

Proceedings of the North Aleutian Basin Information Status and Research Planning Meeting

Anchorage, Alaska

November 28 – December 1, 2006



Minerals Management Service – Alaska Region
U.S. Department of the Interior

Argonne National Laboratory



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**PROCEEDINGS OF THE NORTH ALEUTIAN BASIN
INFORMATION STATUS AND RESEARCH PLANNING MEETING**

NOVEMBER 28 – DECEMBER 1, 2006

ANCHORAGE, ALASKA

prepared by

**Environmental Science Division
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Argonne, Illinois**

for

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

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ERRATA

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Proceedings of the North Aleutian Basin Information Status and Research Planning Meeting

Correction to page 2, paragraph 2: Updated sentence will read..."Of the 113 meeting registrants, MMS invited and paid for the travel expenses of 16 local stakeholders from the Aleutians East Borough, Aleutian Pribilof Islands Association, Bristol Bay Borough, **Bristol Bay Native Association**, and Lake and Peninsula Borough."

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NOTATION

The following is a list of the acronyms, initialisms, and abbreviations used in this document.

ADFG	Alaska Department of Fish and Game
AMNWR	Alaska Maritime National Wildlife Refuge
Argonne	Argonne National Laboratory
EIS	environmental impact statement
ESA	Endangered Species Act
FMP	Fishery Management Plan
FY	fiscal year
GIS	geographic information system
LNG	liquefied natural gas
MMPA	Marine Mammal Protection Act
MMS	Minerals Management Service
NEPA	National Environmental Policy Act
NMFS	National Marine Fisheries Service
NMML	National Marine Mammal Laboratory
NOAA	National Oceanographic and Atmospheric Administration
NPPSD	North Pacific Pelagic Seabird Database
NPRB	North Pacific Research Board
OCS	Outer Continental Shelf
USFWS	U.S. Fish and Wildlife Service

**PROCEEDINGS OF THE NORTH ALEUTIAN BASIN
INFORMATION STATUS AND RESEARCH PLANNING MEETING**

prepared by

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EXECUTIVE SUMMARY

The North Aleutian Basin Planning Area of the Minerals Management Service (MMS) is a large geographic area with significant ecological and natural resources. The Basin includes most of the southeastern part of the Bering Sea continental shelf including all of Bristol Bay. The area supports important habitat for a wide variety of species and globally significant habitat for birds and marine mammals including federally listed species. Villages and communities of the Alaska Peninsula and other areas bordering or near the Basin rely on its natural resources (especially commercial and subsistence fishing) for much of their sustenance and livelihood. The offshore area of the North Aleutian Basin is considered to have important hydrocarbon reserves, especially natural gas.


In 2006, the MMS released a draft proposed program, *Outer Continental Shelf Oil and Gas Leasing Program, 2007–2012* and an accompanying draft programmatic environmental impact statement (EIS). The draft proposed program identified two lease sales proposed in the North Aleutian Basin in 2010 and 2012, subject to restrictions. The area proposed for leasing in the Basin was restricted to the Sale 92 Area in the southwestern portion. Additional EISs will be needed to evaluate the potential effects of specific lease actions, exploration activities, and development and production plans in the Basin. A full range of updated multidisciplinary scientific information will be needed to address oceanography, fate and effects of oil spills, marine ecosystems, fish, fisheries, birds, marine mammals, socioeconomics, and subsistence in the Basin.

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

monitoring, and research related to potential leasing and oil and gas developments in the North Aleutian Basin. The purposes of the meeting were to:

- Involve a broad range of stakeholders and scientists in science planning for the North Aleutian Basin;
- Plan early for pertinent studies and research in key disciplines and topics to be sponsored by the MMS Environmental Studies Program;
- Identify recommended studies and preliminary priorities based on involvement of meeting attendees;
- Obtain preliminary assessment from MMS of the feasibility, appropriateness, and scientific value of inventory, monitoring, and research activities; and
- Identify preliminary priorities of feasible studies based on MMS Alaska OCS Region mission relevance, timing needs, scientific quality, cost, and other criteria such as implementation considerations.

Prior to the meeting, Argonne staff gathered the literature relevant to the Basin that had been authored over the last 10 years (1996 through 2006) and developed a database of that literature for use at the meeting. A synthesis report of this literature will be issued separately from these proceedings.

A total of 190 individuals were invited to participate in the meeting. Invited individuals represented a mix of research scientists, public agency managers, and stakeholders from local government, commercial fishing, subsistence organizations, tribal organizations, and environmental organizations. Of the 113 meeting registrants, MMS invited and paid for the travel expenses of 16 local stakeholders from the Aleutians East Borough, Aleutian Pribilof Islands Association, Bristol Bay Borough, Friends of Bristol Bay, and Lake and Peninsula Borough. 

The first day of the meeting consisted of a plenary session in which background information was provided to participants including the objectives of the meeting, an overview of MMS's 2007–2012 five-year program plan, the results of Argonne's literature review, and topical presentations by subject matter experts (i.e., individuals with research experience in the North Aleutian Basin) on physical oceanography, fish and shellfish populations, federal fisheries, commercial fishery economics, community socioeconomics, subsistence research, seabirds and shorebirds, waterfowl, seals and sea lions, cetaceans, and sea otters and walrus. The intent of this plenary session was to provide sufficient background information for meeting participants on the full array of subject areas to enable them to identify and prioritize information needs relevant to environmental assessments of oil and gas development in the Basin.

On the second and third days of the meeting, participants broke into five working groups, each facilitated by an Argonne staff member. The five working groups included (1) oceanography, ecosystems, and fate and effects of oil spills; (2) socioeconomics and subsistence; (3) fish and fisheries; (4) birds; and (5) marine mammals. The objectives of each working group were to (1) review the status of existing information; (2) identify information needs to support future environmental assessment activities in the Basin; (3) prioritize those

information needs; and (4) develop proposed study profiles to fill high priority information needs.

Thirty-five study profiles were developed by working groups in the following topical areas:

- Oceanography, ecosystems, and fate and effects of oil spills
 - Implementation of a meteorological buoy
 - Mesoscale meteorological modeling
 - Physical oceanography field program
 - Modeling of circulation
 - Characterization of sediments
 - Characterization of benthic communities
 - Intertidal community characterization
 - Identification and characterization of eelgrass communities
 - Determination of sea ice edge productivity
- Socioeconomics and subsistence
 - North Aleutian Basin socioeconomics
 - North Aleutian Basin subsistence
- Fish and fisheries
 - North Aleutian Basin nearshore forage fish seasonal distribution and spawning survey
 - Seasonal distribution and condition of juvenile Pacific salmon and young of the year pollock within the North Aleutian Basin
 - North Aleutian Basin ichthyoplankton and zooplankton monitoring
 - Compilation of historical information on seismic surveys and fisheries in the North Aleutian Basin
 - Evaluation of potential for space-use conflicts between fishery activities and oil and gas development activities within the Sale 92 Area
 - Nearshore distribution of juvenile flatfishes in the eastern Bering Sea
 - North Aleutian Basin fishing communities
 - Bering Sea fish catalog
 - Bering Sea seasonal fish migration
- Birds
 - Spatial and temporal distribution of Steller's eiders (*Polysticta stelleri*) and other waterbirds
 - Spatial and temporal distributions of birds at sea

- Seabird colony census and diet
- Aerial remote sensing of distribution and abundance of eelgrass
- Estuarine systems – Izembek and Port Moller Lagoons
- Spatial and temporal patterns of bird movements
- Marine mammals
 - Distribution, abundance, and habitat use of North Pacific right whales (*Eubalaena japonica*)
 - Seasonal acoustic monitoring of right whales and other endangered cetaceans
 - Abundance, distribution and seasonal movements of humpback whale (*Megaptera novaeangliae*), fin whale (*Balaenoptera physalus*), and other cetaceans
 - Health assessment of stranded marine mammals
 - Steller sea lion (*Eumetopias jubatus*) seasonal distribution and diet
 - Steller sea lion seasonal habitat use
 - Harbor seal (*Phoca vitulina*) and spotted seal (*Phoca largha*) seasonal distribution
 - Seasonal distribution and abundance of Pacific walrus (*Odobenus rosmarus divergens*)
 - Seasonal distribution and abundance of northern sea otter (*Enhydra lutris kenyoni*)

Plenary speakers and meeting participants emphasized the critical importance of resources in the North Aleutian Basin including human subsistence resources, commercial fisheries, and internationally important bird and marine mammal populations and habitats. In general, meeting participants believed that current information is insufficient to address oil and gas leasing issues. The study profiles that were developed at the meeting represent the highest priority studies identified by the working groups.

Some of these information needs can be addressed by systematically evaluating existing data collected by various agencies with an eye towards characterizing distribution and status of resources and patterns of change that could be responses to environmental perturbations in the last few decades. These types of analyses could be particularly important for assessing the effects of leasing, exploration, development, and production activities related to oil and gas development. Study profiles were developed in these areas, and, if funded, could represent an important first step for the program.

Some topics are critically important to address with further study because (1) there is little Basin-specific information on them, (2) the resources they address are considered of vital importance, and (3) additional information is needed as early as possible in the lease-exploration-development-production timeline. On the basis of information gathered at the meeting, Argonne staff identified two topics that fit these criteria: studies of the endangered North Pacific right whale and studies of subsistence patterns. The North Pacific right whale is an endangered species with critical habitat in the Basin, specifically in the Sale 92 Area. Data are needed early because the species is potentially affected by seismic surveys that could occur within the next few years.

Subsistence resources are vitally important to residents of the areas and could be affected by all aspects of oil and gas development including leasing and exploration. These study profiles are of greatest importance in the earliest phases of the North Aleutian Basin leasing program.

Assessments of the effects of oil and gas development activities in the North Aleutian Basin could greatly benefit from development of a high-resolution model of the Basin that characterizes important physical processes. Such a model would be useful for predicting the fate and effects of oil spills or other contaminant releases and could be linked to information collected about other resources in the Basin to better understand the underlying basis of distributions, seasonal patterns of use, population trends, or changes in resource status. Although a fully developed high-resolution model would be useful now, it will be most critical several years from now for use in the assessments of development and production plans.

Other study profiles that were developed at the meeting will be useful for developing a monitoring program of the effects of oil and gas development in the North Aleutian Basin. To be most effective, these studies should start sometime prior to the initiation of oil and gas activities in order to establish baseline data.

Studies and the environmental assessment program they support will be greatly strengthened by strong communication among principal investigators and MMS staff and integration of studies to the extent possible. Studies should focus on hypothesis testing and employ robust statistical design using appropriate sample sizes and data quality objectives identified before the studies are implemented. Standardization of common data needed by several programs, avoidance of duplication of effort, and development of a Web-based data system using standard metadata procedures would improve the usability of results and make them available to a wider group of users.

1 INTRODUCTION

The North Aleutian Basin Planning Area of the Minerals Management Service (MMS) is a large geographic area (more than 130,000 km² [50,000 mi²]) with significant ecological and natural resources. The Basin includes most of the southeastern part of the Bering Sea continental shelf including all of Bristol Bay (Figure 1). The area supports important habitat for a wide variety of species and globally significant habitat for birds and marine mammals including a number of federally listed species. Villages and communities of the Alaska Peninsula and other areas bordering or near the North Aleutian Basin rely on its natural resources (especially commercial and subsistence fishing) for much of their sustenance and livelihood.

The offshore area of the North Aleutian Basin is considered to have important hydrocarbon reserves, especially natural gas (Sherwood et al. 2006). However, concerns about the impacts of oil and gas development on ecological resources of Bristol Bay and the economically important commercial fishery prompted Congress to impose a moratorium on oil and gas development in the North Aleutian Basin, and in 1998 President Clinton withdrew the area for commercial leasing until 2012. Although Congress had imposed moratoria on oil and gas activities in the North Aleutian Basin from fiscal year (FY) 1990 through FY 2003, it discontinued the yearly moratorium in FY 2004. MMS held the last lease sale in the North Aleutian Basin in 1988, which resulted in the issuance of 23 leases at the time.

In 2006, Alaska's Governor Frank Murkowski and other local government and Native Alaskan leaders expressed support for modifying the Presidential withdrawal in the North Aleutian Basin. Also in 2006, the MMS released the draft proposed program, *Outer Continental Shelf Oil and Gas Leasing Program: 2007–2012* and an accompanying draft programmatic environmental impact statement (EIS). The draft proposed program identified two lease sales proposed in the North Aleutian Basin in 2010 and 2012, subject to restrictions. The area proposed for leasing in the Basin was restricted to the Sale 92 Area in the southwestern portion. On January 9, 2007, the President modified the 1998 withdrawal to allow leasing in the Basin.

Future leasing and development decisions will require project-specific environmental assessments that are based on current knowledge of important resources in the North Aleutian Basin. There is concern that relatively few studies of resources in the Basin were conducted after 1992 because of the Congressional moratorium and Presidential withdrawal. It is likely that the status of many resources has changed. New studies may be needed to update previous studies, many of which are now nearly 20 years old. A full range of updated multidisciplinary scientific information is needed that addresses oceanography, fate and effects of oil spills, marine ecosystems, fish, fisheries, birds, marine mammals, socioeconomics, and subsistence in the Basin.

Scientific staff at Argonne National Laboratory (Argonne) were contracted to assist the MMS Alaska Outer Continental Shelf (OCS) Region in identifying and prioritizing information needs related to the North Aleutian Basin and potential future oil and gas leasing and development activities. Identified and prioritized information needs would be used to form the basis of inventory, monitoring, and research planning in the Basin. The overall approach focused

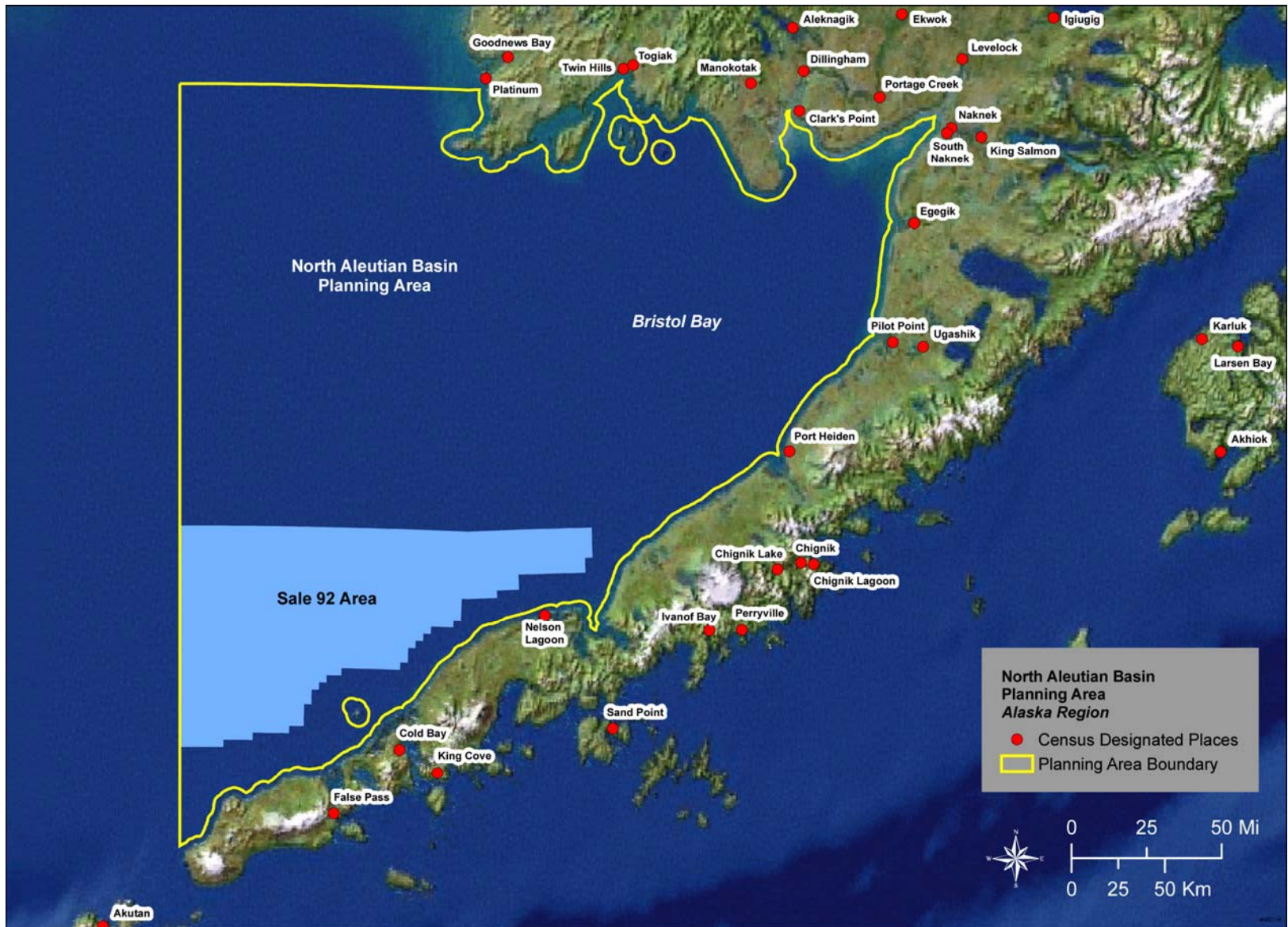


FIGURE 1. North Aleutian Basin Planning Area and the Sale 92 Area.

on three tasks: (1) identification and gathering of relevant literature, (2) synthesis and summary of the literature, and (3) identification and prioritization of information needs.

This report presents a summary of MMS's North Aleutian Basin Information Status and Research Planning Meeting. Prior to the meeting, Argonne staff gathered the literature relevant to the Basin that had been authored over the last 10 years (1996 through 2006) and developed a database of that literature for use at the meeting. A synthesis report of this literature will be issued separately from these proceedings.

