



# ALASKA ANNUAL STUDIES PLAN

U.S. DEPARTMENT OF THE INTERIOR  
BUREAU OF OCEAN ENERGY MANAGEMENT  
ALASKA OUTER CONTINENTAL SHELF REGION  
ANCHORAGE, ALASKA



## FY 2013

SEPTEMBER 2012



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

September 2012

This document may be accessed electronically at <http://www.boem.gov/akstudies/>. To request a hard copy, please contact Dr. Heather Crowley at (907) 334-5281 or by email at [Heather.Crowley@boem.gov](mailto:Heather.Crowley@boem.gov). To request further information about the Studies Program or our planning process, please contact Dr. Dee Williams, Alaska OCS Region Studies Chief, at (907) 334-5283 or by email at [Dee.Williams@boem.gov](mailto:Dee.Williams@boem.gov).

The inclusion of study profiles in this document does not constitute a commitment by the U.S. Department of the Interior, Bureau of Ocean Energy Management 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.

Any use of trade names is for descriptive purposes only and does not constitute endorsement of these products by the Bureau of Ocean Energy Management.



Cover Photos:

Beaufort Sea Coastline with Launch 1273:	cANIMIDA Science Team
Bowhead off Barrow:	BOWFEST Aerial Survey Team
	NMML/Alaska Fisheries Science Center
	NMFS Permit No. 14245
Benthic Organisms	cANIMIDA Science Team



# United States Department of the Interior

## BUREAU OF OCEAN ENERGY MANAGEMENT

Alaska OCS Region

3801 Centerpoint Drive, Suite 500

Anchorage, Alaska 99503-5823

September 12, 2012

Dear Stakeholder:

Thank you for your interest in the Environmental Studies Program (ESP) of the Bureau of Ocean Energy Management (BOEM). The agency assesses its information needs and develops new study profiles on an annual basis. We follow a well-established process that involves a role for both stakeholder input and scientific peer review (see a complete description of our process in Section 1.1.3). We are interested to know your perspectives and to receive any suggestions you may have for the BOEM *Alaska Annual Studies Plan, FY 2014*, which we are now beginning to formulate.

For your convenient reference, we are providing the *Alaska Annual Studies Plan FY 2013*, developed from submissions we received over the past year. For FY 2014 planning, we will continue to receive hardcopy submissions at our regional office. In addition, we have prepared a web docket at <http://www.regulations.gov> to facilitate public submission of new study ideas in digital format. See docket number BOEM-2011-0096.

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 BOEM mission and decision needs (see Section 1.3). Suggestions need to be received by us no later than November 16, 2012, to assure consideration for the 2014 fiscal year. Following revisions to the plan, we will issue a final *Alaska Annual Studies Plan FY 2014* in the autumn of 2013.

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

Sincerely,

Dee Williams, Ph.D.

Chief, Environmental Sciences Management

**Bureau of Ocean Energy Management  
Alaska Environmental Studies Program**  
<http://www.boem.gov/akstudies/>

**Proposed Study for FY 2014**

*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, BOEM 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, Cook Inlet as applicable.]

**Title:** [Fill in concise title.]

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

**Period of Performance:** FY 2014-20XX

**Description:**

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

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

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

**Date information is required:** *Provide dates when products would be most useful, such as "Final report is needed by December 2016." If the product of the study is something additional to the scientific report (e.g. database, model, bibliography), explain in this section.*

# TABLE OF CONTENTS

ACRONYMS .....	ix
SECTION 1.0 PROGRAMMATIC OVERVIEW .....	1
<b>1.1 Introduction to the Region</b> .....	1
1.1.1 Background .....	1
1.1.2 Scientific Studies are Conducted in Partnership .....	2
<b>Figure 1</b> Alaska OCS Region Planning Areas .....	3
1.1.3 Alaska OCS Studies Planning Process .....	5
1.1.4 Addition of a New Studies Planning Tool .....	6
1.1.5 Issues To Be Addressed .....	7
<b>1.2 Projected OCS Activities</b> .....	9
1.2.1 Pre-lease Considerations .....	9
<b>Figure 2</b> Chukchi Sea Oil and Gas Leases .....	10
<b>Figure 3</b> Beaufort Sea Oil and Gas Leases .....	11
<b>Figure 4</b> Cook Inlet Planning Area .....	12
1.2.2 Post-lease Considerations .....	13
<b>Figure 5</b> Northstar Island, August 2000 .....	14
<b>1.3 Identification of Information Needs</b> .....	16
1.3.1 Beaufort Sea General Information Needs .....	16
<b>Figure 6</b> Locations of sampling stations for the cANIMIDA Program .....	17
<b>Figure 7</b> Tracks from satellite-tagged bowhead whales during the spring and fall migrations .....	20
1.3.2 Chukchi Sea General Information Needs .....	21
<b>Figure 8</b> A synthesis map depicting bowhead whale subsistence hunting use areas for the community of Barrow over time. ....	22
1.3.3 Renewable Energy General Information Needs .....	23
1.3.4 Current Keystone Studies .....	23
<b>Figure 9</b> Locations of meteorological data synthesized as a part of the Mesoscale Meteorology Modeling Study Phase II .....	25
SECTION 2.0 STUDY PROFILES .....	29
<b>2.1 Profiles of Ongoing Studies</b> .....	29
<b>2.2 Profiles of Studies Proposed for FY 2013 NSL</b> .....	159
<b>Table 1</b> Alaska OCS Region Studies Proposed for the FY 2013 NSL .....	159
<b>2.3 Profiles of Studies Proposed for FY 2014 NSL</b> .....	185
<b>Table 2</b> Alaska OCS Region Studies Proposed for the FY 2014 NSL .....	185

<b>SECTION 3.0 TOPICAL AREAS FOR FY 2015</b> .....	199
<b>3.1 Climate Change</b> .....	199
<b>3.2 Air Quality</b> .....	200
<b>3.3 Physical Oceanography</b> .....	200
<b>3.4 Fate and Effects</b> .....	200
<b>3.5 Endangered and Protected Species</b> .....	201
<b>3.6 Marine Fish Migrations, Recruitment and Essential Fish Habitat</b> .....	201
<b>3.7 Subsistence</b> .....	202
<b>SECTION 4.0 LITERATURE CITED</b> .....	203
<b>Contributing Alaska OCS Region Staff</b> .....	204

<b>SECTION 2.0 STUDY PROFILES</b> .....	29
<b>2.1 Profiles of Ongoing Studies</b> .....	29
<u><b>Air Quality and Meteorology</b></u>	
Mesoscale Meteorology Modeling Study Phase II (AK-06-05) .....	31
<u><b>Physical Oceanography</b></u>	
COMIDA: Factors Affecting the Distribution and Relative Abundance of Endangered Whales: Biophysical Moorings and Climate Modeling (AK-09-02b)....	33
Application of High Frequency Radar to Potential Hydrocarbon Development Areas in the Northeast Chukchi Sea (AK-09-06).....	37
Characterization of the Circulation on the Continental Shelf Areas of the Northeast Chukchi and Western Beaufort Seas (AK-12-03a) .....	39
Satellite-Tracked Drifter Measurements in the Northeast Chukchi Sea (AK-08-12-08) .....	41
Adaptation of Arctic Circulation Model (NT-08-02).....	43
<u><b>Fates and Effects</b></u>	
Updates to the Fault Tree for Oil-Spill Occurrence Estimators Needed Under the Forthcoming BOEM 2012-2017, 5-Year Program (AK-11-01) .....	45
Oil Spill Occurrence Estimators for Onshore Alaska North Slope Crude and Refined Oil Spills (AK-11-02).....	47
Loss of Well Control Occurrence and Size Estimators for the Alaska OCS (AK-11-12).....	49
ANIMIDA III: Boulder Patch and Other Kelp Communities in the Development Area (AK-11-14a).....	51
Evaluating Chukchi Sea Trace Metals and Hydrocarbons Sourced from Nearby Coastal Rivers (AK-08-12-12).....	53
<u><b>Biology</b></u>	
Arctic Fish Ecology Catalogue (AK-07-05) .....	55
Beaufort Sea Marine Fish Monitoring Survey in the Central Beaufort Sea (AK-10-06).....	57
Joint Funding Opportunities in Existing Marine Fish Studies (AK-10-09).....	59

Seabird Distribution and Abundance in the Offshore Environment (AK-10-10).....	61
Hanna Shoal Ecosystem Study (AK-11-03) .....	63
Distribution of Fish, Crab and Lower Trophic Communities in the Chukchi Sea Lease Area (AK-11-08) .....	65
Shorebirds and Infaunal Abundance and Distribution on Delta Mudflats along the Beaufort Sea (AK-11-10a).....	69
Wading Shorebird Habitats, Food Resources, Associated Infauna, Sediment Characteristics and Bioremediation Potential of Resident Microbiota of Deltaic Mudflats (AK-11-10b) .....	73
Arctic Cod Pilot Genetics and Toxicity Study (AK-11-13a).....	75
U.S.-Canada Transboundary Fish and Lower Trophic Communities (AK-12-04) .....	79
Distribution and Habitat Use of Fish in the Nearshore Ecosystem of the Beaufort and Chukchi Seas (AK-12-06).....	81
Biogeochemical Assessment of the OCS Arctic Waters: Current Status and Vulnerability to Climate Change (AK-08-12-03).....	83
Trophic Links: Forage Fish, Their Prey, and Ice Seals in the Northeast Chukchi Sea (AK-08-12-05) .....	85
Epifaunal Communities in the Central Beaufort Sea (AK-08-12-07) .....	87
Population Assessment of Snow Crab, <i>Chionoecetes opilio</i> , in the Chukchi and Beaufort Seas Including Oil and Gas Lease Areas (AK-08-12-09).....	89
Dispersal Patterns and Summer Ocean Distribution of Adult Dolly Varden from the Wulik River, Alaska, Evaluated Using Satellite Telemetry (AK-08-12-11) .....	91

### **Protected Species**

Populations and Sources of Recruitment of Polar Bears (AK-05-02) .....	93
Bowhead Whale Feeding Variability in the Western Alaskan Beaufort Sea: Satellite Tracking of Bowhead Whales (AK-06-01; AK-10-01).....	95
Bowhead Whale Feeding Variability in the Western Alaskan Beaufort Sea: Oceanography and Feeding (AK-06-01; AK-10-02).....	97
Monitoring Marine Birds of Concern in the Eastern Chukchi Nearshore Area (Loons) (AK-07-04a).....	99
Pinniped Movements and Foraging: Bearded Seals (AK-07-08) .....	101



Pinniped Movements and Foraging: Walrus Habitat Use in the Potential Drilling Area (AK-09-01).....	103
COMIDA: Factors Affecting the Distribution and Relative Abundance of Endangered Whales: Passive Acoustic Detection and Monitoring of Endangered Whales in the Arctic (AK-09-02a).....	105
Migration and Habitat Use by Threatened Spectacled Eiders in the Eastern Chukchi Near and Offshore Environment (AK-09-03).....	107
Demography and Behavior of Polar Bears Summering on Shore in Alaska (AK-09-05a; AK-09-05b) .....	109
Distribution and Relative Abundance of Marine Mammals in the Chukchi Sea and the Fall Migration of Bowhead Whales in the Beaufort Sea – Personnel Needs (AK-10-05).....	111
Synthesis of Arctic Research (SOAR) Physics to Marine Mammals in the Pacific Arctic (AK-11-05).....	115
Distribution and Relative Abundance of Marine Mammals in the Chukchi Sea and the Fall Migration of Bowhead Whales in the Beaufort Sea – Aircraft Needs (AK-11-06).....	119
Satellite Tracking of Bowhead Whales: Habitat Use, Passive Acoustic and Environmental Monitoring (AK-12-02).....	121
Use of the Chukchi Sea by Endangered Baleen and Other Whales (Westward Extension of BOWFEST) (AK-12-07) .....	123
Abundance Estimates of Ice-Associated Seals: Bering Sea Populations that Inhabit the Chukchi Sea (AK-12-x10b) .....	127
A Year in the Life of a Bowhead Whale: An Animated Film (AK-08-12-10).....	129

**Social Systems**

Study of Sharing Networks to Assess the Vulnerabilities of Local Communities to Oil and Gas Development Impacts in Arctic Alaska (AK-05-04a) .....	131
Continuation of Impact Assessment for Cross Island Whaling Activities (AK-08-01) .....	133
COMIDA: Impact Monitoring for Offshore Subsistence Hunting (AK-08-04).....	135
Subsistence Study for North Aleutian Basin (AK-08-06).....	137
Aggregate Effects Research and Environmental Mitigation Monitoring of Oil Industry Operations in the Vicinity of Nuiqsut (AK-08-09).....	139

Social Indicators in Coastal Alaska: Arctic Communities (AK-11-09).....	141
Subsistence Use and Knowledge of Beaufort Salmon Populations (08-12-04) .....	143

**Other**

Alaska Marine Science Symposium (AK-10-03) .....	145
Management, Logistics, and Warehouse Storage of Oceanographic Equipment (AK-10-04) .....	147
ShoreZone–Shoreline Mapping of the North Slope of Alaska (AK-11-07) .....	149
Workshop—Interagency Protocols for Immediate On-Scene Arctic Oil Spill Impact Science (AK-11-11) .....	151
Enhancement of the Environmental Studies Program Information System and the Multipurpose Marine Cadastre to Provide Environmental Studies Data (NT-12-01) .....	153
Conference Management and Reports on BOEM Results (AK-12-01).....	155
BOEM / University of Alaska / State of Alaska Coastal Marine Institute – Management (AK-08-12-01) .....	157

**2.2 Profiles of Studies Proposed for FY 2013 NSL .....** 159

**Table 1 Alaska OCS Region Studies Proposed for the FY 2013 NSL .....** 159

Arctic Air Quality Impact Assessment Modeling.....	161
Chukchi Acoustic, Oceanography and Zooplankton Study: Hanna Shoal (Extension of CHAOZ).....	163
Coastal Marine Institute (extension).....	165
Cook Inlet Workshop: Information Status & Research Planning .....	167
Enhanced Verification and Interpretation of Arctic Ice Formation, Distribution, and Density .....	169
Support for the 2012 United States-Canada Northern Oil and Gas Research Forum.....	171
Walrus Seasonal Distribution and Habitat Use in the Eastern Chukchi Sea .....	173
Physical and Chemical Analyses of Crude and Refined Oils: Laboratory and Mesoscale Oil Weathering.....	175
Subsistence Mapping of Wainwright, Point Lay, and Point Hope .....	177

ANIMIDA III: Contaminants, Sources, and Bioaccumulation (AK-11-14b).....	179
Applications for Mapping Spilled Oil in Arctic Waters (AK-12-03b) .....	181
Ice Seal Movements and Foraging: Village-based Satellite Tracking and Acoustic Monitoring of Ringed, Bearded, and Spotted Seals (AK-12-05).....	183
<b>2.3 Profiles of Studies Proposed for FY 2014 NSL</b> .....	185
<b>Table 2</b> Alaska OCS Region Studies Proposed for the FY 2014 NSL.....	185
Seabird Distribution in the Chukchi and Beaufort Seas: Modeling Patterns Over Space and Time .....	187
Polar Bear Movement Patterns and Habitat Use in Relation to Oil and Gas Activities in the Chukchi Sea .....	189
Improving Estimates of Abundance and Distribution of Avian Species during Peak Spring and Fall Migration Pathways through Near Shore Areas of the Eastern Chukchi Sea .....	191
Ecology of Beluga Whales in the Eastern-Chukchi, Western-Beaufort Seas .....	193
Field Evaluation of an Unmanned Aircraft System (UAS) for Studying Cetacean Distribution, Density, and Habitat Use in the Arctic .....	195
Baseline Nutritional Survey: Inventory and Content Analysis of Subsistence and Market Foods as Consumed by North Slope Communities .....	197

This page left blank intentionally.

## 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
AMSR-E	Advanced Microwave Scanning Radiometer-Earth Observing System
AMSS	Alaska Marine Science Symposium
ANIMIDA	Arctic Nearshore Impact Monitoring in Development Area
ASP	Alaska Annual Studies Plan
AOOS	Alaska Ocean Observing System
AUV	Autonomous Underwater Vehicle
BEST	Bering Sea Ecosystem Study (NSF)
BLM	Bureau of Land Management
BOEM	Bureau of Ocean Energy Management
BOEMRE	Bureau of Ocean Energy Management, Regulation and Enforcement
BOWFEST	Bowhead Whale Feeding Ecology Study
BPXA	British Petroleum Exploration Alaska
BRD	Biological Resources Division (USGS)
BSIERP	Bering Sea Integrated Ecosystem Research Program (NPRB)
BSMP	Beaufort Sea Monitoring Program
BSEE	Bureau of Safety and Environmental Enforcement
BWASP	Bowhead Whale Aerial Survey Project
CAB	Chemistry and Benthos
CAMx	Comprehensive Air Quality Model, with extensions
cANIMIDA	Continuation of Arctic Nearshore Impact Monitoring in Development Area
CCSM	Community Climate System Model
CESU	Cooperative Ecosystem Studies Unit
CHAOZ	Chukchi Acoustics, Oceanography and Zooplankton study
CIAP	USDOI Coastal Impact Assistance Program
CMAQ	Community Multiscale Air Quality model
CMI	Coastal Marine Institute
CODE	Coastal Ocean Dynamics Experiment
COMIDA	Chukchi Offshore Monitoring in Drilling Area
CTD	Conductivity, Temperature, Depth sensor
DFO	Department of Fisheries and Oceans Canada
DIDSON	Dual-Frequency Identification Sonar
DPP	Development and Production Plan
EA	Environmental Assessment
ECS	Eastern Chukchi Sea
EFH	Essential Fish Habitat

EIS	Environmental Impact Statement
EP	Exploration Plan
EPA	Environmental Protection Agency
ESA	Endangered Species Act
ESP	Environmental Studies Program
ESPIS	Environmental Studies Program Information System
FY	Fiscal Year
GIS	Geographic Information Systems
GPS	Global Positioning System
GSA	General Services Administration
HF	High Frequency
ICESat	Ice, Cloud and land Elevation Satellite
IFO	Intermediate Fuel Oil
IPCC	International Panel on Climate Change
ITM	Information Transfer Meeting
IUM	Information Update Meeting
JIP	Joint Industry Program
LCC	Landscape Conservation Cooperative
MMPA	Marine Mammal Protection Act
MMC	Multipurpose Marine Cadastre
MMM	Mesoscale Meteorology Modeling Study
MMS	Minerals Management Service
NAB	North Aleutian Basin
NASA	National Aeronautics and Space Administration
NCAR	National Center for Atmospheric Research
NEP	Net Ecosystem Production
NEPA	National Environmental Policy Act
NIC	National Ice Center
NMFS	National Marine Fisheries Service
NMML	National Marine Mammal Laboratory
NOAA	National Oceanic and Atmospheric Administration
NOPP	National Oceanographic Partnership Program
NOS	National Ocean Service
NPPSD	North Pacific Pelagic Seabird Database
NPRB	North Pacific Research Board
NSB	North Slope Borough
NSSI	North Slope Science Initiative
NSF	National Science Foundation
NSL	National Studies List

OCS	Outer Continental Shelf
OCSLA	Outer Continental Shelf Lands Act
OMB	Office of Management and Budget
OSRA	Oil-Spill-Risk Analysis
OSU	Oregon State University
OWM	Oil Weathering Model
PAH	Polycyclic Aromatic Hydrocarbon
PMEL	Pacific Marine Environmental Laboratory
ROV	Remotely Operated Vehicle
RUSALCA	Russian-American Long-term Census of the Arctic
SAR	Synthetic Aperture Radar
SDI	Satellite Drilling Island
SOAR	Synthesis of Arctic Research
TAR	Technology Assessment and Research
TK	Traditional Knowledge
UAA	University of Alaska Anchorage
UAF	University of Alaska Fairbanks
UAS	Unmanned Aircraft System
uERD	ultra-Extended Reach Drilling
URI	University of Rhode Island
USCG	U.S. Coast Guard
USDOJ	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
WOCE	World Ocean Circulation Experiment
WRF	Weather Research and Forecasting model

This page left blank intentionally.



## **SECTION 1.0 PROGRAMMATIC OVERVIEW**

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

#### 1.1.1 Background

The Environmental Studies Program (ESP) of the Bureau of Ocean Energy Management was established and funded by the United States Congress to support the offshore oil and gas leasing program of the U.S. Department of the Interior (USDOI) in pursuit of national energy policies. The Environmental Studies Program was administered originally by the Bureau of Land Management (BLM) from 1973 until 1982, then by the Minerals Management Service (MMS), and presently by the Bureau of Ocean Energy Management (BOEM) since October 2011. The consistent mandate of the ESP since its inception has been to establish the scientific 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. Also, the National Environmental Policy Act (NEPA) of 1969 requires that all Federal Agencies use a systematic, interdisciplinary approach that will ensure the integrated use of the natural and social sciences in any planning and decision-making that may have effects on the environment. Federal laws impose additional requirements on the offshore leasing process, including the Coastal Zone Management Act; Federal Water Pollution Control Act Amendments; Marine Mammal Protection Act (MMPA); Endangered Species Act (ESA); and Marine Protection, Research and Sanctuaries Act.

The ESP operates on a national scale to assist in predicting, projecting, assessing and managing potential effects on the human, marine and coastal environments of the OCS that may be affected by oil and gas development. Lease-management decisions are enhanced when current, pertinent and timely environmental information is available. Final reports from the ESP are most directly utilized by teams of NEPA analysts within the BOEM Environmental Analysis Sections when they prepare and/or review Environmental Impact Statements (EISs), Environmental Assessments (EAs), Exploration Plans (EPs), and Development and Production Plans (DPPs). Of course, a wide range of arctic scientists, stakeholders and decision-makers also make use of our study products.

Since the ESP began, the USDOI and the MMS/BOEM have funded nationally more than \$975 million for environmental studies through fiscal year (FY) 2012. Approximately \$400 million of that amount has funded studies in Alaska across 15 planning areas in the Arctic,

Bering Sea and Gulf of Alaska sub-regions (see Figure 1) to produce more than 500 different study reports, as well as more than 300 peer-reviewed publications since 1990. The ESP manages ongoing study projects in Alaska (currently about 50) in disciplines such as physical oceanography, meteorology, fate and effects of pollutants, protected and endangered species, wildlife biology, and the social sciences, including traditional knowledge. Completed study reports are posted on our website at [http://www.data.boem.gov/homepg/data\\_center/other/espis/espisfront.asp](http://www.data.boem.gov/homepg/data_center/other/espis/espisfront.asp).

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

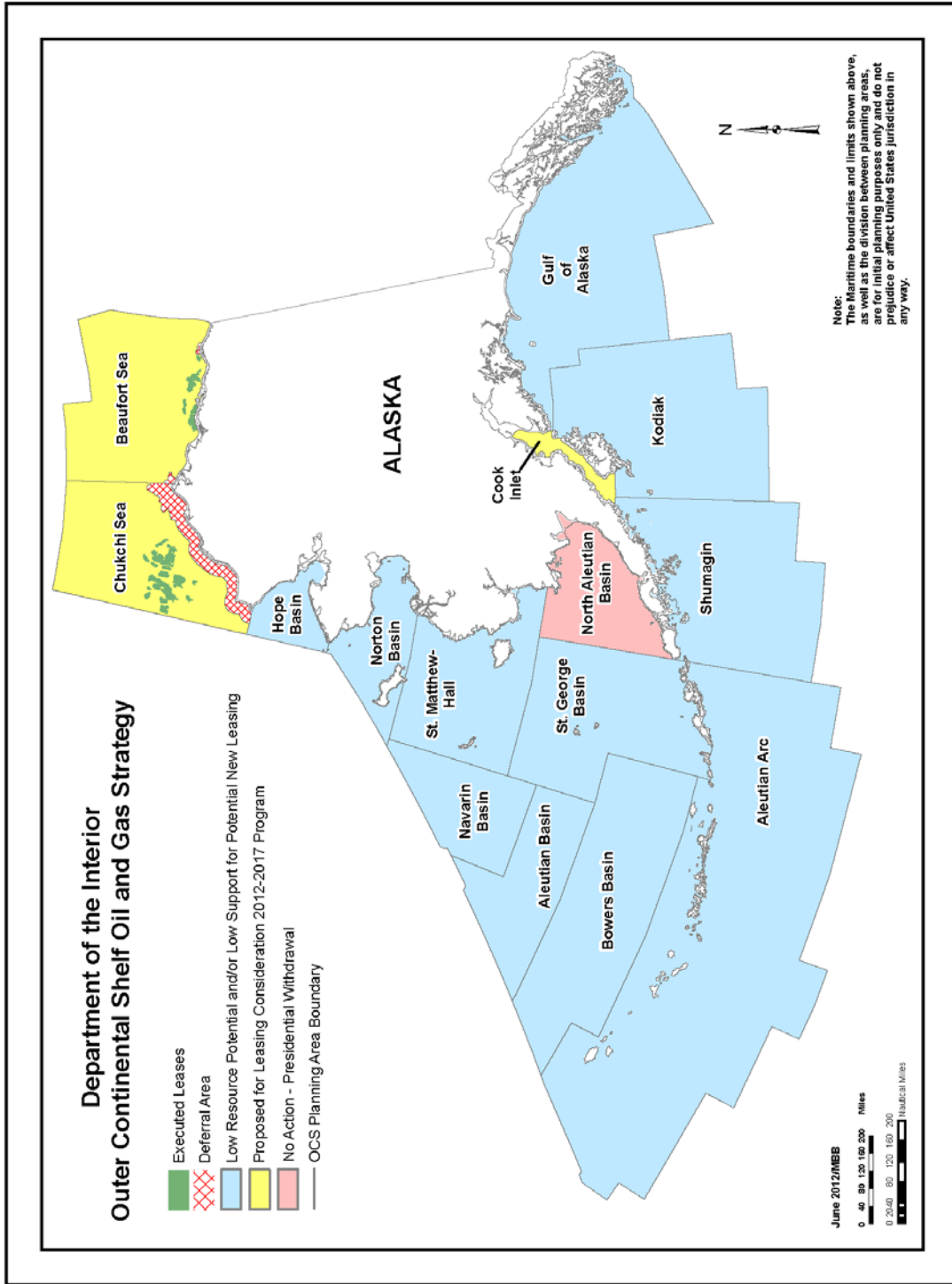
As studies information has been amassed, improved focus has required greater integration of various scientific disciplines. The ESP has initiated Synthesis Meetings, Information Transfer Meetings (ITMs) and Information Update Meetings (IUMs) to gather maximum expertise and assess the status of existing information, as well as to plan the best possible approach to a study within the constraints of time and resources. As BOEM and other Federal and State agencies collect more pertinent information, BOEM funds studies to search and evaluate existing literature and data prior to initiation of field efforts. This prevents duplication of effort and saves valuable resources by focusing study efforts on the areas of greatest information need and highest usefulness to BOEM decision needs. Of course, additional research coordination with groups external to BOEM occurs continuously through a variety of institutional mechanisms, as discussed in the following section.

### 1.1.2 Scientific Studies are Conducted in Partnership

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

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

**Figure 1** Alaska OCS Region Planning Areas



Currently, a major portion of the ESP in Alaska is conducted on a collaborative basis with an extensive range of bilateral and multilateral partnerships. The ESP in Alaska coordinates routinely on major projects with numerous Federal entities, including: National Oceanographic Partnership Program (NOPP); National Oceanic and Atmospheric Administration (NOAA) and the National Marine Fisheries Service (NMFS) Alaska Fisheries Science Center; NOAA's National Marine Mammal Laboratory (NMML); U.S. Geological Survey (USGS)-Alaska Science Center; U.S. Fish and Wildlife Service (USFWS) and the Arctic Landscape Conservation Cooperative (LCC); USDOJ Coastal Impact Assistance Program (CIAP); the North Slope Science Initiative (NSSI); National Aeronautics and Space Administration (NASA); National Science Foundation (NSF); U.S. Arctic Research Commission; and the Polar Research Board.

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

In 1993, the University of Alaska Coastal Marine Institute (CMI) was created by a cooperative agreement between the University of Alaska and the ESP to study coastal topics associated with the development of natural gas, oil and minerals in Alaska's OCS. Under this arrangement, the ESP taps the scientific expertise of regional and local experts through the University of Alaska to collect and disseminate environmental information about resource issues of mutual interest. Through the CMI, the ESP stimulates important studies in a cost-saving one-to-one match structure. Since its inception, the CMI match has come from more than 50 different organizations and has leveraged over \$16 million of agency funds into \$32 million worth of relevant marine-based research. During that time, the CMI program has also provided roughly 120 years of student support and completed over 80 studies. The ESP is working to extend the cooperative agreement through 2017. For this agreement, the Alaska OCS Region has committed \$1,000,000 per year with a dollar-for-dollar match arrangement. More information about the CMI can be found at <http://www.sfos.uaf.edu/cmi>.

The ESP also conducts cooperative research with universities through the Cooperative Ecosystem Studies Units (CESUs). The CESUs are working partnerships among leading academic institutions, Federal, State, and non-governmental organizations. A national network of seventeen CESUs has been established, with each unit focusing a separate biogeographic region. The goal of the CESU network is to facilitate collaboration through the working partnerships to provide high quality research, education and technical assistance for stewardship of cultural and natural resources. The BOEM currently participates in six CESUs that encompass the State of Alaska, the Pacific Northwest, California, the North Atlantic Coast, the South Atlantic Coast and the Gulf of Mexico.

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

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

In ESP field oriented studies, researchers typically coordinate directly with local communities to discuss their plans, seek advice and ensure that interested individuals learn about the project and its results. The ESP strives to assimilate local and traditional knowledge of Alaskan residents directly in the preparation of its study products and interpretation of results. The process of melding local and traditional knowledge varies from project to project, but the outcome of better information for decision making is a common goal.

### 1.1.3 Alaska OCS Studies Planning Process

In the Alaska OCS Region of BOEM, research planning is a continual process that follows a longstanding annual cycle, beginning with the distribution of the *Alaska Annual Studies Plan* (ASP). The ASP is distributed in September to more than 200 stakeholder groups across Federal, State, Native, academic, and industry sectors spanning international, regional, and local interest groups. While the ASP describes ongoing research and reveals approved new studies for the coming fiscal year, it also serves to initiate the next planning cycle by circulating a letter that calls for suggestions about new information needs from all interested parties, including scientists, stakeholders, and the general public.

