potential sites may lead to risks of oil spills from buried pipelines, other discharges, noise from various industrial and support activities and increased human interaction with arctic offshore species. Species protected under the ESA, MMPA and the Migratory Bird Treaty Act are of particular concern if impacted by such factors. Study of the effects of oil and gas-related activities on protected mammals and the need for continued monitoring of endangered species are expected to be continued – as well as assessment of how any changes in the bowhead whale migration's distance from shore could relate to subsistence success (see below). Future bowhead studies are expected to continue to explore use of satellite tagging for information on bowhead whale residence times in development areas. The MMS anticipates the continuation of region-wide monitoring of the fall migration by the Bowhead Whale Aerial Survey Project and the additional knowledge it obtains on bowhead feeding patterns. The 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.

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

Seismic exploration and its effects on fish is becoming a high-priority issue for arctic residents. More information regarding the effects of seismic exploration on the health, behavior, distribution, and migration of the numerous important fish species of the Beaufort and Chukchi Seas would be valuable for NEPA analyses. The study "Field Experiments of Seismic Effects on Arctic Fish and Field Measurements of Seismic Acoustic Characteristics" is proposed for FY 2011.

Residents and non-residents dependent on commercial fisheries are concerned about development activities interfering with those fisheries. Even the mere public perception of tainted commercial fish could cause detrimental effects on fish markets for years to come. Alaska Native villagers are also concerned that OCS activities will affect subsistence fish populations and reduce subsistence utilization. Thus, additional research on arctic fisheries and recruitment to nearshore feeding populations should be considered. Several fish species used for subsistence migrate through, or are found in, the Northstar and Liberty areas of the Beaufort Sea, including arctic and least cisco, Dolly Varden, arctic char, and humpback and broad whitefish. Intermittent occurrences of pink and chum salmon also take place in Beaufort coastal waters.

A need for more information on the forage fish resources and their relation to apex predators in the Bering, Chukchi and Beaufort Seas is also indicated. A good understanding of the seasonal distribution, abundance and habitat use of forage fish, including key spawning and migration events that quickly transfer large amounts of energy to upper trophic levels, is fundamentally important to monitoring the potential environmental impacts associated with offshore development.

3.6 Subsistence

Residents of the North Slope coastal communities frequently express concern about cumulative impacts of offshore and onshore developments on their subsistence lifestyle. Relative to existing oil and gas operations, the villages of most pressing concern are Nuiqsut, Kaktovik and Barrow. Consideration of cumulative impacts is an increasingly important issue for 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 further addressed by additional research.

A significant body of research has emerged to indicate that some North Slope residents increasingly manifest serious health problems that are related to changes in diet and consumption patterns, including diabetes, botulism, iron deficiency anemia, caries, heart disease, obesity, and substance abuse. The study "Baseline Nutritional Survey: Inventory and Content Analysis of Subsistence and Market Foods as Consumed by North Slope Communities" proposed for FY 2011 would contribute to a better understanding of whether and how incremental changes to subsistence activities on the North Slope might produce substantial impacts on the dietary behaviors and health status of identifiable Native groups.

Aggregate effects research also encompasses a broader set of issues concerning how the Iñupiat society has been potentially affected. Relevant issues include a wide range of topics, such as the changing relationship between the cash economy and household subsistence activities, changing sources of anxiety and stress at multiple levels of organization, potential changes in sharing of subsistence resources and potential changes in the recruitment of youth into subsistence activities. Social indicators should be maintained to serve as a basis for estimating long-term aggregate impacts.

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