2 MEETING DESCRIPTION AND APPROACH

The North Aleutian Basin Information Status and Research Planning Meeting was held in Anchorage from November 28 through December 1, 2006. Scientists and stakeholders discussed, identified, and prioritized information needed to support assessments of oil and gas leasing and development in the North Aleutian Basin. The meeting was the primary method used to gather input from stakeholders and identify information needs and priorities for future inventory, monitoring, and research related to potential leasing and oil and gas developments in the North Aleutian Basin. The agenda for the meeting is presented in Table 1.

The purposes of the meeting were to:

- Involve a broad range of stakeholders and scientists in science planning for the North Aleutian Basin;
- Plan early for pertinent studies and research in key disciplines and topics to be sponsored by the MMS Environmental Studies Program;
- Identify recommended studies and preliminary priorities based on involvement of meeting attendees;
- Obtain preliminary assessment from MMS of the feasibility, appropriateness, and scientific value of inventory, monitoring, and research activities; and
- Identify preliminary priorities of feasible studies based on MMS Alaska OCS Region mission relevance, timing needs, scientific quality, cost, and other criteria such as implementation considerations.

Individuals invited to participate in the meeting comprised a mix of 190 research scientists, public agency managers, and stakeholders from local government and commercial fishing, subsistence, tribal, and environmental organizations. Meeting registrants (113 persons) and their affiliations are presented in Appendix A (Table A-1). Of these participants, MMS invited and paid for the travel expenses of 16 local stakeholders from the Aleutians East Borough, Aleutian Pribilof Islands Association, Bristol Bay Borough, Friends of Bristol Bay, and Lake and Peninsula Borough. The affiliations of all meeting registrants are presented in Table 2.

The first day of the meeting consisted of a plenary session in which background information was provided to participants. Presentations covered the objectives of the meeting, an overview of MMS's 2007–2012 program plan, the results of Argonne's literature review, and topical presentations by subject matter experts on oceanography, fish and shellfish populations, federal fisheries, commercial fishery economics, community socioeconomics, subsistence research, seabirds and shorebirds, waterfowl, seals and sea lions, cetaceans, and sea otters and walrus. Subject matter experts were individuals with research experience in the North Aleutian Basin.

The intent of the plenary session was to provide sufficient information to enable meeting participants to identify and prioritize further information needs for the environmental assessments of oil and gas development in the North Aleutian Basin. Synopses of these

TABLE 1. Information Status and Research Planning Meeting Agenda

Time	Topic	Presenter
Tuesday, Nov. 28: Plenary Sessions		
8:00-8:05 AM	Introduction and welcome	Cleve Cowles, MMS, Alaska Chief of Environmental Studies
8:05-8:30 AM	Outer Continental Shelf Oil and Gas Leasing Program, 2007-2012	Paul Stang, MMS, Alaska Regional Supervisor
8:30-9:00 AM	Identifying information needs and research priorities for the North Aleutian Basin	Kirk LaGory, Argonne
9:00-9:15 AM	Recent research relevant to the North Aleutian Basin	Elisabeth Stull, Argonne
9:15-9:30 AM	Oil and gas development in the North Aleutian Basin — an operator scenario	Ian Voparil, Shell Oil Co.
9:30-10:00 AM	Circulation, water mass distribution, and transport in the North Aleutian Basin	Wieslaw Maslowski, Naval Postgraduate School
10:00-10:15 AM	Break	
10:15-10:45 AM	Fish and shellfish populations and distributions	Mike Sigler, NMFS
10:45-11:00 AM	Federal fisheries in the North Aleutian Basin	Diana Evans, NPFMC
11:00-11:30 AM	Economics of commercial fisheries in the North Aleutian Basin	Gunnar Knapp, University of Alaska-Anchorage
11:30-1:00 PM	Lunch	
1:00-1:30 PM	Community socioeconomic	Ed Glazier, Impact Assessment, Inc.
1:30-2:00 PM	Subsistence research in the North Aleutian Basin area	Brian Davis, Former ADFG Subsistence Researcher
2:00-2:30 PM	Seabirds and shorebirds	Kathy Kuletz, USFWS
2:30-3:00 PM	Waterfowl	Bill Larned and Chris Dau, USFWS
3:00-3:15 PM	Break	
3:15-3:45 PM	Seals and sea lions	John Bengtson, NMFS
3:45-4:15 PM	Cetaceans	Phil Clapham, NMFS
4:15-4:45 PM	Sea otters and walruses	Angela Doroff, USFWS
4:45-5:00 PM	Concluding remarks, instructions for next day	Kirk LaGory, Argonne
Wednesday, Nov. 29, and Thursday, Nov. 30: Breakout Sessions to Identify and Prioritize Future Studies		
<i>Purpose: Recommend research to support an assessment of the potential environmental impacts of oil and gas development in the North Aleutian Basin program area on marine, coastal, and human resources</i>		
<i>Breakout Session Topics:</i>		
	Physical oceanography, marine ecosystems, fate and effects of oil spills	Elisabeth Stull, Argonne facilitator
	Fish and commercial fisheries	John Hayse, Argonne facilitator
	Birds	John Krummel, Argonne facilitator
	Marine mammals	Ihor Hlohowskyj, Argonne facilitator
	Socioeconomics and subsistence	Larry Gorenflo, Argonne facilitator
Friday, Dec. 1: Plenary Session		
8:00-11:00 AM	Working group reports: recommended study topics	Argonne facilitators
11:00 AM-12:00 PM	Discussion and adjustment to break-out group reports	Kirk LaGory
12:00	Adjourn	

presentations are provided in Section 3. An audio recording was made of all presentations and discussions in the plenary session.

On the second and third days of the meeting, participants broke into five working groups, each facilitated by an Argonne staff member (Table 1). The five working groups included (1) physical oceanography, ecosystems, and fate and effects of oil spills; (2) fish and fisheries; (3) birds; (4) marine mammals; and (5) socioeconomics and subsistence. Most meeting participants participated in only one of the working groups appropriate to their area of expertise. However, several participants (especially stakeholders) participated at various times in more than one of the working groups. This type of interchange was encouraged. The meeting chair rotated among groups to ensure consistent outcomes and to facilitate communication among groups.

The objectives of each working group were to:

- Review the status of existing information,
- Identify information needs to support future environmental assessment activities in the Basin,
- Prioritize those information needs, and
- Develop proposed study profiles to fill high-priority information needs.

Argonne developed a structured approach using a series of worksheets to guide the working group members in identifying and prioritizing information needs. Some working groups opted to use a different approach or to modify the approach for their particular needs. The progress of each working group was recorded on a laptop computer as the session progressed and projected onto a screen in the front of each room. A more detailed description of the breakout sessions including working group members, process, and findings is presented in Section 4.

On the fourth day of the meeting, facilitators presented summaries of the results of their working groups. A question and answer period and discussion followed the presentations. An audio recording was made of all presentations and discussions on the fourth day.

TABLE 2. Affiliations of Registrants for the North Aleutian Basin Information Status and Research Planning Meeting

Affiliation (alphabetical order)	Number of Registrants
Alaska Department of Environmental Conservation	2
Alaska Department of Fish and Game	7
Alaska Department of Natural Resources	1
Alaska Fisheries Development Foundation	2
Alaska Ocean Observing System	1
Alaska Oil and Gas Association	1
Aleutian Pribilof Islands Association	2
Aleutians East Borough	8
Argonne National Laboratory	7
Bering Sea Fisherman's Association	3
Bristol Bay Borough	2
Bristol Bay Native Association	3
Bureau of Land Management	1
Confederated Salish-Kootenai Tribes of Flathead Nation	1
Cook Inlet Regional Citizens Advisory Council	1
Friends of Bristol Bay	1
Graystar Pacific Seafood	1
Impact Assessment Inc.	1
Lake and Peninsula Borough	2
Minerals Management Service	21
National Marine Fisheries Service	12
National Weather Service	1
Native American Fish and Wildlife Society	1
Naval Postgraduate School	1
North Pacific Fisheries Management Council	1
Pacific Environment	1
Private consultant	1
Sea Star Scientific	1
Shell Oil Co.	2
U.S. Department of the Interior	1
U.S. Environmental Protection Agency	2
U.S. Fish and Wildlife Service	14
University of Alaska	6
World Wildlife Fund	1

3 PLENARY PRESENTATION SUMMARIES

Synopses of the 16 plenary session presentations are presented in this section. Questions and comments from the audience, if provided, and answers given by the speakers are summarized at the end of each presentation in this section. Biographies of the speakers and their presentation materials can be found in Appendix B.

3.1 INTRODUCTION¹

The Secretary of the Interior issued a new five-year proposed program for 2007–2012 in July 2006. The proposed program tentatively scheduled two sales in the North Aleutian Basin beginning in 2010. Should the final five-year program include such sales, environmental studies may be needed to develop key information that MMS would use in preparing EISs for the sales. The planning workshop is an important step to develop study profiles and to jump-start some key projects.

Supporting MMS studies are needed to help assess the potential environmental impacts of oil and gas development on marine, coastal, and human resources. MMS is looking for studies oriented toward hypothesis testing, relevance to agency decisions, and feasibility of implementation. As MMS proceeds with the five-year program, it will continue to seek broad local involvement and local or traditional knowledge links.

MMS is also interested in recent findings and available knowledge from other research efforts, ongoing or planned, to assure that it does not unnecessarily duplicate the efforts of others, but acknowledges that, in some instances, such duplication may be appropriate. MMS encourages interdisciplinary projects that share logistic expenses and information.

3.2 OUTER CONTINENTAL SHELF OIL AND GAS LEASING PROGRAM, 2007–2012²

The prime role of the MMS Alaska OCS Region is OCS oil and gas leasing and regulation. To accomplish this, MMS staff provide expertise in marine sciences, environmental assessment, resource evaluation, safety, environmental compliance, and oil spill contingency plans. MMS scientists include specialists in biology, oceanography, social science, mineral leasing, engineering, geology, and geophysics.

Four areas in the Alaska OCS Region are included in the 2007–2012 proposed oil and gas leasing program: the North Aleutian Basin (specifically the Sale 92 Area), Cook Inlet, Chukchi Sea, and Beaufort Sea. Sales in these planning areas are proposed for 2010 and 2012 (North Aleutian Basin); 2009 and 2011 (Cook Inlet); 2007, 2010, and 2012 (Chukchi Sea); and 2009 and 2011 (Beaufort Sea). However, leasing in the North Aleutian Basin is contingent on

¹ Presented by Cleve Cowles, Chief of Environmental Studies, Alaska OCS Region, MMS.

² Presented by Paul Stang, Regional Supervisor, Alaska OCS Region, MMS

inclusion in the final five-year program, removal of the Presidential withdrawal,³ and pre-sale decisions. Milestones in development of an oil and gas leasing program would include:

- February 2006: Draft proposed program (60-day comment period);
- August 2006: Proposed program and associated draft programmatic EIS (90-day comment period);
- April 2007: Proposed final program and final programmatic EIS (60-day waiting period);
- June 2007: Final approval of program plan; and
- July 2007: Current program ends, new program begins.

Within the North Aleutian Basin Planning Area, only the Sale 92 Area is included in the proposed leasing program. The last EIS for leasing in the North Aleutian Basin was completed in 1985, and the last lease sale in the Sale 92 area was held in 1988. The subsequent Congressional moratorium prompted a buy-back of leases and resulted in a cessation of MMS-sponsored environmental studies after about 1995. As a consequence, most MMS-sponsored studies are now about 15–20 years old.

MMS's intends to have a synthesis of existing information completed and scientists start field work in the Basin in the 2007 season in order for MMS to have as much information as possible by the time the draft EIS for the lease sale is initiated in early FY 2008. Due to budget constraints, and as a matter of general policy, MMS does not fund environmental studies in a planning area unless a sale is scheduled in the current five-year program. MMS is also interested in studies to develop information for the final lease sale EIS, for any EISs on specific development plans in the event that a commercial discovery is made, and on the focus of monitoring in the vicinity of tracts and in the specific areas of any proposed development. The timing of information needs would proceed according to the following approximate schedule:

- Autumn 2007: Information needed to start EIS for proposed lease sale in the Basin;
- 2008: General monitoring in the sale area begins;
- 2010: Lease sale occurs;
- 2011 (at the earliest): First exploration well and first discovery;
- 2012 (at the earliest): Information needed to start development and production plan EIS;
- 2012 (at the earliest): Monitoring in the development area begins;
- 2015 (at the earliest): EIS completed, development and production plan approved, project sanctioned;
- 2017 (at the earliest): Development and construction at North Aleutian Basin site begins;
- 2020 (at the earliest): Oil production begins; and
- 2025 (at the earliest): Gas production (liquefied natural gas [LNG] export) begins.

³ Presidential withdrawal of the North Aleutian Basin from MMS's leasing program was subsequently removed in January 2007.

Public meetings to discuss MMS's proposed program in the Basin were held in the autumn of 2006 in Unalaska, Nelson Lagoon, Sand Point, Naknek, Cold Bay, Anchorage, Goodnews Bay, and Dillingham. Key concerns raised in meetings on the Aleutian Chain included (1) the effects of noise and spills on commercial fisheries, subsistence, endangered and threatened species, and other birds and mammals; (2) impacts to North Pacific right whale (*Eubalaena japonica*) and Steller sea lion (*Eumetopias jubatus*) critical habitat; and (3) economic benefits, including jobs and access to fuel.

Questions and Comments from the Audience

- **Question:** Is it an anomaly that MMS is going through the planning process for an area that is under a moratorium? Is this the first time this has happened or has it happened elsewhere?

Answer: The North Aleutian Basin is not currently under a moratorium. This is the first time MMS has pursued planning while a Presidential withdrawal was still in place. Prior to this instance, there has never been a situation where planning in a withdrawn area could have occurred.

- **Question:** The discussion at this meeting presumes the Presidential withdrawal is lifted. Is the information gathered at the meeting and in subsequent studies to be used for deciding whether or not to lease areas and to identify stipulations that should be included in the leases?

Answer: The information would be used to support decisions related to the areas that should be offered for lease and those areas that should be omitted from leasing. The information would also be used to identify the terms and conditions that should be placed on leases beyond those that MMS already has in place.

- **Question:** Although it is assumed that reserves in the North Aleutian Basin are primarily gas, this would not be known until drilling occurs. Under a typical scenario, would MMS export relatively small amounts of oil?

Answer: Two billion barrels is not a small amount and is sufficient to pay for the cost of infrastructure for its development. MMS presumes most oil would be tankered to the west coast of the United States. If substantial quantities of gas were found in the Basin, it is assumed an LNG plant would be developed on the Alaska Peninsula and LNG would be transported south. If a mix of oil and gas is found, the oil would be developed first.

- **Comment:** Critical habitat for the North Pacific right whale and Steller sea lion was shown in the presentation, but critical habitat also exists for Steller's eider in Izembek Lagoon and the Port Moller-Nelson Lagoon complex.

Response: The referenced slide was not meant to indicate that these were the only species or resources in the area. It is presumed that those resources and their significance would be identified in the meeting.

3.3 IDENTIFYING INFORMATION NEEDS AND RESEARCH PRIORITIES FOR THE NORTH ALEUTIAN BASIN OF ALASKA⁴

The goal of the North Aleutian Basin Information Status and Research Planning Meeting is to recommend research to support an assessment of the potential environmental impacts of oil and gas development in the North Aleutian Basin Planning Area on marine, coastal, and human resources. Recommended studies would be used to support assessments related to two proposed lease sales, to be held in 2010 and 2012. Each lease sale requires an assessment of the anticipated environmental impacts during different phases of activities: prior to the lease sale, post-lease exploration, and development and production.

The North Aleutian Basin contains critically important resources. The Basin is an ecologically, culturally, and economically important area and supports:

- Important fish and shellfish populations;
- A wide variety of seabirds and waterfowl including critical habitat for the federally listed Steller's eider (*Polysticta stelleri*);
- Marine mammals, including critical habitat for the federally listed North Pacific right whale, Steller sea lion, and sea otter (*Enhydra lutris*);
- Coastal communities that depend on the resources of the Basin;
- Cultural resources;
- Important commercial fisheries; and
- Subsistence resources.

Much of the land area adjacent to the Basin is under federal jurisdiction as national wildlife refuges (Izembek, Alaska Peninsula, Becharof, and Togiak National Wildlife Refuges) or within the National Park System (Aniakchak National Monument and Preserve and Katmai National Park and Preserve). Coastal communities adjacent to the Basin include the Aleutians East Borough (including Cold Bay, Nelson Lagoon, and Port Moller), Lake and Peninsula Borough (including Port Heiden, Pilot Point, and Egigik), Bristol Bay Borough (including South Naknek, Naknek, and King Salmon), Dillingham, Twin Hills, Togiak, Goodnews Bay, and Platinum.

Working groups were asked to develop specific study profiles that MMS can use to prioritize and fund study projects in the Basin beginning in FY 2007. Each study profile was asked to contain the following elements:

- Need for study and relevance to MMS mission;
- Study objectives, including hypotheses to be tested;
- Methods;

⁴ Presented by Kirk LaGory, Argonne, meeting chair

- Timing, including start date and duration; and
- Cost and level of effort.

Several types of studies should be considered, including existing data sets, resource inventories, trends in status and distribution, targeted research to address topical areas, model development, and database development. When assessing the impacts of oil and gas development, one must consider:

- Activity phase of oil and gas development, including exploration, construction, operations, and decommissioning;
- Activities, such as seismic surveys, drilling, and trenching;
- Impacting factors, such as noise, disturbance of substrate, traffic, and accidents;
- Affected resources, such as species, habitats, economy, and subsistence use; and
- Affected resource attributes, such as species life stage, special use areas, jobs, hunting, and recreational fishing.

One should also view the North Aleutian Basin as a system of interdependent parts and focus on the important parts (resources) of the system that are relevant to an assessment of the impacts of oil and gas activities. It is important for more effective monitoring and research to look for opportunities to identify representative species or groups for study.