In Alaska, we typically receive more than 60 study profiles from external institutions and BOEM staff with suggestions for new research. Correspondence from agencies such as NMFS, USFWS, and the State of Alaska are carefully considered; particularly information identified under the Endangered Species Act and other interagency consultations. Ideas for new research also derive throughout the year from program reviews and public meetings, including science conferences, multilateral planning sessions, and public hearings. Study profiles also address recommendations from broad programmatic reviews or "data gap" analyses, such as those coming from the National Academy of Sciences, the Interagency

Ocean Policy Task Force, the 2011 USGS Circular1370, and the Arctic Council. We also prepare and advertise a web docket every autumn to facilitate convenient public submission of study ideas for consideration. Of course, the majority of incoming proposals for new research still originate with BOEM staff and managers in the regular performance of job duties.

From these multiple sources of input, BOEM subject-matter experts assimilate the various study comments and recommendations and consolidate them into discrete study profiles. Often, this involves merging several related objectives from multiple sources into a single study effort. It also involves revising submissions to enhance mission-focus or to provide more conclusive results. Consistent with our mission, the Environmental Studies Program funds studies that have strong applicability to pending pre- and post-lease decisions under the active OCS 5-Year Leasing Program. The most important considerations for establishing priorities within the national context include: program relevance; timing in relation to assessment needs; feasibility and likelihood of conclusive findings; and availability of information from other sources.

After extensive internal discussions and evaluations of incoming proposals are complete, we prepare a short-list of the high priority study profiles to be considered by regional and national senior managers. In late January, the short-list of proposed profiles is shared and coordinated with other agencies through multilateral partnerships such as the North Slope Science Initiative and the Arctic Landscape Conservation Cooperative. The proposed new profiles are then formally reviewed each spring by our OCS Scientific Committee (an external peer-review advisory body) to evaluate the priority and quality of each proposed study as well as the technical aspects of proposed study methods. The proposed profiles are again revised and reprioritized as needed, and finalized by August for funding allocation in the new fiscal year. The Annual Studies Plan is then finalized and circulated to the public in September, when the cycle starts all over again.

Once a research project achieves funding and gets underway, interim reports and project websites facilitate report dissemination and data sharing. When a project is complete, final study reports are posted at <http://www.boem.gov/akstudies>, [http://www.data.boem.gov/homepg/data\\_center/other/espis/espisfront.asp](http://www.data.boem.gov/homepg/data_center/other/espis/espisfront.asp), and a number of other scientific web portals to facilitate distribution. Project data are typically delivered to the National Oceanographic Data Center and to customized project websites. The Environmental Studies Program is also currently developing new platforms for enhanced data sharing with all stakeholders. Thus, from start to finish, the entire planning, procurement, and dissemination process involves constant coordination with multiple organizations and scientific entities.

#### 1.1.4 Addition of a New Studies Planning Tool

While the well-established process of studies planning described above has served to meet agency and stakeholder information needs over the last four decades, we believe that a variety of new realities in the Arctic necessitate development of additional science planning and assessment measures. Some of the more relevant pressures include: greater maritime traffic and global access to the region through loss of sea ice; greater social demand for access to energy resources from offshore leases; greater demand by some courts and stakeholders for

more scientific precision in NEPA documents; greater public expectation for transparency in government planning and decision-making; and greater demand by senior government officials to demonstrate research coordination and data sharing among Federal agencies. In a spirit of adaptive management to meet these changing circumstances more effectively, the Alaska OCS Region has set a new course to supplement the environmental studies/assessment information collection process with an additional management tool. We call this new tool under construction the “data status matrix”.

In brief, once constructed the data status matrix is intended to facilitate more efficient identification of research priorities and better communication among Federal subject-matter experts, managers, decision-makers, and external stakeholders about the relative status of scientific information currently available for different categories of environmental resources. For each specific OCS planning area, each phase of development, and each specific data category of interest (such as the Beaufort Sea, lease sales, abundance estimates of bowhead whales), the data status matrix would evaluate the quality of knowledge available to assessment analysts on that topic by choosing a rank order from 0 to 4, with 0 representing the lowest level of knowledge (no data) and 4 representing the highest level (profuse data). Separate matrix sheets would be developed for different categories of resources, grouped according to relevance (such as species or family level taxa). Each matrix cell evaluation would maintain a corresponding brief bibliography of key sources to justify the assigned rank evaluation. As the matrix tool develops and matures over time, it is anticipated that its value will grow and become rather indispensable to promote more precise and productive scientific identification and collaboration over fluctuating “data gaps” and research priorities.

#### 1.1.5 Issues To Be Addressed

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

- Monitoring Marine Environments
- Conducting Oil-Spill Fate and Effects Research
- Minimizing Seismic and Acoustic Impacts
- Understanding Social and Economic Impacts
- Maintaining Efficient and Effective Information Management
- Integrating Scientific Results with Local and Traditional Environmental Knowledge

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

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

- What is the expected change in the human, marine and coastal environment due to offshore activity?
- Can undesirable change be minimized by mitigating measures?

Environmental studies are the primary means to provide information on these questions for use by decision-makers. Currently the ESP in Alaska has primary focus on upcoming developments, exploration activities and existing leases, as well as potential future lease sales, in the Beaufort Sea and Chukchi Sea Planning Areas. Current offshore oil and gas-related issues addressed by ongoing and proposed studies in the Beaufort Sea and the Chukchi Sea include, but are not limited to:

- What refinements are there to our knowledge of major oceanographic and meteorological processes and how they influence the human, marine and coastal environment?
- What role will currents play in distribution of anthropogenic pollutants near exploration and development prospects?
- What long-term changes in heavy metal and hydrocarbon levels may occur near exploration and development prospects, or regionally along the Beaufort and Chukchi coasts?
- How do we improve our model predictions of the fate of potential oil spills?
- If oil is spilled in broken ice, what will its fate be?
- What effects might pipeline construction have on nearby marine communities or organisms?
- What changes might occur in sensitive benthic communities such as the Stefansson Sound “Boulder Patch,” and other Beaufort Sea kelp communities or fish habitats?
- What are the current spatial and temporal use patterns of these planning areas by species that are potentially sensitive, such as bowhead whales, polar bears, other marine mammals, seabirds and other birds, or fish?
- What is the extent of endangered whale feeding in future proposed or potential lease sale areas?
- What changes might occur in habitat use, distribution, abundance, movement or health of potentially sensitive key species such as bowhead whales, polar bears, other marine mammals, seabirds and other birds, or fish?
- What interactions between human activities and the physical environment have affected potentially sensitive species?



- What changes might occur in socioeconomics and subsistence lifestyles of coastal Alaska communities?
- What are current patterns of subsistence harvest, distribution and consumption and what changes might occur in key social indicators as a result of offshore exploration and development?
- How can we continue to integrate local and/or traditional knowledge into studies related to the ESP in Alaska?

## 1.2 Projected OCS Activities

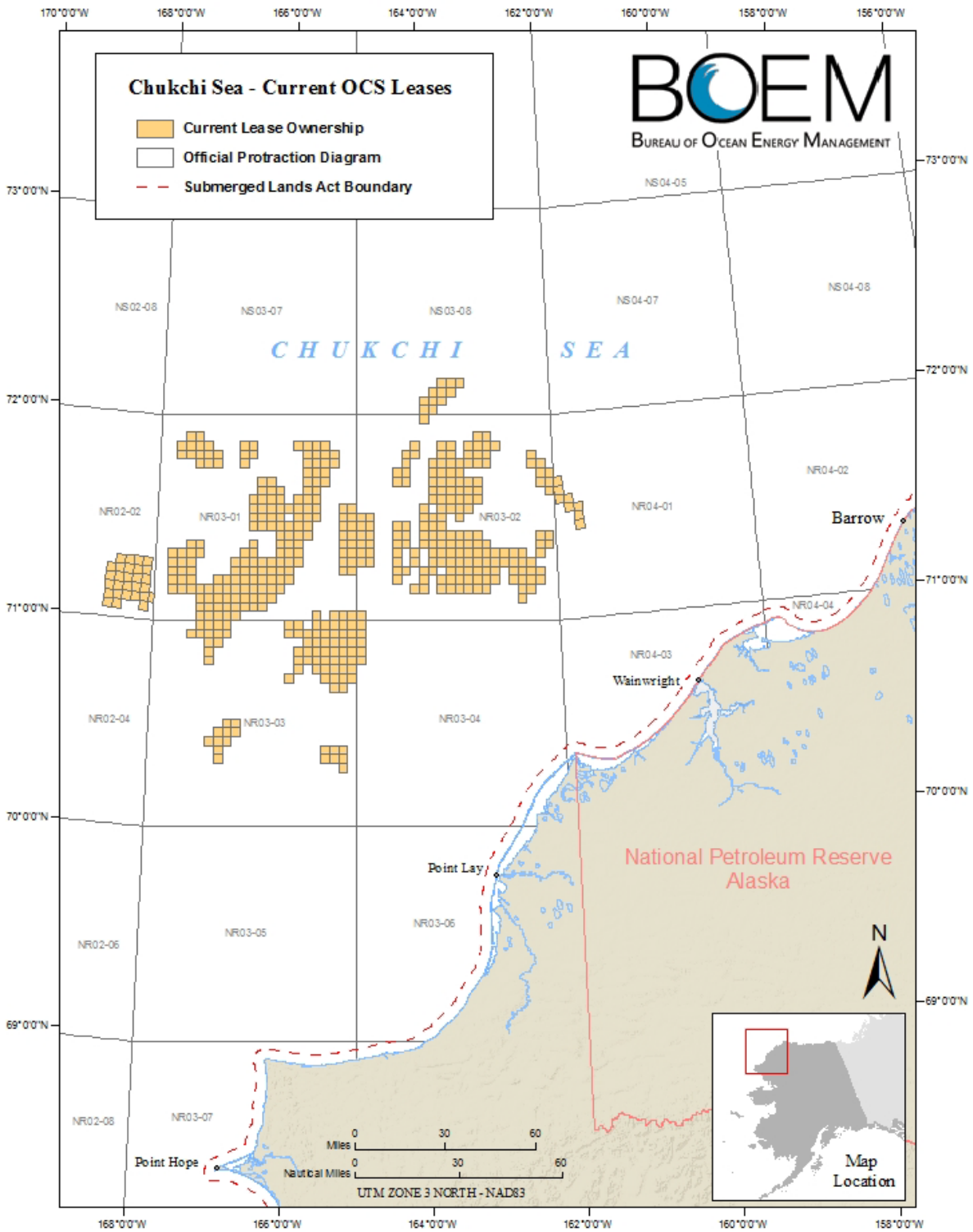
This *Alaska Annual Studies Plan* reflects consideration of the many changes occurring in the Alaska OCS Region, as well as anticipated needs for the future. In a frontier region such as the Arctic, planning lead-time is necessary to conduct adequate environmental studies. Challenges include: large and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

### 1.2.1 Pre-lease Considerations

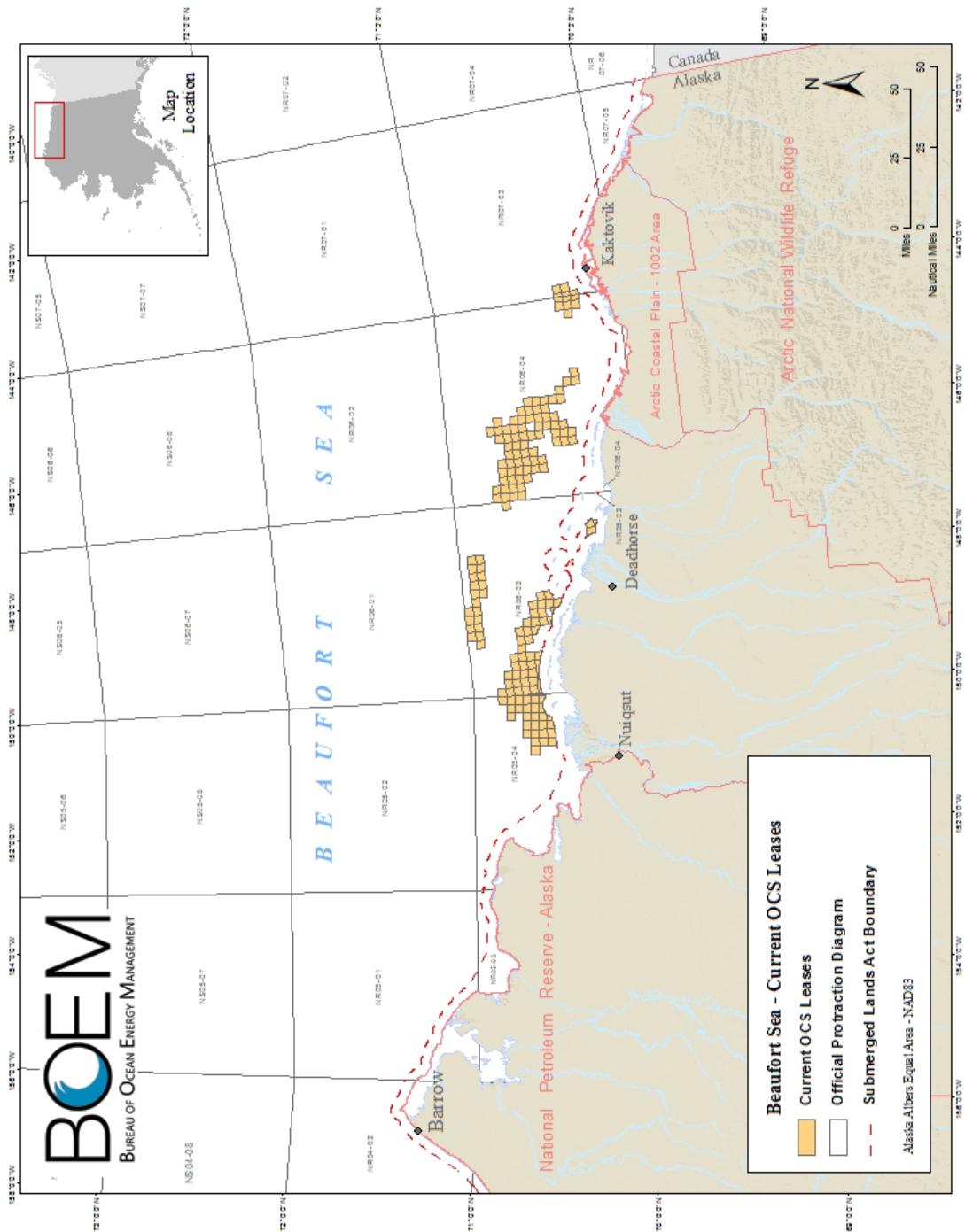
Preparation of an EIS is an essential part of the pre-lease process that requires environmental information. In particular, information is needed in time to prepare EISs for proposed lease sales. Although much information exists for certain Alaska OCS lease areas, data are sparse in other areas. In addition,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

On June 28, 2012, BOEM released the *Proposed Final Outer Continental Shelf Oil & Gas Leasing Program 2012-2017* (USDOJ, BOEM, 2012). This *Proposed Final Program* schedules three potential lease sales in the Alaska OCS. These potential lease sales are deliberately scheduled late in the program to allow for further development of scientific information regarding the sensitive habitats, unique conditions and important other uses, including subsistence hunting and fishing, as well as the oil and gas resource potential in these areas. The first potential sale is planned for 2016 in the Chukchi Sea Planning Area (see Figure 2). The *Proposed Final Program* includes a pre-existing 25-mile nearshore buffer and an additional area to the north of Barrow that will not be considered for leasing due to its documented importance for subsistence use. Another sale is proposed for 2017 in the Beaufort Sea Planning Area (see Figure 3). Two subsistence whaling areas near Barrow and Kaktovik will be excluded from leasing in this sale. Also, the *Proposed Final Program* includes a special interest sale in the Cook Inlet Planning Area (see Figure 4) in 2016. Based on a formal request for industry interest in this area, BOEM has determined that the scope of potential industry interest is sufficient to warrant completion of a full environmental impact statement prior to making a final determination about the lease sale. Historically, industry interest in this area was limited and environmental analysis must be updated for the proposed sale.

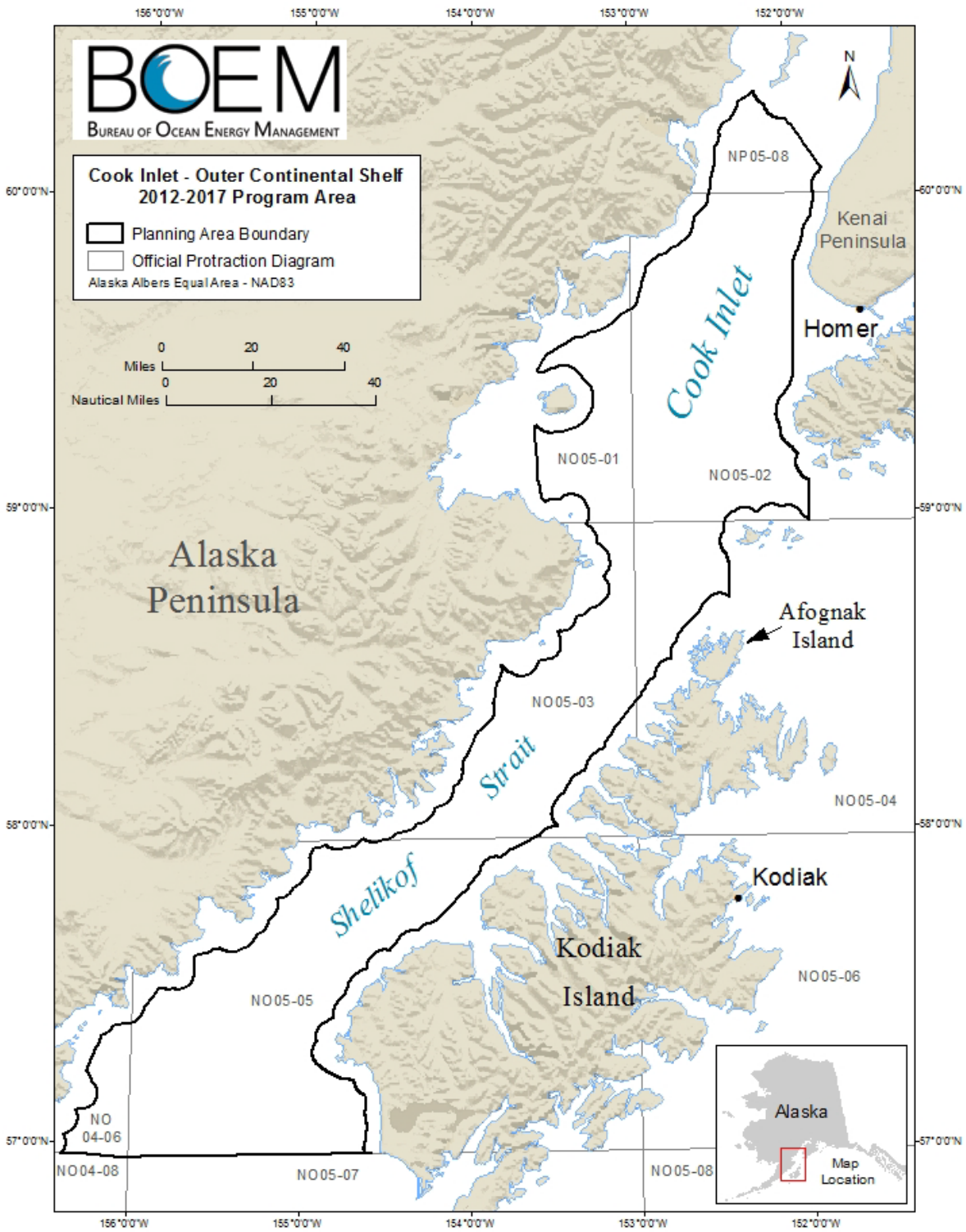
**Figure 2** Chukchi Sea Oil and Gas Leases



**Figure 3** Beaufort Sea Oil and Gas Leases



**Figure 4** Cook Inlet Planning Area



### 1.2.2 Post-lease Considerations

Prior to FY 1982, most studies of the Alaskan offshore were planned, conducted, and concluded before a sale was held in order to provide information for decision making and EISs. However, not all needed information can be obtained prior to a sale. In accordance with mandates of Section 20 of the OCS Lands Act, the need for studies continues into the post-lease period to address environmental concerns and monitoring related to specific developments. The ESP acquires additional information for environmental analyses related to development and production in the post-lease phase. Thus, an increasing number of studies have become more closely related to proposed exploration and development schedules and related monitoring in addition to those broader studies related to the pre-lease phase. As with the pre-lease phase, the wide range of environmental conditions from Cook Inlet to the Arctic is considered during the process of formulating new studies. Post-lease activities that require environmental data and assessment include:

- Geophysical surveys
- Preparation of Exploration Plans (EPs)
- Exploration drilling
- Preparation of Development and Production Plans (DPPs)
- Development, construction and production activities
- Oil and gas transportation
- Platform decommissioning
- Oil spill detection, containment, clean-up and damage assessment

In the Beaufort Sea Planning Area, there have been 929 tracts leased in ten OCS Lease Sales. Industry has drilled 31 exploratory wells and determined 11 to be producible. As of September, 2012, there are more than 180 active leases in the Beaufort Federal offshore area. Lease Sale 193 in February 2008 resulted in 487 leases being issued in the Chukchi Sea Planning Area. There are no active leases from previous lease sales in the Chukchi Sea or Hope Basin portions of the Arctic Subregion or in the Bering Sea, Cook Inlet or Gulf of Alaska Subregions.

#### Production:

*Northstar* – Northstar (see Figure 5) is a joint Federal/State of Alaska unit located in state waters in the Beaufort Sea about 6 miles northwest of Prudhoe Bay. BP Exploration Alaska, Inc. (BPXA) is the lessee and operator of Northstar. The six producing Federal wells fall under BSEE regulatory authority, the State wells fall under the State’s oversight. Production started in 2001 and peaked in 2004. Total production through July 2012 is more than 155 million barrels; with the Federal portion comprising about 27.6 million barrels.

#### Development:

*Liberty* – The Liberty prospect is located in the central Beaufort Sea about 6 miles east of the existing Endicott Satellite Drilling Island (SDI). British Petroleum Exploration Alaska (BPXA) had proposed the use of ultra-Extended Reach Drilling (uERD) technologies to lengths of 5-8 miles, allowing the Liberty unit to be developed from an expansion of the existing Endicott SDI. Following review of their plans, BPXA decided not to pursue the

**Figure 5** Northstar Island, August 2000



project in this form and is considering other development options, including potential construction of a gravel island. BPXA estimates that the reserves for the Liberty project are 105 million barrels of oil.

Exploration:

*Conditionally Approved Exploration Plan for Camden Bay (Beaufort Sea)* – Shell plans to drill up to four exploration wells in the Beaufort Sea, beginning in the 2012 drilling season and continuing over multiple years. The wells will be located about 20 miles offshore, in waters approximately 120 feet deep. BOEM approved Shell’s Beaufort Sea Exploration Plan subject to 11 conditions on August 4, 2011. The conditions included requirements for Shell to receive specific permits and authorizations from the EPA, NMFS and USFWS. The conditions also included requirements that Shell submit documentation for approval on the procedures for deployment, installation and operation of the subsea well-capping and containment system, as well as relief well plans. Under the conditions of the plan, Shell must employ an approved, site-specific bowhead whale monitoring program, beginning on August 1. Shell must also suspend any drilling operations in the Beaufort Sea from August 25 until nearby Native Alaskan villages have completed their subsistence hunts and Shell has received approval from BOEM to resume activity.

*Conditionally Approved Exploration Plan for the Chukchi Sea* – Shell proposes drilling up to six exploration wells in Alaska’s Chukchi Sea, beginning in the 2012 drilling season and continuing over multiple years. The wells will be located about 85 miles northwest of the coastal village of Wainwright, in waters approximately 140 feet deep. BOEM approved the Chukchi Sea EP subject to 15 conditions on December 16, 2011. Among the conditions of approval is a measure designed to mitigate the risk of an end-of-season oil spill by requiring Shell to leave sufficient time to implement cap and containment operations as well as significant clean-up before the onset of sea ice, in the event of a loss of well control. Given current technology and weather forecasting capabilities, Shell must cease drilling into zones capable of flowing liquid hydrocarbons 38 days before the first-date of ice encroachment over the drill site. Based on a 5-year analysis of historic weather patterns, BOEM has estimated November 1 as the earliest anticipated date of ice encroachment. The 38-day period would also provide a window for the drilling of a relief well, should one be required. Approval is also conditioned on a series of other measures to increase safety and confirm the availability of response equipment, including a well capping and containment system, and to ensure that Shell takes important steps to avoid conflicts with subsistence activities. Approval is also conditioned upon receipt of necessary approvals from other agencies, including BSEE.

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

Legal Challenges: Litigation remains a factor for Alaska OCS activities. Currently, there is one active case.

*Native Village of Point Hope v. Salazar*, No. 1:08-cv-00004-RRB (D. Alaska) (Sale 193). In January 2008, a coalition of environmental groups, a local government, a Federally recognized tribe, and an Alaska Native organization challenged the government's decision to hold Lease Sale 193, which offered tracts in the Chukchi Sea. The plaintiffs alleged inadequacies in the environmental reviews supporting the leasing decision. On July 21, 2010, the U.S. District Court for the District of Alaska issued an order that enjoined all activity under Lease Sale 193 and remanded the action back to the government for additional NEPA review. Specifically, the Court instructed the government to: (1) analyze the environmental impact of natural gas development; (2) determine whether missing information identified in the Sale 193 Final EIS was essential or relevant under 40 CFR 1502.22; and (3) determine whether the cost of obtaining the missing information was exorbitant, or the means of doing so unknown. BOEMRE (now BOEM) prepared a Final Supplemental EIS to satisfy these three concerns, and on October 3, 2011, the Secretary of the Interior signed a Record of Decision that affirmed Sale 193 as held.

On February 13, 2012, finding that BOEM had satisfied its remand, the District Court entered an order dismissing the matter in its entirety. On April 12, 2012, Plaintiffs filed a Notice of Appeal. The matter awaits consideration at the Ninth Circuit Court of Appeals.

### **1.3 Identification of Information Needs**

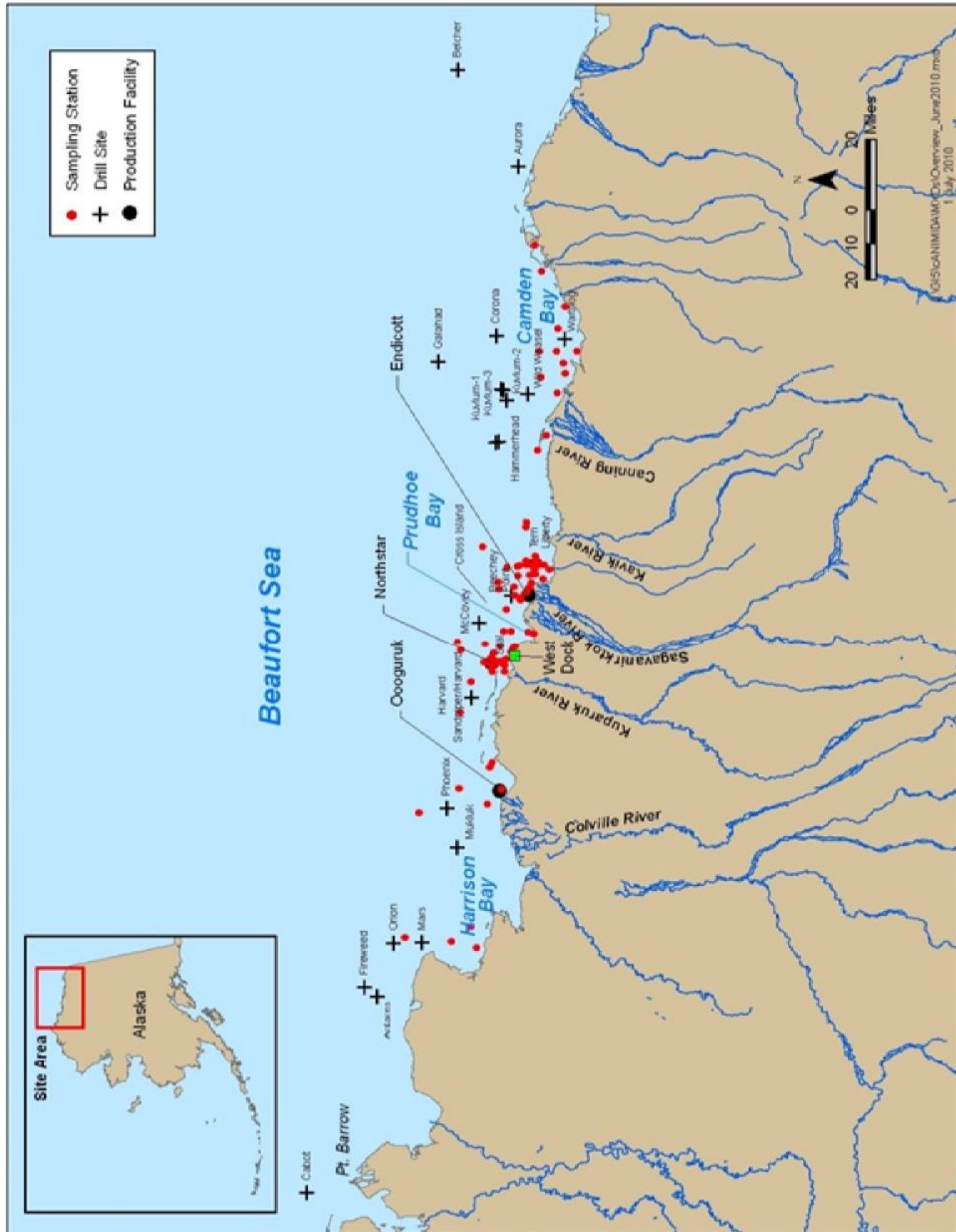
#### **1.3.1 Beaufort Sea General Information Needs**

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

Interdependent Physical, Biological and Social Processes: The "Arctic Nearshore Impact Monitoring in Development Area" (ANIMIDA), a program started in 1999, was developed to provide baseline data and monitoring results for chemical contamination, turbidity, and subsistence whaling in the vicinity of Northstar and Liberty development sites (see Figure 6). This long-term monitoring project gathers biological and chemical data to provide a basis of continuity and consistency in evaluation of potential effects from upcoming site-specific development and production in the Beaufort Sea OCS. The most recent final study reports are available on our agency website and at the project website: <http://www.duxbury.battelle.org/canimida/home/index.cfm>.