Breakout session participants were asked to focus on a series of questions to arrive at study recommendations:

- What aspects of oil and gas development could affect resources in the Basin?
- What are the important resources of concern in the Basin?
- What are the important resource attributes for consideration?
- What are the most important oil and gas impacts that affect resources of concern?
- How well do we understand each resource in the Basin and the potential effects of oil and gas development?

Participants were asked to prioritize resources for study according to ecological value (e.g., importance to system, sustainability of resource or system, and rarity), economic value, and societal or cultural value, and to prioritize impacting factors for study by considering duration, magnitude, and spatial extent of effect, as well as importance of the resource affected.

3.4 DEVELOPING A LITERATURE DATABASE FOR THE NORTH ALEUTIAN BASIN OF ALASKA⁵

Recent literature was identified for inclusion in a database to support an assessment of the impacts of oil and gas development on natural, cultural, and socioeconomic resources in the

⁵ Presented by Elisabeth Stull, Argonne National Laboratory

North Aleutian Basin.⁶ Many types of references were identified and collected, such as workshop and symposium proceedings, personal Web pages, Web pages of government and nongovernmental organizations, EISs, books and articles reporting research results, regulatory documents, technical reports, newspapers and newsletters, and theses and dissertations.

The literature database was organized into 11 categories:

1. Oceanography (biological, chemical, and physical) and other physical sciences;
2. Other biota and community and ecosystem studies;
3. Effects of oil, gas, and other development;
4. Fish and shellfish;
5. Fisheries;
6. Birds;
7. Marine mammals;
8. Subsistence, traditional knowledge, and other related topics;
9. Socioeconomics;
10. Resource and research planning; and
11. Studies related to regulatory requirements.

References were gathered for the years 1996 through 2006, and there was a relatively even distribution of the number of references published each year. Approximately 1,300 references were found, most in electronic format. Most references were related to marine mammals (25%), followed by birds (22%), oceanography (20%), oil and other development (18%), and subsistence (11%). Following is a brief summary of the types of references found in each category.

Oceanography and Other Physical Sciences

- Dynamics of the Bering Sea and the Bering Sea ecosystem;
- Interactions between oceanographic regions (Bering Sea, Chukchi Sea, Beaufort Sea);
- Currents in and around the Aleutian Chain; and
- Effects of global warming.

Little information was found on Bristol Bay nearshore and benthic and intertidal areas.

Community and Ecosystems

- Phytoplankton and plankton productivity of the Bering Sea;
- Relationships of groups of organisms to habitats;
- Cumulative impacts;

⁶ A literature synthesis report will be issued separately from these proceedings.

- Factors structuring communities and ecosystems;
- Benthic organisms;
- Wildlife studies; and
- Impact of oil spills on communities and ecosystems.

Effects of Oil, Gas, and Other Development

- Oil spill history and impacts, especially as related to the *Selendang Ayu* and *Exxon Valdez* accidents;
- Assessments of oil development impacts;
- Population abundance of birds and mammals after oil spills;
- Effects of disturbance from development activities;
- Collisions, with respect to both birds and mammals; and
- Pollutant concentrations in biota.

Fish and Shellfish

- Population dynamics;
- Migration;
- Abundance and distribution; and
- Recruitment.

The most studied fish and shellfish species were salmon species, king (*Paralithodes camtschaticus*) and tanner crabs (*Chionoecetes bairdi*), Pacific herring (*Clupea pallasii*), and walleye pollock (*Theragra chalcogramma*).

Fisheries

- Stock assessments and recruitment and escapement predictions;
- Fish and shellfish diseases and contamination;
- Effect of other activities on commercial fishing;
- Effect of commercial fishing on birds and mammals;
- Fishery management;
- Regulations; and
- Fishery economics.

Major stocks of interest were salmon, crabs (king and tanner), Pacific herring, and groundfish.

Birds

- Waterfowl abundance, distribution, and breeding;
- Seabird by-catch;

- Seabird colonies;
- Effects of petroleum spills;
- Contaminant concentrations and effects; and
- Subsistence harvest.

The most commonly studied bird species were eiders and the Kittlitz's murrelet (*Brachyramphus brevirostris*).

Marine Mammals

- Surveys, distribution, abundance, and migration and movement;
- Diet and food supply;
- Impact of human activities;
- Population trends; and
- Subsistence use and traditional knowledge.

The most frequently studied marine mammal species were right, fin (*Balaenoptera physalus*), and bowhead whales (*Balaena mysticetus*); walrus (*Odobenus rosmarus*); sea otter; and polar bear (*Ursus maritimus*). The geographic areas most studied were the Bering Sea and the North Pacific. Little information was found on marine mammal populations in the immediate vicinity of potential oil and gas development activities.

Subsistence, Traditional Knowledge, and Other Related Topics

- Subsistence harvest of plant products, fish, birds, and mammals;
- Wild foods identification and use;
- Surveys of subsistence practices;
- Native management of resources important in subsistence;
- Traditional knowledge of resource abundance, trends, and ecology; and
- Regulations.

Socioeconomics

- Community descriptions, including population, education, income, housing, and government;
- Resource economics;
- Infrastructure development (i.e., harbors and community services);
- Borough and Native governments and corporations;
- Community planning;
- Developing industries; and
- Mineral resources.

Regulatory Requirements

- Regulations;
- Regulatory analysis;
- Environmental assessments and impact statements;
- Endangered Species Act (ESA) determinations;
- Critical habitat determinations;
- Recovery plans for endangered species; and
- Biological Opinions prepared pursuant to the ESA.

Research and Planning

- North Pacific Research Board (NPRB);
- Bering Sea impacts study;
- Western Arctic shelf-basin interaction study;
- Gulf of Alaska Ecosystem Monitoring and Research Plan; and
- Eastern Bering Sea coastal research.

In conclusion, there are many recent studies of the Bering Sea area. Research emphasis has been placed on wider regional issues, global climate change, marine mammal species, waterfowl and protected bird species, fishery biology and fishery economics. Significantly less research emphasis has been placed on areas adjacent to proposed oil and gas development locations and benthic and coastal communities and ecosystems.

Questions and Comments from the Audience

- Question: In the presentation, it did not seem that there were many references on the Steller sea lion. Is that because most of the Steller sea lion work has been done south of the Aleutian chain?

Answer: No, there have been studies of sea lions and ice seals in the North Aleutian Basin, but not as many as for other species.

- Question: Are there any compendiums or other documents that are critical reading material for participants or others interested in the North Aleutian Basin?

Answer: No, there are not any compendiums available, but the Bering Sea Ecosystem Study has summarized material with an emphasis on oceanographic information. In addition, some available research plans have pulled together relevant material.

- Question: What format is the reference database in?

Answer: The database is available as an Excel spreadsheet with author, date, title, and source. A hyperlink to the actual source material is also provided.

- Question: Why was the literature review limited to the period of 1996 through 2006? Limiting the search to this time period precludes identification of many of the studies funded by MMS in the 1980s.

Answer: The studies conducted in the 1980s are fairly well known and Argonne was directed by MMS to identify only those references from 1996 and afterwards. Syntheses already exist for earlier studies.

3.5 POTENTIAL FINANCIAL AND EMPLOYMENT IMPACT FROM THE DEVELOPMENT OF OIL AND GAS IN THE NORTH ALEUTIAN BASIN⁷

Shell Oil Co. currently envisions oil and gas development in the North Aleutian Basin to consist of offshore drilling production platforms, with product transported via pipeline to a natural gas liquefaction facility on the Alaska Peninsula (e.g., near Sand Point), and LNG transported to the U.S. West Coast market via tanker. Shell estimates that this activity would generate approximately \$12 billion in federal income tax, \$7 billion in royalties, and \$850 million in state and local taxes over the lifetime of the project.

Offshore operations and an onshore LNG facility would create construction and operating jobs. Construction jobs are expected to increase from about 2000 in year 1 to about 5000 in year 4 and subsequently to decline. Operating jobs would be relatively constant over an estimated 25-year period with about 400 workers performing jobs on platforms (including operations and maintenance) and 250 workers at onshore facilities.

To develop its workforce, Shell recruits talent at community and technical colleges and universities, develops a local source of talent by working with schools in areas of operation, and invests in local schools and programs. Shell strives to retain and develop talent and provides both supervisory and technical career paths.

The types of jobs directly associated with oil and gas development would typically include:

- Health, safety, and environment services including spill response and emergency response;
- Well services, including drilling, coring, logging, completion, production, recompletion, and abandonment;
- Platform services, including equipment start-up, maintenance, renewal, and removal;
- Logistics handling, including helicopter, crew boats, and equipment barges; and
- Pipe and materials jobs, including fabrication, transport, loading, installation, maintenance, and removal.

⁷ Presented by Ian Voparil, Shell Oil Co.

Shell estimates that for every job directly related to the industry there would be six jobs created in local communities. These include service jobs (e.g., food services, transportation, police, fire fighting, education, and housing) and jobs related to the provision of goods.

Questions and Comments from the Audience

- Comment: Caution should be applied when applying economic effects of oil and gas development on the Kenai Peninsula to projections of effects in the North Aleutian Basin. There are two significant differences in the nature of the economic impacts that oil leasing in Cook Inlet has had with what we might expect of oil and gas development in the North Aleutian Basin. One key difference is that development in Cook Inlet involved leases of State lands, and the revenues from that development that flowed into State government would be much higher than it would be in the North Aleutian Basin where federal leases would occur. The second difference relates to the extent to which there would be local hires. On the Kenai Peninsula, there is a relatively large percentage of employees that live locally, but a valid question is whether that would occur in an area as remote as the Basin. Oil and gas development in the Basin may create a lot of jobs, but one must be careful about additional multiplier effects that are inferred for the region. Also, one needs to distinguish between local tax revenues that would go to the Aleutians East Borough where most of facilities would be and those that would go to other areas such as the Bristol Bay Borough and the Lake and Peninsula Borough where facilities would not be located.

Response: There was no attempt to mislead the audience, and that is why the projections divided out money vs. potential employment. A part of Shell's corporate culture is local hire and local employment and that would have to be worked out. Cold Bay has 55 residents and it is a community that does not have the infrastructure to support development. One could say that conditions now will affect development potential, but it is also possible that development could help drive economic conditions on the Peninsula.

- Question: The potential development scenario presented is useful in planning for studies. Does Shell have information that they could share on potential exploration especially pre-release exploration that might help guide studies?

Answer: Two-dimensional seismic explorations have already been conducted in the Basin and MMS knows of these. The author is unable to share Shell's proprietary information.

- Question: Our organization [Pacific Environment] has had a lot of experience with Shell on Sakhalin Island and we have seen Shell make many of the same promises concerning local gas deliveries, protection of habitat, and benefits for communities. What we have seen is communities experiencing large impacts and Shell ignoring independent scientific panels. We have seen a lot of damage to salmon habitat, critical habitat for whales compromised, and communities compromised. Has there been any change in Shell's corporate culture because of the experience on Sakhalin Island and will Shell be able to ensure that promises to communities are kept and ecologically sensitive development occurs?

Answer: Shell supports ecologically sensitive development. Shell convened an International Union for the Conservation of Nature panel to review their activities. Have you ever heard of another company doing the same? Shell took their recommendations and relocated a pipeline. Shell hopes to be proactive and participate in these kinds of meetings and remove people's concerns beforehand.

- Comment: There is a revenue sharing program that was included in the Energy Bill of 2005. Alaska gets 1% of the total revenue and local governments get 35% of that. The program is called the Coastal Impact Assistance Program and is administered by MMS.

Response: There is a national program that was started after what happened in the Gulf in 2005. The program provides for resources that are developed offshore to be shared locally. This is an important issue that people in Alaska should support.

- Question: Do you have a methodology for evaluating local employment defined as people who come from the State of Alaska and people who come from the local region? What is the experience regarding local employment in other remote regions (not the Kenai Peninsula, but more third world situations)?

Answer: No, I am not personally aware of such a methodology.

3.6 CIRCULATION, WATER MASS DISTRIBUTION, AND TRANSPORTS IN THE NORTH ALEUTIAN BASIN—MODEL RESULTS⁸

A regional model has been developed to predict sea ice dynamics throughout the entire Arctic region. The model is a parallel ocean program coupled with a Hibler-type ocean and sea ice model with a spatial resolution of about 9 km. This model has potential for modification and use in modeling circulation, water mass distribution, and transport (including spilled oil or other contaminants) in the North Aleutian Basin.

For the purposes of modeling processes in the Basin, the model requirements include (1) consideration of inflow through the Aleutian Island passes and outflow through the Bering Strait, (2) a required resolution of 1–2 km in the horizontal and 1–5 m in the vertical direction (depth), (3) consideration of mesoscale eddies on the order of 20–50 km, and (4) tidal mixing and residual currents.

Circulation in the Basin is dominated by the Alaskan Stream, Alaska coastal current, and wind forcing resulting from the strength and location of the Aleutian Low. Data from 1979 through 2004 are available to characterize these processes and develop model parameters in the North Aleutian Basin for circulation and total kinetic energy of water movement (seasonal and annual), volume transport, heat flux, salt flux, and freshwater flux.

For purposes of assessing potential environmental effects in the Basin, finer resolution is needed to account for the relatively narrow region of the Alaska Coastal Current (about 20 km wide), bathymetry of narrow and shallow Aleutian Island passes, and mesoscale eddy fields in

⁸ Presented by Wieslaw Maslowski, Naval Postgraduate School

the Gulf of Alaska and southeastern Bering Sea. An important consideration is the ability to model the formation and extent of the “cold pool,” a pool of cold water that forms on the Bering Sea shelf when winter sea ice traps cold water in place as ice retreats in summer. The cold pool affects water column stratification, which in turn affects mixing, spring plankton blooms, and biological productivity.

Existing models can predict movement of spilled oil in the area. These models demonstrate the importance of the timing of the spill in terms of the movement of oil and areas affected. Depending on the timing of a spill, currents can either move spilled oil eastward or westward in the Basin.

Limited data exist to refine the model for the Northern Aleutian Basin. Additional observations, especially upstream and within the Northern Aleutian Basin region, are needed for model validation and improvement. The Northern Aleutian Basin is a challenging region for ocean modeling. Regional ice-ocean models exist that have a reasonable capability to simulate the Northern Aleutian Basin mean state and variability. High model grid-cell resolution in horizontal (1–2 km) and vertical (1–5 m) directions is required to realistically represent (1) narrow and shallow Aleutian Island Passes; (2) the shallow Northern Aleutian Basin shelf; (3) the narrow Alaska Coastal Current (about 20 km wide); (4) mesoscale eddies on the order of 20–50 km; and (5) the Bering Slope Current. Realistic high-resolution interannual atmospheric forcing is necessary and the effect of tides on mixing and circulation should be accounted for.

In developing a physical process model for the North Aleutian Basin, the following limitations and possibilities should be considered:

- Modern computer technology allows for realistic multidecade integrations of the Pan-Arctic region at scales of 10 km horizontally and 5 m vertically or better (see Maslowski 2007);
- Multi-decade simulations with prescribed realistic atmospheric forcing allow studying interannual-to-interdecadal variability of ocean circulation and may provide guidance to field programs (Maslowski et al. 2000);
- Limited predictions are possible using models with one-way coupling of the atmosphere to the ice and ocean (Maslowski et al. 2001);
- Decadal hindcasts at an eddy-resolving grid for the North Aleutian Basin are achievable at present; and
- A regional climate model should allow seasonal to annual forecasts.

3.7 MARINE FISH ABUNDANCE AND DISTRIBUTION IN THE MMS NORTH ALEUTIAN BASIN PROGRAM AREA⁹

The National Marine Fisheries Service (NMFS) collects and maintains fisheries and fish survey data that are used to assist with fishery management. Over 40% of the commercial U.S.

⁹ Presented by Michael Sigler, NMFS

fisheries catch comes from the North Aleutian Basin, including groundfish, shellfish, salmon, and herring. Much effort is expended to understand the distribution and abundance of these fishery resources. Information pertaining to commercial catches and fisheries within the Basin is collected for commercially important species, and indicates a high level of effort and catch within the Sale 92 Area.

In addition, surveys are periodically conducted to evaluate abundance and distribution of important fishery species within the Basin. Standardized bottom trawl surveys are conducted for a variety of commercially important bottom-dwelling species, including walleye pollock and red king crab. These data indicate high variability in distribution from year to year. Under an ongoing NMFS program, major summer surveys have been conducted using a combination of acoustic and trawl surveys in the water column within the Basin (including the Sale 92 Area) from 1979 through 2006; similar surveys have been conducted in other areas surrounding the Alaska Peninsula, although the period of record is not as long and the seasons may differ. These surveys indicate that, while the distributions of monitored species differ from year to year, there are concentrations of some commercially valuable species in the vicinity of the proposed lease area. Because of this annual variability, single-year surveys would be largely insufficient for understanding the factors that affect distribution and abundance. Surface layer fishery surveys have been conducted annually during the fall for the past 6–8 years and are useful for examining distributions of adult salmon and juvenile pollock.

Additional oceanographic and biological data have been collected during these surveys that help in understanding other facets of the ecological relationships within the Basin. Examples of these data include information about nutrients, primary productivity (chlorophyll a), secondary productivity (zooplankton), and the distribution and abundance of ichthyoplankton (fish eggs and larvae). Distributions of ichthyoplankton collected over a number of years demonstrate that the North Aleutian Basin in the vicinity of the Sale 92 Area supports concentrations of eggs and larvae of walleye pollock and sand lance (*Ammodytes hexapterus*) as well as other important species.

In order to better understand and predict socioeconomic outcomes of management decisions and changes in the distribution and abundance of fishery resources, NMFS also collects information about communities within the region that rely on fisheries.

While the summer distribution of species in offshore areas is relatively well known (because this has been more fully surveyed for a number of years), information about the distribution of fishes in other seasons and of fish abundance and distribution in nearshore waters in the vicinity of the Sale 92 Area is not well known. Therefore, additional information remains to be collected in order to better understand and predict the potential effects of oil and gas development on the fisheries of the Basin. In addition, information in existing NMFS databases could be made more readily available to researchers through the development of Web-based access. Examples of information needs include:

- Seasonal distribution and abundance of nearshore fish, including information about spawning and juveniles. Ideally this information would include the seasonal use by fish of various types of habitats in areas less than 20 m in depth.

- Seasonal distribution and condition of juvenile Pacific salmon and walleye pollock. Information about the distribution of these species outside of the autumn period is not well known, but there are clearly changes from season to season. Acoustically tagged fish could potentially be used to better understand seasonal movements and distributions.
- Ichthyoplankton abundance and distribution in Bristol Bay. This area of the Basin is clearly important to early life stages for many species.

Uncertainties related to the seasonal distribution and abundance of nearshore juvenile fish, including ichthyoplankton should be addressed first.

3.8 FEDERAL FISHERIES IN THE NORTH ALEUTIAN BASIN¹⁰

The Magnusson-Stevens Fishery Management Act established eight regional councils throughout the nation. The North Pacific Fishery Management Council focuses exclusively on Alaskan fisheries. The Council recommends management measures for each fishery in the form of Fishery Management Plans (FMPs). NMFS then develops regulations to implement approved management measures, monitors the fishery, and enforces management measures. The responsibilities of the Council are to prepare a FMP for each fishery under its authority, submit amendments to FMPs as necessary, conduct public hearings on FMPs and their implementation, and review stock assessments and harvest specifications. The Council, composed 11 voting and four nonvoting members, is advised by various committees and advisory panels; public comment feeds into all of these advisory groups.

The FMPs relevant to the Sale 92 Area and the North Aleutian Basin are the Bering Sea-Aleutian Islands groundfish FMP, the Bering Sea-Aleutian Islands King and Tanner Crab FMP, the Alaskawide scallop FMP, the Alaskawide salmon FMP, and the halibut FMP. Fishing for Pacific salmon is prohibited in federal waters, although it is allowed in state waters. Harvest levels for groundfish within the Basin are set by the Council. For the crab and scallop fisheries, the Council determines the optimum yield and overfishing levels, but the actual harvest levels are set by the state. Harvest levels for halibut are set by the International Pacific Halibut Commission, but the management measures are put in place by the Council.

The Sale 92 Area overlaps with three areas for which groundfish statistics are collected and evaluated. Within this area, there are trawl fisheries for pollock, Pacific cod (*Gadus macrocephalus*), flatfish (yellowfin sole [*Pleuronectes asper*], rock sole [*Lepidopsetta polyxystra*], and flathead sole [*Hippoglossoides elassodon*]), as well as longline and pot fisheries for Pacific cod. A substantial portion of the overall Bering Sea-Aleutian Islands catch within each of these groundfish categories is taken from these three statistical areas. According to fishery observer data from 2005, a substantial proportion of the fishery effort occurs in the vicinity of the Sale 92 Area for nearly all of these fisheries. The Sale 92 Area is currently closed to commercial halibut fishing.

¹⁰ Presented by Diana Evans, North Pacific Fishery Management Council

Three shellfish fisheries are concentrated in the vicinity of the Sale 92 Area: the Bering Sea tanner crab fishery, the Bristol Bay red king crab fishery, and the Bering Sea weathervane scallop (*Patinopecten caurinus*) fishery. The Bristol Bay red king crab fishery occurs primarily in the winter. During the 2005-2006 season, between 1 and 51 vessels participated weekly in that fishery and it is estimated that 16.5 million pounds of crabs (2.5 million crabs) were harvested. The Bering Sea tanner crab fishery was closed from 1997 to 2004 and in 2005 there was no direct overlap with the Sale 92 Area (the fishing occurred farther to the west). The fishing effort for weathervane scallop overlapped with the Sale 92 Area in 2004-2005, although the fishery was closed in other portions of the Basin during that period. Few vessels participate in the scallop fishery in this area; between 2000 and 2005, the meat harvested in this fishery dropped from over 205,500 pounds to just over 10,000 pounds. In 2004-2005, the scallops harvested from the Bering Sea area accounted for approximately 2% of the overall scallop harvest in Alaska.

Questions and Comments from the Audience

- Question: The area northeast of Unimak Pass, the area that would overlap with the lease sale area is considered “cod alley,” an area fishermen consider the heart of the Bering Sea fishery where 21% of pollock and 40% of cod trawls occur. This is the nation’s largest fishery. Is there an economic evaluation of the fishery’s value?

Answer: The Council has that information, but it was not included in the presentation.

- Question: Why is the halibut fishery closed in the area?

Answer: The area is closed because it is an important nursery area for juvenile halibut.

3.9 POTENTIAL IMPACTS OF NORTH ALEUTIAN BASIN OIL AND GAS DEVELOPMENT ON COMMERCIAL FISHERIES: WHAT DO WE KNOW? WHAT RESEARCH IS NEEDED?¹¹

Commercial fisheries in the North Aleutian Basin are economically significant, with an annual wholesale value of close to half a billion dollars. However, the fisheries within the North Aleutian Basin are highly seasonal and the catches, production, prices, and value can vary widely from year to year.

Commercial fishing and processing is overwhelmingly the most important private-sector industry of the region. In the small, predominantly native villages, salmon fishing is an important source of income and jobs and several towns within the region have major fish processing industries or support industries that rely upon Basin fisheries. The economic benefits and impacts of the commercial fishery in the Basin also extend outside the region: many of the fishermen are from outside the region and a large share of the processing work force is composed of nonresidents. Most of the processing industry is headquartered in Seattle.

The fisheries that could be affected by oil and gas development in the North Aleutian Basin are diverse and complex. These fisheries occur over a wide geographic area and rely upon

¹¹ Presented by Gunnar Knapp, University of Alaska Anchorage

multiple fish species. There are different types of fisheries (commercial, sport, and subsistence) that use a variety of types of fishing vessels (small to very large) and involve participants at various scales (families to large corporations). Management of these fisheries is influenced by various state, federal, and international agencies. As a consequence, the fisheries within the Basin can have economic impacts and importance over a large geographic region extending throughout Alaska and the Pacific Northwest. Potentially affected fisheries of significant economic importance are not limited to commercial fisheries: both the guided sport fishing industry and subsistence fisheries are also of significant economic importance.

The principal commercial fisheries within the North Aleutian Basin are salmon, groundfish, and shellfish, although other types of fisheries are also present. The salmon fishery relies on sockeye (*Oncorhynchus nerka*) and chinook salmon (*Oncorhynchus tshawytscha*). In Bristol Bay, salmon are commercially taken using drift gillnets and set gillnets; purse seines are utilized in addition to gillnets in other areas along the north Alaska Peninsula. The salmon fishery is managed by the Alaska Department of Fish and Game (ADFG), following policy established by the Board of Fisheries. The groundfish fishery is under federal management (policy set by North Pacific Fishery Management Council and administered by NMFS). The principal species captured in the groundfish fishery include pollock, Pacific cod, and sole (including yellowfin, flathead, and rock sole). They are captured using trawls, longlines, and fishing pots. Shellfish fisheries in the area are for scallops (principally weathervane scallops) and crab (primarily red king crab). The scallop fishery is managed by the federal government, whereas management of the crab fishery has been delegated to the state by the federal government.

Oil and gas development within the North Aleutian Basin could affect fisheries in a number of ways. Probably the most significant and wide-ranging impact would occur in the event of an oil spill. The level of impact would depend on timing, size, and location of the spill, as well as weather conditions. The economic effect of an oil spill would vary depending on which fisheries were impacted, and different types of effects (e.g., acute vs. chronic) could occur over different time scales.

Other aspects of oil and gas development could also affect fisheries. Some of these impacts are probably more likely to occur, but would probably be smaller in scale and easier to assess than impacts from oil spills. For example, development of infrastructure such as placement of drill rigs, oil platforms, pipelines, roads, ports, airstrips, and energy facilities could affect fisheries by creating navigational hazards or causing some areas to be closed to fishing. Additional marine traffic could similarly create navigational hazards or cause some areas to be closed to fishing. Increased population growth could lead to an increased demand for sport fishery resources.

Oil and gas development could also positively impact fisheries: for example, development of infrastructure could reduce transportation and energy costs for fishermen and processors and increased tax revenues could lead to improvements in fishery infrastructure.

It can be difficult to measure the societal importance of fisheries. Different fisheries are important to different individuals, communities, and regions in different ways. Regardless, the

relative ranking of societal importance or economic importance among fisheries would not be the same for all measures. Selected economic measures of societal importance of fisheries could include those used to describe gross revenues (e.g., ex-vessel value, processing value-added, or support-industry income), net economic benefit (e.g., harvester net income, processor profit, or support industry profit), participation (e.g., number of persons working in harvesting, processing, and support industries), employment (e.g., person months or person years worked for harvesting, processing, and support facilities), and tax revenues.

The data needed to evaluate many of the potential measures of societal or economic importance are limited and data availability differs among fisheries and with the agency responsible for managing the fishery. Such evaluations are further complicated because the economic importance of Alaska fisheries extends far beyond the regions in which the resources are located: many fishermen and processing workers come from other regions, fishing boats and processing plants are often owned by people from other regions, and processing and support industries are often located in other regions. It is generally easier to measure the aggregate importance of fisheries than to evaluate their importance to particular regions or communities. The available economic measures of societal importance of fisheries that might be affected by oil and gas development in the North Aleutian Basin are limited, particularly measures of importance to particular regions or communities. The simplest measures of economic importance, and those for which data are most readily available, are ex-vessel and wholesale value. As a very rough rule-of-thumb, these fisheries have a combined annual ex-vessel value of about \$200 million and an annual wholesale value of about \$450 million. Values may be significantly lower or higher in some years.

In most of the major fisheries, the majority of permit holders live outside the region or outside of Alaska.¹² For example, in 2004 approximately 23% of the permit holders for the Bristol Bay drift gillnet fishery for salmon were from within the region, about 25% were from other areas of Alaska, and approximately 52% were from other states. For the Bristol Bay set gillnet salmon fishery, 39% of permit holders were from within the region, 31% were from other areas of Alaska, and 30% were from other states. For the Bering Sea red crab fishery, 29% of permit holders were from Alaska, compared with 71% from other states.

To understand the potential impacts to fisheries of oil and gas development in the North Aleutian Basin, a number of questions need to be addressed:

- First, the location, timing, and other specifics regarding oil and gas development scenarios must be known. With this information, the potential for spills can be evaluated by considering the probability of spills of different volumes and for different times of the year. Spill trajectory modeling can then be conducted to evaluate the probabilities that spilled oil would reach particular locations and that the spill would cause the closures of specific fisheries.

¹² Statistics from the Alaska Peninsula maintained by the State of Alaska Commercial Fisheries Entry Commission suggest that the percentage of permit holders from outside the region is lower than the Bristol Bay statistics presented by Dr. Knapp.

- The probability of long-term effects on fishery resources also needs to be addressed. With this information, the effects on catches and prices would need to be evaluated, along with the overall aggregate economic effects and the distribution of effects within the region.

The answers to many of these questions are dependent upon answers to other questions and the level of uncertainty increases with each question that needs to be answered. Currently, we are not able to make specific or probabilistic predictions regarding development scenarios, the potential for spills, spill trajectories, the probability of fishery closures, the effects of spills on specific resources, effects on catches and prices, and the resulting economic effects. However, the ability to make predictions will likely improve with targeted research. Currently, any estimates of the potential spill-related economic effects of oil and gas development in the North Aleutian Basin on fisheries will be highly uncertain.

3.10 COMMUNITY SOCIOECONOMICS: NORTH ALEUTIAN BASIN¹³

This presentation discussed previous MMS socioeconomic research conducted in the North Aleutian Basin, and gave a theoretical orientation for further research in advance of prospective OCS development in the region. Impact Assessment Inc.'s early work in the Basin, now 25 years ago, included a 20-year forecast of socioeconomic conditions in the absence of OCS development. The work was intended as a baseline against which development scenarios and OCS-related socioeconomic change could be assessed; forecasts were based on systematic ethnographic work in communities in the Aleutians East Borough and points west. Similar work was undertaken by Impact Assessment Inc. in Bristol Bay and other areas potentially affected by prospective OCS industry activity.

The research was organized to enable assessment of long-term social change both with and without OCS development. Three components were involved:

1. OCS development assumptions and scenarios based on industry needs and interests;
2. Baseline social, cultural, and economic conditions against which OCS-related changes could be assessed while controlling for other sources of change; and
3. Potential socioeconomic effects of OCS development at state, regional, and local levels.

A systems modeling approach was used to assess relationships between social structural aspects of the communities and agents or forces of change. The approach was applied along many dimensions: ecology, demography, economics, sociopolitics, social networks, education, health care, and religion. It was attentive to factors such as economic stratification, the effects of external revenue on subsistence practices, and intraregional variation in effects of involvement in commercial fisheries.

At the time, the Alaska Native Claims Settlement Act was relatively new and a newer economic order was developing; commercial fisheries were growing and limited-entry fisheries were being introduced; technology was improving the efficiency of exploitation of natural

¹³ Presented by Ed Glazier, Impact Assessment Inc.

resources. The dominant source of change was projected to be a growth of commercial fisheries and closer integration of the local indigenous society with more formalized systems of social and political interaction. This led to forecasts (working hypotheses) that then-current trends of social change would extend into 2002 even in the absence of OCS development.

Several hypotheses were generated in 1982 about the communities in the vicinity of the North Aleutian Basin, as follows:

- Commercial salmon resources would increasingly constitute an important basis of social and economic change.
- Growth of nonindigenous populations would be less significant than other projections were indicating, due in part to the effects of the Alaska Native Claims Settlement Act and limited-entry fisheries.
- Increased income and predominance of the cash economy were seen as likely, but class dichotomization would occur where involvement in commercial fisheries was mixed.
- Increased correlation between income, economic wealth, and political power would be likely.
- Social and economic interaction and political structures in indigenous communities would become more formalized.
- Traditional means of subsistence would decline given increasing availability of imported goods.
- Adoption of “mainstream” material and social values would accelerate at the expense of traditional orientations.

In short, there was emphasis on probable responses to exogenous social and economic sources of change, and the prediction was made that integration of traditional indigenous and capitalist American-Alaskan societies was inevitable. While some of the hypotheses can now be seen as valid, there is much depth to the story, and detailed ethnographic work would aid in adequately assessing social change in the region since 1982. This would be highly instructive given ongoing potential for OCS development and the associated introduction of new agents and forces of change in this unique region of Alaska.

Given lessons that have been learned since 1982, future analysis is likely to indicate that traditional Unangan, Alutiiq, and other Alaska Native values and lifeways are being enacted with more resilience than was hypothesized. The authors recognized the complexity of social change and the probability that indigenous residents would retain individual and collective identity. Indeed, it is possible to accommodate exogenous forces and factors of change without fully adopting them or sacrificing identity, and many would argue that Unangan and Alutiiq identities are most durable. In fact, indigenous societies have persisted for millennia in Alaska despite a range of challenging factors. Cash and capital are now clearly seen as enabling subsistence-oriented lifeways and associated cultural practices. These aspects of life are not mutually exclusive.

But one should not infer that these differing ways of life are typically compatible or that attending to traditional lifeways is easy given the pressures of modern societies. In fact, a conundrum is often generated. That is, cash is required in the modern context, but in the absence of opportunity it is not easily acquired, particularly if one highly values subsistence practices and associated traditional cultural lifeways. As such, forms of economic opportunity that readily enable rather than obviate Alaska Native cultural traditions and practices are typically highly desirable to the practitioners.

Understanding the aforementioned conundrum and indigenous interests and the way these have played out over time in the North Aleutian Basin are critically important dimensions of social analysis to be considered in advance of potential OCS development or any other sources of planned change in the region. This is particularly important given the large percentage of Alaska Natives living in the region, the local importance of commercial fisheries, extensive outside participation in the fisheries, and the paucity of other employment alternatives.

The likely community-level social and economic effects of oil and gas development in the Basin cannot be immediately analyzed or answered. Although recent social research in the region has covered a broad geographic area (e.g., NMFS fishing community research), its depth of coverage has generally been limited to specific programmatic needs that yield information that is useful but inadequate for generating sufficient understanding of socioeconomic change and its correlates.

Comprehensive social assessment would require work at the level of detail previously conducted for MMS in the region and careful monitoring of select social and economic variables and indicators over time. Logically, the research would address the nature of participation of indigenous and nonindigenous residents in predominant and subsidiary industries in the region; the potential nature of their involvement in, or interface with, prospective oil and gas industry activity in the Basin; and the dynamic interactive effects of such participation on involvement in traditional cultural practices.

Finally, future assessment must be designed so that the effects of other sources of change (e.g., salmon abundance or lack thereof, or opportunities associated with the proposed Pebble Mine) are analytically controlled for, thereby enabling measurement and adequate understanding of the potential (or actual) local and regional social and economic effects of specific industry actions in the Basin. This is increasingly challenging given that many sources of change are now seen as global in scope and effect.

Effective social assessment will also need to address the potential for spatial conflict and competition between local (indigenous or nonindigenous) fishing interests and the interests of the oil and gas and other maritime industries potentially active on or adjacent to the Basin. This would also require assessment of the larger systems of navigation and maritime traffic through Unimak Pass and elsewhere in the region.