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



Much of this work is planned to continue under the 2012-2017 five-year leasing program. The “Continuation of Impact Assessment for Cross Island Whaling Activities” has been extended to add a fifth field season. The study “ANIMIDA III: Boulder Patch and Other Kelp Communities in the Development Area” was awarded in 2012. A companion study, “ANIMIDA III: Contaminants, Sources, and Bioaccumulation” will comprise a continuation of monitoring of sediment chemistry, turbidity and suspended sediment dispersion, and bioaccumulation of contaminants. This study, planned to begin in FY 2013, has been expanded in area to include Camden Bay, where drilling to delineate existing oil discoveries is planned.

A number of ongoing studies also take an integrated approach to examining the interdependence of physical, biological and social processes and filling identified information needs across the various disciplines. Highlights of these and other important research projects are provided in Section 1.3.4.

Ocean Circulation and Sea Ice: Accurate information on surface wind fields, ocean currents, and sea ice is important for determining the fate of spilled oil in this region and the impacts on biota associated with these systems. Studies conducted by the Alaska OCS Region have demonstrated that landfast ice completely blocks wind forcing of under-ice waters. Thus, water moves differently under landfast ice than adjoining open or pack ice waters. It becomes very important to know locations of and seasonal changes in the distribution of polynyas, leads, and landfast ice. The study “Enhanced Interpretation of Arctic Ice Formation, Distribution, and Density,” proposed for FY 2013, will enhance the resolution of regional-scale ice data to improve understanding of spatial and temporal variations in sea ice characteristics.

Air Quality: The transfer of authority to BOEM to regulate industrial emissions in Arctic OCS areas necessitates prioritization of Arctic OCS air quality studies. Arctic oil and gas exploration and extraction activities proposed for the OCS require environmental evaluations pursuant to the National Environmental Policy Act and air pollution operating permits to comply with the impact analysis required under NEPA and the Clean Air Act. Information will be used to assess the cumulative air quality impact of off-shore Arctic oil and gas activity, including oil spill response equipment and associated support equipment not already accounted for through State and Federal air quality permit requirements. The study “Arctic Air Quality Impact Assessment Modeling,” proposed for FY 2013, will compile a database of emission sources that will be used to drive EPA-approved air quality models.

Pollutants: North Slope villagers are concerned about potential contamination of their food supply. In the Beaufort Sea such foods include bowhead whales, seals, waterfowl and fish. Of particular concern are environmental effects of development on these biota, including those from potential oil spills. Up-to-date information on ocean currents and sea ice is necessary to fully address these concerns. The study “The Hanna Shoal Ecosystem Study” in the area between Barrow and the Chukchi Sea drilling area and the planned “ANIMIDA III” study in the Beaufort Sea industrial development area will continue contaminant monitoring in biota and sediments.

Concern has also been raised over increasing spillage from corroded pipelines on the North Slope. The ongoing study “Oil Spill Occurrence Estimators for Onshore Alaska North Slope

Crude and Refined Oil Spills” will update spill data for the Alaska North Slope and estimate occurrence rates for onshore oil spills. Information on the fate (weathering) of oil spills has recently been examined as part of a joint industry consortium (Oil in Ice JIP [Joint Industry Program]) doing field experiments on cleanup, behavior, and weathering of oil in broken ice. The study “Physical and Chemical Analysis of Crude and Refined Oils: Lab and Mesoscale Oil Weathering,” proposed for FY 2013, will conduct laboratory and mesoscale oil weathering tests on a number of Alaskan crude or condensate oils, as well as refined oils.

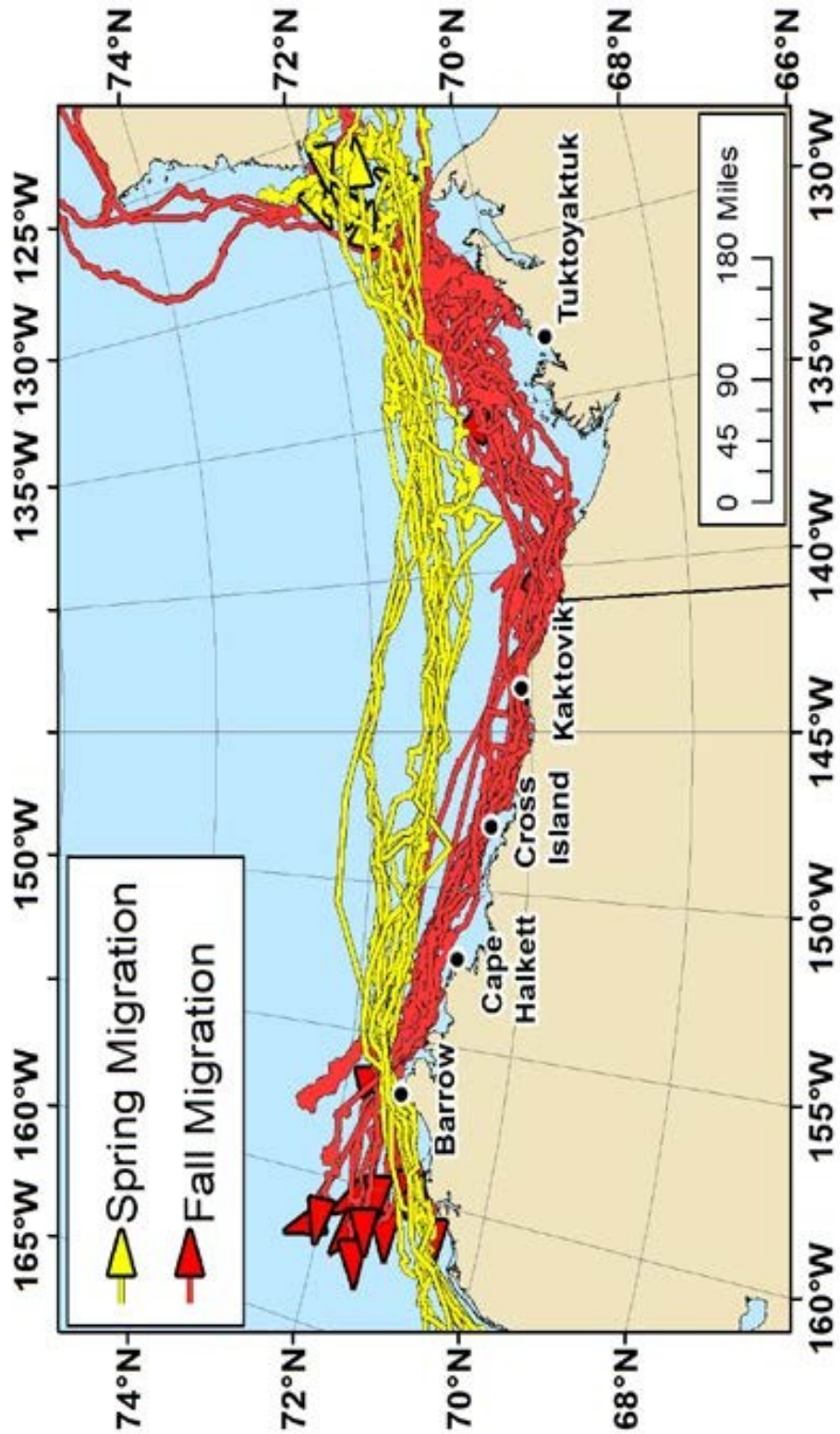
Information on Bowhead Whales and Other Wildlife: Iñupiat whale hunters rely heavily on bowhead whales for subsistence. The bowhead whale is central to village cultural and spiritual life. Whale hunters have reported that migrating bowhead whales deflect from their normal migratory route well upstream 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. Figure 7 depicts a synthesis of tracks from satellite-tagged bowhead whales during the spring and fall migrations showing that spring migration occurs farther from shore than in fall. A total of 57 bowheads were tagged between 2006 and 2010. Bowhead whales also feed along the fall migration route and information about bowhead feeding and habitat use is needed. Additionally, Iñupiat whale hunters and the scientific community have raised concerns about potential cumulative impacts on bowhead whales. Noise from industrial activity is a central concern. It is important to assess the factors that may be affecting the habitat use, health, population status and migration routes of bowhead whales.

The populations of bowhead whales, polar bears, spectacled eiders, and other threatened and endangered species, as well as candidate species such as walrus and ice seals, are an ongoing concern of environmental groups, Federal agencies and others. Potential effects from loss of sea ice are a particular concern. More comprehensive abundance estimates for these ice-associated seals are needed to establish extinction risk assessments under the ESA and to ensure compliance with Federal management and regulatory mandates for marine mammals under the MMPA. North Slope villages are also concerned about potential disturbance of beluga whales, ringed seals, waterfowl and other subsistence-wildlife species by oil industry activities such as helicopter overflights.

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

The Magnuson-Stevens Fishery Conservation and Management Act is the Federal law that governs U.S. marine fisheries management for all outer continental shelf waters. Under the Magnuson-Stevens Act, each fishery management plan must describe and identify Essential Fish Habitat (EFH) for the fishery, minimize to the extent practicable the adverse effects of fishing on EFH, and identify other actions to encourage the conservation and enhancement of

**Figure 7** Tracks from satellite-tagged bowhead whales during the spring and fall migrations (Quakenbush et al. 2012)



EFH. BOEM and other Federal agencies must consult with NMFS regarding any action that may adversely affect EFH. BOEM engages in consultation with NMFS officials and EFH assessment for a number of species, including Arctic cod (adult and late juvenile), Pacific salmon (adult and late juvenile), and saffron cod (adult and late juvenile). This EFH includes both waters and substrate that are utilized by these species within waters potentially affected by energy management activities.

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

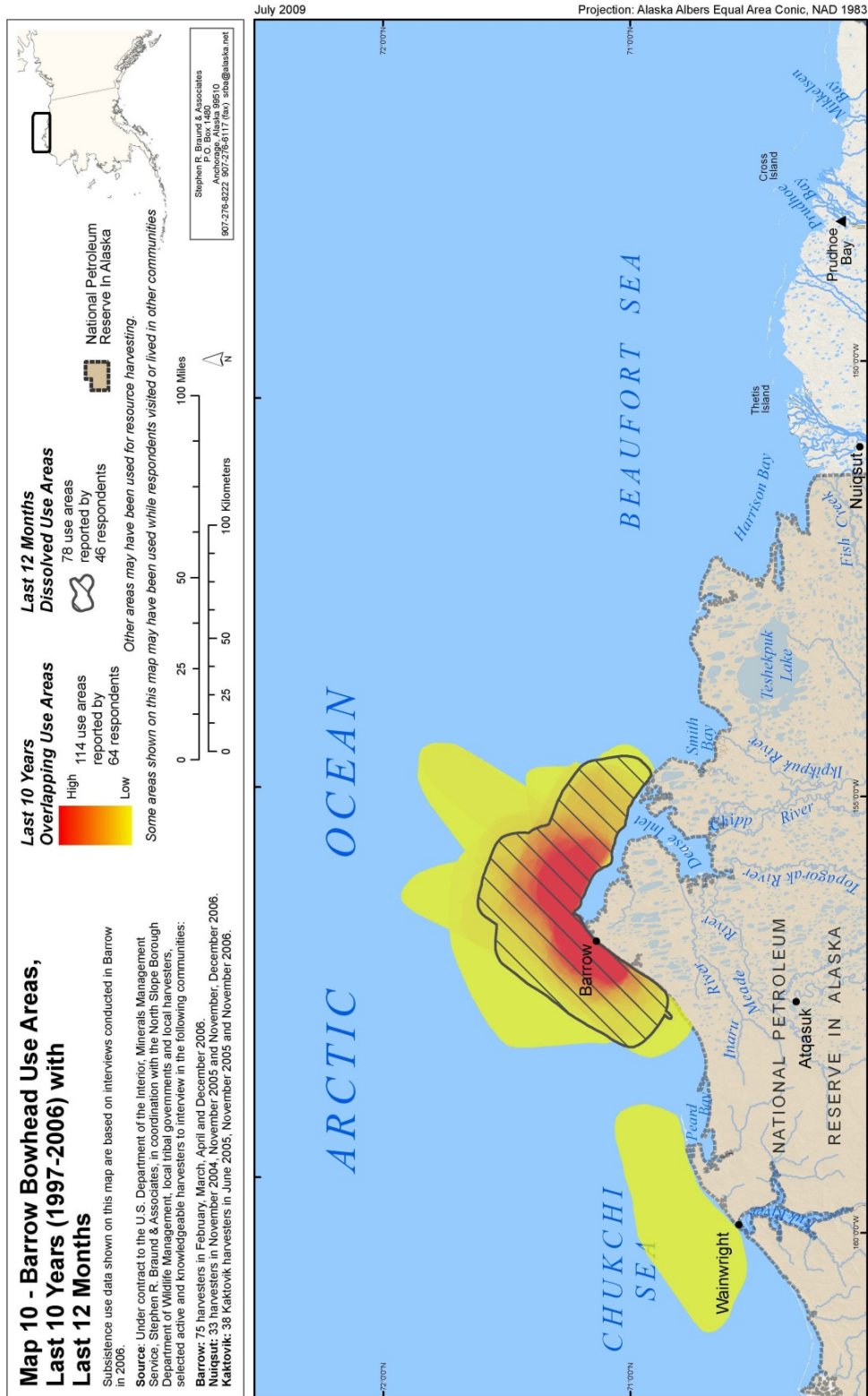
- Social disruption and a change in cultural values through population shifts (immigration of large numbers of non-Iñupiat to the North Slope)
- Employment changes (potential effects on subsistence lifestyle by a cash economy)
- Cumulative effects of multiple industrial activities, alteration of subsistence-harvest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

There is an ongoing need to monitor key indicators of socioeconomic and cultural changes on the North Slope. The Iñupiat rely on a wide variety of marine resources as significant sources of food. In addition, the harvesting, sharing and consuming of subsistence resources form an important part of the traditional Iñupiaq culture and spiritual life. People are concerned that a temporary or permanent elimination of primary subsistence foods would cause North Slope residents either to shift to less desired subsistence resources or to replace subsistence foods with expensive Western foods. Figure 8 provides an example of a synthesis map depicting bowhead whale subsistence hunting areas near Barrow over time. The Iñupiat are concerned about mitigation, including compensation for potential losses. An anticipated decline in oil revenues to the NSB is an issue of concern also. Another concern is the use of local and traditional knowledge in analysis of potential environmental effects. We continue to seek and include firsthand knowledge of local subsistence hunters to augment the scientific knowledge base.

### 1.3.2 Chukchi Sea General Information Needs

The fundamental issues in the Chukchi Sea are very similar to the Beaufort Sea (see Section 1.3.1), although many species that regularly appear within the Chukchi Sea are not typically found within the Beaufort Sea. One major difference is that USDOJ placed less emphasis on studying the Chukchi Sea than the Beaufort Sea beginning in the mid-1990s in recognition of leasing priorities at the time. Since 2007, however, the Alaska OCS Region has developed a new suite of studies in the Chukchi Sea, leveraging more than \$50 million (through FY 2011) to conduct interim baseline research and monitoring in all the following fields of interest: meteorology, ice dynamics and basic oceanography, benthic fauna and sedimentation, marine mammals (including whales, walrus, seals, and polar bear), fish, birds, and social systems. Most of the projects exhibit complex, multilateral collaborations, with explicit interdisciplinary linkages between the physical and biological sciences, and many of them also provide a role for active participation by Alaska 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.

**Figure 8** A synthesis map depicting bowhead whale subsistence hunting use areas for the community of Barrow over time. (Stephen R. Braund & Associates, 2009)



### 1.3.3 Renewable Energy General Information Needs

Section 388 of the Energy Policy Act of 2005 amended the OCSLA to give discretionary authority to BOEM to issue leases, easements or rights-of-way on the OCS for alternative energy projects, such as wind, wave, or ocean current facilities. Under this new authority, the areas that BOEM makes available for alternative energy leasing are likely to be determined through a process that assesses different types of alternative energy resources, anticipated and potential environmental impacts, and other relevant information on a national, regional, or local basis.

### 1.3.4 Current Keystone Studies

#### Integrated Multidisciplinary Studies:

*Hanna Shoal Ecosystem Study:* This study will continue the ecological monitoring of the recently completed Chukchi Sea Offshore Monitoring in Drilling Area (COMIDA): Chemistry and Benthos (CAB) study and extend it to the region of Hanna Shoal. The study also will document the circulation and density fields, as well as ice conditions, at Hanna Shoal and examine important chemical, physical and biological interactions with the unique ecological regime in this highly productive area.

*U.S.-Canada Transboundary Fish and Lower Trophic Communities:* In collaboration with the Department of Fisheries and Oceans Canada, this partnership with UAF will document baseline fish and invertebrate species presence, abundance, distribution and biomass in the U.S. and Canadian Beaufort Sea. The hydrographic structure of the eastern Beaufort shelf will also be documented to provide enhanced understanding of the effects of habitat variables such as temperature and salinity on species distributions under different climate conditions.

*COMIDA: Passive Acoustic Detection and Monitoring of Endangered Whales in the Arctic:* This study documents the general presence of bowhead, right, fin, gray, and other baleen whales in areas of potential seismic, drilling, construction, and production activities. Data will be useful for estimating temporal limits and formulating designs of mitigation for such activities. The study funds the fabrication and deployment of arrays of long-term acoustic recorders that are capable of continuous year-round recording. The three-year study “Chukchi Acoustics, Oceanography and Zooplankton (CHAOZ): Hanna Shoal” proposed for FY 2013 will extend this monitoring to the area of Hanna Shoal.

*Synthesis of Arctic Research:* Between the years 2005 and 2015 MMS/BOEM will have invested more than \$50,000,000 in marine mammal and related oceanographic studies in the western Arctic. These data serve to increase our ecosystem knowledge about the region considerably, but interpretation will be complicated by concurrent environmental changes. This study will conduct a synthesis of multidisciplinary marine science information in the northern Bering, Chukchi and Beaufort seas from recent and ongoing research conducted by BOEM, as well as other Federal and State agencies and industry.

### Air Quality and Meteorology:

*Mesoscale Meteorology:* Accurate specification of the surface wind and stress field is essential to predict ocean and ice circulation, and to improve oil spill models. In partnership with UAF, this study conducts a long-term hindcast simulation with an optimized data-modeling system to produce a high resolution meteorological dataset and to document climatological features of the Beaufort/Chukchi Seas. This study includes development of a database that synthesizes meteorological observations from nearly 200 locations across northern Alaska, covering the period 1979-2009 and encompassing several different observational networks (see Figure 9).

### Physical Oceanography:

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

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

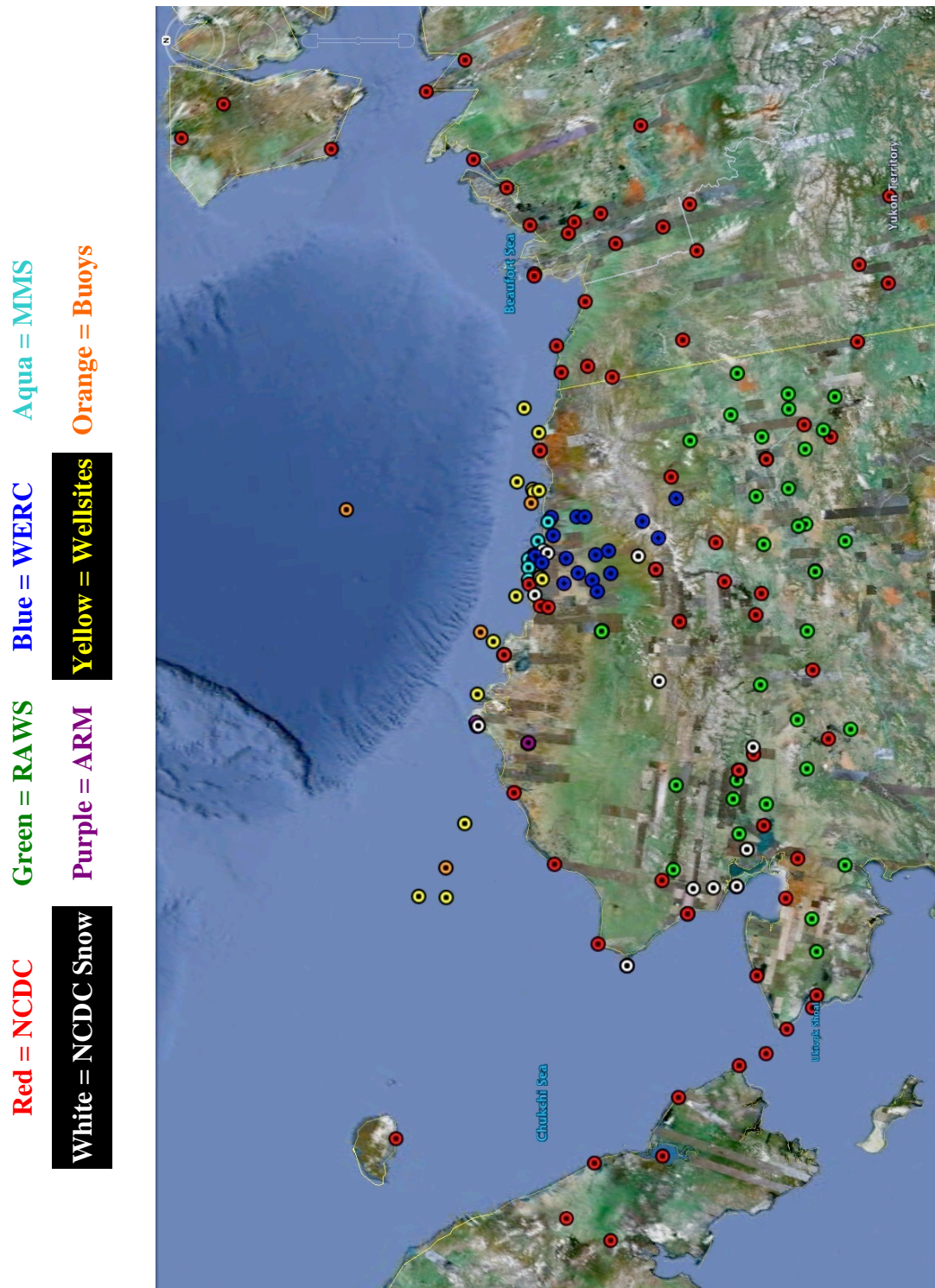
### Marine Mammals:

*Use of the Chukchi Sea by Endangered Whales:* In collaboration with NMFS and the Pacific Marine Environmental Laboratory (PMEL), this study will assess patterns of spatial and temporal use of the Chukchi Sea by endangered bowhead, fin and humpback whales, and beluga and gray whales, and evaluate ecological relationships that affect critical habitat for these species. This effort combines targeted oceanographic sampling with biological sampling and satellite tagging of individual humpback, fin and gray whales to expand scientific understanding of whale behavior and to improve predictions about where and when aggregations of feeding whales are likely to occur. This study will extend the research of the “Bowhead Whale Feeding Ecology Study” (also known as BOWFEST) research into the Chukchi Sea and expand the scope to include other cetacean species.

*Distribution and Relative Abundance of Marine Mammals in the Chukchi Sea and the Fall Migration of Bowhead Whales in the Beaufort Sea:* In partnership with NMML, this study merges the Bowhead Whale Aerial Survey Project (BWASP) and the Chukchi Sea aerial surveys of marine mammals. This combined effort collects aerial survey data on seasonal distribution, relative abundance, and habitat use of marine mammals in the Beaufort and Chukchi seas. Observations are focused on bowhead whales, but also help to monitor gray whales, beluga whales, Pacific walrus, polar bears, bearded seals, and several other species of ice seals. All of these species are subject to changes in environmental variables such as



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



oceanographic currents, sea temperature, sea ice cover, prey availability, and anthropogenic impacts. MMS/BOEM has conducted aerial surveys of the fall migration of bowhead whales each year since 1987. Methods are comparable from year to year and based on similar monitoring dating to 1979.

*Satellite Tracking of Bowhead Whales: Habitat Use, Passive Acoustic and Environmental Monitoring:* In collaboration with the Alaska Department of Fish and Game, this study will track the movements and document the behavior and habitat utilization of bowhead whales using satellite telemetry. Tags equipped with environmental sensors will be deployed to monitor, collect, and transmit ambient oceanographic conditions during bowhead whale migrations. Acoustic tags will document vocalization rates and ambient noise levels to develop analysis of call rates relative to behavior and disturbance. Data will be used to examine interannual variation in bowhead feeding concentrations and vocalizations. Other large cetacean species (Gray whale, Humpback whale and Fin whale) may be opportunistically tagged and tracked as a pilot study for future research.

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

*Abundance Estimates of Ice-Associated Seals in the Chukchi Sea:* In collaboration with scientists at NOAA's National Marine Mammal Laboratory (NMML) and the Russian Institution Giprobyflot, this study will conduct surveys of ice-associated seals using high-resolution digital photographic and thermal imaging sensors and calculate abundance estimates for bearded, spotted and ribbon seals in the Bering and Chukchi seas. Abundance estimates will be computed using hierarchical models for seal abundance developed at NMML.

#### Habitat and Ecology:

*Distribution of Fish, Crab and Lower Trophic Communities in the Chukchi Sea Lease Area:* This partnership with NOAA and UAF documents and characterizes the distribution of pelagic and demersal fish and invertebrate communities in the Chukchi Sea lease area. The study includes field surveys to obtain baseline data on the structure and function of the Chukchi ecosystem and the ecology of important fish species in the region. This project is a component of the "Arctic Ecosystem Integrated Survey," a collaborative effort involving scientists from UAF, NOAA's Alaska Fisheries Science Center, USFWS and ADF&G.

*Beaufort Sea Marine Fish Monitoring in the Central Beaufort Sea:* In partnership with UAF, this study designs a long-term fish monitoring plan for the central Beaufort Sea and implements a survey to establish baseline knowledge of fish species, distribution and relative abundance in the region.

*Biogeochemical Assessment of the OCS Arctic Waters:* In collaboration with the Coastal Marine Institute at UAF, the objective of this cooperative study is to assess the effect of ocean acidification on the marine environment of the Bering Sea and Chukchi Sea. Dissolved organic and inorganic nutrients and carbon, total alkalinity, particulate organic matter, and pCO<sub>2</sub> measurements are used to calculate net ecosystem production and acidification.

Social Systems:

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

*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.

*Social Indicators in Coastal Alaska: Arctic Communities:* This study will update key socio-cultural and economic baseline data for analysis of potential local and regional impacts from offshore exploration and development activities. It will evaluate the pace, direction and magnitude of regional socio-economic changes experienced by residents in select Arctic coastal communities including: Pt. Lay, Wainwright, Barrow, Nuiqsut and Kaktovik.

This page left blank intentionally.

## **SECTION 2.0 STUDY PROFILES**

### **2.1 Profiles of Ongoing Studies**

Profiles of ongoing studies can be found at:

<http://www.boem.gov/akstudies/>

This website is updated three times each year and includes:

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

For completed Alaska OCS Region Studies, go to:

[http://www.data.boem.gov/homepg/data\\_center/other/espis/espisfront.asp](http://www.data.boem.gov/homepg/data_center/other/espis/espisfront.asp)

This page left blank intentionally.

## ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2013

**Region:** Alaska

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

**Title:** Mesoscale Meteorology Modeling Study Phase II (AK-06-05)

**BOEM Information Need(s) to be Addressed:** The final modeled data could be used to inform the BOEM oil-spill trajectory model. Information will be used in NEPA analysis and documentation for Beaufort and Chukchi Sea Lease Sales, Exploration Plans (EPs), and Development and Production Plan (DPPs).

**Total Cost:** \$1,748,735

**Period of Performance:** FY 2006-2012

**Conducting Organization:** UAF Geophysical Institute

**BOEM Contact:** [Warren Horowitz](#)

### **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 BOEM 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;
- 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/BOEM 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 2012



## ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2013

**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-09-02b)

**BOEM Information Need(s) to be Addressed:** The BOEM 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. In addition, this study will provide information useful for ground-truthing and tuning of numerical ocean models.

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

**Conducting Organization:** NOAA-Pacific Marine Environmental Laboratory

**BOEM Contact:** [Dr. Heather Crowley](#)

### **Description:**

**Background:** During the last three decades there has been a northward shift of some fish species in the eastern Bering Sea. It is hypothesized that these changes are a result of global climate change and the loss of sea ice. The western Arctic physical climate is rapidly changing. The summer minimum sea ice extent in 2007 and 2008 covered an area which was 37% less than the areal coverage of two decades ago and 20% less than the previous minimum coverage in 2005. The rapidity of these changes was unexpected, as the consensus of the climate research community just a few years ago was that such changes would not be seen for another 30 years, as expected from the CO<sub>2</sub> 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 2012

This page left blank intentionally.

## ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2013

**Region:** Alaska

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

**Title:** Application of High Frequency Radar to Potential Hydrocarbon Development Areas in the Northeast Chukchi Sea (AK-09-06)

**BOEM Information Need(s) to be Addressed:** The collection of surface current data will be useful for validating the ocean circulation model of the Chukchi Sea that will support the BOEM Oil-Spill-Risk Analysis (OSRA) used in regional EISs, environmental assessments (EAs), and oil-spill contingency planning. Information from this study will be used in NEPA analysis and documentation for Chukchi Sea lease sales, EPs and DPPs.

**Total Cost:** \$1,193,586 plus Joint Funding      **Period of Performance:** FY 2009-2013

**Conducting Organization:** University of Alaska Fairbanks

**BOEM Contact:** [Warren Horowitz](#)

### **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, the ocean circulation models that support BOEM's oil-spill trajectory analysis 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 very useful for validation of a Chukchi ocean circulation model.

The University of Alaska-Fairbanks, under contract to MMS successfully collected surface current measurements within the central Beaufort Sea Outer Continental Shelf out to 70 km, covering an area over 2500 km<sup>2</sup>. 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 in validating 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 would also be useful for model validation.

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

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

Objectives:

- The deployment of HF radar instruments along the Chukchi Sea coast for the purpose of collecting high resolution surface currents within a portion of the proposed OCS Chukchi lease sale boundary from July through October for four field seasons.
- 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, gliders, wind data from coastal meteorological stations, and varying ice conditions from satellite imagery.
- Provide final report, and spatial database.

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

**Revised Date:** August 2012

## ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2013

**Region:** Alaska

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

**Title:** Characterization of the Circulation on the Continental Shelf Areas of the Northeast Chukchi and Western Beaufort Seas (AK-12-03a)

**BOEM Information Need(s) to be Addressed:** The BOEM needs information on several aspects of the temporal and spatial structure of ocean currents in the northeastern Chukchi and western Beaufort seas. This characterization encompasses a description of the mean circulation under different wind and sea ice coverage conditions. This knowledge will be valuable for (a) improving the quality of information used in the Oil-Spill-Risk Analysis conducted by BOEM, (b) inferring the transport of zooplankton, contaminants and other quantities in key areas, (c) providing insight into the flow-related feeding aggregations of bowhead whales near Barrow, (d) providing important information for the preparation of NEPA documents, (e) providing information for ocean modeling efforts (including validation and skill assessment), and (f) complementing ongoing social research on offshore subsistence hunting.

**Total Cost:** \$5,056,252 plus Joint Funding      **Period of Performance:** FY 2012-2016

**Conducting Organization:** University of Alaska Fairbanks

**BOEM Contact:** [Warren Horowitz](#)

### **Description:**

**Background:** The circulation in the region of the junction between the Chukchi and Beaufort continental shelves is likely complex given the abrupt change in the orientation of the isobaths, change in shelf width, and the convergence of the mean westward wind-driven flow over the Alaskan Beaufort Sea with the mean northeastward flow along the eastern flank of Barrow Canyon. The nature of this junction varies with the winds and ice environment. The regional circulation is such that contaminants introduced on either the Chukchi or Beaufort shelf will likely have a variety of fates. These include being advected from one shelf to the other, being flushed offshore into the Arctic basin, or perhaps accumulating within the vicinity of the western Beaufort Sea due to flow convergence from currents on both shelves. The conditions under which these various scenarios occur are not well known.

This proposed study is a continuation and expansion of the existing surface circulation study within the northeast Chukchi Sea. Prior to 2009, surface current observations on the Chukchi shelf were extremely limited. Through a joint Industry/BOEM supported study, the University of Alaska Fairbanks (UAF), Coastal Marine Institute began measuring surface currents during the open water period on the Chukchi shelf beginning in September 2009 with the deployment of long range (180 km), High Frequency (HF) radar systems located at the villages of Barrow and Wainwright. In 2010, coverage was expanded to the southwest to

include additional offshore lease areas. The surface current data was supplemented by water column profile data collected by Slocum Gliders. Acoustic Doppler current profilers (ADCPs) were also deployed across the Alaska Coastal Current at the head of Barrow Canyon to assess the annual flow regime, the connectivity between surface and subsurface currents during the open water season, and the changes in subsurface currents beneath the mobile pack ice and lead system during the winter months. This new study will expand our present efforts to improve understanding of the flow regime and shelf dynamics between the inner and outer Chukchi shelf, the exchange of waters between the Chukchi Sea and western Beaufort shelf through Barrow Canyon, and the upwelling of Atlantic Waters.

Objectives:

- Extend the present Chukchi Sea HF radar, mooring and glider study to include the western Beaufort shelf slope and Barrow Canyon to investigate the spatial and temporal structure of ocean currents within the western Beaufort and northeast Chukchi shelves and the exchange of waters between these areas.
- Characterize the flow regimes and surface water exchange among areas of the inner and outer Chukchi shelf and the western Beaufort shelf under varying conditions of wind forcing and sea ice coverage.
- Describe the oceanic response, at different levels in the vertical, using all available wind observations, as well as those generated by atmospheric and/or coupled models.

Methods: The above objectives will be pursued using a suite of instrumentation including: ADCPs, CTDs, Ice Profiling Sonar (IPS5), gliders, surface drifters and HF radars. Long Range HF radar systems presently deployed along the Chukchi coast at Point Lay, Wainwright and Pt. Barrow will be modified to increase the maximum observable range to approximately 250 km to capture the summer surface current flow over a larger area of the Chukchi shelf and around Hanna Shoal. A planned HF radar deployment at Cape Simpson (CIAP funds) will capture surface current flow along the western Beaufort shelf and slope and within Barrow Canyon. Gliders, surface drifters, moored ADCPs and towed CTDs will collect data on depth and time dependent current, temperature and salinity structure. Ice Profiling Sonar and moored ADCPs will be used to calculate ice drift and velocity. Sea ice extent will be obtained from satellite information, while drifting buoys will be crucial for computing flow trajectories and diffusivities. Data from the ADCPs, CTDs, glider deployments, HF radars, planned drifter measurements and available industry data will be synthesized to acquire a comprehensive characterization of the circulation in the study area. This project will coordinate and collaborate with other research projects in the area (BOEM, WHOI, industry, etc.) to synthesize and integrate all available data.

**Revised Date:** August 2012



## ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2013

**Region:** Alaska

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

**Title:** Satellite-Tracked Drifter Measurements in the Northeast Chukchi Sea (AK-08-12-08)

**BOEM Information Need(s) to be Addressed:** This study will provide information on surface currents in the vicinity of the Chukchi Sea Lease Area during the open water season. Results from his study will provide model validation data for BOEM modeling efforts, and provide new information regarding current shear in the upper ocean and its relation to changes in stratification and winds.

**Total Cost:** \$459,892 plus Joint Funding      **Period of Performance:** FY 2011-2014

**Conducting Organization:** CMI, UAF

**BOEM Contact:** [Warren Horowitz](#)

### **Description:**

Background: The oil and gas industry plans to drill exploratory wells within the Chukchi Sea during the open water season within the coming years to assess the extent of potential hydrocarbon resource within the subsurface formations. The BOEM and the oil and gas industry are presently sponsoring a physical oceanographic study in the Chukchi Sea to measure ocean current circulation fields from High Frequency (HF) radar sites located along the northwestern coast of Alaska at Barrow, Wainwright and Point Lay. The data from this study are providing us with significant new information on Chukchi Sea surface current circulation within the boundary of the radar coverage. The drifter measurements as proposed within this CMI study will provide information on near surface current movements, augmenting the HF radar effort by extending the surface current measurements beyond the range of HF radar coverage. In addition, the drifter measurements will answer critical questions on not only how currents flow at the surface, as HF radars define, but how currents flow below the surface, where pollutants could also get transported.

Objectives: The objectives of the drifter deployment program are to:

- Map the surface current drift within the upper water column at one meter and ten meter water depths.
- Document the differences in the surface and subsurface flow fields as related to the bathymetry, seasonally-varying winds, stratification, and/or ice-edge fronts.
- Display the daily results of the drifter trajectories on a project website open to the public.

Methods: A ship will deploy CODE-type drifters to measure the upper meter surface current flow and WOCE-drifter drogues to measure current speed and direction at a depth of 10

meters. Each drifter will contain a surface thermistor to measure surface water temperatures. The drifters will be deployed from a ship from two different oil and lease block locations, on a weekly basis, beginning in early August and ending by mid-September. The drifter positions will be determined by satellite GPS fixes twice every hour during its time of operation. Repeated drifter deployments will allow statistical analysis of the spatial and temporal distribution of upper ocean flow, its vertical shear, and surface water motion. Comparison of drifter movements will also be made against available subsurface current measurements from current meters and ADCPs and surface measurements collected from HF radars. The impacts on drifter motion from the seasonal changes in ocean stratification will also be examined. Synthetic Aperture Radar (SAR) satellite imagery will be analyzed to document whether drifter motion is impacted by ice edge fronts. These drifter deployments will encompass a near full range of sea ice concentrations, meteorological, and oceanographic conditions that would be expected during the July/August through September/October open water season in the northeast Chukchi Sea. Their individual trajectories will be updated daily to a map on the publically available, University of Alaska Fairbanks project web site. A second field season has been added to this program.

**Revised Date:** August 2012

## ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2013

**Region:** Alaska

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

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

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

**Total Cost:** \$349,999

**Period of Performance:** FY 2011-2013

**Conducting Organization:** Rutgers University

**BOEM Contact:** [Dr. Walter Johnson](#)

### **Description:**

**Background:** The BOEM proposes to lease within the Beaufort and Chukchi Sea Planning Areas. To maintain its state-of-the-art in oil-spill-risk analysis, BOEM seeks to take advantage through time of the increasing skill of circulation models supported by more and better data. A coupled ice-ocean model can be modified and expanded to capture provide multi-year circulation, ice, and forcing fields for use in BOEM NEPA oil-spill-risk analysis and post-sale oil spill response planning.

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

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

**Revised Date:** August 2012

This page left blank intentionally.

## ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2013

**Region:** Alaska

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

**Title:** Updates to the Fault Tree for Oil-Spill Occurrence Estimators Needed Under the Forthcoming BOEM 2012-2017, 5-Year Program (AK-11-01)

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

**Total Cost:** \$229,840

**Period of Performance:** FY 2011-2016

**Conducting Organization:** Bercha International

**BOEM Contact:** [Caryn Smith](#)

### **Description:**

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

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

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

**Methods:** This study will: 1) review and assimilate oil-spill occurrence reports, data and geohazard data from alternative sources and locations as needed; 2) use updated Gulf of Mexico OCS historical data together with its measures of spill size and frequency variance to run the Monte Carlo fault tree model with these measures of variance; 3) provide updated fault tree analyses for Arctic oil and gas lease sales based on BOEM-supplied exploration and development scenarios, generating life-of-field oil spill occurrence rates and indicators; 4) provide up to two additional fault-tree analyses for Beaufort and/or Chukchi Seas for site-specific oil and gas development taking into account site-specific geohazards and generating life-of-field occurrence indicators; 5) provide a formal report documenting each analytical or fault-tree update, and 6) provide professional support to BOEM in regard to statistical issues of occurrence rates and estimator(s) related to this study and its results.

**Revised Date:** August 2012

## **ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2013**

**Region:** Alaska

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

**Title:** Oil Spill Occurrence Estimators for Onshore Alaska North Slope Crude and Refined Oil Spills (AK-11-02)

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

**Total Cost:** \$199,260

**Period of Performance:** FY 2011-2014

**Conducting Organization:** Nuka Research and Planning Group

**BOEM Contact:** [Dr. Heather Crowley](#)

### **Description:**

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

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

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

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

Objectives:

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

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

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

Deliverables will include user-friendly models and/or algorithms to allow BOEM staff to recalculate the contractor's measures of variability as additional information or data become available.

**Revised Date:** August 2012



## ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2013

**Region:** Alaska

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

**Title:** Loss of Well Control Occurrence and Size Estimators for the Alaska OCS (AK-11-12)

**BOEM Information Need(s) to be Addressed:** The Oil-Spill-Risk Analysis (OSRA) is a cornerstone to regional EISs, environmental assessments, and oil-spill-contingency planning. A fault-tree approach is used to extrapolate the historical non-Arctic spillage to Arctic conditions for Arctic NEPA analyses. The OSRA spill rate calculations, because of oil-spill issues, constitutes a significant portion of public comments submitted on lease sale or development EISs and exploration EAs in the Alaska OCS Region even prior to 2010 *Deepwater Horizon* spill in the Gulf of Mexico OCS. Well control incident data from Gulf of Mexico, the North Sea, and offshore Australia exploration and development well activities will be reviewed, statistically analyzed and formatted for use for future fault tree and NEPA analyses.

**Total Cost:** TBD

**Period of Performance:** FY 2012-2014

**Conducting Organization:** TBD

**BOEM Contact:** TBD

### **Description:**

**Background:** The BOEM uses the historical blowout record on the Outer Continental Shelf (OCS) and the North Sea as an input to the fault tree model to develop oil spill occurrence rates for oil-and-gas-lease sales and any development projects in the Chukchi and Beaufort Sea OCS Planning Areas proposed under BOEM and industry planning. In recent years, the Alaska OCS Region has frequently been tasked to provide frequency estimates and analysis of loss of well control occurrence during lease sale, exploration and development in NEPA assessments. The largest spill from a single well control incident in the history of offshore oil industry, the *Deepwater Horizon* blowout in the Gulf of Mexico OCS, has further focused interest in consideration of very large spills from well control incidents in NEPA analyses.

Under the Bureau of Safety and Environmental Enforcement Regulations 30 CFR § 250.188 (3) industry must report all losses of well control. “Loss of well control” means: (i) Uncontrolled flow of formation or other fluids. The flow may be to an exposed formation (an underground blowout) or at the surface (a surface blowout); (ii) Flow through a diverter; or (iii) Uncontrolled flow resulting from a failure of surface equipment or procedures. *Offshore Blowouts: Causes and Control* (Holand, 1997) has the most comprehensive analysis of worldwide blowout data, but those data are in need of updating. The primary world database for this information has been compiled by and is held by SINTEF, with SINTEF and a few others with access providing statistical analyses based on the database.

Objectives:

- Update offshore loss of well control frequency information through 2011 for the Gulf of Mexico and Pacific OCS, the North Sea, Australian offshore regions and other areas with a comparable regulatory regime.
- Apply statistical procedures to develop loss of well control occurrence rates for different operational phases and product spilled (e.g., gas, crude and condensate, drilling mud).
- Estimate confidence intervals for occurrence rates.
- Provide statistical measures such as mean and median spill sizes including appropriate methods for statistical outliers such as the *Deepwater Horizon* blowout.

Methods: The investigators will collate and analyze available data on offshore well control incidents in the Gulf of Mexico and Pacific OCS, the North Sea, Australian offshore regions and other areas with a comparable regulatory regime. Existing very large oil spill examples (probability, size, and basis) from regional (Alaska) oil spill contingency plans and environmental assessments will also be reviewed. The investigators will calculate well control incident frequencies and perform appropriate statistical analyses, including trend analysis.

**Revised Date:** August 2012

## ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2013

**Region:** Alaska

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

**Title:** ANIMIDA III: Boulder Patch and Other Kelp Communities in the Development Area (AK-11-14a)

**BOEM Information Need(s) to be Addressed:** The Arctic Nearshore Impact Monitoring in Development Area (ANIMIDA) and continuation of ANIMIDA (cANIMIDA) have monitored the Boulder Patch Area of Special Biological Concern in the Beaufort Sea OCS, with last Boulder Patch survey in 2007. There is a continuing, ongoing need for this monitoring in the development area within the Beaufort Sea during the performance period of the study, which will coincide with continued production from Northstar, development and production from Liberty, and Camden Bay delineation and potential development. The information will be used for NEPA analysis and documentation for Beaufort Sea Lease Sales and DPPs.

**Total Cost:** \$606,000

**Period of Performance:** FY 2012-2018

**Conducting Organization:** University of Texas at Austin

**BOEM Contact:** [Catherine Coon](#)

### **Description:**

**Background:** The ANIMIDA started monitoring of the Boulder Patch in 2000. These and multiple other research projects on the Boulder Patch by BOEM, National Science Foundation, and industry have allowed one of very few long-term monitoring records in the Arctic to be cobbled together, stretching from the late 1970's through the current decade.

The Liberty prospect adjoins the Boulder Patch. In 2008, the MMS approved a development plan for the Liberty prospect that would use directional drilling from an enlarged Satellite Drilling Island (SDI) at the east end of the Endicott Causeway. Shell has also submitted an exploration plan to MMS that would delineate existing oil discoveries in the Sivulliq and Torpedo prospects in Camden Bay, an area with known but poorly mapped kelp beds. Ongoing industry activities necessitate ongoing monitoring projects.

### **Objectives:**

- Evaluate the potential impact from additional activities at the Liberty prospect on the Boulder Patch kelp community.
- Monitor the impact to the Boulder Patch community from increased summer turbidity and other oceanographic changes occurring with climate change.
- Estimate the importance of and extent of Camden Bay kelp patches.

Methods: The Boulder Patch/Kelp patch surveys and monitoring will be conducted from small vessel support in the “open” water season. Kelp production will be measured using established or comparable techniques. Oceanographic measurements shall include ambient light intensity and total suspended solids using established or comparable techniques. Data will be combined with the existing long-term dataset. The extent of Kelp in Camden Bay will be surveyed and GIS maps constructed of kelp and implied (boulder and or hard bottom) kelp beds in the study area.

**Revised Date:** August 2012

## ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2013

**Region:** Alaska

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

**Title:** Evaluating Chukchi Sea Trace Metals and Hydrocarbons Sourced from Nearby Coastal Rivers (AK-08-12-12)

**BOEM Information Need(s) to be Addressed:** Quantifying trace metals and polycyclic aromatic hydrocarbons (PAH) contributions from these terrestrial sources will provide needed information about chemistry and seasonal variability in outputs of contaminants and pollutants from land to the offshore Chukchi lease areas and thus provide a major constraint on background source variability of these chemicals. BOEM analysts and decision makers will use this information in NEPA analysis and documentation for Lease Sales, EPs and DPPs.

**Total Cost:** \$232,760 plus Joint Funding      **Period of Performance:** FY 2012-2014

**Conducting Organization:** CMI, UAF

**BOEM Contact:** [Dr. Heather Crowley](#)

### **Description:**

Background: The Yukon, Kobuk, and Noatak Rivers comprise 88% of the land-derived area draining into the Chukchi Sea (via strong northward directed currents through the Bering Strait). These rivers deliver relatively unknown quantities of particulate and dissolved phases (including metals and hydrocarbons) to the Bering and Chukchi seas. There are ambient levels of metals and hydrocarbons present in marine sediments and seawater in the Arctic, much of which are thought to be originally derived from terrestrial sources. Metals and hydrocarbons from offshore drilling operations can alter the natural biogeochemical state of marine ecosystems. Previous studies have added to our knowledge about concentrations of metals and hydrocarbon pollutants proximate to the OCS lease areas (e.g., ANIMIDA, cANIMIDA, COMIDA CAB). This study will complement previous work by quantifying terrestrial particulate inputs to the Chukchi Sea from “upstream” sources such as the Yukon, Kobuk and Noatak Rivers.

### Objectives:

- Develop an inventory of trace metals and PAHs to the Chukchi Sea derived from coastal sources.
- Assess the relative contributions of trace metals and PAHs from different terrestrial sources (i.e., the Yukon and nearby rivers, coastal erosion).
- Evaluate the completeness of the historic record found in cores taken from high-sedimentation areas.
- Examine the relationship between trace metal abundance in riverine sediment sources and sediment grain-size.

Methods: Researchers will collect active river channel bedload and suspended load sediments for trace metal and PAH analyses from the Yukon Kobuk and Noatak rivers during two summer field seasons. Bedload samples will be collected from river banks whereas suspended sediment load samples will be collected from water pumped at a 1 m depth below the surface. Samples will then be filtered using a continuous flow centrifuge. Sediment cores will also be extracted from the three locations using a vibrocorer. Local residents will be trained to collect additional suspended load and bedload samples during the fall, winter and spring seasons.

**Revised Date:** August 2012

## **ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2013**

**Region:** Alaska

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

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

**BOEM Information Need(s) to be Addressed:** The BOEM 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 BOEM decision making and mitigation. Also, study results will be used in similar pre-lease analyses and documentation for potential future Chukchi Sea Lease Sales.

**Total Cost:** \$275,000 plus Joint Funding      **Period of Performance:** FY 2009-2013

**Conducting Organization:** USGS

**BOEM Contact:** [Kate Wedemeyer](#)

### **Description:**

**Background:** A comprehensive synthesis of ecological and behavioral information concerning arctic fishes of Alaska is important to BOEM 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 BOEM 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 BOEM NEPA analysts.

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

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

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

**Revised Date:** August 2012



## ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2013

**Region:** Alaska

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

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

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

**Total Cost:** \$1,764,252 plus Joint Funding      **Period of Performance:** FY 2010-2013

**Conducting Organization:** University of Alaska

**BOEM Contact:** [Kate Wedemeyer](#)

### **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 BOEM 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 BOEM 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 BOEM 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 BOEM information needs in the Beaufort Sea for use in future surveys.
- Identify the fish species that occupy the central lease area during the ice-covered season.
- Correlate observation of seabirds and marine mammals to fish and zooplankton for increased understanding of this arctic ecological system.

Methods: The survey will sample fish and zooplankton in the central Beaufort between 147° and 152° west longitude, where BOEM 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 include methods adapted to sampling small sized and rare fish thought to inhabit the Beaufort Sea and 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 2012

## ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2013

**Region:** Alaska

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

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

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

**Total Cost:** \$225,981

**Period of Performance:** FY 2010-2014

**Conducting Organization:** Various

**BOEM Contact:** [Kate Wedemeyer](#)

### **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 BOEM 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.

Implement quantitative ecological analyses of existing 2008 Western Beaufort Sea Marine Fish and Invertebrate Survey data with emphasis on ecological relationships among fish species, prey, habitats and communities.

**Revised Date:** August 2012

## ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2013

**Region:** Alaska

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

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

**BOEM 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 Planning Area. Data on the distribution of marine birds is needed for ESA Section 7 consultations and NEPA analyses, DPPs and other documentation. The information obtained from these surveys may assist in development of mitigation measures and strategies to reduce potential impacts.

**Total Cost:** \$138,000

**Period of Performance:** FY 2010-2015

**Conducting Organization:** USFWS

**BOEM Contact:** [Catherine Coon](#)

### **Description:**

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

Species composition of marine birds varies tremendously by season. For example, in the Bering Sea, shearwaters (*Puffinus* spp.) are the dominant species in summer and fall, accounting for 40-60 % of total marine bird density (birds/km<sup>2</sup>). When shearwaters return to their southern breeding grounds in winter and spring, seaducks (*Anatidae* spp.) and Murres (*Uria* spp.) dominate. These species groups have very different dispersal patterns and foraging behaviors, thus seasonal changes should be integrated into management schemes. Furthermore, there is little information on seabird distribution during the migration and winter

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

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

Objectives:

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

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

**Revised Date:** August 2012

## **ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2013**

**Region:** Alaska

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

**Title:** Hanna Shoal Ecosystem Study (AK-11-03)

**BOEM Information Need(s) to be Addressed:** This study will constitute a key component of Chukchi Sea environmental studies pertinent to Chukchi Sea oil and gas activity. The highest oil industry interest is in the Burger prospect bordering Hanna Shoal to the south. The BOEM analysts and decision makers will use the information in NEPA analysis and documentation for Lease Sales, EPs and DPPs, and in post-sale and post-exploration decision making in the Chukchi Sea.

**Total Cost:** \$5,645,168

**Period of Performance:** FY 2011-2016

**Conducting Organization:** University of Texas at Austin

**BOEM Contact:** [Dr. Heather Crowley](#)

### **Description:**

Background: The ongoing COMIDA CAB study is highlighting the importance of Hanna Shoal in the NE Chukchi Sea as a biological oasis bordering the boundary between Chukchi and Arctic Ocean waters. The reason for this, however, is poorly understood. The shallower waters of the shoal have long been known as traps for grounding of bergy bits and deep-keeled sea ice, and a reoccurring polynya is created down current of the grounded ice.

Bering Sea water entering the Chukchi Sea and flowing north is thought to flow both to the east and west of the shoal. Historically, the transport of this warmer Bering Sea water past Hanna Shoal has resulted in melt out of open water “bays” in the ice cover on either side of Hanna Shoal. In most recent years with global warming, floating pack ice in summer persists in this area longer than elsewhere in the Chukchi, often surrounded by open water even to the north. This persistence strengthens the vertical stratification over Hanna Shoal as this residual summer ice melts and freshens the surface layer. Taylor columns may be responsible for maintaining ice in the regions of Herald and Hanna shoals. Circulation processes around Hanna Shoal are poorly understood, but the circulation here is part of a broader circulation field that connects the Chukchi and Beaufort. Waters draining through Herald Valley to the western Chukchi shelf and slope regions are carried to the eastern Beaufort, where outer shelf and slope waters are very likely brought back onto the shelf.

Biological “hot spots” in the Chukchi Sea are thought to be related to coupled pelagic and benthic productivity. A high abundance of bottom fauna is correlated with high pelagic primary production, possibly associated with the ice edge that reached the seabed mostly ungrazed. However, the mechanisms that must explain the productivity at Hanna Shoal are relatively poorly understood. With the retreat of the summer ice-edge to deeper, more northern waters in

recent years, this pelagic/benthic coupling may be weakening at Hanna Shoal. The ongoing productivity of this region depends on the timing and position of the ice edge. Other BOEM projects in the Chukchi are showing sustained benthic productivity in the area of Hanna Shoal accompanied by high concentrations of water birds, walrus, and whales. Ongoing BOEM studies looking at ocean heat transport across the central U.S. Chukchi Sea, to the south and at circulation to the east, toward Barrow Canyon will provide context to this study.

Objectives:

- Refocus the ecological monitoring started under COMIDA CAB to the region of Hanna Shoal, including nearby biological “hot spots.”
- Verify and enhance the food web/contaminant bioaccumulation structure developed in the COMIDA CAB study.
- Measure water column and benthic primary and secondary productivity and biomass, and determine the relation to oceanographic processes.
- Document annual circulation and density fields, as well as ice conditions, at Hanna Shoal throughout the year and examine important chemical, physical and biological interactions with the unique ecological regime in this highly productive area.
- Better understand the physical processes controlling circulation patterns in the region through analyses of numerical ocean process model results.
- Integrate effort and findings with recent and ongoing BOEM and other NE Chukchi Sea studies of higher trophic levels.
- Participate in the Distributed Biological Observatory for the Northeast Chukchi Sea

Methods: This project will continue COMIDA CAB benthic sampling, food web analysis, and contaminant measurements, focusing on the Hanna Shoal region. Water column primary and secondary production and biomass also will be measured. Cruise zooplankton data will be supplemented by data from moored zooplankton-sensing ADCP units capable of distinguishing copepod and euphausiid biomass signatures. Appropriate moored and shipboard measurements of currents, sea ice drift, and hydrography (including geochemistry) will examine circulation and density fields. Moorings will be used for long term profiling of temperature and salinity, including under ice measurements in winter. Additional oceanographic data may be obtained from other projects in the Chukchi, these data include: HF radar, moored acoustic Doppler current profilers (ADCP), meteorological buoys, gliders and moored zooplankton-sensing ADCP units capable of distinguishing copepod and euphausiid biomass signatures. Formal integration with other BOEM projects will be made through the planned “Marine Mammal/Physical Oceanography Synthesis” to provide upper trophic components to the study. Coordination will occur with other international, NSF, NOAA, ADEC, and industry research in the Chukchi Sea.

This study will use numerical ocean process model simulations for the Chukchi Sea, with focus on Hanna Shoal, to better understand the physical processes controlling circulation patterns in the region. Analyses will be performed on the model results to examine interactions of the flow field and density structure with the topography and their relation to productivity and biomass distribution. An ecosystem model also may be incorporated into the simulations.

**Revised Date:** August 2012



## ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2013

**Region:** Alaska

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

**Title:** Distribution of Fish, Crab and Lower Trophic Communities in the Chukchi Sea Lease Area (AK-11-08)

**BOEM Information Need(s) to be Addressed:** This project continues collection of marine fish baseline in the Chukchi Sea, and will provide information on the abundance and distribution of fish, crab, and lower trophic communities in the Chukchi Sea lease area. The study will provide the basis for a better understanding of distribution and relative importance of fish communities. The Alaska OCS Region identified a need for continued fish and invertebrate baseline monitoring during the 2007 MMS-sponsored “Chukchi Sea Information Status and Research Planning Meeting” to provide useful information to upcoming NEPA reviews and post-sale needs.

**Total Cost:** \$2,600,000

**Period of Performance:** FY 2012-2016

**Conducting Organization:** University of Alaska Fairbanks; NOAA

**BOEM Contact:** [Catherine Coon](#)

### **Description:**

**Background:** This study proposes to develop a broader understanding of abundance and distribution of demersal and pelagic fish, crab, and lower trophic communities needed to evaluate and mitigate the effects of offshore oil and gas development. Interim results from a current BOEM funded Coastal Marine Institute (CMI) project, “Current and Historic Distribution and Ecology of Demersal Fish in the Chukchi Sea Planning Area,” have identified temporal, seasonal, and spatial gaps in data on fish in the Chukchi Sea in particular to sampling on or near the lease areas. This proposal was designed specifically to fill these information needs. It will build upon recent information on invertebrate communities in the Chukchi offshore lease area obtained by the 2009 study “Chukchi Sea Offshore Monitoring in Drilling Area (COMIDA): Chemistry and Benthos (CAB).” This will also complement the 2010 LGL component of COMIDA CAB that undertook midwater and benthic fishery samples at 20 sites within the COMIDA CAB sample design. This study would utilize these data and create a similar survey design such that data sets were compatible, comparable, and extend the time series. This study would contribute to further knowledge of pelagic fishes in the northeast Chukchi Sea. Data from this study will provide abundance and distribution information for NEPA analysis on fish and invertebrate species. This study will coordinate with the BOEM central Beaufort Sea Fish Survey for under-ice pilot survey which will occur near Barrow, Alaska, and examine the potential for using icebreakers for fish samples in the ice-covered season. The pilot under-ice marine survey will implement a design outlined in the 2007 MMS “Under-Ice Sampling Workshop.”

In the well-studied Bering Sea, it is apparent that the distribution and community composition of fish has changed in recent decades and many species are shifting their distributions northward. A MMS Beaufort Sea fish survey in 2008 indicated presence of common Bering Sea species, such as walleye pollock and dense aggregations of snow crab in the western Beaufort Sea. These species are also likely to be present in the adjacent Chukchi Sea. This study will increase the extent of fisheries information within the lease area and extend a baseline for further studies linking species distributions between the Bering and Beaufort Seas.

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

#### Objectives:

- Document, characterize and understand the distribution of pelagic and demersal fish and invertebrate communities in the Chukchi Sea lease area for the open water season.
- Estimate the geographic range of fish, invertebrates, and lower trophic biomass in the lease area by comparing recent and historic fishery databases.
- Provide a comparison of these communities with that of prior studies, as well as adjacent regions (Beaufort and Bering Seas) and relate the data to oceanographic fronts.
- Assess utilizing icebreakers to undertake sampling during the winter for the iced-covered season.
- Provide GIS based maps and attribute tables of marine fish and lower trophics for OSRA and NEPA analysis.