In conclusion, various social science research projects have been conducted in the North Aleutian Basin over the last decade, but the detailed descriptive and theoretically based research that enabled MMS to comprehensively characterize socioeconomic and sociocultural aspects of

life in the North Aleutian Basin in the early 1980s has not yet been replicated in the region, leaving a series of important hypotheses not fully tested. By comprehensively revisiting old and new socioeconomic variables and theoretical perspectives in advance of prospective further social change, analysts would be able to continue the long-term systematic research begun in the region in the 1980s, and in so doing (1) advance understanding of the human implications of oil and gas development scenarios in the Basin, (2) satisfy National Environmental Policy Act (NEPA) and Outer Continental Shelf Lands Act-related social-analytical mandates, and (3) generate sufficient information for developing policy that could serve to enhance the life experiences of persons residing in adjacent communities.

Questions and Comments from the Audience

- Question: Has an evaluation been conducted of lessons learned from the effects of the *Selendang Ayu* grounding on local native jobs?

Answer: The author was involved in conducting interviews of local residents after the accident. The results will be developed into a report that focuses on local reaction to the accident and its effects on subsistence activities.

- Question: Is there a link between that event and the perception of the risk of Outer Continental Shelf development?

Answer: Yes.

3.11 SUBSISTENCE RESEARCH IN THE NORTH ALEUTIAN BASIN¹⁴

Subsistence is a legally defined harvest or use that includes any rural Alaskan harvest, customary harvests, and the cultural values related to harvest. Alaska native cultural groups involved in subsistence in the Basin include (1) Yup'ik Eskimo in Goodnews Bay and Togiak; (2) Alutiiq (Aleut) in King Salmon and Chignik; (3) Unangan Aleut in Unalaska and False Pass; and (4) Athabaskan Indian in Pedro Bay and Naknek. Major subsistence resources in the Basin include salmon, halibut, whitefish, herring and herring roe, smelt (family Osmeridae), cod, dolly varden (*Salvelinus malma*), clams, tanner crab, king crab, caribou (*Rangifer tarandus*), moose (*Alces alces*), harbor seals (*Phoca vitulina*), sea lions, beluga whale (*Delphinapterus leucas*), ducks, ptarmigan (*Lagopus* spp.), sea gull eggs, beaver (*Castor canadensis*), berries, and vegetation.

Subsistence research in the North Aleutian Basin is conducted by government agencies, Alaska Native organizations, and independent contractors and has covered a variety of topical areas including (1) subsistence foods safety; (2) subsistence traditions, customs, and education; (3) subsistence land use mapping; and (4) subsistence harvest assessment.

Government agencies conducting subsistence research in the Basin include:

- ADFG Division of Subsistence;

¹⁴ Presented by Brian Davis, Former Program Coordinator, ADFG, Division of Subsistence

- ADFG Division of Commercial Fisheries;
- U.S. Fish and Wildlife Service (USFWS) migratory birds, marine mammals, and subsistence divisions; and
- NMFS.

Alaska Native organizations conducting subsistence research in the Basin include:

- Bristol Bay Native Association,
- Aleutian Pribilof Islands Association,
- Alaska Native Harbor Seal Commission,
- The Alaska Sea Otter-Steller Sea Lion Commission,
- Aleut Marine Mammal Commission, and
- Qayasiq Walrus Commission of the Bristol Bay Native Association.

Independent contractors conducting subsistence research in the Basin include:

- Steve Braund and Associates;
- Herbert Maschner, Idaho State University;
- Robert Wolfe and Associates;
- University of Alaska, Institute of Social and Economic Research; and
- The Nature Conservancy.

Subsistence harvest data are available from:

- ADFG Division of Subsistence: community studies – baseline and directed;
- ADFG Division of Commercial Fisheries: Bristol Bay salmon permit data from 2003;
- NMFS: subsistence halibut harvest by community, 2003-2004;
- Alaska Native Harbor Seal Commission: marine mammal harvest by community from 1992 to 2004; and
- USFWS: migratory bird harvest, 2004, 2005 (not yet available).

The following Web sites provide information on subsistence in the region:

- ADFG Division of Subsistence: www.subsistence.adfg.state.ak.us
- Aleut Marine Mammal Commission: www.aleutmarinemammals.com
- Alaska Native Harbor Seal Commission: www.harborsealcommission.org
- Alaska Native Knowledge network: www.ankn.uaf.edu
- The Alaska Sea Otter-Steller Sea Lion Commission: www.seaotter-sealion.org
- Aleutian Pribilof Island Association: www.apiai.org
- Bristol Bay Native Association: www.bbna.com

- NMFS subsistence halibut fishing: www.fakr.noaa.gov/ram/subsistence/halibut.htm
- USFWS Subsistence Management: alaska.fws.gov/asm/home.html

3.12 BRISTOL BAY–NORTH ALEUTIAN BASIN SEABIRDS AND SHOREBIRDS¹⁵

Bristol Bay is a critically important area for shorebirds. Up to one-third of the world's population of the bar-tailed godwit (*Limosa lapponica*) uses Egegik Bay in the autumn, and the only nesting area for a subspecies of marbled godwit (*Limosa fedoa*) is found in the Bristol Bay Lowlands. More than 300,000 shorebirds, primarily dunlin (*Calidris alpina*), were counted during aerial surveys of Alaska Peninsula estuaries in 1999. The area serves as a migration corridor and filling station for shorebirds. Western Hemisphere Shorebird Reserve Network sites are located along the Alaska Peninsula and most are considered of hemispheric importance: that is, they support at least 500,000 shorebirds annually or at least 30% of the biogeographic population of a species.

The Bristol Bay area also supports important seabird colonies. Thirty colonies exist within the North Aleutian Basin with over 60,000 breeding seabirds occurring within the colonies. Forty-four colonies exist between the lease area and Cape Newenham, with over 900,000 breeding seabirds. Although 26 species occur in these colonies, most of the seabirds are common murre (*Uria aalge*), black-legged kittiwakes (*Rissa tridactyla*), and tufted puffins (*Fratercula cirrhata*). Selected colonies are monitored annually or every few years. Others are censused opportunistically. Monitoring is used to determine productivity, breeding chronology, diet, and population trends. These data are maintained by the USFWS.

Many of the seabirds in the Basin do not breed there, but instead feed in the area during the summer months. These species include albatrosses from Hawaii and Japan and shearwaters from New Zealand and South America. Albatrosses (including the Laysan albatross [*Phoebastria immutabilis*] and endangered short-tailed albatross [*Diomedea albatrus*]) wander into the Bristol Bay area and concentrate their feeding activities in the Aleutian passes. In fact, Unimak Pass and other Aleutian passes attract millions of feeding birds of a variety of species annually. Movements of the short-tailed albatross throughout the Bering Sea have been determined using satellite telemetry, and these data indicate the species concentrates activity along the Aleutian Chain and occasionally within the open waters of the Basin.

Seabird surveys have been conducted at sea opportunistically on ships traveling through the area for other purposes. Data from these surveys are kept in the North Pacific Pelagic Seabird Database (NPPSD). Most data were collected under the auspices of the Outer Continental Shelf Environmental Assessment Program between 1974 and 1984. Data-collection coverage in the Basin varies seasonally, but is best in the summer; relatively few transects have been conducted during the winter and spring. In 2006, the NPRB provided funding to the USFWS to conduct at-sea seabird surveys and to update the NPPSD. Funding covers surveys through 2007; the USFWS intends to seek funding to continue transect data collection. Species commonly

¹⁵ Presented by Kathy Kuletz, USFWS

observed at sea have included a variety of shearwater species, puffins, and auklets. Other species observed include loons and murrelets, including the Kittlitz's murrelet.

3.13 BRISTOL BAY–ALASKA PENINSULA: AVIAN CROSSROADS AND DESTINATION¹⁶

Why are there so many birds in the Bristol Bay-Alaska Peninsula area? This area represents a convergence of migratory pathways, and individuals of many species breeding in the Arctic funnel through this region. The area, especially the Alaska Peninsula, has significant food resources, including nutrient-rich estuaries; eelgrass beds; and anadromous fish, marine fish, and invertebrate food resources. It has the most northern ice-free coastal habitats in winter, and the area is remote with a low-level of human disturbance. The importance of the area to birds has been recognized through a variety of special habitat designations including:

- 23 Bering Sea Important Bird Areas;
- Six hemispheric and one international Western Hemispheric Shorebird Reserve Network sites;
- Five state critical habitat areas “essential for wildlife and fisheries resources”;
- Three Steller’s eider critical habitat units within the North Aleutian Basin planning area and two in adjacent areas
- One spectacled eider (*Somateria fischeri*) critical habitat unit adjacent to the Basin;
- Two national wildlife refuges;
- Two state game refuges; and
- The first Ramsar Convention Site (Izembek Lagoon) in the United States that represents a “wetland of international importance.”

A wide variety of data on waterfowl of the area are available, including USFWS aerial surveys conducted during spring staging, winter, molting, and fall staging; many estuarine studies that collect some data on birds (e.g., marine ecology, abundance, biology, disturbance factors of waterbirds); and several radiotelemetry studies using both VHF and satellite receivers.

Waterfowl are vulnerable to a variety of impacts. Molting birds have high nutritional requirements, limited mobility, and are easily stressed by disturbance. Migration bottlenecks force many birds to move through staging areas where they could be exposed to oil or fuel spills, or other contaminants. In addition, they form wintering concentrations, when spill response would be most challenging.

The species considered most at risk include a variety of sea ducks (Steller’s eider, king eider [*Somateria spectabilis*], black scoter [*Melanitta americana*], and long-tailed duck [*Clangula hyemalis*]), geese (Pacific brant [*Branta bernicla*], emperor goose [*Chen canagica*], and cackling Canada goose [*Branta canadensis minima*]), and other ducks, loons, grebes, and

¹⁶ Presented by Bill Larned and Chris Dau, USFWS

gulls that occur in estuaries and along shorelines during spring and fall migrations. The following text summarizes information on several of these species.

Steller's Eider

- Alaska breeding population is considered threatened under the ESA. The population is considered a “world population of concern.”
- Pacific population contains less than 200,000 individuals.
- Maximum population in the Basin is estimated at 137,000 individuals.
- The Basin population represents about 70% of the Pacific population.
- The species is present in the Basin from August through May.
- Concentration sites include all major Alaska Peninsula lagoons, Chagvan, Nanvak, Goodnews, and Kuskokwim Bays from August through May. Birds use the sites for molting, migration, and wintering.

King Eider

- Considered a “species of concern” with a worldwide decline.
- Western North America population is about 300,000 to 400,000 individuals.
- Maximum population in the Basin is estimated at 240,000.
- The Basin population represents about 70% of the Western North America population.
- The species is present in the Basin from August through May.
- Concentration sites include the upper Bristol Bay shoals, mouths of all Alaska Peninsula lagoons, and shorelines throughout the Basin.

Black Scoter

- Considered a “species of concern” with a worldwide decline, including in Alaska.
- Western North America breeding population is estimated at 200,000 individuals.
- Maximum population in the Basin is estimated at 48,000 individuals, which occurs there during spring migration.
- The Basin population represents about 24% of the Western North America population.
- The species is present in the Basin from August through May.
- Concentration sites include upper Bristol Bay shoals, most major Alaska Peninsula lagoons, especially Port Moller, and shorelines throughout the Basin.
- Greatest periods of vulnerability include migration (March through May) and molting (August through October).

Pacific Brant

- Considered an international “species of concern” because there has been an approximate 40% reduction in population.

- Pacific Coast and High Arctic population that breeds in Alaska, Canada, and Russia is estimated at 120,000 individuals.
- Maximum population in the Basin is estimated at 95% of the total population.
- The species is present in the Basin from September through May.
- Concentration sites include Izembek Lagoons and Bechevin, Chagvan, and Nanvak Bays from September through November and April through May.

Emperor Goose

- Considered an international “species of concern” because there has been an approximate 50% reduction in population.
- Entire world population is estimated at 80,000 individuals and occurs in western Alaska and Russia.
- Maximum population in the Basin is estimated at 95% of the total population.
- The species is present in the Basin from September through May.
- Concentration sites include all Alaska Peninsula estuaries and Bechevin, Chagvan, and Nanvak Bays.

A number of significant data gaps are relevant to an assessment of the impacts of oil and gas development in the Basin:

- Information on food resources including quantitative and qualitative data from major coastal and estuarine habitats. Needed data include prey density, distribution, competitors, and contaminants relevant to species of concern.
- Spatial information on the year-round distribution of sea ducks, but especially their winter distribution.
- Relationships of seasonal waterbird distribution and migration to environmental variables, especially sea ice, weather, prey distribution and abundance, and disturbance.

3.14 IMPORTANT PINNIPED POPULATIONS: NORTH ALEUTIAN BASIN¹⁷

Four important species of pinnipeds live in the North Aleutian Basin: the Steller sea lion, northern fur seal (*Callorhinus ursinus*), harbor seal (*Phoca vitulina*), and spotted seal (*Phoca largha*). Critical information gaps concerning pinniped populations and the potential impacts of oil and gas development in the North Aleutian Basin on those populations are (1) distribution and habitats, (2) life history, (3) abundance and trends, and (4) stocks and status.

Steller Sea Lion

In the North Pacific, the range of the Steller sea lion extends from northcentral California northward to the Bering Straits and the Aleutian Islands, and westward along the Russian coast

¹⁷ Presented by John Bengtson, National Marine Mammal Laboratory

to the Korean Peninsula and Japan. Critical habitat in the North Aleutian Basin includes haulouts along the northern coast of the Basin and a haulout along the Alaska Peninsula immediately south of the Sale 92 Area on Sea Lion Rock and Amak Island. This area also includes a rookery site, while the southwestern portion of the Basin and the Sale 92 Area include critical feeding habitat for this sea lion. Additional haulouts and rookery sites occur farther westward along the Aleutian Islands.

Steller sea lions individually marked as pups on Ugamak Island have been tracked to Sea Lion Rock and Amak Island south of the lease sale area, to a haulout along the northern coast of the Basin, and to haulout and rookery sites on islands in central St. George Basin. Steller sea lions from Sea Lion Rock and Amak Island are thought to travel to these same areas.

Steller sea lions give birth to a single pup (median date June 10). Suckling occurs through 9 months to as long as 2–3 years. Maternal foraging trips may last from 7 to 24 hours. Females reach reproductive maturity at about 4 years of age. Steller sea lions depend on blubber and fur for insulation.

The Steller sea lion population has exhibited a dramatic decline at Ugamak Island since 1969. Regional population trends of the western U.S. stock in Alaska include:

- Eastern Gulf of Alaska: rapid decline in the early 1990s, stable or increasing since;
- Central Gulf of Alaska: steady decline in the late 1950s through mid-1980s, rapid decline in the late 1980s, slower decline from the 1990s to present;
- Western Gulf of Alaska: steady decline in the late 1950s through the mid-1980s, rapid decline in the late 1980s, stable from the 1990s to present;
- Eastern Aleutian Islands: steady decline in the late 1950s through the 1980s, stable from the 1990s to present;
- Central Aleutian Islands: thought to be increasing from the 1950s through the 1970s, rapid decline in the 1980s, slower decline or stability from the 1990s to present; and
- Western Aleutian Islands: rapid decline in the 1980s, slower decline from the 1990s to present.

Critical information needs for the Steller sea lion in the North Aleutian Basin include (1) seasonal movements, (2) seasonal habitat selection and use, and (3) age-specific dispersal patterns. These information needs may be addressed using satellite tagging and resighting of marked individuals.

Northern Fur Seal

The northern fur seal ranges throughout the North Pacific and Bering Sea. The focus of most of the work discussed here is on the Pribilof Islands and Bogoslof Island. Breeding and pup rearing occurs from June to November, and winter migrations occur from November to June. The National Marine Mammal Laboratory conducted fur seal telemetry studies in 2005. A collaborative project partially funded by the NPRB to look at adult female condition both during

the nursing period and overwinter coincided with a large project involving investigation of the overwinter behavior of newly weaned pups.

Overwinter movements of adult females indicate the area that is used by fur seals during the winter. Satellite telemetry data from 2002 and 2003 of 13 females tagged at St. Paul Island indicated individuals moving as far south as the central California coast. Tagged individuals departed St. Paul Island between November 20 and 29, and departed the Bering Sea near Unimak Pass between November 29 and January 1.

Northern fur seals give birth to single pup. Suckling occurs through the first 4 months. During this time, maternal foraging trips may last up to 12 days. Females reach reproductive maturity at about 3–4 years of age. This species depends on fur for insulation; because of its fur, the species has a long history of commercial harvest.

Between 1912 and 2006, northern fur seal pup production has exhibited a similar pattern on St. Paul and St. George Islands. Between 1910 and the 1950s, there was a steady increase in pup production. Since the late 1950s and early 1960s, pup production has exhibited a steady decline on these two islands. Pup production on St. Paul Island exhibited a 15.7% decrease between 2002 and 2004, and a 4.1% decrease on St. George Island over this same time. The one bright spot in the fur seal situation is Bogoslof Island, where in the summer of 2005 we conducted the first pup survey since 1997 and found a 12% annual increase. That is interesting and leads us into other research. Much of our work involves the comparison of the demographics at this island with those found on the Pribilof Islands.

Critical information needs for the northern fur seal in the North Aleutian Basin include (1) seasonal movements, (2) seasonal habitat selection and use, and (3) age-specific dispersal patterns. This information could be obtained using satellite tagging.

Harbor and Spotted Seals

The range of the spotted seal includes the North Aleutian Basin and extends northward into the Beaufort and Chukchi Seas, and westward along the coast of Asia as far as the Korean Peninsula and the Islands of Japan. The harbor seal occurs along both coasts of the Alaska Peninsula and the Aleutian Islands, the North Aleutian Basin, and along the Kamchatka Peninsula and to the islands of Japan. Both species occur in the North Aleutian Basin. Surveys conducted in 2000 reported counts of 500 to more than 2,000 harbor seals at several locations along the coast, while telemetry tracking of spotted seals during this same time showed activity to be largely occurring in the northern portions of the Basin. Telemetry data for both species shows harbor seals to extensively use habitats within Cook Inlet, while spotted seals use habitats north of the Alaska Peninsula and make movements northward through the Bering Straits and to the western Bering Sea.