Methods: Conduct a one-two year field study with fisheries and lower trophic survey in the Chukchi Sea region to obtain baseline data on the structure and function of these ecosystems and on the ecology of important fish species. Samples locations will be determined such that it compliments and extends recent work in the COMIDA CAB, and could provide for collaboration with the logistics and project goals of the Arctic Ecosystem Integrated Survey scheduled for 2012 in the northeastern Bering Sea to the southern portion of the Chukchi Sea. The abundance of pelagic fish, jellyfish, and large zooplankton (e.g., euphausiids) will be estimated with a multi-frequency echo-sounder and ground-truthed using pelagic gear. The results will be directly comparable to historic surveys conducted by COMIDA CAB, RUSALCA, Conoco/Shell, and Beaufort surveys which will allow them to be placed into a broader latitudinal context. A series of coordinated bottom trawls would use the same survey methodology used by in the 1990/1991 Chukchi Sea Survey, and the RUSALCA surveys 2004-2008. The results will extend the time series (2004-2008) and build upon the earlier

surveys (1990, 1991) of demersal fish and invertebrate communities. To interpret the distribution of fishes and their importance as prey, water column properties (temperature, salinity, light level, chlorophyll fluorescence) will be measured at all trawl stations. This study will coordinate with other ongoing BOEM or other agency or university studies in oceanography and biology to maximize data needs and study design. This study has several collaborators which reference the study as Arctic Ecosystem integrated survey (Arctic Eis).

**Revised Date:** August 2012

This page left blank intentionally.

## ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2013

**Region:** Alaska

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

**Title:** Shorebirds and Infaunal Abundance and Distribution on Delta Mudflats along the Beaufort Sea (AK-11-10a)

**BOEM Information Need(s) to be Addressed:** More information is needed about the species composition, abundance, or distribution of the microfauna and meiofauna invertebrates that shorebirds depend upon for pre-migratory fattening along the Beaufort Sea coast. This study will assess the lower trophic levels forming the base of complex food webs and the biochemistry that influences these relationships. The infaunal abundance contributions to shore bird foraging, migration, and reproductive biology as well as bioremediation of oil spills has been shown to be important factors in the recovery and cleanup of past oil spill events in Alaska and other regions. The information obtained from this jointly-funded research will contribute to development of mitigation measures and strategies to reduce potential impacts from post-lease exploration and development.

**Total Cost:** \$237,169

**Period of Performance:** FY 2011-2016

**Conducting Organization:** USGS

**BOEM Contact:** [Catherine Coon](#)

### **Description:**

**Background:** The Beaufort Sea coast includes a variety of biologically productive habitats in lagoons, barrier islands, river deltas, and adjacent tundra areas. These habitats support diverse biota and could be affected by oils spills or disturbance resulting from offshore oil exploration in the Beaufort Sea. Oil spills could impact shorebirds through direct oiling, potentially impacting their prey and the benthic invertebrate community. The impacts of oil on aquatic invertebrates can be significant. Some components of the infaunal invertebrate community would be extirpated, while in others recovery may take 3-5 years depending on the conditions of the oil and environment. These ecosystems are particularly vulnerable to predicted climate-change effects, such as inundation and increased erosion caused by rising sea levels and longer periods of open water. More information is needed about the species composition, abundance, or distribution of the aquatic invertebrates that shorebirds depend upon for pre-migratory fattening along the Beaufort Sea coast. This information need extends to the lower trophic levels forming the base of these complex food webs and the biochemistry that influences these relationships. Their contributions to shore bird foraging, migration, and reproductive biology as well as bioremediation of oil spills has been shown to be important factors in the recovery and cleanup of past oil spill events in Alaska and other regions. Microfauna (e.g. bacterial, fungal, or protozoan populations), and meiofauna (nematodes, gastrotriches, and other eukaryotic organisms) living within the interstitial spaces of these zones become important considerations in mitigation of long and short-term damage due to

anthropogenic oil spill contamination in these microhabitats and surrounding environments. Additionally understanding the chemical factors that determine the distribution of these microfauna and meiofauna is necessary.

Quality foraging habitat for shorebirds is determined by the abundance of benthic invertebrates, but can also be influenced by lagoon water levels that can inundate the delta making the habitat inaccessible to shorebirds. Most of the change in water level on delta mudflats comes from wind driven waves. If wind patterns are consistent then available habitat is predictable, but changes in tide due to westerly storms can be significant and may inundate the whole delta for several days. Climate change may change the frequency of storms and seems to have changed the intensity of the storms by increasing the size of waves because the reduced amount of ice results in fewer impediments to wave build up. This has the potential to change the availability of shorebird feeding areas, making the occurrence of this habitat less predictable to birds during the post-breeding period.

In addition to quantifying invertebrate resources, the study will assess whether the resources available to shorebirds are sufficient to prepare the birds for their fall migration. A functional response model will be used for this assessment based on the capture rate and handling time modeled against invertebrate abundance.

This study will survey the shorelines and consist of taking core samples for laboratory analysis for chemical analysis, population structure, numbers of individuals, and diversity of populations from the interstitial spaces within the littoral zone of coastlines along the Beaufort Sea.

Objectives: The specific objectives of this study are to:

- Quantify the spatial and temporal distribution of macrofauna assemblages at coastal lagoons and river deltas along the Beaufort Sea coast within the USFWS Arctic Refuge- at 3 sites associated with the coastal lagoons at the Jago, Hulahula/Okpilak, and Canning Rivers.
- Assess whether patterns of invertebrate abundance and distribution correspond to foraging shorebird abundance and distribution.
- Develop a model describing the connection between wind patterns and water levels on the mudflat and sediment dispersion that can be used to assess available foraging habitat for shorebirds.
- Assess whether shorebirds respond physiologically to a greater abundance in food resources through body condition measurements and increased triglyceride levels.
- Assess whether available invertebrate resources in the coastal lagoons and river deltas along the Beaufort Sea are sufficient for pre-migratory fattening of shorebirds or provide information for bioremediation.

Methods: This study builds on an existing study with the U.S. Fish and Wildlife Service (USFWS) and tiers off a previous MMS/CMI shorebird study by Abby Powell across the Beaufort and Chukchi Sea coasts. This study focuses intensively on a few sites along the coast of the USFWS Arctic Refuge and two years data collection has been funded by USFWS. This project is also in collaboration with the Arctic Landscape Conservation

Cooperative (LCC). The USGS/BOEM partnership would collect data on a few sites intensively within the USFWS Arctic Refuge at 3 sites associated with the coastal lagoons at the Jago, Okpilak, and Canning Rivers for two additional field seasons. This project will provide additional sampling locations and core analysis to analyze population structures, chemical footprint, numbers of individuals, and diversity of populations from the interstitial spaces within the littoral zone. The project will continue to map the distribution of common functional groups of invertebrates using spatial analysis kriging techniques. Results will produce data reflecting measures of abundance of benthic invertebrates using mudflat core samples to determine availability of food resources for shorebirds.

**Revised Date:** August 2012

This page left blank intentionally.



## ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2013

**Region:** Alaska

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

**Title:** Wading Shorebird Habitats, Food Resources, Associated Infauna, Sediment Characteristics and Bioremediation Potential of Resident Microbiota of Deltaic Mudflats (AK-11-10b)

**BOEM Information Need(s) to be Addressed:** More information is needed about species composition, abundance, or distribution of the microfauna and meiofauna living within the interstitial spaces of the littoral zones along the Beaufort Sea coast. Shorebirds depend on meiofauna for food for pre-migratory fattening. Additionally, these organisms make important contributions to bioremediation of oil spills as well as the chemical factors that determine their distribution. The information obtained from this research will contribute to development of mitigation measures and strategies to reduce potential impacts from post-lease exploration and development.

**Total Cost:** \$365,236

**Period of Performance:** FY 2011-2015

**Conducting Organization:** University of Alaska Fairbanks

**BOEM Contact:** [Catherine Coon](#)

### **Description:**

**Background:** Nearshore shelf areas of the Beaufort Sea are defined by specific biological and physical gradients that have influence on the Arctic ecosystem including trophic structure, productivity, and the species that inhabit there. Massive freshwater discharges from the Mackenzie River along with numerous smaller rivers produce an environment that is estuarine in characteristic. The features of these estuarine ecosystems vary in trophic structure and productivity. The role of terrestrial carbon in these estuarine food webs is especially important in view of current warming trends in the Arctic and from post-lease exploration and development. Shorebirds depend on invertebrates for food for pre-migratory fattening along the delta mudflats that are at the river face. Smaller organisms that supply food sources for these organisms may also make important contributions to bioremediation of oil spills as well as the chemical factors that determine their distribution. More information is needed about species composition, abundance, or distribution of the microfauna and meiofauna living within the interstitial spaces of the littoral zones along the Beaufort Sea coast. Combined with the distribution of these microfauna and meiofauna a link can be generated with a collection of the chemical stimulation of this biota by describing sediment size and the amount and source of organic carbon.

The Beaufort Sea coast includes a variety of biologically productive habitats in lagoons, barrier islands, river deltas, and adjacent tundra areas. These habitats support diverse biota and could be affected by oils spills or disturbance resulting from offshore oil exploration in

the Beaufort Sea. These ecosystems are particularly vulnerable to predicted climate-change effects, such as inundation and increased erosion caused by rising sea levels, glacial melt, and longer periods of open water. More information is needed about the species composition, abundance, or distribution of the aquatic invertebrates along the Beaufort Sea coast. This information need extends to the lower trophic levels forming the base of these complex food webs and the biochemistry that influences these relationships. Their contributions to shore bird foraging, migration, and reproductive biology as well as bioremediation of oil spills has been shown to be important factors in the recovery and cleanup of past oil spill events in Alaska and other regions.

Objectives: The specific objectives of this study are to:

- Quantify the spatial and temporal distribution of bacterial assemblages, meiofauna, and macrofauna at coastal lagoons and river deltas along the Beaufort Sea coast within the USFWS Arctic Refuge at three sites associated with the coastal lagoons and deltas of Jago, Hulahula/Okpilak, and Canning Rivers; and
- Characterize the sediment pore water chemistry for salinity, ammonium, organic carbon, chlorophyll a, stable carbon isotopic signature, and sediment grain size at sample locations representative of each site.

Methods: This study builds on an existing study with USGS to assess shorebird abundance and macrofauna assemblages and tiers off a previous MMS/CMI previous shorebird study by Abby Powell across the Beaufort and Chukchi Sea coasts. This study focuses intensively on a few sites along the coast of the USFWS Arctic Refuge. The USGS/ UAF/ BOEM partnership would collect data on a few sites intensively within the USFWS Arctic Refuge at 3 sites associated with the coastal lagoons at the Jago, Okpilak, and Canning Rivers. This project will provide additional sampling locations and core analysis to analyze population structures, chemical footprint, numbers of individuals, and diversity of populations from the interstitial spaces within the littoral zone. The project will continue to map the distribution of common functional groups of invertebrates using spatial analysis kriging techniques. Results will produce data reflecting measures of abundance of benthic invertebrates using mudflat core samples to determine availability of food resources for shorebirds.

**Revised Date:** August 2012

## ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2013

**Region:** Alaska

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

**Title:** Arctic Cod Pilot Genetics and Toxicity Study (AK-11-13a)

**BOEM Information Need(s) to be Addressed:** A major element of NEPA analyses in the Alaska OCS program is the assessment of effects of accidental releases of oil and gas in arctic waters and on arctic species. A greater understanding of the keystone species Arctic cod is necessary to fully assess the potential effects of offshore development in arctic waters. Arctic cod plays a critical ecological role as key prey species and the primary pathway through which lower trophic production gets funneled to marine mammals, birds and fish. Thus, Arctic cod dynamics are important to EFH- and ESA-related NEPA analyses. In order to assess effects from potential oil and gas development on Arctic cod and the cumulative effects from climate change, it is important to understand the ability of Arctic cod to survive and adapt as the ice retreats. Understanding how Arctic cod are affected by oil and dispersants under arctic conditions will support both impact assessments and development of oil spill response and monitoring protocols.

**Total Cost:** \$30,000

**Period of Performance:** FY 2011-2013

**Conducting Organization:** USGS-BRD

**BOEM Contact:** [Kate Wedemeyer](#)

### **Description:**

Background: Arctic cod is a key species in Arctic food webs and occupies nearly all depths during its life cycle. Whether Arctic cod is likely to be driven to extinction as the arctic ice retreats is a subject of discussion in scientific circles. Genetics can shed light on whether Arctic cod (*Boreogadus saida*) are truly ice dependent or whether there is potential to adapt to retreating ice through differential expression of existing genes.

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

A workshop held in Anchorage in March 2008 facilitated the discussion of the effects of dispersed oil on two Arctic species, Arctic Cod and a copepod (*Calanus glacialis*). The workshop was followed by fieldwork in 2009 and 2010. The results of the JIP study of

toxicity to Arctic species at surface pressures could parlay into an assessment of what broader research may prove beneficial in terms of assessing effects at depth.

The effects of subsurface blowouts are receiving renewed focus following the *Deepwater Horizon* explosion and subsequent oil and gas release in the Gulf of Mexico. Although the question of subsurface oil, gas and dispersant behavior in the Gulf of Mexico is currently on the forefront, these same questions need to be addressed separately and proactively under conditions unique to the U.S. Arctic. Assumptions and practices from different geographic locations may not accurately translate to the U.S. Arctic. Carefully designed toxicity laboratory research on Arctic cod at controlled temperatures, pressures (i.e. depth) and light would begin to address some of these complex questions of effects of oil, gas and dispersants on species at various depths in the Arctic. This proposed study will evaluate the feasibility of conducting such research and provide recommendations for study design and implementation.

This genetic and toxicity testing will help analysts respond to basic questions under NEPA review that address future oil and gas developments in the Arctic. Examples of the questions to be answered include: Are Arctic cod a single pan-Arctic population that exhibits varied genetic responses under different conditions or are Arctic cod a number of genetically distinct stocks that are individually at risk to offshore development? How do the oil spill effects on and the responses of Arctic cod vary in relation to a complex of different oil/gas/dispersant mixtures, different life stages, different body mass, different temperatures and different depths typical of the U.S. Arctic? How do the toxicity test results at depth compare to results of the ongoing JIP toxicity study at surface pressure?

#### Objectives:

- Conduct mitochondrial DNA Assessments of Chukchi and Beaufort Sea Arctic cod.
- Provide recommendations for a pan-arctic genetic stock separation and genetics study of Arctic cod.
- Assess the feasibility of conducting an Arctic cod and zooplankton toxicity study.

Methods: Conduct mitochondrial DNA profiles of Chukchi and Beaufort Sea Arctic cod samples presently held by John Nelson at the BC Canada DFO lab. Provide protocols and sampling supplies for field collection of central Beaufort Sea Arctic cod genetic samples in August 2011. Develop recommendations for a circumpolar effort to evaluate whether all or a portion of Arctic cod are ice dependent. In 2012, conduct mitochondrial DNA on Arctic cod samples collected in the 2011 central Beaufort Sea Marine Fish field survey. Final report to include recommended future directions for Arctic cod genetic research.

Conduct a feasibility analysis for an Arctic cod and zooplankton toxicity study project design based on the results of the JIP study of toxicity to Arctic species at surface pressures. Review the results of the JIP study of toxicity to Arctic species at surface pressures, Arctic Oil Dispersant Toxicity Study. Provide recommendations for design and implementation of controlled laboratory studies to test the toxicity effects of gas/oil/dispersant mixtures on Arctic cod at critical lifestages, and at a range of temperatures and depths (pressures) typical of the U.S. Arctic OCS. Search for and review facilities capable of conducting toxicity tests simulating a minimum of 50 meter depths. Provide a range of recommended options and

budgets to assess the effects on Arctic cod (and perhaps other species) of accidental subsurface release of gas/oil/dispersant mixtures at low temperatures and at pressures and oceanographic conditions typical of the U.S. Arctic OCS.

**Revised Date:** August 2012

This page left blank intentionally.

## ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2013

**Region:** Alaska

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

**Title:** U.S.-Canada Transboundary Fish and Lower Trophic Communities (AK-12-04)

**BOEM Information Need(s) to be Addressed:** Arctic OCS development interests have recently intensified in the eastern Beaufort Sea, accelerating the need to collect ecological baseline data for fish and lower trophic organisms in transboundary marine waters. Information needs include documentation of fish species presence, abundance and distribution in the lease area as well as their ecological interactions with habitat and other trophic levels (prey species and plankton). This project extends recent marine fish and lower trophic surveys in the Beaufort Sea to assess potential effects of offshore development on lower trophic food webs and essential fish habitat (EFH). Study information will be used for NEPA and other environmental analyses for future lease sales, exploration plans, and potential development and production plans in both the U.S. and Canada.

**Total Cost:** \$5,191,125 plus Joint Funding      **Period of Performance:** FY 2012-2016

**Conducting Organization:** UAF; Department of Fisheries and Oceans, Canada

**BOEM Contact:** [Kate Wedemeyer](#)

### **Description:**

**Background:** Information needs in the eastern Beaufort Sea are growing, especially in light of new emphasis on marine spatial planning, EFH consultation, food web modeling and Arctic climate change issues. Currently, NEPA analysts must rely on limited historical data and extrapolation to analyze potential development impacts on eastern Beaufort Sea marine fish and lower trophic communities. A 2008 MMS fish survey in the western Beaufort documented unexpected diversity, including several commercial fish species (cod, pollock, crab) previously unknown in the region. We need better information in the eastern Beaufort about what fish species inhabit the lease area, as well as baseline information about abundance, distribution, habitat, and seasonal and inter-annual variability of fish and invertebrates in the understudied lower foodweb. An under-ice fish and invertebrate baseline, while challenging to obtain, is needed because Beaufort species live under ice three-fourths of the year. Additional oceanographic information about currents, upwelling, and hydrographic structure through fine-scale CTD resolution is needed to document biological habitats. Data will be used in NEPA documents to meet new NOAA requirements for Essential Fish Habitat (EFH) ecological analyses of fish, their prey and their habitat established for three additional Beaufort fish species (Arctic cod, saffron cod, and snow crab).

This trans-boundary survey effort, jointly-funded with the Canadian Department of Fisheries and Oceans (DFO), Central and Arctic Region, will share a research vessel, as well as expertise and methods. Costs will be shared in proportion to area surveyed. The collaboration

will advance our knowledge of the Beaufort Sea shelf ecosystem, trans-boundary fish stocks, essential fish habitat, life stage history, and oceanographic variability. Inclusion of invertebrate and primary production sampling will address lower trophic food webs and ecological relationships to bird and marine mammal populations. This work will also contribute to other studies including long-term monitoring efforts near Camden Bay and future international Arctic cod studies.

Objectives:

- Document baseline fish and invertebrate species presence, abundance, distribution and biomass.
- Analyze dietary habits, age and growth patterns of the most abundant species to support Canadian development of a Beaufort shelf fish and marine mammal food web model.
- Test under-ice methods and provide baseline information for the ice-covered season.
- Estimate seasonal variability of fish and habitats.
- Document the hydrographic structure of the eastern Beaufort shelf.
- Enhance understanding of how habitat variables (such as temperature and salinity) affect distributions under different climate conditions.

Methods: The survey will sample fish, invertebrates, and related biological and oceanographic habitat characteristics between longitudes 141° and 147° in the U.S. and into Canadian waters to ~138° (across the Canadian border to Herschel Island and the Mackenzie canyon). Field surveys will be performed every other year in order to reduce autocorrelation of climate conditions and to refine sampling strategy based on analysis of first year data. Field sampling will occur in years 1 and 3. Additional funds will be sought for a third survey in year 4 to better evaluate inter-annual variability.

This survey will expand the scope and reach of a Beaufort Sea Pilot Fish Survey conducted in 2008. Methodologies will follow those from the 2008 survey and the ongoing BOEM Central Beaufort Sea Fish Survey, modified in consideration of lessons learned from the earlier work. Sampling will deploy gear types such as beam trawl (10m wide), otter trawl, Isaacs-Kidd, and bongo nets. This study will include additional field surveys in both the under-ice and open water seasons to provide a better understanding of variability and collect additional habitat characteristics; collect invertebrates in both the water column and benthos; collect CTD data to document hydrographic structure; and collect and analyze ecological (e.g. energetics, isotope, genetic and otolith) samples for a foodweb model. This contemporaneous collection of integrated data over the lower food chain and physical environment supports an ecosystem management approach.

Products will include annual progress reports, final synthesis, databases, and GIS based maps and attribute tables of marine fish and lower trophic communities for inclusion in the in-house fisheries database and use in NEPA analyses.

**Revised Date:** August 2012



## ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2013

**Region:** Alaska

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

**Title:** Distribution and Habitat Use of Fish in the Nearshore Ecosystem of the Beaufort and Chukchi Seas (AK-12-06)

**BOEM Information Need(s) to be Addressed:** Information is needed on nearshore habitats and fish abundance in the Beaufort and Chukchi Seas to refine the legal definitions of Essential Fish Habitat (EFH) as presented in the Arctic FMP, adopted by NOAA in 2009. Fish in the ecologically fragile nearshore environments are particularly vulnerable to oil spills. The information from this study would be used to better identify and describe EFH in NEPA analyses and in Oil-Spill-Risk Analysis. A better understanding of how fish species respond to habitat variables to improve predictions on distributions under different climate conditions. This project will operate concurrently with other fish sampling efforts (AK-10-06 and AK-11-08) to provide a seamless baseline of forage fish data from the beach to the offshore environment.

**Total Cost:** \$164,000 plus Joint Funding

**Period of Performance:** FY 2012-2014

**Conducting Organization:** NOAA

**BOEM Contact:** [Catherine Coon](#)

### **Description:**

**Background:** The Arctic is one of the most rapidly changing ecosystems in the world, yet a large void exists in information on EFH and what species and life stages use these habitats. Information is nonexistent or sparse for fishes in the Arctic, especially in shallow, nearshore waters (shoreline out to 8 m depth). Nearshore habitats are some of the most productive habitats in Alaska and the most at risk to development and oil spills. Many species included in the Arctic Fisheries Management Plan for the Arctic, such as capelin and rainbow smelt, use nearshore habitats at some time in their life but estimates of their abundance and habitat use are poorly documented. Nearshore habitats differ from offshore (>30 m depth) habitats, as do fish assemblages in each area. Recent nearshore research in the Arctic has been limited to the Barrow area, which represents only a small fraction of the nearly 1,700 km of the U.S. Arctic coastline. Prior to major development or transportation activities in the Arctic, more information is needed on fish distribution and habitat use, life history characteristics, food webs, and species at risk to make informed management decisions regarding potential effects from global climate change and human disturbance. In addition, warming conditions in the Arctic will likely result in a reorganization of community structure; new fish species are expected to migrate to the Arctic with unknown consequences to existing stocks and food webs.

Many Arctic fish species are important in the diet of higher-level predators and in Inupiat subsistence fisheries. For example, in the Bering, Beaufort, and Chukchi seas, Arctic cod and

saffron cod occur in the diets of 13 marine mammal species and 20 seabird species. Availability of prey is critical to some Arctic marine mammals such as ice seals, which themselves are important in the diet of polar bears. Larger predators are already under stress by reduced ice cover. The distribution, diversity, and habitat use of nearshore fishes is largely unknown in other areas of the Arctic, especially in the Chukchi Sea. The proposed study would expand fish distribution and habitat use information to the eastern Beaufort Sea and western Chukchi Sea.

Objectives:

- Inventory the distribution and diversity of nearshore fish, their habitat and prey along high priority sites in the Beaufort and Chukchi Seas
- Assess age and diet of fish important as prey species
- Describe oceanographic features of areas with nearshore fish
- Understand how habitat variables like temperature and salinity affect fish species distributions

Methods: Beach and small otter trawl sampling will occur in areas of high importance, defined as locations near oil and gas production, or close to foraging areas for birds or marine mammals, followed by areas with opportunities for research platforms for three sampling seasons. In the summer and fall 2013/2014 two primary areas will be at sites between Barrow and Peard Bay to establish a baseline of fish and habitat use and as reference sites to the Chukchi Lease area.

A random sample of key fish species (e.g., Arctic cod, saffron cod, and capelin) will be collected for age and diet analyses. A sample of select fish species will also be collected, frozen, and archived for later fatty acid and genetic analyses. Habitat will be measured at each sampling site. At seine sites each beach will be profiled according to ShoreZone protocols. Intertidal invertebrates and macroalgae will also be recorded. Additionally, a drop camera will be deployed, depending on water visibility, to search for and identify unusual habitat types and other fish species that may not be captured by seine or trawl.

Models will be generated to predict habitat use by fishes according to habitat variables. Maps will be generated to describe species distribution relative to multiple habitat variables. Information that may lead to NOAA's EFH general distribution will be shared. Relational databases will be built that contain data on species presence and abundance that will expand the current BOEM fish database, be suitable for use in GIS, and complement ShoreZone mapping efforts.

**Revised Date:** August 2012

## ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2013

**Region:** Alaska

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

**Title:** Biogeochemical Assessment of the OCS Arctic Waters: Current Status and Vulnerability to Climate Change (AK-08-12-03)

**BOEM Information Need(s) to be Addressed:** 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 study was initiated for NEPA analysis and documentation for the North Aleutian Basin, but has shifted emphasis north into the Chukchi Sea.

**Total Cost:** \$756,704 plus Joint Funding      **Period of Performance:** FY 2008-2014

**Conducting Organization:** CMI, UAF

**BOEM Contact:** [Nancy Deschu](#)

### **Description:**

Background: This study initially emphasized the North Aleutian Basin in the southeastern Bering Sea, one of the most productive marine ecosystems in the world. The scope of the study has expanded to include measurements first in the northern Bering Sea and now in the Chukchi Sea. Over the last decade, the character of the ecosystem productivity in the southeastern Bering Sea has undergone dramatic changes due to variability in hydrographic and climate forcing. 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. This BOEM-sponsored Alaska Coastal Marine Institute (CMI) Task Order is being conducted in conjunction with BEST and also with the Bering Sea Integrated Ecosystem Research Program (BSIERP). This CMI study was extended to December 2013, to allow time for inclusion of additional samples and analyses from the Chukchi Sea.

### Objectives:

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

Methods: The CMI Task participates in multiple cruises in Bering and Chukchi Sea, including samples during the COMIDA CAB study. Dissolved organic and inorganic

nutrients and carbon, total alkalinity, particulate organic matter, and pCO<sub>2</sub> measurements are used to calculate net ecosystem production and acidification. The seasonal changes in stocks of inorganic C and N are a measure of NEP. The fraction of NEP accumulating in the dissolved organic matter, suspended particulate matter, and sinking particulate matter pools will be estimated.

**Revised Date:** August 2012

## ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2013

**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)

**BOEM Information Need(s) to be Addressed:** This study will provide BOEM NEPA analysts with 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 will be used to meet Essential Fish Habitat and Marine Mammal Protection Act and NEPA requirements in the EISs for Chukchi Lease Sales.

**Total Cost:** \$532,173 plus Joint Funding

**Period of Performance:** FY 2009-2013

**Conducting Organization:** CMI, UAF

**BOEM Contact:** [Kate Wedemeyer](#)

### **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:

- Assess the diet composition of forage fishes;
- Establish trophic level of forage fish species and of their prey;
- Analyze interannual differences in diet of fishes and in the trophic level of fishes and their prey;
- Document the trophic level of ice seals;
- Document ice seal trophic history;
- Develop isotopic mixing models;
- Compare trophic levels of forage fishes to those of ice seals;
- Provide diet and trophic level data to BOEM in electronic format;
- Complete data archiving with NODC and make available to BOEM 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 2012

## ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2013

**Region:** Alaska

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

**Title:** Epifaunal Communities in the Central Beaufort Sea (AK-08-12-07)

**BOEM Information Need(s) to be Addressed:** Information from this study will be used by Alaska OCS Region staff to acquire a better understanding of the benthic community of the Central Beaufort Sea. This will be used in preparing future, Beaufort Sea exploration and development EISs and in reviewing oil-spill-contingency plans for OCS and coastal facilities.

**Total Cost:** \$50,139 plus Joint Funding

**Period of Performance:** FY 2011-2013

**Conducting Organization:** CMI, UAF

**BOEM Contact:** [Kate Wedemeyer](#)

### **Description:**

**Background:** One of BOEM's target science interests is to learn more about the current spatial use patterns in the Beaufort Sea by potentially sensitive organisms, such as the epibenthics. Currently little is known about the epibenthic communities in the central Beaufort Sea. This proposed project is piggybacking an existing BOEM project that will characterize fish communities in the targeted area of the central Beaufort Sea. The study will characterize the epibenthic invertebrates in this area and relate these communities to the fish communities and to various physical drivers, such as sediment grain size, bottom temperature and salinity.

### **Objectives:**

- Characterize the epibenthic communities in the central Beaufort Sea (between 147° and 150° west longitude)
- Compare these communities to those found in the adjacent Chukchi Sea.
- Compare these communities to those found in other areas around the Beaufort Sea.
- Determine whether epibenthic communities are distributed in patches or all species evenly distributed throughout the study area.
- Determine which species are most important in determining community structure in terms of abundance and biomass.
- Determine the current population structure of the most dominant species; i.e., size frequency, abundance, biomass and male to female sex ration.
- Identify how the community varies with environmental (depth, grain size, temperature, salinity) or fish community parameters.
- Compare how these epibenthic communities and the patterns found within them compare to the communities in the Chukchi Sea and in other areas of the Beaufort Sea.

**Methods:** In conjunction with the Central Beaufort Fish Survey, five to ten transects will be conducted perpendicular to shore and between 10 and 100 m water depth. This sample plan will use a stratified, random sampling technique, with the strata based on water depth and distance from shore. Within each transect, replicate stations will be sampled for fish and epibenthic invertebrates using a fine mesh plumb-staff beam trawl deployed by an A-frame. Trawl catches will be sorted and placed into larger taxonomic groups and epibenthic species lists will be compiled by station during the cruise to create a presence/absence database. Voucher specimens also will be prepared by station for organisms that cannot be identified in the field. Voucher specimens of unknown species will be fixed and shipped to UAF for further taxonomic identification. In addition to a species list for each station, target organisms from the trawls will be selected for a more detailed community examination. Target organisms will include species that are trophically important or exhibit relatively high abundance and/or biomass. In similar Chukchi Sea studies, these taxa included various crabs, echinoderms, and gastropods. The community examination will include measures of abundance, biomass, and population size structure. In addition, for crabs we will examine the size at which females become gravid, the overall size frequency of all gravid females, and the percentage of females in the population that are gravid. Environmental data including vertical profiles of temperature and salinity will also be collected. A non-parametric multivariate approach will be used to analyze the data, including similarity, multidimensional scaling, community structure and importance of individual species, groups of species and physical factors.

**Revised Date:** August 2012



## ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2013

**Region:** Alaska

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

**Title:** Population Assessment of Snow Crab, *Chionoecetes opilio*, in the Chukchi and Beaufort Seas Including Oil and Gas Lease Areas (AK-08-12-09)

**BOEM Information Need(s) to be Addressed:** This study will provide information on historic and current data on abundance, biomass, stock structure, diet, and trophic position of snow crab (*Chionoecetes opilio*) in the Chukchi and Beaufort Seas including lease sale areas and relate patterns to environmental variables. This information will be used to evaluate and mitigate the potential environmental effects on marine invertebrates of offshore development. The BOEM analysts and decision makers will use the information from this study in NEPA analysis for potential lease sales, EPs and DPPs, mitigation, and monitoring in the Beaufort and Chukchi Seas.

**Total Cost:** \$181,019 plus Joint Funding

**Period of Performance:** FY 2011-2014

**Conducting Organization:** CMI, UAF

**BOEM Contact:** [Catherine Coon](#)

### **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. For commercially important or subsistence species in particular, we must understand the ecological and environmental parameters that influence population structure and species distributions if we are to predict how climate change or human activities such as oil and gas exploration will affect both new and established populations in sensitive areas. Snow crab (*Chionoecetes opilio*) concentrations have recently contracted northward in the Bering Sea. It is a current predominant commercial fishery in this region and is thought to be a very common species throughout the Chukchi and parts of the Alaskan Beaufort Seas, including oil and gas lease sale areas. However, existing knowledge for adequate management planning and risk assessment is sparse and more background information on stock size and structure and reproductive condition is needed.

To conduct a current assessment of Arctic snow crab, this proposal will cost-effectively use recently collected snow crabs from the Chukchi and Beaufort Seas, in addition to new collections to be made during the 2011 central Beaufort Sea fish survey and a NOAA-funded 2012 Chukchi Sea survey. The proposed work will address a BOEM research need by providing information to better understand potential resources and marine environments potentially affected by offshore oil and gas exploration and extraction. This information will also aid in defining the general distribution for crab species Essential Fish Habitats (EFH).

Sensitivity of fauna to potential oil and gas-related pollution is related to trophic level (the position of a taxon in a food web), because bioaccumulation and biomagnification potential of persistent pollutants, including a suite of chemicals contained in petroleum products, are dependent on the trophic position of an organism. Snow crab prey includes polychaete worms, crustaceans, bivalves and brittle stars with some regional and age-specific variability in dominant prey items. Recent research indicates that Snow crabs in the southern Chukchi Sea occupy a trophic level among the highest levels of dominant invertebrates and fishes in the region. Organisms feeding at high trophic levels have a high potential for biomagnification, the accumulation of chemicals in organism tissues through dietary accumulation. Combining stable isotope analysis to determine trophic level and stomach content analysis to determine prey taxa will allow us to interpret the food web connections of snow crab and their bioaccumulation and biomagnification potential in light of food availability and distribution within and outside oil and gas exploration areas.

Objectives:

- To estimate abundance and biomass and assess distribution of snow crab in the Chukchi Sea and Beaufort Sea lease sale areas and adjacent regions in relation to water depth, bottom water temperature and salinity, water mass and sediment type using existing and new data.
- To determine stock structure including: sex ratio, size-frequency distribution, size at maturity, fecundity of female snow crab, and sperm reserves in spermathecae.
- To identify diet and trophic position of snow crab in different geographic areas.
- To compare our findings between years at re-sampled Chukchi Sea stations, compare to existing recent data from the northern Bering Sea and to the few available earlier quantitative studies in the Chukchi.

Methods: Adult specimens of *C. opilio* collected 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 BOEM planning needs.

**Revised Date:** August 2012

## ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2013

**Region:** Alaska

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

**Title:** Dispersal Patterns and Summer Ocean Distribution of Adult Dolly Varden from the Wulik River, Alaska, Evaluated Using Satellite Telemetry (AK-08-12-11)

**BOEM Information Need(s) to be Addressed:** This study addresses an important subsistence fish that is a key resource for residents of northwestern Alaska. It will provide important information about the distribution of Dolly Varden in the Chukchi Sea. BOEM analysts and decision makers will use this information in NEPA analysis and documentation for Lease Sales, EPs and DPPs.

**Total Cost:** \$146,511 plus Joint Funding      **Period of Performance:** FY 2012-2013

**Conducting Organization:** CMI, UAF

**BOEM Contact:** [Kate Wedemeyer](#)

### **Description:**

Background: In northwest Alaska, Dolly Varden (*Salvelinus malma*) are highly valued as a subsistence fish and local residents harvest thousands of these fish each year. Dolly Varden are classified as anadromous fishes, meaning they spawn and rear as juveniles in freshwater and feed in saltwater later in life. Young Dolly Varden rear in freshwater for 2–5 years and after this freshwater residence period, they undertake annual migrations in the spring into marine waters to feed during the summer, sometimes traveling large distances. In northwestern Alaska, Dolly Varden usually undertake three to five ocean migrations before reaching maturity, and once becoming sexually mature, they generally only spawn every two years.

In the fall, these fish return to rivers to overwinter. The lower Wulik, Kivalina, and Noatak rivers, where sufficient groundwater provides suitable habitat throughout the winter, are important overwintering areas. Immature and mature-nonspawning Dolly Varden do not demonstrate site fidelity to overwintering areas, therefore during this phase in their life they may become distributed over a wide geographic area resulting in mixed populations in overwintering areas. However, Dolly Varden appear to return home to natal streams for spawning.

Objectives: This study will describe baseline ecological information about Dolly Varden tagged in the Wulik River, Alaska, including: timing of outmigration from the Wulik River; summer dispersal; temporal and spatial distribution; and depth and temperature occupancy

Methods: This study will tag 20 large Dolly Varden in the Wulik River using satellite pop-up tags. The tags will be programmed so that four tags will pop-up every two weeks and transmit their data via satellite. The tags will measure and record temperature, depth and ambient light data for daily geolocation estimates at 10-minute intervals. Information on depth and temperature occupancy may provide important insights into Dolly Varden behavior, such as feeding migrating and spawning.

**Revised Date:** August 2012

## **ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2013**

**Region:** Alaska

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

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

**BOEM Information Need(s) to be Addressed:** The study will enhance BOEM 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:** \$1,139,137 plus Joint Funding      **Period of Performance:** FY 2005-2012

**Conducting Organization:** University of Alberta, Canada

**BOEM Contact:** [Mary Cody](#)

### **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 archive 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 2012

## ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2013

**Region:** Alaska

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

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

**BOEM 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* 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." 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, EPs and DPPs.

**Total Cost:** \$2,000,000 plus Joint Funding      **Period of Performance:** FY 2005-2012

**Conducting Organization:** ADF&G

**BOEM Contact:** [Jeff Denton](#)

### **Description:**

**Background:** A previous MMS study estimated the extent to which the bowhead whale population utilizes OCS areas in the eastern Alaskan Beaufort Sea for feeding, as well as that area's importance to individual whales. Additional research on this subject has been requested particularly at locations other than those included in the previous study. In a 2001 Arctic Region Biological Opinion NMFS made a Conservation Recommendation that MMS (now BOEM) 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/BOEM 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, BOEM 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, AEWG, NSB, ADF&G, NMFS, BOEM 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 AEWG 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 2012



## ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2013

**Region:** Alaska

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

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

**BOEM 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* 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." 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, EPs and DPPs.

**Total Cost:** \$6,887,320 plus Joint Funding      **Period of Performance:** FY 2006-2013

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

**BOEM Contact:** [Jeff Denton](#)

### **Description:**

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

In this 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, BOEM 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 status 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, BOEM 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 BOEM *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 2012

## ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2013

**Region:** Alaska

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

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

**BOEM 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/BOEM (Section 7 Consultation, Beaufort Sale 186) recommended research on migratory species of concern. Thus, updated information on marine bird distribution, species composition, molting, staging and timing of use in the eastern Chukchi coastal area between Barrow and Point Hope is needed. Avian species of moderate-high concern include the Spectacled Eider, Yellow-billed Loon, Red-throated Loon, and Pacific Black Brant. Both the threatened Spectacled Eiders and the Yellow-billed Loon occur in coastal and marine environments from Barrow south to Cape Lisburne. Ledyard Bay is ESA Critical Habitat for the Spectacled Eiders, and limited surveys indicate Peard Bay may also be an important molting area.

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

**Total Cost:** \$819,482 plus Joint Funding      **Period of Performance:** FY 2007-2012

**Conducting Organization:** USGS-BRD

**BOEM Contact:** [Catherine Coon](#)

### **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 BOEM. 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 BOEM 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 2012

## **ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2013**

**Region:** Alaska

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

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

**BOEM 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 BOEM decision making and mitigation. Also, study results will be used in pre-lease analyses and documentation for potential future Chukchi Sea lease sales.

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

**Conducting Organization:** NMFS-NMML

**BOEM Contact:** [Dr. Dan Holiday](#)

### **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<sup>-2</sup>. However, densities could not be converted into abundance estimates without information on the proportion of animals hauled out. As adult bearded seals in these areas have never been live captured and instrumented with devices for estimating the haul-out proportion, a reliable estimate for the abundance of the Alaska stock of bearded seals is considered unavailable. Therefore, understanding the timing of haul-out behavior is important because abundance estimates are needed for developing sound plans for conservation, management, and response to potential environmental impacts of planned oil and gas activities.

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

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

Objectives:

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

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

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

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

**Revised Date:** August 2012

## ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2013

**Region:** Alaska

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

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

**BOEM 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 BOEM decision-making and mitigation.

**Total Cost:** \$1,529,137

**Period of Performance:** FY 2009-2014

**Conducting Organization:** ADF&G

**BOEM Contact:** [Catherine Coon](#)

### **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, walrus, bearded seals, and other pinnipeds have followed the ice edge from wintering areas to its northern margin. For example, large numbers of walrus 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 walrus moved along coastal leads between Point Hope and Point Barrow and were hunted by Natives.

Over the past few years, summer distribution of walrus 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. Walrus 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 walrus 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 walrus 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 pinnipeds 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 BOEM. 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 pinniped 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 2012



## ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2013

**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-09-02a)

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

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

**Conducting Organization:** NOAA-NMML

**BOEM Contact:** [Dr. Heather Crowley](#)

### **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: “COMIDA: Factors Affecting the Distribution and Relative Abundance of Endangered Whales: Biophysical Moorings and Climate Modeling” 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 2012

## ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2013

**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)

**BOEM 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:** \$1,200,000

**Period of Performance:** FY 2009-2014

**Conducting Organization:** USGS

**BOEM Contact:** [Catherine Coon](#)

### **Description:**

**Background:** Basic information on timing and duration of habitat use by Spectacled Eiders within the Chukchi Sea Planning Area and the Beaufort Sea Planning Area 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 Chukchi Sea Planning Area and Beaufort Sea Planning Area.
- 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 2012

## ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2013

**Region:** Alaska

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

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

**BOEM Information Need(s) to be Addressed:** A jointly-funded study could address information needs identified in a 2005 MMS funded workshop hosted by the 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, ESA consultations, MMPA permitting, and development of related mitigation.

**Total Cost:** \$1,480,767 plus Joint Funding      **Period of Performance:** FY 2009-2014

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

**BOEM Contact:** [Mary Cody](#)

### **Description:**

**Background:** 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 Arctic sea ice over deep waters 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.

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 2012

## ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2013

**Region:** Alaska

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

**Title:** Distribution and Relative Abundance of Marine Mammals in the Chukchi Sea and the Fall Migration of Bowhead Whales in the Beaufort Sea – Personnel Needs (AK-10-05)

**BOEM Information Need(s) to be Addressed:** This study will generate information pertaining to possible impacts to marine mammals from exploratory offshore seismic surveying for oil and gas and subsequent leasing in the Chukchi and Beaufort Seas. The information will assist BOEM in NEPA analyses, ESA Section 7 consultations, MMPA documentation for Lease Sales, EPs and DPPs, and post-sale and post-exploration decision-making in the Beaufort and Chukchi Seas.

**Total Cost:** \$4,786,585

**Period of Performance:** FY 2011-2016

**Conducting Organization:** NOAA-NMML

**BOEM Contact:** [Jeff Denton](#)

### **Description:**

**Background:** Bowhead whales (*Balaena mysticetus*), gray whales (*Eschrichtius robustus*), beluga whales (*Delphinapterus leucas*), Pacific walrus (*Odobenus rosmarus divergens*), polar bears (*Ursus maritimus*), 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 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 needed 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.

A recent, BOEM-funded investigation of the seasonal migration of the bowhead whales using satellite-tracked animal tags revealed that they are resident in the Bering Sea during the winter and return to the Beaufort Sea in the summer when opening spring leads allow for passage along the Alaskan and Canadian coasts. The bowheads leave the Beaufort in the fall and cross the Chukchi Sea before moving back into the Bering Sea for the winter.

Since 1979, aerial surveying of the fall migration of the bowheads has been conducted, initially by the Bureau of Land Management and subsequently by MMS, now BOEM. This is one of the longest-maintained monitoring of a biological phenomenon and has produced an invaluable baseline of the distribution and habitat use of the bowheads. The baseline can be used to observe changes in distribution and habitat use that may occur due to changing atmospheric and oceanic climates and to offshore oil and gas development activities. This investigation will continue the aerial observations of the fall migration for evidence of these changes

Since the beluga whales and other marine mammals seasonally or otherwise resident in the Beaufort and Chukchi are often sighted during the bowhead whale aerial surveys, their occurrence will also be part of the acquired data. This will be coincidental sightings, but of scientific value nonetheless.

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.
- Define the annual fall migration of bowhead whales, significant inter-year differences, and long-term trends in the distances from shore and water depths 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 BOEM and NMFS on the general progress of the fall migration of bowhead whales across the Alaskan Beaufort Sea for use in protection of this Endangered Species, if needed.
- Provide an objective wide-area context for management understanding of the overall fall migration of bowhead whales and site-specific study results.
- Record and map beluga whale distribution and incidental sightings of other marine mammals.
- Determine seasonal distribution of endangered whales in other planning areas of interest to BOEM.

Methods: Aerial line-transect surveys will be flown in the Chukchi Sea Program Area during two time periods: late-July to early-August and October to early-November. Aerial line-transect surveys will be flown in the Beaufort Sea to observe the fall migration of the bowhead whales, continuing the decades-long set of observations. For surveys in both seas, the observational and data recording methodology shall follow protocols used by the BOEM in the past surveys of the bowhead fall migration.

The observations, data recording, and subsequent data analysis will be performed by scientists and support personnel at the National Marine Mammal Laboratory. Additionally, the scientists will be responsible for the management of this project, all necessary training of



support personnel, providing all needed field equipment, conducting all logistical tasks, and insuring the safety of all people involved.

Aircraft support is funded under the companion study titled “Distribution and Relative Abundance of Marine Mammals in the Chukchi Sea and the Fall Migration of Bowhead Whales in the Beaufort Sea – Aircraft Needs.”

**Revised Date:** August 2012

This page left blank intentionally.

## ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2013

**Region:** Alaska

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

**Title:** Synthesis of Arctic Research (SOAR) Physics to Marine Mammals in the Pacific Arctic (AK-11-05)

**BOEM Information Need(s) to be Addressed:** The changing physical environment of the U.S. Arctic OCS is hypothesized to drive a rapid tempo of change in the distribution and behavior of a number of protected marine mammals that inhabit those waters. The same species may be affected by oil and gas activities within BOEM Planning Areas, with strong potential for deleterious interactions between natural and human induced phenomena. Under NEPA and the ESA, BOEM is required to evaluate whether and how federal actions associated with oil and gas development may affect these protected populations. Information on ocean circulation and hydrography is useful for those evaluations as well as for input into various models used to predict the outcome of oil spills and other physical phenomena. Given recent high investment in interdisciplinary biological and oceanographic research by the Governments in the region, a synthesis of results of completed and ongoing studies would be useful to inform management decision-makers and may be useful in determining needs of future research activities.

**Total Cost:** \$1,798,459 plus Joint Funding      **Period of Performance:** FY 2011-2016

**Conducting Organization:** NOAA- Pacific Marine Environmental Laboratory

**BOEM Contact:** [Dr. Heather Crowley](#)

### **Description:**

**Background:** The physical climate of the western Arctic appears to be rapidly changing. The summer minimum sea ice extent in 2007 and 2008 covered an area which was 37% less than the areal coverage of two decades ago and 20% less than the previous minimum coverage in 2005. High water temperatures and dense concentrations of zooplankton have been observed near Barrow. The rapidity of these changes was unexpected, as the consensus of the climate research community just a few years ago was that such changes would not be seen for another 30 years, as expected from the CO<sub>2</sub> anthropogenic contribution alone.

During the same period, several marine mammals have exhibited unusual movements or behaviors that may be related to these environmental changes. The range of humpback whales has moved northward to include the northern Chukchi and western Beaufort Seas. Fin whales have expanded their range northward to include waters north of Icy Cape in the Chukchi. In 2009, bowhead whales fed extensively in the northern Chukchi Sea, a phenomenon not observed since the end of commercial whaling one hundred years ago. In recent years, gray whales have fed in increasing numbers along the coastline between Wainwright and Barrow. In 2007 and 2009, walrus formed large aggregations on shore between Norton Sound and Barrow. This behavior appears to be related to the summer retreat of sea ice well northward of traditional walrus feeding areas on the shelf break.

Given the continuing retreat of sea ice and the known high-latitude range of these species in other oceans, it is likely that the recent sightings represent a climate-related range expansion that will continue in future years. Other changes in behavior and/or expansion of feeding areas also may accelerate as ice continues to degrade and water temperatures rise.

Between the years 2005 and 2015 MMS/BOEM will have invested more than \$50,000,000 in marine mammal and related oceanographic studies in the western Arctic. These data will increase our body of knowledge about the region considerably, but interpretation will be complicated by concurrent environmental changes. This study proposes a synthesis of research from the ongoing studies in the Region. These studies include, but are not limited to:

- Bowhead Whale Feeding Variability in the Western Alaskan Beaufort Sea: Satellite Tracking of Bowhead Whales & Oceanography and Feeding
- Passive Acoustic Detection and Monitoring of Endangered Whales in the Arctic
- Ecosystem Observations in the Chukchi Sea: Biophysical Mooring and Climate Modeling
- Distribution and Relative Abundance of Marine Mammals in the Chukchi Sea and the Fall Migration of Bowhead Whales in the Beaufort Sea
- Walrus Habitat Use in the Potential Drilling Area
- Pinniped Movements and Foraging: Bearded Seals
- Arctic marine research studies supported through NOPP
- Studies conducted by the State of Alaska and the North Slope Borough under the USDOJ Coastal Impact Assistance Program (CIAP)

#### Objectives:

- Increase scientific understanding of the inter- and intra-relationships of oceanographic conditions, lower trophic prey species, such as small fish and krill, and marine mammal distribution and behavior in the Chukchi Sea lease area, and adjacent waters.
- Enhance capability to predict future changes in oceanographic features such as currents, upwellings, and ice leads and associated changes in the behavior of marine mammals and their prey.

Methods: Using a synthetic approach, PIs will analyze data available from BOEM supported, and related, studies in the Chukchi Lease Sale Area and adjacent waters, using available statistical and other models to identify and test hypotheses that cross scientific disciplines. This study will be guided by an oversight committee formed of senior scientists and accomplished through annual, or more frequent, meetings (with significant data preparation and analysis beforehand). In the first meeting participants will inventory available data and deem its sufficiency for use to address specific hypotheses and questions identified by the participants in facilitated sessions. Recommendations for further analyses and publication development will be provided in a report to BOEM summarizing that meeting. After BOEM review and approval, subgroups of interdisciplinary scientists will work together to prepare data for integration and conduct appropriate statistical analyses or modeling to identify interdisciplinary relationships and/or test hypotheses previously identified. If useful, PIs may integrate data with on-going oceanographic programs (e.g. RUSALCA and the Distributed Biological Observatory) to inform ecosystem models and enhance their predictive capability. After analyses are completed, sub-groups will prepare multi-authored manuscripts for publication in appropriate

peer-review literature. Topics for synthesis include, but are not limited to, inter- and intra-relationships of oceanographic circulation, sea ice, hydrography, lower-trophic abundance and distribution, and marine mammal distributions and behavior. Deliverables from this study will include multiple workshop proceedings and summary recommendation reports, as well as multiple peer-review journal publications.

**Revised Date:** August 2012

This page left blank intentionally.

## ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2013

**Region:** Alaska

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

**Title:** Distribution and Relative Abundance of Marine Mammals in the Chukchi Sea and the Fall Migration of Bowhead Whales in the Beaufort Sea – Aircraft Needs (AK-11-06)

**BOEM Information Need(s) to be Addressed:** This study will generate information pertaining to possible impacts to marine mammals from exploratory offshore seismic surveying for oil and gas and subsequent leasing in the Chukchi and Beaufort Seas. The information will assist BOEM in NEPA analyses, ESA Section 7 consultations, MMPA documentation for Lease Sales, EPs and DPPs, and post-sale and post-exploration decision-making in the Beaufort and Chukchi Seas.

**Total Cost:** \$8,750,000

**Period of Performance:** FY 2011-2016

**Conducting Organization:** USDOJ National Business Center

**BOEM Contact:** [Jeff Denton](#)

### **Description:**

**Background:** Bowhead whales (*Balaena mysticetus*), gray whales (*Eschrichtius robustus*), beluga whales (*Delphinapterus leucas*), Pacific walrus (*Odobenus rosmarus divergens*), polar bears (*Ursus maritimus*), 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 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 needed 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.

A recent, BOEM-funded investigation of the seasonal migration of the bowhead whales using satellite-tracked animal tags revealed that they are resident in the Bering Sea during the winter and return to the Beaufort Sea in the summer when opening spring leads allow for passage along the Alaskan and Canadian coasts. The bowheads leave the Beaufort in the fall and cross the Chukchi Sea before moving back into the Bering Sea for the winter.

Since 1979, aerial surveying of the fall migration of the bowheads has been conducted, initially by the Bureau of Land Management and subsequently by MMS, now BOEM. This is one of the longest-maintained monitoring of a biological phenomenon and has produced an invaluable baseline of the distribution and habitat use of the bowheads. The baseline can be used to observe changes in distribution and habitat use that may occur due to changing atmospheric and oceanic climates and to offshore oil and gas development activities. This investigation will continue the aerial observations of the fall migration for evidence of these changes

Since the beluga whales and other marine mammals seasonally or otherwise resident in the Beaufort and Chukchi are often sighted during the bowhead whale aerial surveys, their occurrence will also be part of the acquired data. This will be coincidental sightings, but of scientific value nonetheless.

Objectives: Obtain the necessary aircraft services (planes, fuel, maintenance, pilots, etc.) via Interagency Agreement between NBC-AMD and BOEM required by the study titled “Distribution and Relative Abundance of Marine Mammals in the Chukchi Sea and the Fall Migration of Bowhead Whales in the Beaufort Sea –Personnel Needs.”

Methods: The USDOJ National Business Center’s Aviation Management Directorate will issue contracts to private companies to obtain the needed aircraft services.

**Revised Date:** August 2012



## **ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2013**

**Region:** Alaska

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

**Title:** Satellite Tracking of Bowhead Whales: Habitat Use, Passive Acoustic and Environmental Monitoring (AK-12-02)

**BOEM Information Need(s) to be Addressed:** This project will extend ongoing research to provide more information on the locations and use of bowhead whale feeding areas, the variability of those locations from year to year, and the environmental factors that can be used to predict where bowhead whales will concentrate. This information is used for developing mitigation options for Beaufort and Chukchi Lease sales and exploration and development activities. Information on the vocal behavior of bowhead whales under various environmental conditions is needed to interpret the habitat use and call behavior being collected on many passive acoustic recorders currently in use. Information from this study will be used for ESA Section 7 consultations and NEPA documentation.

**Total Cost:** TBD

**Period of Performance:** FY 2012-2016

**Conducting Organization:** TBD

**BOEM Contact:** TBD

### **Description:**

**Background:** A previous MMS study using satellite telemetry has greatly added to the knowledge of bowhead whale movements, concentration areas, and the timing of both. Multiple years of tracking during this study has begun to provide information regarding the inter-annual variability in movements and concentration areas. Continued tracking will provide a better understanding of this variability and will allow us to predict the timing and location of bowhead concentration areas making mitigation measures more directly applicable and useful.

Satellite-linked transmitters are a valuable tool for tracking bowhead whales and they have been effective at documenting movements of large and small whales of both sexes, and the timing and locations of concentration areas. Another tool, of increasing use, is the passive acoustic recorder deployed near areas of interest to record marine mammal vocalizations. Recorded bowhead vocalizations indicate that a bowhead was present at the time of vocalization, but an absence of calls could mean bowheads are present but not vocalizing. Bowhead whale vocalization rates related to various behaviors (e.g., feeding and travelling) or potential disturbances (e.g., boat traffic, seismic operations, and drilling) are needed to interpret the information being collected by passive acoustic recorders. Sensors for monitoring environmental conditions such as temperature and salinity have been developed and are in use on large whales, including bowheads in Greenland.

Objectives: To better understand inter-annual variation in bowhead whale feeding concentrations and to interpret call counts and calling rates collected by passive acoustic recorders.

Methods: This study will track the movements and document the behavior of bowhead whales using satellite telemetry to compare among years emphasizing new tagging locations such as St. Lawrence, Island, Pt. Hope and Canada. Bowhead whale vocalization rates and ambient noise levels will be documented using an acoustic tag to develop analysis of call rates relative to behavior and disturbance. Tags equipped with environmental sensors will be deployed to monitor, summarize, and transmit ambient oceanographic conditions as bowheads migrate. Limited numbers of individuals of other species of large whales (Gray, Humpback, Fin) may be tagged and tracked as opportunities arise as a pilot study for future work.

This study also will continue collaborations between whaling captains, AEW, NSB, ADF&G, NMFS, BOEM, DFO-Canada, and Natural Resources Greenland and develop additional collaborations with oil companies and consultants collecting acoustic data to accomplish this project. Satellite transmitters with environmental and passive acoustic monitoring capabilities will be deployed on bowhead whales near Native villages in the Beaufort, Chukchi, and Bering seas. Plots of whale tracks will be made available weekly and location data compared among years to determine inter-annual variability of movements and concentrations. Acoustic data will be analyzed to determine individual whale calling rates relative to whale behavior and disturbance factors. This study will be coordinated with AEW and local whaling captains' associations to prevent any interference with subsistence whaling and hunting. All necessary research and access permits will be obtained by the PI.

**Revised Date:** August 2012

## ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2013

**Region:** Alaska

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

**Title:** Use of the Chukchi Sea by Endangered Baleen and Other Whales  
(Westward Extension of BOWFEST) (AK-12-07)

**BOEM Information Need(s) to be Addressed:** Whale 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 Chukchi Sea planning areas. These include, but are not limited to the humpback (*Megaptera novaeangliae*), the fin (*Balaenoptera physalus*), and the bowhead (*Balaena mysticetus*), all of which are listed as endangered. Recent sightings of both humpback and fin whales in the Chukchi and/or Beaufort seas, indicate a range expansion by one or both species. Gray (*Eschrichtius robustus*) and beluga (*Delphinapterus leucas*) whales also use these waters in large numbers. Under NEPA and the ESA, BOEM will be required to evaluate if and how Federal actions associated with oil and gas development may affect these whales. The occurrence, distribution and habitat use of these species in the areas concerned may play an important role in determining where and when exploration or access to petroleum reserves may be conducted.

**Total Cost:** \$4,502,000

**Period of Performance:** FY 2012-2017

**Conducting Organization:** NOAA-NMFS

**BOEM Contact:** [Jeff Denton](#)

### **Description:**

**Background:** Research underway on the Bowhead Whale Feeding Ecology Study (BOWFEST) indicates that large concentrations of bowhead whales feeding in the Barrow arch (Wainwright to Smith Bay) are attracted by prey and nutrients transported from the Bering Sea through Barrow Canyon and upwelled onto the Beaufort shelf near Barrow. Other large concentrations of whales, pinnipeds and water birds are found in the area and may be attracted by elements of the same mechanism. However, it is not clear exactly how this transport mechanism operates as these resources could be transported through the Chukchi Sea on the Alaska Coastal Current or by other sources of Bering Sea waters. This study will undertake to determine relationships between dominant currents passing through the Chukchi Sea and resources delivered to the Barrow Arch area and will provide information about the dynamic nature of those relationships relative to whale distribution and habitat utilization in the eastern-Chukchi and extreme western-Beaufort seas.

The relationships between Chukchi Sea currents and the transport of nutrients and prey may be more dynamic than formerly appreciated and may be changing as a result of the warming of the surface waters and increasing retreat of summer sea ice in the Chukchi. Recent observations of humpback and fin whales in the Chukchi are likely a climate change-related

range expansion that will continue in future years. Even as the range of these cetaceans appears to be expanding, with the exception of the bowhead whale, little is known about the population identities of any of the whales observed there. In the case of the humpback whales, it is possible that they are part of the relatively small western North Pacific stock. Virtually nothing is known about the extent to which the region is important for humpback or fin whales. Gray whales make extensive use of the Chukchi for feeding and at least some gray whales have been documented in the area during every calendar month. Gray whales potentially could belong to stocks associated with either North America or Asia; the latter is considered to be critically endangered, with fewer than 150 animals remaining. Although gray whales have been documented in the Chukchi Sea by surveys over the past three decades, the ecology of the species has not been studied in the area. Over 10% of the Eastern Pacific Stock may use the Chukchi for summer feeding. They are known to make extensive summer use of waters near the Burger Prospect and Peard Bay, areas of significant interest for industrial development. Beluga whales are frequent visitors to lagoons and coastal waters along the eastern Chukchi Sea coast. They are prized as a traditional species taken for subsistence and ceremonial purposes by Natives resident along that coastline. Beluga stock associations are not well known but belugas in the region are probably from a mixture of several stocks inhabiting the Chukchi Sea and Arctic Ocean.

Since all five species winter in, or south of, the Bering Sea, large numbers must pass through the Bering Strait during seasonal migrations to feeding grounds further north. Beginning at the Bering Strait, this research will investigate the currents and nutrient/prey transport process using methods and equipment developed for physical and biological oceanography. Additional work on the distribution, stock identity, and ecological relationships is needed for all five whale species and this all will be accomplished in a cooperative, highly-integrated study involving scientists supported by BOEM, the NSB Department of Wildlife Management, and the NSF.

#### Objectives:

- Assess spatial and temporal patterns of use of the Chukchi Sea by endangered bowhead, fin and humpback whales, and beluga and gray whales.
- Assess population structure and origin of animals.
- Evaluate ecological relationships for the species, including physical and biological oceanography.
- Extend existing studies of bowhead whale foraging ecology into the Chukchi Sea to further understand the sources, transport and advection of krill from the Bering Strait.