Spotted seal habitat includes sea ice and land. The spotted seal breeds on sea ice, forming breeding triads from February to May. Pups are born with lanugo (soft woolly hair). This species exhibits long-range movements. Harbor seal habitat includes coastal and insular areas and

exhibits colonial breeding on land or glacial ice. Breeding occurs between April and July, and pups are born with adult-type pelage. This species exhibits short- and medium-range movements.

Harbor seal abundance has exhibited a decline throughout much of its Alaska range; abundance in the North Aleutian Basin has declined by 58%. Harbor seals in Alaska have been provisionally grouped into several genetic units, and harbor seals in the North Aleutian Basin may belong to a separate stock.

Critical information needs for harbor and spotted seals in the North Aleutian Basin include (1) seasonal movements, (2) seasonal habitat selection and use, and (3) age-specific dispersal patterns. This information may be best obtained through the use of satellite tagging.

Questions and Comments from the Audience

- Question: Were the comparative photos that were presented of rookeries taken at the same time each year when the animals would be expected to be in these locations?

Answer: Yes, all photographs were taken in July.

- Question: Did the dates of photographs and subsequent conclusions take into consideration annual changes in temperature? Could it be that animals were elsewhere because of annual differences in water temperature?

Answer: It is unlikely that seals were somewhere else because of water temperature differences. If large numbers occurred elsewhere, they would have been noticed during surveys.

- Comment: One needs to know spatial patterns of resource use to identify where the risks are relative to potential areas of development. In the 1980s, there was a lot of modeling done on oil spill risk for areas where seals and sea lions occurred. One needs to use GIS data for that purpose and to determine acoustic impacts. That information helps in making decisions regarding impacts.

Response: Focusing on seasonal and spatial components on a regional scale is a good approach. Finer details can be evaluated once broad patterns are identified. We really do not know what is going on for the Steller sea lion, spotted seal, and harbor seal in the North Aleutian Basin and Bristol Bay.

3.15 RIGHT WHALES AND OTHER CETACEANS IN THE NORTH ALEUTIAN BASIN¹⁸

Several species of cetaceans occur, at least during some part of the year, within the North Aleutian Basin, including the North Pacific right whale, humpback whale (*Megaptera novaeangliae*), fin whale (*Balaenoptera physalus*), and several other cetacean species in the Basin.

¹⁸ Presented by Philip Clapham, National Marine Mammal Laboratory

North Pacific Right Whale

There are three species of right whale: the North Pacific right whale (*Eubalaena japonica*), the North Atlantic right whale (*E. glacialis*), and the Southern Hemisphere right whale (*E. australis*). The North Pacific right whale, which is critically endangered, is currently recognized to consist of separate eastern and western North Pacific populations.

Right whales belong to a group of planktivorous whales that likely arose in their present form around 8 million years ago. They reach a length of 20 m and a weight of 106,000 kg. Distinguishing features include a black, robust body lacking a dorsal fin and rough, light colored patches found on the head, chin, jawline, and above the eyes. These patches are collectively known as callosities, which provide habitat for whale lice. Callosities do not change much over the lifetime of an individual and their pattern is used to identify individuals in the population.

Whaling for this species in the north Pacific began in 1835 on the Northwest Ground, and whalers moved into the western North Pacific by 1845. Between 21,000 and 30,000 whales were killed in the 1840s, and by 1849 the population was depleted. Some whaling for this species continued into the early 20th century. This species has continued to decline in abundance since that time. There were approximately 598 sightings of right whales in the eastern North Pacific between 1941 and 1964, but only 82 sightings between 1965 and 1999. This decline in whale abundance is believed to be due, in part, to illegal Soviet whaling activities that killed 372 whales (251 in the Gulf of Alaska and 121 in the Bering Sea) between 1963 and 1967. Soviet whaling activities also killed many whales in the Sea of Okhotsk in the western North Pacific. As a result of these past whaling activities, the eastern stock of the North Pacific right whale is considered the most endangered stock of large whales in the world.

Since 1979, a number of research efforts that are focused on cetacean distribution and abundance have occurred in Alaskan waters, and dedicated surveys documenting right whale presence and absence in the southeastern Bering Sea have taken place since 1998. In addition to aerial surveys in the Bering Sea, marine mammal observers on fishing vessels and National Oceanographic and Atmospheric Administration (NOAA) ships are used to collect sightings under the NMFS Platforms of Opportunity Program. Surveys conducted between 1979 and 2005 have sighted whales within the North Aleutian Basin and in the immediate vicinity of the Sale 92 Area.

An evaluation by Townsend of whaling log data for the North Pacific, north of 40 degrees latitude, indicate a harvest of over 2,000 right whales between 1839 and 1904, with 90% of the whales caught by 1859, and more than 1,000 of this catch occurring east of 180 degrees longitude. Most of the reported catch was from the Gulf of Alaska and south of the Alaska Peninsula; 90% of these whales were killed within a 20-year time period. It is important to note that in densely packed areas such as the Gulf of Alaska, up to 20% of the catch data may not have been included in the whale log data evaluation. In the Bering Sea, most whaling occurred in August and September, while south of the Aleutian Islands, most of the whaling occurred in May and June and in the Gulf of Alaska in June and July. All of the takes south of the Aleutian Islands occurred in waters greater than 2,500 m deep; at least 80% of the harvest in the Gulf of

Alaska occurred at this depth or greater as well, while in the Bering Sea over 90% occurred in shelf waters less than 200 m deep.

The greatest change from the 1800s to the 1940s is the number of North Pacific right whales found in slope waters of the southeastern Bering Sea. Also in the 1920s, right whales were taken by shore whalers in the vicinity of Unimak Pass. The right whales in steep slope waters were reported by Japanese catcher boats from 1941 to the early 1960s and six whales were harvested under scientific permit. The illegal Soviet harvest of 121 right whales occurred in the shallow shelf waters just west of Bristol Bay in the late 1960s. The Japanese also reported right whales in shelf waters in the late 1960s but exact locations were not provided. Most of the whales were observed in June and July.

Sighting from 1982 to present have been largely in the eastern Bering Sea (western North Aleutian Basin), although survey efforts have not been extensive in slope waters of the Bering Sea. One survey did explore offshore waters south of the Aleutians, but this occurred in August, which may have been a bit late in the season for detecting right whales because Townsend reported most in May and June and Japanese catcher boats saw almost all in June and July. Most of the recent sightings occurred in July, though sightings were reported as early as April (near Unimak Pass) and as late as October.

Many of the sightings from 1924 to 1967 were along the periphery of the Townsend whaling data. Shore whaling stations on Kodiak Island recorded right whales from May through September, while kills by stations operating in British Columbia near the Queen Charlotte Islands occurred in June. In the early 1960s, Japanese catcher boats reported whales in July and August and three whales were harvested under scientific permit near Kodiak Island.

Soviet whalers illegally harvested 251 right whales between 1963 and 1966 near the Patton Seamount. A few sightings by weather ships and a sighting of about 200 right whales by Soviet vessels (it is not clear if all of these sightings were in the same area) were reported as far south as 50 degrees latitude. Japanese sighting efforts continued from 1967 to 1990 and whales were observed throughout the Gulf particularly near the Queen Charlotte Islands, but exact dates and sighting locations were not provided.

Between 1979 and the present, a group of four right whales were seen very early in the season in March near Yakutat Bay, and one animal near Kodiak in July 1998 and in August 2004. However, survey effort has not been extensive over the abyssal plain of the Gulf of Alaska. The right whales seen off Kodiak were among a large group of humpback whales feeding at the surface.

Acoustic monitoring has detected right whale calls in the eastern Bering Sea and Bristol Bay, and at two locations south of the Alaska Peninsula in the Kodiak area. No calls were detected elsewhere in the Gulf of Alaska or the vicinity of the Queen Charlotte Islands. Right whales have recently been reported in the immediate vicinity of the Sale 92 Area from satellite-tracking data from a tagged whale, 2004 acoustic detection data, and encounters with 17 individuals.

From these sighting and catch datasets, it appears that right whales do not have a particular depth preference. Much of their feeding occurs in the summer months when their primary prey is most abundant. Concentrations of these calanoid copepods are found throughout the Gulf of Alaska, in the steep slope waters of the Bering Sea as well as on the Bering Sea shelf. From the few stomach samples available, right whales appear to be targeting the calanoid species that make up the greatest biomass within these areas, regardless of whether they occur over shallow or deep water.

If right whales opportunistically take advantage of any large concentration of prey and do not appear to prefer inhabiting a particular depth, should the entire Bering Sea and Gulf of Alaska be considered important habitat?

Threats to the right whale may include entanglement with fishing gear and ship strikes. There have been no reported ship strikes and only one entanglement incident, but minimal effort was made to evaluate these threats. Basic research is needed on the abundance and distribution of right whales in the North Aleutian Basin. Because year-round surveys are impractical, this information may be obtained more readily using satellite tagging, acoustic monitoring, ecological studies, and predictive modeling.

Humpback Whale

There is only one species of humpback whale. It occurs worldwide and is considered endangered. The North Pacific is home to four breeding populations. There is no overall abundance estimate for the humpback whale, but its numbers are clearly on the rise. The North Pacific feeding ground for this species includes the North Aleutian Basin and the western portion of the Gulf of Alaska. In the summer of 2000, the abundance of this whale in the eastern Bering Sea was estimated at 102 individuals.

While humpback whales are present in the Bering Sea, it is not conclusively known whether these animals belong to the Western or Central North Pacific stocks. Between 1999 and 2004, vessel and aerial surveys have reported humpback whales from northern Bristol Bay, near Unimak Pass, north of the Sale 92 Area, and along the southern edge and within the Sale 92 Area.

Fin Whale

There is only one species of fin whale. Like the humpback whale, the fin whale occurs worldwide and is considered endangered. There is no population estimate for the North Pacific population. Two stocks (Eastern and Western) occur in the North Pacific, and it is not known whether they may be mixing in the Bering Sea. Based on 1999 and 2000 vessel surveys, the population on the southeastern Bering Sea is estimated at 683 animals. Abundance estimates for the eastcentral Bering Sea are nearly five times higher, with most sightings in this area occurring along a zone of particularly high productivity along the shelf break. Between 1999 and 2004, surveys have observed fin whales within the Sale 92 Area, immediately north of the Sale 92 Area, and along the southern edge of the Sale 92 Area.

Other Cetaceans

Other cetaceans in the North Aleutian Basin include the Pacific white-sided dolphin (*Lagenorhynchus obliquidens*), the killer whale (*Orcinus orca*), the harbor porpoise (*Phocoena phocoena*), Dall's porpoise (*Phocoenoides dalli*), the gray whale (*Eschrichtius robustus*), and the minke whale (*Balaenoptera acutorostrata*). The North Pacific stock of the Pacific white-sided dolphin is classified as a strategic stock under the Marine Mammal Protection Act (MMPA). The stocks of the other species are not considered strategic. Minke whales have been sighted within the Sale 92 Area, while minke and gray whales have been observed along the southern edge of the Sale 92 Area. The Pacific white-sided dolphin, the killer whale, the harbor porpoise, and Dall's porpoise have been observed from within and along the southern boundary of the Sale 92 Area.

Summary

Many cetaceans live in the Sale 92 Area. While many occur year round, their occurrence is poorly understood. Of biggest concern are the right whales.

Basic research is needed on the abundance and distribution of cetaceans in the North Aleutian Basin. Because year-round surveys are impractical, this information may be obtained more readily using satellite tagging for right, humpback, and fin whales; acoustic monitoring to evaluate occurrence and changes in distribution and in vocalization rates following seismic or industrial activity; and ecological studies of right whales.

The North Aleutian Basin contains right whale critical habitat and is a feeding ground for several species. Potential development areas likely occur in the migratory path of the large whale species. All three listed whale species migrate through Unimak Pass. It is not known how seismic surveys in the North Aleutian Basin may affect passage through the pass. Closely related bowhead whales are known to divert from their migratory path at received sound levels of 120 decibels, which may occur 80 km from the seismic source. It is critical to understand the responses of listed species during feeding and migration to better identify mitigation and monitoring requirements.

Questions and Comments from the Audience

- Question: How many right whales could we afford to lose from this population before driving it into a downward trend?

Answer: No one has determined that number because data are not available, but since there are fewer than 100 animals, and possibly far fewer, we do not want to lose a single animal. Population modeling has been conducted for the North Atlantic population, which contains about 300 animals. That model is somewhat controversial, but suggests that the loss of even a couple of females per year would accelerate a trend towards extinction in less than 200 years. The calculated safe level of removal is zero in the North Atlantic.

- Question: Are any of the recommended studies of Pacific right whale more important than others?

Answer: No, all of the identified studies are of equal importance.

3.16 THE NORTH ALEUTIAN BASIN: NORTHERN SEA OTTERS AND PACIFIC WALRUS¹⁹

The northern sea otter (*Enhydra lutris kenyoni*) occurs in nearshore coastal waters of the United States from the Aleutian Islands to California. There are three stocks in Alaskan waters: the southeastern Alaska stock, the southcentral Alaska stock, and the southwest Alaska stock. The southwest Alaska stock occurs from the Aleutian Islands, through the Alaska Peninsula, to lower western Cook Inlet, including the Kodiak archipelago. The area occupied by the southcentral Alaska stock includes Prince William Sound, Kenai Fiords, and Kamishak Bay, while the southeast Alaska stock extends from Yakutat Bay to Prince of Wales Island.

Once the Bering expedition had “discovered” Alaska, sea otters were hunted to the brink of extinction by Russian and, later, American fur hunters. When the species was finally protected by international treaty in 1911, there were only 13 remnant colonies, and it is estimated that only 1,000 to 2,000 sea otters remained worldwide. Six of these remnant colonies occurred within the range of the southwest Alaska stock. In the absence of commercial hunting, the remaining sea otter colonies grew rapidly and began to re-occupy their former range.

Recent surveys indicate that the sea otter population in southwest Alaska has undergone a dramatic decline in the past 10–20 years. Population surveys conducted in 1986 along the northern coast of the Alaska Peninsula in the vicinity of the Sale 92 Area found many offshore concentrations of sea otters. Surveys conducted in 2000 showed a considerable decrease in the abundance of northern sea otters in this area. Also, in 2000, fewer animals were seen away from shore, and higher concentrations were observed in coastal habitats, especially in the vicinity of Port Moller and Nelson Lagoon.

Conservation concerns for northern sea otters include:

- Oil and gas transport and spills,
- Improper waste disposal in nearshore marine waters,
- Chronic disturbance,
- Entanglement in fishing gear,
- Vessel strikes, and
- Disease.

Human activities may affect a variety of sea otter behaviors, including grooming, foraging, or resting. Unlike seals, sea lions and whales, sea otters lack a blubber layer, and maintain their body temperature in the cold waters through the insulation of their fur and a high

¹⁹ Presented by Angela Doroff, USFWS

metabolic rate (2–3 times the resting metabolic rate of a terrestrial animal). Disturbance of resting behavior may cause sea otters to deplete their energy reserves and thus may affect growth, reproduction, and survival. Changes in sea otter activity patterns may deplete an otter's energy reserves; in areas where food is limited, sea otters may spend 50–60% of their day foraging. Disturbance may cause exclusion of individuals from preferred resting, foraging, or pup-rearing habitat.

Sea otters are also sensitive to contaminants and waste discharge. Contaminants and waste products such as fish offal may directly cause mortality or may reduce resistance to disease. When pollutants such as oils come in contact with the sea otter's fur, they can foul the fur and reduce its insulating ability. Any pollutant that damages the insulating value of the fur may result in hypothermia and potentially death.

While we know much about the life history of the northern sea otter, there are some important data gaps for the population present in the North Aleutian Basin region. The population surveys conducted in 1986 and 2000 indicate a downward population trend as well as a change in the distribution of sea otters in the vicinity of the Sale 92 Area. The basis of this observed decline and change in distribution is unknown. Habitat use of northern sea otters in this area is also not well understood, especially with regard to seasonal and annual movement patterns and the prey base for this population. The health and condition of northern sea otters in this area is also not well understood. Conservation and management priorities to address these data gaps include:

- Population surveys for sea otter abundance and distribution involving systematic surveys of sea otters in nearshore and offshore habitats;
- Longitudinal studies of sea otter survival, reproduction, and movement involving the use of radiotelemetry studies to assess population demography; and
- Health and condition studies of free-ranging northern sea otters, involving the capture of individuals to assess health, condition, and potential disease agents.

The North Aleutian Basin historically supported the largest populations of Pacific walrus (*Odobenus rosmarus divergens*) in the world. The population ranges throughout the Bering and Chukchi Seas, occasionally moving into the East Siberian Sea and the Beaufort Sea. During the late winter breeding season, large breeding aggregations of walruses form in the broken pack ice of northwestern Bristol Bay; one of three known breeding grounds of the Pacific walrus population. The specific location of breeding aggregations is thought to vary with sea ice conditions and weather patterns. The number of animals that overwinter in the Bristol Bay region is poorly known. In April and May, female walruses and their dependent young migrate out of the region following the receding pack ice to summer feeding areas in the Chukchi Sea. Several thousand animals, primarily adult males, remain in Bristol Bay through the ice-free season, foraging on rich beds of benthic invertebrates and resting at isolated coastal haulout sites.

The most heavily used coastal haulouts sites in Bristol Bay are located at Round Island (within the Walrus Islands State Game Sanctuary), Cape Peirce and Cape Newenham (located on the Togiak National Wildlife Refuge), and Cape Seniavin on the Alaska Peninsula. Less

consistently used haulouts form at Cape Constantine, Amak Island, The Twins, Crooked Island, High Island, and Hagemeister Island.

Activity patterns of Pacific walruses include long foraging excursions from the haulouts that may be 4–10 days in duration. Post-trip haulout duration is typically 1–2 days. Walruses travel up to 130 km from the haulouts during these foraging excursions. The distance traveled is likely a function of prey density; however, the status of walrus food stocks in Bristol Bay is not known.

Walruses are highly sensitive to disturbance. They often flee haulouts in response to the sight, sound, or odor of humans and machines. Disturbance events occasionally result in animal injuries and mortalities. Because walruses are obliged to haulout to rest between feeding bouts, secondary effects on animal condition may also occur when chronic disturbance events disrupt normal haulout behavior. The potential for long-term displacement of animals due to continuous or regular and frequent disturbances at the haulouts is also of concern. There is some historical evidence of coastal walrus haulouts being abandoned as a result of prolonged or repeated disturbances. The abandonment of preferred haulout locations could displace animals from preferred feeding areas or require them to travel greater distances to reach the nearest refuge.

Little information is available to assess the extent or effects of offshore disturbances to walruses in the Bristol Bay region. Walruses may respond to disturbances by moving away from important feeding areas. Changes in distributions and abundance that prevent a species from exploiting its prey base in the most efficient manner could result in long-term changes in survival and abundance.

Primary conservation concerns associated with oil and gas exploration and development in the North Aleutian Basin and effects on Pacific walrus are:

- Introduction of noise and related disturbance from oil and gas activities that could disturb adults and young in breeding, resting and foraging areas; and
- Exposure of walruses, their habitats, and their prey base to pollutants released by local and distant pollution sources.

Research and monitoring priorities to address data gaps in our knowledge and understanding of the ecology of the Pacific walrus in the Basin, and of how the Pacific walrus population might be affected by oil and gas development in the Sale 92 Area, include:

- Identification and delineation of important foraging areas;
- Investigation of seasonal distributions and haulout use patterns, with emphasis on use of the Cape Seniavin walrus haulout on the Alaska Peninsula;
- Investigation of the responses of Pacific walrus to vessel and aircraft traffic and seismic operations; and
- Modeling of oil spill trajectories related to breeding, feeding, and resting areas and evaluation of potential effects of spills on walruses, prey species, and habitats.

4 WORKING GROUP PROCESS AND FINDINGS

On the second and third days of the meeting, participants broke into five working groups, each facilitated by an Argonne staff member. The five working groups included (1) physical oceanography, ecosystems, and fate and effects; (2) fish and commercial fisheries; (3) birds; (4) marine mammals; and (5) socioeconomics and subsistence. This section summarizes the process and findings of each working group.

4.1 OCEANOGRAPHY, ECOSYSTEMS, AND FATE AND EFFECTS

The Oceanography, Ecosystems, and Fate and Effects of Oil Spills Working Group evaluated the knowledge base of studies completed for Bristol Bay and the Bering Sea and recommended a suite of further studies to address deficiencies in information needed to support environmental assessment and decisionmaking for oil and gas leasing. The topic of oceanography included the physical, chemical, and biological environment of open waters. The ecosystems topic included marine, freshwater, and terrestrial habitats of potentially affected areas. Fate and effects included oil and gas exploration, development, and production; transportation of workers, equipment, and petroleum products; and construction and maintenance of infrastructure.

The working group was facilitated by Elisabeth Stull of Argonne. The group included representatives of Aleutians East Borough, EPA, NMFS, MMS, University of Alaska-Fairbanks, National Weather Service, Naval Post Graduate School, and USFWS (Appendix A, Table A-2).

Working Group Process

At the beginning of the session, participants introduced themselves and gave a brief description of their backgrounds and interests. The moderator gave a presentation on the purpose, goals, and proposed methodology for identifying high-priority studies. Participants then discussed the proposed working group methodology and how it could be adapted for use in the working session. MMS described three phases of environmental review that would be required for potential leasing and oil and gas development: (1) an EIS prior to a lease sale, (2) a post-lease environmental assessment on exploration activities, and (3) an EIS for the development and production plan.

The working group first addressed the definition of impacted resources and resource attributes. Ecosystem resources were easily identified by community name, such as benthos or coastal lagoons. However, the definition of impacted resources in the areas of oceanography and fate and effects was more difficult. In these topical areas, the important environmental elements were best described as a process or a characteristic of the physical environment that either determines fate and effects or supports biological communities. The working group identified 24 key ocean processes, environmental characteristics, habitats, or ecological communities that were to be considered “impacted resources” Table 3 lists these resources and identifies why they were considered important to the group.

TABLE 3. Affected Resources Identified for Further Evaluation in the Oceanography, Ecosystems, and Fate and Effects Working Group

Resource	Importance
Water quality	Regulatory and public concern
Air quality	Regulatory concern, health
Sediment quality	Contaminants, environmental indicator
Existing contaminants	Natural and human causes
Sediment description	Ecology, fate of contaminants
Benthos	Ecology, trophic importance
Eelgrass communities	Ecosystem, keystone community
Intertidal community	Habitat, ecosystem
Terrestrial communities	Habitat disturbance
Wetlands	Important habitat
Lakes and streams	Habitat disturbance
Primary productivity	Food web, trophic importance
Secondary productivity	Food web, trophic importance
Nutrient dynamics	Crucial process
Coastal flow	Crucial process
Regional circulation	Crucial process
Fronts and stratification	Crucial process
Waves	Contributory process
Sea ice	Contributory process
Tides	Pollutant distribution
Storm surges	Contributory process
Meteorology	Crucial process; wind circulation
Spill occurrence probability	Natural and human causes
Geologic hazards	Contributory process

The working group attempted to assign priorities to these resources and attributes, but almost all of them were viewed as high priority. Further evaluation by the group was needed to prioritize the resources and attributes. This evaluation first examined the strength of the linkage between the resource and development activity and the relative magnitude of impact. While this first step proceeded smoothly for communities and habitats, the rest of the linkages and resources did not fit neatly into this structure. The affected resources were often linked to a chain of events that resulted in an impact from oil and gas development. For instance, coastal circulation was not seen as being affected directly by oil and gas development activities, but it was a critical element

in the distribution of spilled oil to marine habitats and species. Because of the web of connections between oil and gas exploration and the rest of the list of affected resources, the linkage evaluation was not useful for many resources listed in Table 3.

The participants discussed different approaches for prioritizing resources and attributes, but decided to proceed directly to determining critical information needs by examining the high-priority environmental impacts of oil and gas activities and high-priority resources. Priority was determined by the magnitude of the effect; spatial extent of the effect; and existence of environmental controls, regulations, and industry practices to mitigate impacts. Both primary and secondary impacts were considered in the working group's evaluation.

Working Group Findings

Water Quality. There are many potential sources of impacts to water quality from oil and gas development. Activities associated with routine operations are regulated and mitigated by environmental controls at the impact source. Methods of controlling and mitigating the impacts of accidents have been developed and are well described. While site-specific information on water quality in the location of potentially affected areas is not well developed, the mechanisms of impacts of oil and gas development are well known. Impacts from routine operations are tightly regulated and the industry has well-developed control and mitigation practices. However, in the case of an oil spill, the impacts can be far-reaching and difficult to mitigate. These impacts have received extensive study for the *Exxon Valdez* oil spill; however information is lacking for assessment of oil spills in the area affected by the proposed leasing. The missing information which is important for water quality analysis is baseline information. The working group determined that this information would most likely be developed as part of permitting, and no study profile was developed.

Sediment Quality. While there could be impacts to sediment quality during drilling operations, the working group did not give them a high priority because such impacts would be localized. However, impacts to sediment quality from accidental oil spills could be far reaching. The working group identified critically important information that was needed to assess the potential impact of an oil spill on sediment quality. Baseline characteristics of existing sediment quality in the lease area and other potentially affected areas are a key information need. Although the mechanism and types of impacts to sediment quality are fairly well known, the assessment of the magnitude, duration, and potential mitigation of oil spill impacts would require a description of sediments in the affected area, and that information is currently missing.

Benthic Communities. Benthic communities could be affected both by oil spills and by drilling and trenching. Studies on the *Exxon Valdez* oil spill have provided information on the impacts of oil spills on benthos in general. However, the benthic communities of potentially affected areas and along transportation routes have been poorly described. There is a critical need for baseline information describing the benthic communities that could be affected by oil and gas development. This is essential data for impact assessment. At a minimum, benthic surveys of the areas of potential lease sales and nearshore environments are needed.

Eelgrass Communities. Eelgrass communities found in the coastal lagoons are of global importance to migrating waterfowl and shorebirds. Information on the distribution of eelgrass communities and a determination of food web linkages within the eelgrass community are necessary for assessing the primary, secondary, and cumulative impacts of pipeline trenching and oil contamination. Development of potential mitigation procedures also requires this information.

Intertidal Communities. Detailed descriptive information on intertidal communities in the vicinity of the lease-sale area is scarce; however, Environmental Sensitivity Index maps have been developed by NOAA for emergency planning. Intertidal communities could be seriously affected by oil after a spill, and intertidal communities could also be disturbed in the vicinity of pipeline construction. Rocky intertidal areas contain important habitats for marine mammals. While the types of impacts from oil contamination on intertidal communities are known from studies of the *Exxon Valdez* oil spill, assessment in the proposed lease area requires information specific to the Bristol Bay shoreline.

Terrestrial Communities, Lakes, Streams, and Wetlands. The terrestrial communities, lakes, streams, and wetlands potentially affected either by development of transportation networks or by an on-land petroleum spill in this part of Alaska have not been described in detail. The specific impacts of development of the offshore leases on terrestrial communities, lakes, streams, and wetlands are not known, because information is missing on the details of the location of habitat disturbances by pipeline, road, and other infrastructure construction. Information on habitat descriptions and the locations of onshore activities are judged to be critically important. The working group discussed whether this information need was identified by any other working group.

Primary Productivity. The working group discussed the impacts of oil and gas development on primary productivity and plankton. The highest priority information need identified was related to accumulation of oil at the edge of sea ice. The sea ice edge is an important habitat for marine mammals and sea ducks. While research priorities developed for these animals was the assignment of other working groups, the sea ice edge is also an area of high productivity of marine plankton. The working group identified the study of primary productivity at the sea ice edge as a way to assess the impact of oil contamination.

Physical Oceanographic and Atmospheric Factors. The working group discussed the state of knowledge of physical oceanographic and atmospheric factors that determine the distribution and fate of contaminants (including oil) that could arise from all phases of oil and gas development. Of these factors, regional circulation in the Bering Sea and Bristol Bay during the summer period is the best known. However, regional circulation patterns during the winter are poorly known. Information is also not available on coastal flow and wave patterns in the vicinity of the lease area, fronts, and stratification in Bristol Bay and the Bering Sea, and marine weather in the lease area. All of these factors are essential for modeling the distribution and fate of waterborne contaminants. It is not reasonable to assume that oil release in the marine environment would occur only during clement weather in the summer. Oil releases may be as likely in the autumn and winter when migrating birds are using nearby habitats and sea ice habitats of marine mammals and sea ducks are closer to the lease area. Information to be used to model the fate of

oil contamination in the autumn and winter is critical. The working group identified the following physical studies as of critical importance:

- Seasonal observation and modeling of coastal flow,
- Description and modeling of seasonal and inter-annual regional circulation,
- Statistical baseline study of waves in the lease area,
- Continued observation of sea ice,
- Determination of tidal exchanges in passes and lagoons, and
- Weather observations at the sea surface in the lease area.

Summary. On the basis of the discussions and findings of the working group, study profiles were developed for physical oceanographic studies and ecosystem studies. Physical oceanographic studies were linked to provide a sound basis for modeling and predicting the fate of oil and other contaminant releases. Ecosystem studies were developed to describe the most poorly known systems, and those that would be the primary receptors of contaminants. The working group developed the following study profiles:

- Modeling of circulation,
- Physical oceanography field program,
- Implementation of a meteorological buoy,
- Mesoscale meteorological modeling,
- Characterization of sediments,
- Characterization of benthic communities,
- Determination of the biological productivity of the sea ice edge,
- Characterization of eelgrass communities, and
- Characterization of intertidal communities.

Individual study profiles are presented in Appendix C (Section C.1).

4.2 SOCIOECONOMICS AND SUBSISTENCE

The issues covered under the Socioeconomics and Subsistence Working Group included a broad range of topics related to culture and human society — economic structure, income, pursuit of traditional lifeways, demographics and immigration, public services, and other social, economic, and cultural attributes. Subsistence discussions focused on the exploitation of natural animal and plant resources harvested for personal use and local exchange. There exists considerable overlap between socioeconomics and subsistence. While the working group attempted to keep topics distinct or separate, it was acknowledged by most participants that it would be virtually impossible to separate certain socioeconomic issues from subsistence, and vice versa.

Larry Gorenflo of Argonne facilitated the working group discussions. The names of participants and their affiliations appear in Appendix A (Table A-2). The group consisted of about 20 individuals, with people moving in and out of the session over the two days. The working group comprised a broad array of individuals, including several representatives from the MMS who served as observers and who could answer questions on MMS roles and responsibilities related to leasing activities. Representatives from other federal agencies and the state of Alaska also participated. Many individuals who live in the North Aleutian Basin and represent local peoples (including Alaska Natives) attended the working session, and provided some of the most important information in the working group.

Working Group Process

The Socioeconomics and Subsistence Working Group began working through a series of worksheets designed specifically to guide discussions and develop systematic information on possible impacts of oil and gas development. The group began with a worksheet on impacting factors, in an attempt to identify the consequences of oil and gas development that would affect socioeconomics and subsistence. After a period of discussion and debate, the group decided to revise the original worksheet format for developing study profiles.

The group decided to identify a process to enhance group interaction, facilitate communication, and address data needs while including the views of a diverse group of individuals from a broad range of backgrounds. The working group decided to try to generate discussion by asking each participant their thoughts and ideas on two topics — the important impacts of oil and gas development and the type of information necessary to evaluate these impacts. This process is similar to discussions often held in rural Alaska and was familiar to most working group participants. The group spent the remainder of the first day of the session using this process to discuss subsistence, and decided to focus on socioeconomics during the first half of the next day.

Once the facilitator and group recorded the comments of the group on socioeconomics and subsistence, the group turned its attention toward generating study profiles. The facilitator and a typist recorded information from the group's discussion on a flip chart and on a computer; the latter projected the information onto a screen in front of the meeting room. The group then went through the main headings of a study profile: information needs, total cost, organization conducting the study, description (objectives and methods), and the data information is required. The information for these categories was obtained by drawing upon the information developed during the discussions to outline study profiles for socioeconomics and subsistence.

Working Group Findings

Subsistence. The main concerns of the working group, expressed particularly by group members who live in local communities, revolved around subsistence. Group members expressed great concern that oil and gas development might have adverse effects on subsistence activities, primarily through affecting the resources themselves, but also through interrupting subsistence harvests (e.g., through noise and additional air and water traffic) and by introducing additional people to the region who might compete for subsistence resources. Several working group

members stressed the importance of taking explicit steps to ensure that such impacts did not occur, thereby ensuring the continuation of subsistence and the important economic and cultural roles that it plays. The working group discussed and identified the need to verify that mitigation strategies and procedures have been effective in protecting human communities from the adverse effects of oil and gas development on the North Slope of Alaska. The need for such research achieved broad consensus within the group. An MMS annual study plan already includes an active profile for such a study (entitled *Aggregate Effects Research and Environmental Mitigation Monitoring of Oil Operations in the Vicinity of Nuiqsut*). The working group endorsed that existing study profile rather than develop a new profile on the topic.

Working group members discussed a range of subsistence resources, including marine resources (invertebrates, mammals, and fish), terrestrial mammals, and birds. Although several group members declined to rank one above another, marine resources emerged in the discussions as the most important (particularly fish), followed by the variety of birds that migrate through this region, and then terrestrial mammals. Group members mentioned not only possible oil and gas-related impacts, but also the timing of impacts, such as important bird migration or fish spawning periods.

Working group members noted the need to systematically obtain data to identify current subsistence behavior in the North Aleutian Basin. It was generally agreed that the most systematic efforts to obtain such data were the community surveys conducted by ADFG Division of Subsistence, though some participants questioned the accuracy of certain types of information (such as mapped subsistence use areas) due to a propensity of subsistence practitioners to keep this information secret from others. Group members also mentioned that data obtained by these surveys currently are quite old, thus identifying a need to update past surveys with new efforts to identify current baseline subsistence conditions. Finally, group members recommended supplementing the standard ADFG surveys with additional information, notably information on issues such as sharing resources, the timing of subsistence activities, and how economics of the household affect subsistence activities. These supplemental topics appear in the subsistence study profile presented below.

Socioeconomics. Working group members conveyed major concerns about the socioeconomic impacts of oil and gas development. The main concern, by far, was the potential impact on the fishing industry, which is a major source of income for area residents that already has suffered and is susceptible to impacts. Other issues raised by working group members included the ability of local communities to accommodate an influx of new people (and provide infrastructure and services required by these additional people), the post-oil and gas development period where the added infrastructure remains in local communities (but lacks funding for adequate maintenance), potential impacts on local life of major shifts in the economy, and the need for the oil and gas industry to hire local people not only for lower level jobs, but also for higher level positions.

Working group members generally agreed that much of the necessary data already exist to define socioeconomic baselines for communities in the North Aleutian Basin. Participants suggested that various data sources be considered, emphasizing local communities and the increasingly broad range of data collected on their residents. Once these data are compiled, any shortcomings could be identified with additional information obtained (if necessary) through

specific studies or surveys. In certain cases, notably the fishing industry and its importance to the region, working group members suggested coordinating socioeconomic data compilation with biological data, to better understand the status and behavior of the resources.

Summary. The Socioeconomics and Subsistence Working Group ultimately generated two study profiles, one for socioeconomic and one for subsistence. In each case, the profiles represented the highest priority issues and were determined necessary for EISs and assessments on leasing, exploration, and development and production activities. The aim of the socioeconomic study profile is to provide a detailed socioeconomic overview (baseline) of key communities in the North Aleutian Basin. The approach recommended is to synthesize existing socioeconomic data, using focus groups for certain types of qualitative data. The basis for the subsistence profile is updating ADFG surveys for key communities. The geographic focus of these updated surveys would be Cold Bay, False Pass, Nelson Lagoon, and three other representative communities to be named later (after further consideration). The full study profiles are provided in Appendix C (Section C.2).