Methods: This study requires technologies including satellite tracking, passive acoustic monitoring, genetic analyses, and oceanographic and biological methodologies and technologies.

*Northern Bering Sea.* Satellite tags will be attached to humpback and fin whales, and their movements through the Chukchi Sea will be monitored through the Argos system. No fin whales have been satellite tagged in this region. Up to 20 tags per species would be deployed in each of 4 years. Population structure and origin will be assessed by genetic analysis of biopsy samples. Areas where aggregations of whales occur will be targeted to increase the

probability of successful tagging. For example, an aggregation of humpback whales tends to occur in the northern Bering Seas southwest of St. Lawrence island (around the M8 oceanographic mooring). Sonobuoys will be used to target fin whales which use a triplet call that occurs in both the Bering and Chukchi seas. An array of listening devices will be deployed through the Bering Sea to monitor occurrence and movement of large whales transiting through the area to facilitate tagging efforts and target whales that move into the Chukchi Sea.

*Chukchi Sea/Bering Strait.* In the Chukchi, 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, fin and gray whales are found en route. Humpback, fin, and gray whales will be tagged in the region as practical. Cruises will be organized to extend similar research activities to those areas during years 3-4 of the study. Whales will be tagged in the region as practical. Oceanographic surveys, including prey sampling, will be conducted in association with cruises, and will include studies of foraging ecology of bowheads using similar methods to those employed in the Beaufort Sea. Instrumented moorings may be deployed for year-around monitoring of oceanography and sound. The study will be integrated with other ongoing studies in the regions including aerial surveys, passive acoustic monitoring and oceanography. Analysis of acoustic data from new and existing recording packages will investigate the occurrence of gray, humpback, fin and bowhead whales on a year-round basis.

**Revised Date:** August 2012

This page left blank intentionally.

## **ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2013**

**Region:** Alaska

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

**Title:** Abundance Estimates of Ice-Associated Seals: Bering Sea Populations that Inhabit the Chukchi Sea (AK-12-x10b)

**BOEM Information Need(s) to be Addressed:** BOEM needs reliable abundance estimates of ice-associated seal species for NEPA analysis and the future development of sound plans for management, conservation, and mitigation of potential environmental impacts from oil and gas activities and climate change. Improved monitoring of ice-associated seals is also fundamental for ensuring compliance with Federal management and regulatory mandates for stock assessments under the Marine Mammal Protection Act (MMPA) and establishing extinction risk assessments under the Endangered Species Act (ESA). Study findings will be used in pre-lease analyses and documentation for potential future Chukchi Sea lease sales, as well as post-sale NEPA analysis, review of EPs, DPPs and other reviews for post-sale and post-exploration BOEM decision making and mitigation.

**Total Cost:** \$700,000 plus Joint Funding

**Period of Performance:** FY 2012-2014

**Conducting Organization:** NMFS-NMML

**BOEM Contact:** [Dr. Dan Holiday](#)

### **Description:**

**Background:** Bearded, spotted, and ribbon seals, collectively referred to as ice seals, are key components of Arctic marine ecosystems and are important subsistence resources for northern coastal Alaska Native communities. These seals are protected under the MMPA and bearded seals are under consideration for listing through the ESA. More comprehensive abundance estimates for these ice-associated seals are needed to establish extinction risk assessments under the ESA and to ensure compliance with Federal management and regulatory mandates for marine mammals under the MMPA. Obtaining reliable abundance estimates for ice seals is also a key requirement for developing sound plans for response to potential environmental impacts of oil and gas activities and the impacts to ice seal populations due to climate change.

Scientists at NOAA's National Marine Mammal Laboratory (NMML) have been collaborating with Russian colleagues to conduct synoptic aerial surveys of ice-associated seals in the Bering and Okhotsk Seas. The seals' geographic distributions are broad and patchy, and the extent, locations, and conditions of their sea ice habitats change rapidly. Therefore, surveys must cover large areas throughout the species' ranges and must be completed in a relatively short period of time, preferably during the reproductive and molting period when the greatest proportions of the populations are hauled out on the ice and visible. Two years of survey effort will be required to achieve adequate precision (CV= 0.1) for abundance estimates and to ensure that sufficient periods of suitable weather occur during

survey periods. Aerial surveys for bearded, spotted, and ribbon seals will be conducted in the spring of 2012 and 2013.

Objectives:

- Calculate abundance estimates for bearded, spotted, and ribbon seals in the Bering and Chukchi Seas.
- Use BOEM funds to obtain the contract for a NOAA Twin Otter and a second longer-range aircraft to conduct surveys of the central and eastern Bering Sea shelf in April and May of 2012 and 2013.
- Conduct surveys of ice-associated seals using high-resolution digital photographic and thermal imaging sensors, with the coverage required to obtain annual seal abundance estimates with adequate precision (CV=0.2).
- Effectively retrieve, manage, and process sensor imagery for analyses.

Methods: 1) U.S. surveys will begin April 1, 2012, out of Anchorage. A total of 17,000 – 22,000 km of survey transects at an altitude between 800 -1000 ft. will be conducted during an estimated 6 week time period. 2) Surveys will be conducted using two aircraft: a NOAA Twin Otter aircraft and a chartered long range aircraft. The charter aircraft efforts will be focused on the central Bering Sea, an important concentration and breeding area for bearded, spotted, and ribbon seals that is inaccessible to the Twin Otter. 3) New instrument-based methods rather than traditional observer-based methods will be utilized. Multiple high-resolution digital cameras (Canon Mark III 1Ds) will allow surveys to be flown at altitudes too high for on-board observers to identify species. The increase in altitude will reduce disturbance to ice seals being surveyed while providing areal coverage equivalent to surveys flown at lower altitudes during observer-based surveys. 3) Temperature data from a thermal camera (FLIR SC645) paired with each Canon digital camera image will be used to identify when seals are present in the survey area. Utilizing these data will be a thermal automated count and camera-trigger system (Snowflake), a new system that will be tested during this study. This new system allows for images to be collected at regular intervals to monitor sea ice habitat throughout the survey in addition to collecting images when seals are present in the thermal signal. The purpose of this fully automated image collection system is to greatly reduce the number of images collected, thus reducing time for analysis and reducing computer storage space of raw imagery data. 4) After each survey, the digital images, thermal data, and GPS records will be downloaded, duplicated, and stored with appropriate metadata for later analysis. 5) Abundance estimations will be achieved using hierarchical models for seal abundance developed at NMML.

**Revised Date:** August 2012



## ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2013

**Region:** Alaska

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

**Title:** A Year in the Life of a Bowhead Whale: An Animated Film  
(AK-08-12-10)

**BOEM Information Need(s) to be Addressed:** The project is for public outreach. It serves to promote an aware and informed public, and in so doing, strengthens public voices in crafting policy.

**Total Cost:** \$87,587.00 plus Joint Funding      **Period of Performance:** FY 2012-2014

**Conducting Organization:** CMI, UAF; University of Alaska Museum of the North

**BOEM Contact:** [Jeff Denton](#)

### **Description:**

**Background:** Science and technology increasingly play important roles in the development of public policies relating to a wide range of societal issues. Science outreach serves to promote an aware and informed public and, in so doing, strengthens public voices in crafting policy. Research has been underway on bowhead whale ecology, movements and distribution for decades, and significant body of knowledge regarding annual migrations, seasonal ranges, movements and bowhead feeding concentrations in the Barrow arch attracted by prey and nutrients transported from the Bering Sea through Barrow Canyon and upwelled onto the Beaufort shelf near Barrow. Other large concentrations of whales, pinnipeds and water birds are found in the area and may be attracted by elements of the same mechanism.

This project will undertake to produce an animated film for outreach purposes that will visualize processes relating how bowhead whales feed on zooplankton (krill and copepods) and how winds, ocean currents, and bathymetry interact to create favorable feeding opportunities for bowhead whales and animate the year-long cycle of bowhead seasonal movement and areas of habitat use. An animated film was chosen as the outreach medium because the aforementioned processes are best visualized through a medium that conveys motion. The narrative script will be translated from English to Iñupiaq by a native speaker and the Iñupiaq language track will be narrated by a native speaker.

### **Objectives:**

- To produce an animated film to improve public understanding of the arctic marine ecosystem (a BOEM framework issue), with emphasis on those components associated with the bowhead whale and its zooplankton prey.
- To synthesize of some recent and ongoing MMS/BOEM-funded (directly or indirectly) research projects (whale tagging, aerial surveys, oceanography) conducted in the Chukchi and Beaufort Seas.

**Methods:** The organizing framework for the proposed animated film will be the annual migration of the bowhead whale encompassing the wintering grounds in the Bering Sea, northward and eastward migration through the Chukchi and Beaufort Seas during spring to the summer feeding grounds in the Canadian Beaufort Sea, westward and southward migration during fall, and return to their wintering grounds in the Bering Sea.

Production of the animated film is broken into three overlapping phases. Pre-production includes intensive scripting by museum writers/editors, museum educators and researchers; storyboarding; and initial work on existing data collection and processing, and production graphic and sound design. The pre-production phase sets production parameters and style, and determines level of detail for all following project components. The production phase of the project will entail computer-graphic modeling, rigging, determined environment layouts, animation, lighting, textures, and effects. The post-production phase includes shot editing, sound editing, output to DVD media, printing, promotion, and distribution.

**Revised Date:** August 2012

## **ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2013**

**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)

**BOEM Information Need(s) to be Addressed:** The information gained from this study 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 2007-2013

**Conducting Organization:** UAF, Resilience and Adaptation Program

**BOEM Contact:** [Chris Campbell](#)

### **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 2012

## **ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2013**

**Region:** Alaska

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

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

**BOEM 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:** \$328,507

**Period of Performance:** FY 2008-2013

**Conducting Organization:** Applied Social Cultural Research

**BOEM Contact:** [Chris Campbell](#)

### **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 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 industry 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 2012

## ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2013

**Region:** Alaska

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

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

**BOEM 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 BOEM 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 BOEM analysts and decision makers will use the information in NEPA analysis and documentation for Lease Sales, EPs and DPPs and in post-sale and post-exploration decision making in the Chukchi Sea.

**Total Cost:** \$999,795

**Period of Performance:** FY 2009-2013

**Conducting Organization:** Stephen R. Braund and Associates

**BOEM Contact:** [Chris Campbell](#)

### **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 help assess whether OCS oil development activities in the Chukchi Sea will result in changes to offshore subsistence hunting practices. The first research question is whether subsistence hunting in the Chukchi Sea displays significant variation over time. The second question is whether such variation can be attributed to offshore oil and gas industrial activities.

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

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

**Revised Date:** August 2012



## **ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2013**

**Region:** Alaska

**Planning Area(s):** North Aleutian Basin

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

**BOEM 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 2009-2012

**Conducting Organization:** Idaho State University

**BOEM Contact:** [Chris Campbell](#)

### **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 BOEM 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 2012

## **ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2013**

**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)

**BOEM 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 BOEM analysts and decision makers will use the information in NEPA analysis and documentation for Lease Sales, EPs and DPPs and in post-sale and post-exploration decision making in the Beaufort Sea.

**Total Cost:** \$373,298

**Period of Performance:** FY 2009-2013

**Conducting Organization:** Stephen R. Braund and Associates

**BOEM Contact:** [Chris Campbell](#)

### **Description:**

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

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

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

The study is intended to pilot-test the prospects for a more comprehensive future undertaking by limiting the initial scope of research to a few recent exploration and development projects. The projects to review would likely include Northstar, McCovey, Endicott, Alpine and

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

Objectives:

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

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

**Revised Date:** August 2012

## **ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2013**

**Region:** Alaska

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

**Title:** Social Indicators in Coastal Alaska: Arctic Communities (AK-11-09)

**BOEM Information Need(s) to be Addressed:** This study will update key socio-cultural and economic baseline data for analysis of potential local and regional impacts from offshore exploration and development activities that may occur in federal waters off the North Slope of Alaska. Information from this study will be used for Outer Continental Shelf Lands Act (OCSLA) and National Environmental Policy Act (NEPA) analyses, for documentation, and may serve as the basis for long-term monitoring for Chukchi and Beaufort oil and gas exploration and development in the region.

**Total Cost:** \$669,659

**Period of Performance:** FY 2011-2014

**Conducting Organization:** Stephen R. Braund and Associates

**BOEM Contact:** [Chris Campbell](#)

### **Description:**

Background: The goal of this study is to update baseline data measuring the pace, direction, and magnitude of regional socio-economic changes, as well as the sense of well-being as expressed by residents in select Arctic coastal communities. These data will assist in NEPA evaluation of the effects of exploration and possible development of offshore energy resources in the Chukchi and Beaufort Seas on local populations through the formulation of social indicators nested within sets of key social domains. This study will facilitate evaluation of current conditions and trends in: economic prosperity; the status of health and safety; cultural continuity and well-being; changes in the status of indigenous rights and local control; quality of the physical environment; and education. Likely communities for sampling will include: Pt. Lay, Wainwright, Barrow, Nuiqsut, and Kaktovik.

### Objectives:

- Formulate a set of key social indicators nested within domains that will facilitate the monitoring of changes in human well-being in coastal communities of the Alaskan Arctic most proximate to proposed oil and gas exploration and development.
- Obtain an OMB control number for a longitudinal survey instrument that can be repeated to identify long term trends, periodic changes, and fluctuations in the rate of change throughout coastal Alaska.
- Provide useful information on regional socioeconomic conditions and regional aspirations from which government officials and stakeholders can monitor and evaluate potential changes in well-being resulting from oil and gas exploration and development.

**Methods:** Establish formal contact with potential host communities and develop a written protocol to facilitate community participation and meaningful collaboration in the performance of this research. Conduct a literature search on previous northern social indicator studies. Utilize existing identified arctic social indicators or develop alternative relevant social indicators in conjunction with BOEM. Prepare a strategic survey instrument, pre-test it, and obtain the necessary approvals for use from relevant BOEM review offices and the Office of Management and Budget, and administer it. Organize data into a workable database and analyze with appropriate multivariate statistical techniques. Conduct a comprehensive analysis of the results of all prior tasks and prepare a draft report of the study findings. Circulate the draft report to the BOEM and host community leaders to facilitate parallel reviews by peer scientists and interested stakeholders; respond to review comments and prepare a final report, incorporating reviewer edits and comments where appropriate; report the study results to participating communities through public meetings or workshops.

**Revised Date:** August 2012

## ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2013

**Region:** Alaska

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

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

**BOEM 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 BOEM of ecosystem health, which is so important to subsistence lifestyle.

**Total Cost:** \$119,459 plus Joint Funding      **Period of Performance:** FY 2009-2012

**Conducting Organization:** CMI, UAF

**BOEM Contact:** [Chris Campbell](#)

### **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, BOEM 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 2012



## **ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2013**

**Region:** Alaska

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

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

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

**Total Cost:** \$100,000

**Period of Performance:** FY 2010-2015

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

**BOEM Contact:** [Warren Horowitz](#)

### **Description:**

Background: The Alaska Marine Science Symposium (AMSS) is the largest and most comprehensive annual marine science conference within the State of Alaska (<http://www.alaskamarinescience.org/>). The AMSS 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 1100 people attended the most recent Symposium, and many organizations pitched in to make it a success. The BOEM 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 BOEM 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 BOEM Alaska OCS Region environmental studies research for the Arctic and Bering Sea
- Provide a forum for Alaska OCS Region scientists and Principal Investigators to come together with other researchers that are conducting similar scientific studies within the Alaska OCS or adjoining areas of the Alaska marine ecosystem.

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

**Revised Date:** August 2012

## **ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2013**

**Region:** Alaska

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

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

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

**Total Cost:** \$200,000/year

**Period of Performance:** FY 2010-2013

**Conducting Organization:** Kinnetic Laboratories Inc.

**BOEM Contact:** [Catherine Coon](#)

### **Description:**

**Background:** The BOEM 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 BOEM 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 BOEM 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 2012

This page left blank intentionally.

## **ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2013**

**Region:** Alaska

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

**Title:** ShoreZone–Shoreline Mapping of the North Slope of Alaska  
(AK-11-07)

**BOEM Information Need(s) to be Addressed:** ShoreZone mapping is a technique that will provide BOEM with the most comprehensive biological, physical, and geomorphologic data of the Beaufort and Chukchi coastal areas. The BOEM analysts and decision makers will use shoreline mapping information for identifying high priority fish and wildlife habitats in NEPA and ESA (Endangered Species Act) analyses and documentation for Lease Sales, EPPs and DPPs and in post-sale and post-exploration decision making. The data will also provide an improved level of detail for coastal contingency planning, oil spill response activities, and habitat recovery efforts in the context of future offshore oil, gas and mineral development activities upland of Beaufort and Chukchi Seas; and a value added benefit from more accurately append the current Environmental Sensitivity Indices (ESI).

**Total Cost:** \$481,720

**Period of Performance:** FY 2011-2015

**Conducting Organization:** Nuka Research and Planning Group

**BOEM Contact:** [Catherine Coon](#)

### **Description:**

**Background:** The ShoreZone program is a partnership of scientists, GIS specialists, web specialists, nonprofit organizations, and governmental agencies. The multi-agency program offers the opportunity to build a contiguous, integrated coastal resource database that extends from the mouth of the Columbia River through BC, the Gulf of Alaska, Bristol Bay, and now northward to the Arctic Coast (on the order of 100,000 km).

ShoreZone is a powerful coastal habitat classification, mapping, and inventory system that relies on the collection and interpretation of aerial imagery of the intertidal zone, nearshore, and estuarine environments. Aerial video and high resolution still photos are collected by geologists and biologists at extreme low tides. This imagery is georeferenced and then mapped, providing a recording of the physical and biological features of the intertidal zone, nearshore, and estuarine environments, including archaeological resources and manmade features. The digital imagery and associated data are made accessible to the public through the National Oceanic and Atmospheric Administration (NOAA) National Marine Fisheries website as a collaborative partnership with BOEM.

Coastal video imagery of the North Slope from Barrow to Harrison Bay (1,090 km) and from Flaxman Island to the Canadian border (890 km) was collected in 2001 under an MMS contract (Polaris Applied Sciences Inc. and Environmental Mapping Ltd) for the purpose of

Environmental Sensitivity Indices (ESI). This aerial video exists in the form of 11 DVDs and may be suitable for ShoreZone mapping. The USGS has also collected topographical imagery (LIDAR) in the Arctic in 2009-2010 for shoreline change that can be applied to morphological changes of the tundra. These imagery sets will be described, cataloged, and summarized for historical perspective for BOEM use. This project will provide an additional imagery necessary, combined with a ground verification component through a series of shore stations, to describe the shoreline and the physical and biological features of the intertidal zone, nearshore, and estuarine environments.

Objectives:

- Summarize existing historic coastal video imagery.
- Assess the use of USGS topographic LIDAR for research on shoreline change and how it can apply to coastal inundation of slopes for spill scenarios and shoreline position change of the barrier islands.
- Conduct new video imagery along the Arctic Coast of Alaska.
- Groundtruth imagery with shore stations to verify geomorphic features. Map video imagery using the ShoreZone methodology.
- Develop the completed imagery and mapping package available to BOEM and the public via the NOAA ShoreZone website (<http://www.fakr.noaa.gov/maps/szintro.htm>).
- Assess the feasibility of extending the project to include a bathymetric LIDAR component.

Methods: The *ShoreZone Coastal Habitat Mapping Protocol for the Gulf of Alaska* will be used to map the imagery collected in the North Slope, Alaska. ([http://www.fakr.noaa.gov/habitat/shorezone/goa\\_protocol.pdf](http://www.fakr.noaa.gov/habitat/shorezone/goa_protocol.pdf)). A new protocol for Coastal Alaska is in progress.

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

The completed ShoreZone Mapping will provide a comprehensive region-wide database of nearshore habitat and physical attributes and will also be linked to the existing web interface hosted by NOAA 'Nearshore Fish Atlas of Alaska' (<http://www.fakr.noaa.gov/habitat/fishatlas/>).

**Revised Date:** August 2012

## **ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2013**

**Region:** Alaska

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

**Title:** Workshop—Interagency Protocols for Immediate On-Scene Arctic Oil Spill Impact Science (AK-11-11)

**BOEM Information Need(s) to be Addressed:** This study would seek to develop a mechanism, should a spill occur, to improve multilateral coordination in the effort to obtain interdisciplinary environmental data about the immediate effects of an oil spill in Alaskan seas. The resulting information will provide improved analyses and mitigation measures as required by the National Environmental Policy Act.

**Total Cost:** TBD

**Period of Performance:** FY 2012-2013

**Conducting Organization:** TBD

**BOEM Contact:** TBD

### **Description:**

Background: Many of the impacts of oil spills happen in the first three days after oil or gas is spilled. In the past 20 years, two major marine oil spills, the *Exxon Valdez* and the *Selendang Ayu*, have occurred in Alaska. Most recently, the *Deepwater Horizon* blowout in the Gulf of Mexico has triggered the need for a fresh look at lessons learned, including new preparations for spill response planning in arctic waters. In all these cases, collection of scientific data in the critical initial period was hampered by the lack of standing interagency collaborative agreements with pre-established sampling protocols. Information produced by planned spill response research would potentially improve the government's ability to track, monitor, and mitigate oil spill impacts and long-term environmental consequences. Successful completion of Alaskan protocols and agreements would facilitate replication in other OCS areas.

### Objectives:

- Assemble a collection of relevant “lessons learned” from the Deepwater Horizon oil spill to improve environmental data collection in the event of a spill in arctic waters.
- Develop a protocol for sampling during the initial stages of an Alaska marine oil or gas spill.
- Develop interagency working agreements or other instruments necessary to implement immediate scientific sampling should an oil spill occur in marine waters.

Methods: Workshop participants, including NEPA analysts and other interagency scientists, would be systematically queried about information needed at onset of an oil spill. Sampling protocols to meet those information needs will be drafted. Appropriate framework documents will be developed to initiate pursuit of broader operational agreements across multiple relevant agencies, including the U.S. Coast Guard and NOAA.

**Revised Date:** August 2012

This page left blank intentionally.



## **ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2013**

**Region:** Alaska

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

**Title:** Enhancement of the Environmental Studies Program Information System and the Multipurpose Marine Cadastre to Provide Environmental Studies Data (NT-12-01)

**BOEM Information Need(s) to be Addressed:** The offshore energy extraction process requires physical, biological, oceanographic and social science information at all stages from leasing through exploration and production, to decommissioning. Regulatory agencies and prospective lease holders rely on scientific studies and other data mining exercises to build their knowledge base from past and ongoing work conducted in the Alaska OCS Region. A web-based visual display of completed and ongoing study efforts will assist BOEM in (1) planning new research, (2) promoting collaboration with other agencies on similar projects, (3) evaluating exploration and development plans, and (4) improving BOEM decision making to safeguard activities on the OCS.

**Total Cost:** \$500,000

**Period of Performance:** FY 2012-2015

**Conducting Organization:** NOAA-Coastal Services Center

**BOEM Contact:** [Rick Raymond](#)

### **Description:**

Background: BOEM places digital copies of final study reports online. However, it remains challenging to process some report information efficiently, such as study boundaries, data collection efforts, or conclusions from multiple study efforts. It is also a challenge for internal BOEM staff to remain current with all research due to the volume of activities conducted within the OCS Planning areas. BOEM as well as other agencies and academia have identified a statewide need for a centralized database of past, present and future projects with associated observations.

This study will design, develop, document, and implement a BOEM Internet Geospatial Web Portal utilizing the online Environmental Studies Program Information System (ESPIS) database Browser and the Multipurpose Marine Cadastre (MMC) spatial data tool for BOEM completed and ongoing environmental studies that can be queried and displayed by internal BOEM staff and other agencies. The project is national in scope and will include a subcontract dedicated to service information needs for the Alaska OCS Region.

### Objectives:

- Develop a BOEM Environmental Studies project database that can be fully utilized to query, graphically display, and extract project specific information.
- Develop programming tools that would allow BOEM staff and others to query, display, and extract available spatial data sets collected from each study.

- Automate the updating of new studies project information through development of programming tools that can seamlessly import BOEM Environmental Studies project information from newly completed or existing studies into ESPIS and MMC.
- Develop programming tools that can automatically search, retrieve, upload and merge project specific information and data from other State and Federal agencies, and industry, into the BOEM project database and data directories.
- Develop a BOEM Geospatial Website User Interface and Graphical Display whereby users can query, display, and extract project specific information, and display and extract BOEM Environmental Studies data sets covering the Alaska OCS.
- Provide complete documentation on the database and user interface application.
- Provide a user manual and train internal staff on the use of the BOEM Geospatial Web Portal.
- Provide online documentation for external users.

Methods: Under this study, NOAA-Coastal Services Center and BOEM internal staff will gather environmental studies project information and available data in a concerted effort to make information readily available to BOEM staff and other agencies. This effort will centralize functions to collect, catalogue, and distribute BOEM environmental studies project information and associated project studies data gathered since 2000. A BOEM web link will interface with ESPIS and MMC displaying maps of project boundaries, link to project specific information, data, metadata, and reports.

**Revised Date:** August 2012

## **ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2013**

**Region:** Alaska

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

**Title:** Conference Management and Reports on BOEM Results (AK-12-01)

**BOEM Information Need(s) to be Addressed:** Conference management supports formal information transfer meetings (ITMs) and workshops to disseminate study results and to resolve environmental and technical issues for BOEM program managers. These conferences increase public confidence in the data used by the OCS program. Workshops may be coordinated with future lease sales and for NEPA analyses and documentation focusing primarily on the Beaufort Sea and Chukchi Sea.

**Total Cost:** TBD

**Period of Performance:** FY 2012-2015

**Conducting Organization:** TBD

**BOEM Contact:** TBD

### **Description:**

Background: The transfer of scientific information is continuous and the Alaska Environmental Studies Program (ESP) needs to constantly organize and conduct ITMs and workshops. Conference participants have the opportunity to exchange environmental studies information with experts and interested parties on selected topics oriented to formulating concepts for new research projects and/or to address study needs. During the past decade the Alaska ESP has held information status meetings and planning workshops for the exchange of studies information among scientists, stakeholders and the general public.

To improve the accessibility, use and exchange of study results, the Alaska OCS Regional office conducts public meetings with a variety of formats. Generally, ITMs are 3-day events and workshops of shorter duration (1 to 2 days in length) that may focus on a single discipline or topic. ITM conferences make clear the scope and detail of information-gathering activities relating to the Alaska OCS. They give interested parties an opportunity to participate in discussions of important topics dealing with oil and gas leasing, exploration, and development in the Arctic region. They also serve as opportunities for regional staff to learn about the information that has been gathered and, therefore, help ESP to formulate study plans for future years.

Objectives: The objective of this procurement is to provide the logistical support for small meetings and workshops to highlight the work of the Environmental Studies Program in Alaska and foster sharing of information among researchers and interested parties through small meetings, 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 2012

## **ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2013**

**Region:** Alaska

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

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

**BOEM 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, and Chukchi Sea can be made. Final reports will be available for lease sales and post-sale decisions; interim data products and inputs will be used to address information needs. Topical areas to be addressed under the Coastal Marine Institute have been identified through this Annual Study Plan, previous Alaska Region study plans, and the Framework Issues. The study also will develop information that addresses public concerns raised during outreach efforts.

**Total Cost:** \$453,320 plus Joint Funding      **Period of Performance:** FY 2008-2013

**Conducting Organization:** CMI, UAF

**BOEM Contact:** [Dr. Heather Crowley](#)

### **Description:**

**Background:** This study provides management of a large ongoing program of scientific research into framework issues related to potential future lease sales in the Alaska OCS Region. It is a cooperative program between BOEM and the University of Alaska, with State of Alaska participation. The Coastal Marine Institute (CMI) is expected to leverage additional scientific results and logistics capability at levels comparable to the BOEM contribution of \$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 BOEM and State of Alaska decision makers that is consistent with the needs outlined by the Framework Issues. The Framework Issues are:

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

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

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

**Revised Date:** August 2012

## 2.2 Profiles of Studies Proposed for FY 2013 NSL

**Table 1** Alaska OCS Region Studies Proposed for the FY 2013 NSL

Page No.	Discipline	Title	Ranking
161	AQ	Arctic Air Quality Impact Assessment Modeling	1
163	MM	Chukchi Acoustic, Oceanography and Zooplankton Study: Hanna Shoal (Extension of CHAOZ)	2
165	IM	Coastal Marine Institute (extension)	3
167	IM	Cook Inlet Workshop: Information Status & Research Planning	4
169	PO	Enhanced Verification and Interpretation of Arctic Ice Formation, Distribution, and Density	5
171	IM	*Support for the 2012 United States-Canada Northern Oil and Gas Research Forum	6
173	MM	*Walrus Seasonal Distribution and Habitat Use in the Eastern Chukchi Sea	7
175	FE	Physical and Chemical Analyses of Crude and Refined Oils: Laboratory and Mesoscale Oil Weathering	8
177	SS	Subsistence Mapping of Wainwright, Point Lay, and Point Hope	9
179	FE	†ANIMIDA III: Contaminants, Sources, and Bioaccumulation (AK-11-14b)	
181	PO	†Applications for Mapping Spilled Oil in Arctic Waters (AK-12-03b)	
183	PS	†Ice Seal Movements and Foraging: Village-based Satellite Tracking and Acoustic Monitoring of Ringed, Bearded, and Spotted Seals (AK-12-05)	
AQ = Air Quality IM = Information Management PO = Physical Oceanography		FE = Fates & Effects SS = Social Systems HE = Habitat & Ecology	MM = Marine Mammals and Protected Species REN = Renewable Energy

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

† Project deferred from previous year.

This page left blank intentionally.



## **ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2013**

**Region:** Alaska

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

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

**BOEM Information Need(s) to be Addressed:** BOEM requires information to assess the cumulative air quality impact of off-shore Arctic oil and gas activity, including oil spill response equipment and associated support equipment not already accounted for through State and Federal air permit requirements. This information would be used by BOEM and various Federal and State agencies to support compliance with the Clean Air Act and environmental justice initiatives. In addition, the information would provide public agencies, permit applicants, and the public with a holistic view of the air pollution impact on the people and environment in Northern Alaska.

**Cost Range:** TBD

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

### **Description:**

Background: Arctic oil and gas exploration and extraction activities proposed for the OCS require environmental evaluations pursuant to the National Environmental Policy Act and air pollution operating permits to comply with the impact analysis required under NEPA and the Clean Air Act. An air quality model capable of conducting an air impact analysis requires various input datasets, including emission sources, meteorology, and pre-existing pollutant concentrations. This project proposes development of these major input datasets, which would be applied to an air quality model such as the Community Multipurpose Air Quality model (CMAQ) or the Comprehensive Air Quality Model, with extensions (CAMx), to assess the cumulative air quality impact of proposed offshore OCS projects and North Slope support activities.

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

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

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

The meteorological and emissions datasets would be applied to a regional air quality model such as CMAQ or CAMx. The results would assist in defining the cumulative impacts of all pollution sources induced by OCS activity, including the formation of secondary fine particulate matter (PM<sub>2.5</sub>) and ozone chemistry that may be occurring in this environment. This study will be coordinated with work in the Gulf of Mexico OCS Region to avoid duplication of efforts and ensure consistency with similar approaches.

#### Objectives:

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

#### Methods:

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

**Revised Date:** August 2012

## ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2013

**Region:** Alaska

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

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

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

**Cost Range:** TBD

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

### **Description:**

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

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

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

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

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

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

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

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

**Revised Date:** August 2012

## **ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2013**

**Region:** Alaska

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

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

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

**Cost Range:** TBD

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

### **Description:**

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

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

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

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

**Revised Date:** August 2012

## **ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2013**

**Region:** Alaska

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

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

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

**Cost Range:** TBD

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

### **Description:**

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

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

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

Methods:

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

**Revised Date:** August 2012



## ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2013

**Region:** Alaska

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

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

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

**Cost Range:** TBD

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

### **Description:**

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

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

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

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

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

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

**Revised Date:** August 2012

## **ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2013**

**Region:** Alaska

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

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

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

**Cost Range:** TBD plus Joint Funding

**Period of Performance:** FY 2013

### **Description:**

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

The Second Canada-US Northern Oil and Gas Research Forum was hosted by the Department of Indian and Northern Affairs Canada in 2010 in Calgary, Alberta. Ninety attendees presented their research results as part of a panel discussion or in oral and poster presentations

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

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

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

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

**Revised Date:** August 2012

## ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2013

**Region:** Alaska

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

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

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

**Cost Range:** TBD plus Joint Funding

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

### **Description:**

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

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

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

associated with proposed exploration and development scenarios. The monitoring activities described in this study profile follow recommendations of the national Ocean Research Priorities Plan (ORPP).

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

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

Methods:

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

**Revised Date:** August 2012

## ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2013

**Region:** Alaska

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

**Title:** Physical and Chemical Analyses of Crude and Refined Oils:  
Laboratory and Mesoscale Oil Weathering

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

**Cost Range:** TBD

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

### **Description:**

**Background:** The rate of oil dispersion into the water column calculated by the OWM is used to estimate whether State and Federal water quality standards and criteria would be exceeded by a spill, over what area and for how long. The model calculates the area covered by a spill, an important parameter for estimating effects, but the OSRA does not. The model also calculates the persistence of the lighter, but most toxic components of the oil slick. This calculation allows analysts to directly estimate persistence of toxicity, rather than assume, as in the OSRA, that these toxic components persist over the first three days of a spill. Because the size of a spill affects its weathering, the model helps distinguish between effects of large ( $\geq 1,000$  bbl) and small ( $< 1,000$  bbl) spills. The in situ viscosity and degree of emulsification provided by the model are used in assessing the mitigation by and effectiveness of oil spill countermeasures such as mechanical recovery, dispersant, and in-situ burning.

This proposed research will be informed by results from the study “Validation of the Two Models Developed to Predict the Window of Opportunity for Dispersant Use in the Gulf of Mexico” conducted by the Bureau of Safety and Environmental Enforcement’s Technology Assessment and Research Program. That project aims to validate and improve two correlation models that were developed to predict the window of opportunity for successful chemical dispersant use in the Gulf of Mexico (GOM). The project will also evaluate the sensitivity of the models to various oil weathering parameters.

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

### **Methods:**

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

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

**Revised Date:** August 2012



## ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2013

**Region:** Alaska

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

**Title:** Subsistence Mapping of Wainwright, Point Lay, and Point Hope

**BOEM Information Need(s) to be Addressed:** This study will update baseline time-series data to monitor community impacts in the vicinity of the Chukchi Sea Lease Sale area. Systematic mapping of last decade and last twelve months subsistence harvest in Wainwright, Point Lay, and Point Hope will complement OCS Study 2009-003 (*Subsistence Mapping of Nuiqsut, Kaktovik, and Barrow*). BOEM analysts and decision makers will use the information in NEPA analysis and documentation for Lease Sales, EPs and DPPs and in post-sale and post-exploration decision-making in the Chukchi Sea.

**Cost Range:** TBD

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

### **Description:**

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

**Objectives:** This study will parallel and match the objectives expressed in OCS Study MMS 2009-003, and will be a companion volume for providing baseline information on the Chukchi Sea. The study will gather and map long term (10 years) subsistence data and associated traditional and local knowledge to help assess whether OCS oil development activities in the Chukchi Sea will result in changes to onshore subsistence hunting practices. It will provide a time series or longitudinal record of subsistence activities over the last decade to document land use patterns and to develop a baseline from which to understand the potential impacts of any future development action. Specific objectives include:

- Consulting subsistence harvesters from Wainwright, Point Lay, and Point Hope about land use activities – where they hunted and what they harvested – delineating use over the past decade and then depicting use over the past year on map overlays.
- Recording discussion and topics of interest to provide supporting data.
- Addressing the methodological problem of respondent recall and accuracy, especially as related to “time.”
- Correlating hunter tract lines with environmental variables and socio-economic variables that explain land-use patterns.
- Drawing upon local knowledge and best available science as sources of information.
- Defining the intensity of use per species harvested over a 10-year period and in the last year (or last trip as duration).
- Developing geospatial layers to be used for modeling purposes.

Methods: This project will entail extensive community engagement. Early procedures will involve organizations such as the North Slope Borough Wildlife Management Department, the Alaska Eskimo Whaling Commission, the Iñupiat Community for the Arctic Slope, the Native Village Traditional Councils for Wainwright, Point Lay, and Point Hope and others as appropriate. The effort will include the compilation of information regarding subsistence geospatial patterns from BOEM and other studies conducted in Wainwright, Point Lay, and Point Hope. It will assess the quality of existing geospatial data and convert to GIS format where possible. The study will gather primary source data regarding current subsistence effort, and use of resources from knowledgeable residents of Wainwright, Point Lay and Point Hope. The data collection effort will coordinate with other relevant BOEM studies.

Contractors will disseminate ongoing and final products of study to local residents through community workshops and integrate workshop feedback into the final analysis. All final spatial information on subsistence and industry activity will be put into a GIS or GIS compatible format to provide to BOEM for NEPA analyses. The final product will include a descriptive report that is at least as explicit as OCS Study MMS 2009-003.

**Revised Date:** August 2012

## ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2013

**Region:** Alaska

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

**Title:** ANIMIDA III: Contaminants, Sources, and Bioaccumulation (AK-11-14b)

**BOEM Information Need(s) to be Addressed:** This project has monitored the development area in the Beaufort Sea OCS, with last sampling of contaminants, sources, and bioaccumulation in 2006. There is a continuing, ongoing need for this monitoring in the development area within the Beaufort Sea during the performance period of the study, which will coincide with continued production from Northstar, development and production from Liberty, and Camden Bay delineation and potential development. The information will be used for NEPA analysis and documentation for Beaufort Sea Lease Sales and DPPs.

**Cost Range:** TBD

**Period of Performance:** FY 2013-2019

### **Description:**

Background: The Arctic Nearshore Impact Monitoring in Development Area (ANIMIDA) and continuation of ANIMIDA (cANIMIDA) started in 1999 and, has provided baseline data and monitoring results for chemical contamination, turbidity, Boulder Patch productivity, and subsistence whaling in the vicinity of oil industry development in the Beaufort Sea OCS. Northstar and Liberty prospects were monitored prior to development and Northstar into development and production. A second continuation of the subsistence whaling task is already under way and a continuation of the Boulder Patch monitoring is proposed for FY 2012.

In 2008, the MMS approved a development plan for the Liberty prospect that would use directional drilling from an enlarged Satellite Drilling Island (SDI) at the east end of the Endicott Causeway. Shell has also submitted an exploration plan to MMS that would delineate existing oil discoveries in the Sivulliq and Torpedo prospects in Camden Bay. Ongoing industry activities necessitate ongoing monitoring projects. The last contaminant sampling under cANIMIDA occurred in 2006 and did not include the deeper Camden Bay area of interest.

### Objectives:

- Continue the ANIMIDA/cANIMIDA sediment chemistry monitoring emphasizing hydrocarbon and priority metal concentrations.
- Improve the cANIMIDA conceptual model of suspended sediment interactions, loading, and export from the ANIMIDA area, continue to delineate and quantify the offshore dispersion of river runoff and suspended sediments during the spring melt, trace the dispersion of suspended sediments into deeper, outer shelf water, continue to refine sourcing techniques for suspended sediments particularly in the expanded eastern ANIMIDA area, expand the chemical analyses of suspended sediments to

- include hydrocarbon composition, estimate the contribution of shoreline erosion, Mackenzie River, and offshore waters to suspended sediment load and composition.
- Continue development of a conceptual model of bioaccumulation and trophic interaction in ANIMIDA biota, monitor bioaccumulation of contaminants in selected species, and continue ANIMIDA/cANIMIDA contaminant monitoring program for amphipod and bivalve samples.
  - Develop and initiate a contaminant monitoring program for deeper water benthic biota found in this expanded ANIMIDA study area. Include mid-Beaufort Distributed Biological Observatory stations as part of the monitoring program

Methods:

Field logistics will include small vessel support in the “open” water season. Larger vessel support will be needed in offshore Camden Bay for the biological/contaminant effort. Primary biological/contaminant field surveys should occur in the open-water period, with some effort during breakup with high river flow, and at least once during the ice-covered season.

Sediment and biota sampling will be scheduled such that stations sampled in eastern, central, and western Beaufort in ANIMIDA/cANIMIDA will be resampled at least once and that new deeper eastern Beaufort Region stations around Sivulliq and Torpedo would be sampled at least twice (to form a baseline). Focus will be on oil and gas development potential contaminants in sediments and benthic biota, and distribution and abundance of benthic biota.

Chemical fingerprinting and cANIMIDA/ANIMIDA ratio techniques will be used to characterize sources of suspended sediments. Profiles for turbidity, salinity, temperature and current would be obtained from numerous sites around the pertinent project area at the time of sampling. The choice of elemental and isotope parameters to be analyzed for suspended sediment will be designed to maximize the potential for discriminating among different sources of particles. A variety of dispersion models and predictive tools should be considered.

The study will use cANIMIDA conceptual food web model to help guide development of specific objectives for this task, increase statistical viability of the results with the goal of longer-term strategy for biological contaminant monitoring, and will make improvements to this conceptual model based on study findings.

**Revised Date:** August 2012

## ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2013

**Region:** Alaska

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

**Title:** Applications for Mapping Spilled Oil in Arctic Waters (AK-12-03b)

**BOEM Information Need(s) to be Addressed:** The results from this study could inform BOEM Oil-Spill-Risk Analysis (OSRA) and oil spill fate modeling efforts, and may improve detection and cleanup operations in the event of a large oil spill. Outputs could be used to verify oil spill contingency plans. Results will support decisions associated with environmental assessments and exploration plans. The BOEM analysts and decision makers may use the results to improve NEPA analysis and documentation for any future Alaska OCS lease sales.

**Cost Range:** TBD

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

### **Description:**

**Background:** Based upon the recent tragic event in the Gulf of Mexico, there is a strong need in the Arctic OCS to test, develop, and implement the observational platforms, mapping software, and oil spill models that could track and assess the fate of spilled hydrocarbons. Such systems are presently being tested in the Gulf of Mexico and preliminary tests have been successful. This study would build and test similar equipment to be used on AUVs for the Arctic. This study will jointly fund and field test environmental response and mapping software in cooperation with Federal, State, and industry parties who would be willing to share costs and incorporate real-time observational data into this tracking and mapping software system. We will develop and test the instrumentation for AUV gliders that can map, sample and analyze potential subsurface hydrocarbon-enriched plumes in order to understand their distributions, transport, aging, and ecosystem consequences, especially with regard to the potential use of dispersants. The BOEM will jointly work with other interested parties to field test the capability of the environmental response and mapping software to track a planned release of fluorescein dye within the Chukchi Sea. Real time data streams from aerial surveys, ship tracks, gliders, drifters, meteorological buoys, HF radar generated surface currents and possibly satellite tagged marine mammals and birds will be tracked. Protocols will be developed and tested over multiple field experiments to assess applications for tracking a potential spill in the offshore during the open water season.

### **Objectives:**

- Develop a better understanding of small scale transport processes important to fate and effects modeling used in oil impact analysis.
- Assess the effectiveness of HF Radar surface current mapping system and drogued drifters for providing near-surface current input data to oil spill models.
- Develop, test, and deploy instrumentation for Autonomous Underwater Vehicles (AUV) that can be customized for use in the Arctic to detect the spatial and temporal locations of subsurface hydrocarbon plumes. (Field tests to be conducted with non-toxic fluorescein dyes.)

- Conduct at least two field tests of the dispersal and tracking of non-toxic fluorescein dye off the Chukchi coast.
- Track the dispersed dye plume by incorporating input from the AUVs and other real time data collection sensors in the Chukchi Sea (e.g., surface currents from HF Radar, drifters, real time WRF high resolution wind fields, data from meteorological buoys and other offshore instruments) to assess the fate and transport of the dye plume.
- Develop algorithms quantifying small scale transport processes based on measurable oceanographic and meteorological data (i.e., advection, Langmuir circulation, wind drift, vertical and horizontal dispersion coefficients, etc.)

Methods: The first part of this effort will develop the instrumentation necessary for gliders to map the subsurface movement of a hydrocarbon plume. The second part will develop the field protocols to track the movement of dispersed fluorescein dyes (simulated spill) on the surface and within the water column utilizing shipboard and aerial surveys and real time observation systems within the Chukchi Sea. The researchers will obtain permits to release non-toxic dyes that can be tracked within the Chukchi Sea through the use of shipboard CTDs and fluorometers, aerial surveys or very high resolution satellite imagery, existing coastal radars, drifters and underwater gliders. Researchers will conduct two years of field tests to perfect equipment and produce protocols, work to improve existing or develop new mapping systems for the Chukchi Sea that could be used to incorporate real time data feeds from the deployed AUVs along with other real time surface observations and conduct analysis of the dispersed dyes to achieve a better understanding of the associated transport processes.

**Revised Date:** August 2012

## ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2013

**Region:** Alaska

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

**Title:** Ice Seal Movements and Foraging: Village-based Satellite Tracking and Acoustic Monitoring of Ringed, Bearded, and Spotted Seals (AK-12-05)

**BOEM Information Need(s) to be Addressed:** More information is needed on seal movements and feeding areas relative to areas of interest for oil and gas leasing, exploration and development. Additional information would be particularly useful to evaluate potential interaction between industrial development and anticipated effects of diminished summer sea ice in much of their habitat. Data can be used to help design monitoring and mitigation measures and will provide more information to be used in NEPA environmental analyses. Since ice seals have been petitioned for listing under the ESA, information from this study may be useful for future ESA Section 7 consultations.

**Cost Range:** TBD

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

### **Description:**

**Background:** Considerable effort has been expended since the 1980s to document the distribution, abundance and behavior of ice seals in the Beaufort and Chukchi Seas. However most of that effort involved aircraft surveys and analysis of prey from stomachs collected by biologists or in subsistence harvests. Some satellite telemetry studies of ringed, bearded, and spotted seals movements have been conducted (funded by MMS and others) showing large scale movements by all species and age classes. One highly successful project was conducted from 2004-2010 near Kotzebue in which local hunters were trained for capture and tagging. Seals tagged near Kotzebue ranged farther north than Barrow and south to Bristol Bay. Overall, because of the proximity to the tagging location most of the locations are in the southern Chukchi Sea near Kotzebue. Additional tagging locations are needed to better understand the range of movements and use patterns. Other village-based tagging projects could be developed to expand the tagging locations and increase the knowledge of seal movements. Tagging near Pt. Lay, Wainwright, and Barrow may show a greater use of Lease Sale 193 and the Beaufort Sea than use by seals tagged near Kotzebue. On the other hand, if seals tagged near Kotzebue go to the Yukon-Kuskokwim area and Bristol Bay, seals tagged in the Bering Sea may also use the Chukchi and Beaufort seas.

Adult ringed seals are the most ice adapted and are known to use the heaviest ice concentrations throughout winter and spring and it was assumed that juveniles occupied similar habitats in winter. Movements of adult and juvenile ringed seals tagged near Kotzebue, however, showed juveniles travelling to and wintering near the ice edge in the Bering Sea while adults wintered in heavy ice in the northern Bering and Chukchi seas. It is likely that other similar patterns of use by species or sex/age classes will be documented during this tagging study.

Objectives: To better understand movements and habitat use of ice seals in the Beaufort, Chukchi, and northern-Bering seas.

Methods: Using the tagging project conducted in Kotzebue Sound by the Native Village of Kotzebue as a model, develop similar collaborations between local Village Councils, seal hunters, the Ice Seal Committee, NSB, ADF&G, NMFS, BOEM, to establish seal tagging projects near several Native villages selected for their importance in provided missing seal movement information. Biologists will train hunters in seal capture and tag deployment and provide weekly maps of seal tracks to the hunters and their communities. Movement data will be analyzed relative to ice edge, ice concentration, bathymetry, and residence times. To the extent feasible, passive acoustic recordings of vocalizations from acoustic arrays deployed in other BOEM studies such as BOWFEST and CHAOZ will be used to estimate relative local calling-rates for bearded and other ice seals. Native deployed “dipping hydrophones” will be used to document call rates and types near coastal villages.

**Revised Date:** August 2012



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

**Table 2** Alaska OCS Region Studies Proposed for the FY 2014 NSL

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

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

This page left blank intentionally.

## ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2013

**Region:** Alaska

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

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

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

**Cost Range:** TBD

**Period of Performance:** FY 2014-2017

### **Description:**

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

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

### Objectives:

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

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

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

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

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

**Revised Date:** August 2012

## ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2013

**Region:** Alaska

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

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

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

**Cost Range:** TBD

**Period of Performance:** FY 2014-2019

### **Description:**

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

Objectives:

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

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

**Revised Date:** August 2012

## ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2013

**Region:** Alaska

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

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

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

**Cost Range:** TBD

**Period of Performance:** FY 2014-2015

### **Description:**

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

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

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

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

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

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

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

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

**Revised Date:** August 2012



## **ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2013**

**Region:** Alaska

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

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

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

**Cost Range:** TBD

**Period of Performance:** FY 2014-2019

### **Description:**

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

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

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

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

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

Objectives:

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

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

**Revised Date:** August 2012

## ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2013

**Region:** Alaska

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

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

**BOEM Information Need(s) to be Addressed:** Bowhead whales (*Balaena mysticetus*) and gray whales (*Eschrichtius robustus*) are seasonal residents of the western Beaufort Sea and the Chukchi Sea. These Arctic waters provide important feeding grounds and migration pathways for both species. Bowhead and gray whale distributions overlap spatially with lease sale areas in this region. Their occurrence in Arctic waters coincides with the timing of industrial activities related to oil and natural gas exploration, development, and extraction, which occur mostly in the “open water” season when sea ice is at its minimal. Both species are protected under the Marine Mammal Protection Act (MMPA), and the bowhead whale is granted additional protection as an endangered species under the Endangered Species Act (ESA). The density, spatiotemporal distribution, and habitat use of these species may play an important role in determining where and when the oil and gas industries may conduct their activities. Current standard methodologies for studying these ecological questions include the use of vessel observations, passive acoustics, and aerial surveys conducted from manned aircraft. In recent years, there has been increasing interest in using Unmanned Aircraft Systems (UASs) to survey cetaceans (especially bowheads) in the Alaska outer continental shelf (OCS). Presently, the performance of UASs relative to human observations for cetaceans from manned aircraft in identifying species, estimating group size and age classes, and estimating population density in space and time is unknown. The UASs' ability to encounter, detect, and identify and quantify cetacean abundance needs to be understood relative to the proven capabilities of human observers in manned aircraft.

**Cost Range:** TBD plus Joint Funding

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

### **Description:**

Background: Manned aircraft are a common platform for studying wildlife because they offer survey opportunities over large geographic areas, taking advantage of human ability to quickly integrate sensory information to collect data on species of interest. Manned flights have limitations since they must adhere to stringent requirements regarding wind, visibility, and minimum flight elevation due to safety and noise concerns. In recent years, there has been increased interest in using UASs to study marine wildlife populations. UASs have been suggested as an alternate survey platform for studying the distribution and density of the Bering-Chukchi-Beaufort (BCB) stock of bowhead whales in the western Arctic. A ship-based UAS could potentially provide a repeatable method for imaging cetaceans with the accuracy and fidelity necessary for population surveys at a cost low enough to allow frequent monitoring safely in remote locations.

A small number of limited field tests have been conducted and have provided initial insight into the levels of success that may be achieved using UASs. The results from these preliminary studies warrant further investigation into the use of UASs for studying cetaceans. Additional insight will be gained only through direct comparisons of UASs and the human eye in the field, with large whales (bowheads and gray whales) as the primary targets.

Objectives:

- Evaluate detection rates and ability to identify cetaceans in Arctic waters using available UAS technology.
- Compare cetacean encounter rates, detection probabilities, identification abilities, and group size estimates between a UAS and human observers during simultaneous field tests and surveys.
- Describe improvements needed in UAS technology (payloads, cameras, etc.).
- Provide recommendations for the types of monitoring or mitigation requirements that can likely be met by UASs.
- Evaluate multiple unmanned aircraft platforms and imaging solutions to collect the necessary imagery.
- Engage with scientists to compare benefits and limitations of manned and unmanned survey operations.

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

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

**Revised Date:** August 2012

## ENVIRONMENTAL STUDIES PROGRAM: Alaska Annual Studies Plan FY 2013

**Region:** Alaska

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

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

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

**Cost Range:** TBD plus Joint Funding

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

### **Description:**

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

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

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

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

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

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

**Revised Date:** August 2012

## SECTION 3.0 TOPICAL AREAS FOR FY 2015

This section presents a general forecast of significant topical issues and concerns to be addressed by studies for FY 2015 and beyond. In general, these topics conform with the research themes of the ESP. Due to the great differences existing between Alaskan environments and other OCS areas, the uniqueness of issues in Alaska has dictated the need to anticipate new topical areas for implementation within the ESP in Alaska. These projects will focus on BOEM mission needs within the context of increasing offshore exploration and development and potential trends in a changing climate.

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

As noted in Section 1.2.1 of this document, the *Proposed Final Outer Continental Shelf Oil & Gas Leasing Program 2012-2017* (USDOJ, BOEM, 2012) pointed to a need for further development of scientific information regarding the sensitive habitats, unique conditions and important other uses, including subsistence hunting and fishing in the Arctic, as well as the oil and gas resource potential, prior to additional leasing. Development of additional information for the Cook Inlet Planning Area is also needed to support updated analysis of the potential effects of OCS activities on its environment and uses in anticipation of Lease Sale 244.

### 3.1 Climate Change

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

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

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

Climate change also entrains many socio-economic issues. Some immediate concerns include: increased shoreline erosion and permafrost melt that threatens arctic villages and infrastructure; changes in distribution and availability of hunted subsistence species; and potential changes in commercial and subsistence fisheries as commercial species such as salmon move north. In

consideration of such basic transition, scientists are challenged to project how climate change effects will interact with OCS activities in the Arctic over the next 25-50 years.

### **3.2 Air Quality**

In December 2011, Congress transferred jurisdiction and authority for the control of air emissions on the Alaskan OCS from the EPA to BOEM. While implementing this authority, BOEM will require air quality monitoring information to assess the cumulative air quality impact of off-shore Arctic oil and gas activity and to support compliance with the Clean Air Act and environmental justice initiatives.

### **3.3 Physical Oceanography**

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

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

A better understanding of the first order physics controlling regional circulation and ice conditions within the U.S. Beaufort and Chukchi seas, as well as interactions with the Arctic basin and Canadian Beaufort, would inform and improve regional EISs, environmental assessments (EAs), and oil-spill contingency planning. In particular, more information is needed to assess the impact of ice on the nature and amplitude of the upwelling/downwelling and to gain a better understanding of the dynamics associated with river outflow plumes, especially under ice.

### **3.4 Fate and Effects**

The Region has collected baseline biological and chemical monitoring data in the vicinity of the Liberty Prospect and Northstar since 1999, as part of the studies “Arctic Nearshore Impact Monitoring in the Development Area (ANIMIDA)” and “Continuation of Arctic Nearshore Impact Monitoring in the Development Area (cANIMIDA).” The summer of 2007 was the last field season for the cANIMIDA project. The planned continuation of ANIMIDA/cANIMIDA sediment chemistry monitoring has been expanded to include Camden Bay, where drilling is planned to delineate discoveries in the Sivulliq and Torpedo prospects.

In addition to site-specific monitoring, ANIMIDA and cANIMIDA re-examined the regional sediment quality in the nearshore U.S. Beaufort Sea. The MMS set up the Beaufort Sea Monitoring Project (BSMP) in the 1980s to monitor sediment quality. The BSMP monitored trace metal and hydrocarbon levels in sediments and benthic biota at specific locations on a regional basis. The ANIMIDA and cANIMIDA projects have resampled many of the BSMP



stations from Harrison Bay to Camden Bay and Coastal Marine Institute studies resampled BSMP areas further west (Point Barrow) and east (Beaufort Lagoon). The need for additional monitoring will continue to be re-evaluated as oil and gas development in the Alaska Region OCS evolves.

### **3.5 Endangered and Protected Species**

Production at the Northstar site and at other potential sites may lead to risks of oil spills from buried pipelines, other discharges, noise from various industrial and support activities and increased human interaction with arctic offshore species. Species protected under the ESA, MMPA and the Migratory Bird Treaty Act are of particular concern if impacted by such factors. Study of the effects of oil and gas-related activities on protected mammals and the need for continued monitoring of endangered species are expected to be continued—as well as assessment of how any changes in the bowhead whale migration's distance from shore could relate to subsistence success (see below). Future bowhead studies are expected to continue to explore use of satellite tagging for information on bowhead whale residence times in development areas. BOEM anticipates pursuit of new opportunities to obtain and update information on bowhead behavior in response to industrial noise through the use of appropriate research partnerships.

Effects of construction activities on polar bears, especially on denning bears, and concerns about the adequacy of information about all age/sex categories of the bear population will need to be addressed by additional research. Several ongoing studies are expected to lead to recommendations for additional information regarding polar bears and continued study of the bear population's vulnerability to oil spills through improved models.

Other key subsistence species potentially exposed to short-term or cumulative impact factors for which behavioral or monitoring studies may be needed include beluga whales, walrus, ringed seals, ribbon seals and bearded seals.

### **3.6 Marine Fish Migrations, Recruitment and Essential Fish Habitat**

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

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

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

Alaska Native villagers are concerned that OCS activities will affect subsistence fish populations and reduce subsistence utilization. Thus, additional research on arctic fisheries and recruitment to nearshore feeding populations should be considered. Several fish species used for subsistence migrate through, or are found in, the Northstar and Liberty areas of the Beaufort Sea, including arctic and least cisco, Dolly Varden, arctic char, and humpback and broad whitefish. Intermittent occurrences of pink and chum salmon also take place in Beaufort coastal waters.

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

### **3.7 Subsistence**

Residents of the North Slope coastal communities frequently express concern about cumulative impacts of offshore and onshore developments on their subsistence lifestyle. Some of the concerns of the Iñupiat include diminished access to hunting and fishing areas around oil industry infrastructure, reduced harvests, increased hunter efforts and increased hunter cost. How, and to what degree, subsistence activities have been affected by industry infrastructure and industry activity is a concern that may be further addressed by additional research. Consideration of cumulative impacts is an increasingly important issue for BOEM in preparing NEPA documents.

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

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

## SECTION 4.0 LITERATURE CITED

- Holand, P. 1997. *Offshore Blowouts: Causes and Control*. Gulf Publishing Company, Houston, Texas. 163 pp.
- Neff, J. M. 2010. *Continuation of the Arctic Nearshore Impact Monitoring in the Development Area (cANIMIDA): Synthesis 1999-2007*. Anchorage, Alaska. OCS Study BOEMRE 2010-032. 291 pp.
- Quakenbush, L., J. Citta, J. C. George, M. P. Heide-Jorgensen, R. Small, H. Brower, L. Harwood, B. Adams, L. Brower, G. Tagarook, C. Pokiak, J. Pokiak. 2012. Seasonal Movements of the Bering-Chukchi-Beaufort Stock of Bowhead whales: 2006-2011 Satellite Telemetry Results. Presented to the Scientific Committee of the International Whaling Commission, June, 2012, SC/64/BRG1; Panama City, Panama. 22pp.
- Sigler, M. F., R. J. Foy, J. W. Short, M. Dalton, L. B. Eisner, T. P. Hurst, J. F. Morado, and R. P. Stone. 2008. *Forecast Fish, Shellfish and Coral Population Responses to Ocean Acidification in the North Pacific Ocean and Bering Sea: An Ocean Acidification Research Plan for the Alaska Fisheries Science Center*. Alaska Fisheries Science Center, NOAA, National Marine Fisheries Service, Juneau, Alaska. AFSC Processed Rep. 2008-07. 35 pp.
- Stephen R. Braund & Associates. 2009. *Subsistence Mapping of Nuiqsut, Kaktovik, and Barrow*. Anchorage, Alaska. OCS Study MMS 2009-003. 349 pp.
- USDOI, BOEM. 2012. *Proposed Final Outer Continental Shelf Oil & Gas Leasing Program 2012-2017*. Herndon, Virginia.

### **Contributing Alaska OCS Region Staff**

Chris Campbell, Sociocultural Specialist

Mary Cody, Wildlife Biologist

Cathy Coon, Marine Biologist

Heather Crowley, Oceanographer

Jeff Denton, Wildlife Biologist

Dan Holiday, Oceanographer

Warren Horowitz, Oceanographer

Rick Raymond, Program Coordination Analyst

Kate Wedemeyer, Fisheries Oceanographer

Marty Byrne, Cartographer

Dee Williams, Chief, Environmental Sciences Management