4.3 FISH AND FISHERIES

The Fish and Fisheries Working Group addressed the potential of oil and gas development to affect key biological system components of fish and associated food chains and the commercial harvest of fish populations. The working group addressed fish distribution and abundance, data availability, key population issues, and linkages to other ecological resources or systems.

John Hayse of Argonne was the facilitator for this working group. Participants in the working group included representatives from NMFS, USFWS, MMS, ADFG, University of Alaska, Shell Oil Co., Native American Fish and Wildlife Society, Bristol Bay Borough, Aleutians East Borough, Lake and Peninsula Borough, and Bering Sea Fishermen's Association (Appendix A, Table A-2). Attendees also included local residents, commercial fishers and processors, and members of the Alaska Fisheries Development Association, the Alaska Marine Conservation Council, and Pacific Environment. Although there were 18 individuals that participated in most of the working group discussions, other individuals participated as they moved between concurrent working group sessions.

Working Group Process

The working group used worksheets to focus discussions on the fish and fishery resources within the North Aleutian Basin that were of greatest concern. Worksheets were used to guide discussions and record information from group discussions about the impacting factors associated with oil and gas development that were most likely to affect key resources. The group identified the level of understanding for various resources, as well as the effects of impacting factors on resource attributes. The group discussed and identified the type and coverage of available data, gaps in knowledge, and potential study topics. Finally, the group prioritized potential studies on the basis of the anticipated level of urgency for gathering information prior to oil and gas development and the importance of filling information gaps.

The working group session began with a brief introduction from the facilitator and a review of the objectives of the meeting as a whole and of the working group in particular. The group used a worksheet to record the results of discussions on impact duration and location.

The working group identified species and their attributes that were at risk from oil and gas development and the specific impacting factors that could affect those resources. In addition, participants discussed the current knowledge of fish and fishery resources (e.g., current condition, distribution, or status) and the degree to which species could be affected by offshore oil and gas development activities.

The group developed a list of potential study topics. To identify studies that should be conducted in the near-term, the working group discussed and developed an overall ranking for the study topics that considered the perceived importance of addressing an information need, the need to collect the information prior to or in the early stages of planning, and the anticipated levels of cost and effort. Perceived importance and urgency were of greater concern to participants than cost and effort.

Working Group Findings

A concern raised by many working group members was the incomplete understanding of the distribution and abundance of many of the important fishery resources within the North Aleutian Basin. In some cases (e.g., for salmon species) there was relatively good information available for some seasons of the year, life stages, or habitats, but very little information for others. Some information is available on adult salmon spawning migration pathways along the lower Alaska Peninsula and early smolt out-migration. However, where smolts occur outside of the early summer months, whether juvenile salmon inhabit the potential lease area during part of their maturation process, and the routes taken by migrating adults are not known. Knowledge of species distributions and abundance would be needed to better assess potential impacts and as baseline information to conduct monitoring. Collection of this baseline information was considered to be a high-priority item.

Oil and gas development within the Sale 92 Area also has the potential to affect fisheries within a wider geographic area, including adjacent offshore and nearshore marine areas and onshore freshwater areas. For example, impacts to a substantial portion of the adult salmon from specific stocks could result in reduced migration to spawning streams, continued harvest in the mixed-stock fishery, and subsequent long-term reductions in those stocks. This could, in turn, affect commercial and subsistence fisheries and the economies that are supported by the fisheries. There are similar situations with some other important species. For example, it is unknown whether herring stocks on the north side of the Alaska Peninsula differ from stocks on the south side, and, although smelt spawning areas are known, where they occur during other portions of their life history is not. For some species, there is only a general understanding of distribution during a portion of the year. For instance, there is only a limited understanding of adult flatfish location and habitat use in offshore locations during the summer and of forage fish habitat during spring and summer; distributions and habitat requirements during other seasons are not known. As a consequence, the group considered it important to develop adequate baseline information and evaluations of potential impacts for areas extending outside the Sale 92 Area.

The impacting factor of greatest concern to the group was potential oil spills from development activities. It was recognized that impacts of oil spills would depend on a number of factors, including spill volume, timing, location, and prevailing currents. Thus, it is critical to know which species and life stages are present, their location in the water column, seasonal abundance, and their susceptibility to oil. Tainting and the perception of tainting from an oil spill could have as great or greater impact on the fishery as oil contamination itself. The potential sensitivity of crabs to oil toxicity was of particular concern due to the importance of the crab fishery to local residents.

Concerns were expressed about the effects of seismic surveys on the behavior of species and life stages and on conflicts with fishery activities. In addition, there were concerns about the potential for invasive species to be introduced by oil and gas development activities and concerns that such introductions could lead to ecosystem-level changes. An ecosystem model could be useful in understanding these sorts of effects. Economic aspects of fisheries, associated with both subsistence and commercial fishing, also were discussed, although it was assumed that identification of necessary studies would be undertaken by the Subsistence and Socioeconomics Working Group.

The working group specifically discussed opportunities to collect fisheries information in conjunction with other resource studies and noted that coordinating these studies could improve the usefulness of the information. For example, opportunistic identification and sampling of forage fish at locations with concentrations of predators, examination of predator diets, and using satellite tags on predators to locate and track seasonal concentrations of prey fish species could result in a better understanding of the role of forage fish within the North Aleutian Basin ecosystem. Other cooperative studies could include identification of important subsistence harvest areas and surveys in nearshore areas and streams that could be affected by oil and gas development.

Members of the working group ranked study ideas from the group to identify priorities. Priority information needs and studies included:

- The impact of seismic surveys on fish. One suggestion was to compile historic information about locations of seismic surveys in the North Aleutian Basin and overlay fisheries data to evaluate if there were any detectable effects. However, it was noted that such a post-hoc study poses many statistical and scientific methodology problems and might not be feasible.
- Nearshore benthic fish distributions.
- Migration pathways for adult salmon.
- Late spring and early summer distributions of juvenile salmon, young-of-the-year pollock, and epipelagic fish species.
- Energy development conflicts with commercial fishing in the Sale 92 Area.
- Distribution and abundance of plankton (especially ichthyoplankton) within the North Aleutian Basin during May and September.

Because the time available to the working group did not allow development of detailed study profiles, study profiles provided by some participants were considered and adopted by the group. In total, there were nine study profiles related to fish and fisheries topics in five general study categories (Table 4). Five studies were proposed to collect data on the distribution and abundance of important forage and fishery species within the North Aleutian Basin that could be affected by oil and gas development and to use currently available data to evaluate the degree to which oil and gas development activities within the Basin are likely to affect or conflict with fisheries (full study profiles are provided in Appendix C, Section C.3). The four remaining study profiles address key issues, but the group did not feel these four profiles deserved priority attention.

TABLE 4. Fish and Fisheries Working Group Study Profiles

Study Category	Brief Description ^a
Information	Develop a Web-based Bering Sea fish catalog using existing NMFS and other data to evaluate potential for species of concern to occur in areas where oil and gas development would occur. Compile historical information about seismic surveys and fishery information in the North Aleutian Basin to evaluate whether there is evidence of potential effects.
Nearshore surveys	Conduct seasonal nearshore habitat assessments, evaluate juvenile fish abundance, and identify potential spawning locations for species of concern on the Bering Sea side of the Alaska Peninsula.
Salmon	Conduct late spring and early summer epipelagic surveys for juvenile salmon and young of the year pollock.
Fisheries	Evaluate potential for fishing gear conflicts with energy development in Sale 92 Area. Conduct local fishing community surveys and studies to predict potential impacts of oil spills and development on commercial and recreational fisheries and related economies.
Other	Conduct seasonal juvenile flat fish survey. Evaluate seasonal fish migration (especially cod and halibut) within the North Aleutian Basin. Conduct pelagic studies of plankton (especially ichthyoplankton) during May and September.

^a Priority studies identified by the working group are presented in bold type.

4.4 BIRDS

The Birds Working Group was assigned the task of developing study profiles that outlined high-priority research on seabirds and shorebirds needed to support environmental impact analyses of offshore oil and gas leasing in the North Aleutian Basin. John Krummel of Argonne facilitated working group discussions that included experts from USFWS, ADFG, Bureau of Land Management, MMS, and the University of Alaska-Fairbanks (see Appendix A, Table A-2). The working group included individuals with field and research experience in shorebird, sea duck, geese, and seabird ecology and management. In addition, over half of the group had direct field experience in the nearshore and sea areas of the Basin that contain important habitat for these bird populations (e.g., Izembek Lagoon National Wildlife Refuge, Nelson Lagoon). Local knowledge of habitat areas that could be within the range of influence of oil and gas leasing activities helped the working group better understand key research issues and set research priorities.

Three members of the working group provided overviews of the subject area at the beginning of the meeting. Kathy Kuletz summarized key issues related to seabirds and shorebirds, while Bill Larned and Chris Dau addressed sea ducks, geese, and important habitat issues in Bristol Bay and the Basin. The Basin contains world-class habitat that at certain times of the year supports a significant percentage of the world population of some species of seabirds and shorebirds, sea ducks, and geese. Extensive food resources in offshore, nearshore, and onshore habitats coupled with the northernmost icefree coastal areas in Alaska during the winter attract millions of resident and migratory birds.

Working Group Process

The facilitator outlined a proposed process that used worksheets to systematically outline issues and potential study needs. The working group had a number of questions related to MMS environmental impact analysis needs, schedule, and timing issues related to MMS oil and gas leasing activities. The MMS staff, who served as information resources on MMS needs and issues, provided summaries of the impact analysis process and how MMS used study profiles.

After initial questions and discussions, the group examined the first worksheet designed to help the group identify oil and gas development impacting factors, duration, and areas potentially affected. The group noted some new issues on the worksheet, but the members decided to forgo further review of the worksheet. The group then listed resources potentially at-risk to oil and gas development. Each member of the group was also asked to list their priority resources of concern. The outcome was an extensive list of resources for further consideration. The working group ended by focusing on three key issues: populations (species), food types (offshore, nearshore, and onshore), and key geographic areas important to bird population dynamics (breeding, feeding, and nesting). These categories also helped the group identify priority issues related to oil and gas leasing in the North Aleutian Basin.

The working group examined the remaining worksheets and decided that further use of the worksheets would be tabled; rather, the group would directly frame problem areas or study issues that could be developed into study profiles. Because the members of the group were

familiar with important bird issues in the Basin and the MMS resource staff were able to highlight the impact analysis needs of oil and gas leasing, the first day produced a list of preliminary study issues.

The discussion then moved to a set of questions posed by the group to the MMS staff on what type of information had been helpful in the past when examining leasing issues and associated data needs for impact assessments. The MMS staff explained how data were obtained and how data gaps were addressed. A long discussion ensued on data requirements for ocean spills analysis and how linkages between spills modeling output and impact receptors were evaluated by MMS staff. After these discussions were completed, the facilitator went over the study profiles template with the group.

Working Group Findings

The group selected six priority studies based on group consensus, and divided into small groups, with each small group assigned to complete a draft study profile. The study profiles reflected key issues discussed in working group discussions:

- Lack of current and reliable population census data based on statistically valid sampling methods,
- Little information about winter population sizes or distributions,
- Oil spills as potential catastrophic events to bird populations (especially rare or threatened and endangered species),
- Bird populations that are spatially clustered during breeding or while at feeding areas (high exposure consequence to spills),
- Birds attracted to light sources during migration or feeding (infrastructure development for oil and gas activities), and
- Spatially clustered populations of birds that represent a significant percentage of the total world population (exposure to disturbance or spills).

The working group was especially concerned about impacting factors from oil and gas development that could perturb birds when populations congregate in relatively small areas (island nesting areas, tidal flats, ocean feeding areas). Ocean spills were viewed as potentially catastrophic events that could significantly reduce total world populations of certain species. Other impacting factors (light, construction, and operation disturbances) could also significantly threaten bird populations if these factors affected clustered populations.

The working group agreed that scientifically valid surveys were needed to determine the seasonal locations of key bird populations. These survey data would allow MMS to determine the risk to populations from ocean spills. Current information on the location of birds does not have the spatial or temporal resolution to reduce the high level of uncertainty for modeling the impacts of ocean spills on bird populations. While nesting and nearshore areas are periodically surveyed, some in the group noted that the data have not always been systematically collected and analyzed with valid statistical approaches. For ocean areas, virtually no systematic surveys have been conducted to determine where birds feed and congregate.

Based on suggestions and discussions, the working group agreed to one final task at the end of the two day sessions: vote on ranking the six study profiles in terms of importance to the resource and MMS study needs for the leasing program. Each participant (not including the MMS staff and the facilitator) then anonymously voted for their top three study profiles. The results were tabulated and the profiles were then ranked from 1 (highest priority) to 6 (lowest priority).

The draft study profiles developed by the working group reflect the consensus professional opinion of the individuals who participated in the working group. The following study profiles were developed and are provided in Appendix C (Section C.4). They are listed in decreasing order of priority.

- Spatial and temporal distribution of Steller's eiders and other waterbirds,
- Spatial and temporal distributions of birds at sea,
- Seabird colony census and diet studies,
- Aerial remote sensing of distribution and abundance of eelgrass,
- Studies of the Izembek Lagoon and Port Moller Lagoon estuarine systems, and
- Spatial and temporal patterns of bird movements.

While process studies and linkages to other working group study priorities are noted, the birds working group strongly recommended that statistically valid seasonal (especially winter) population surveys should receive the highest MMS funding priority, especially for threatened and endangered species or to identify areas and times when a significantly large proportion of the world's population gathers in the North Aleutian Basin. The group also strongly advocated that bird surveys should not be conducted as "add-ons" to other research agendas (i.e., fish or marine mammals). In the past, bird observers have been placed on ships, but the sampling protocols have been dictated by other research priorities. Thus, many bird surveys are observations, rather than statistically valid samples.

4.5 MARINE MAMMALS

The Marine Mammals Working Group addressed each of the 21 marine mammals stocks that occur in the North Aleutian Basin but focused on threatened and endangered species and critical habitat. The working group was especially cognizant of the timing and scope of MMS leasing activities, because seismic studies could have potential impacts on many of the marine mammals in the Basin.

The working group session was facilitated by Ihor Hlohowskyj of Argonne. Participants in the working group included representatives from NMFS, USFWS, MMS, Shell Oil Co., ADFG, Aleut Corporation, and Aleutians East Borough (Appendix A, Table A-2). Representatives from other organizations also participated occasionally in the session as they moved among concurrent sessions of other working groups.

Working Group Process

The working group session began with a brief introduction from the facilitator reviewing the overall objectives of the workshop and working groups. Overall, the working group identified oil and gas development-related activities that could affect marine mammals in the Basin, identified and prioritized marine mammal resources, identified nine studies for consideration of funding, and prioritized the implementation of these studies based on an expected timeline of oil and gas activities related to potential development in the Sale 92 Area.

The working group used the first worksheet to identify oil and gas development impacting factors, impact duration, and the area potentially affected. Discussion focused on seismic survey studies, because these surveys likely would be the first activities initiated in the Basin related to lease sales and development in the Sale 92 Area. There was general agreement among the participants that seismic surveys should be the initial focus of the working group. Additional discussion dealt with the spatial scale to be considered, namely, whether studies should focus only on the Sale 92 Area or include other portions of the Basin. The group decided to focus on the Sale 92 Area, while acknowledging that an accidental oil release could very likely move beyond the Sale 92 Area boundary and affect marine mammals and their habitats in other portions of the Basin.

The working group used the second worksheet to identify and prioritize resources potentially affected by oil and gas development, but revised the worksheet extensively. The working group felt it appropriate to identify marine mammal stocks as the potentially affected resources because that is how the species are protected and managed. The group developed five categories of importance for marine mammal stocks:

- Listing status (endangered, threatened, or depleted);
- Stock status (population is increasing, decreasing, stable, or unknown);
- Availability of current abundance estimate (yes, no, or poor);
- Percentage of the stock potentially affected (small, large, or all); and
- Subsistence use (yes or no).

Each of the 21 marine mammal stocks that occur in the Basin were then evaluated with regard to these categories and given an overall importance ranking of moderate or high. A stock was automatically given a high overall importance ranking when it was either threatened or endangered, the stock was declining, or the stock represented a subsistence resource. None of the stocks were considered to be of low importance. Of the 21 stocks evaluated, 11 were given a ranking of high, including:

- North Pacific right whale;
- Fin whale,;
- Humpback whale, western Pacific stock;
- Humpback whale, central Pacific stock;
- Beluga whale, Bristol Bay stock;

- Steller sea lion, western U.S. stock;
- Northern fur seal, eastern North Pacific stock;
- Harbor seal, Bering Sea stock;
- Spotted seal, Alaska stock;
- Pacific walrus, Alaska stock; and
- Northern sea otter, southwest Alaska stock.

The working group then considered whether oil and gas exploration, development, and production in the Sale 92 Area has the potential to negatively affect the stocks using the following regulatory criteria:

- Adversely change a stock's population trajectory (MMPA);
- Adversely impact subsistence harvest (MMPA);
- Result in jeopardy of listed stocks (ESA);
- Adversely modify critical habitat (ESA); and
- Cause significant impacts (NEPA).

The working group felt that for each of the 11 high-importance stocks, oil and gas-related activities have the potential to adversely change a stock's population trajectory and cause significant impacts.

The working group next focused on identifying which of the following resource attributes was of most importance for each of the 11 high-importance stocks (using a modified third worksheet):

- Feeding;
- Resting (including haulouts, rafting areas, and nearshore areas);
- Reproduction (including mating, rearing, lactation, and other reproduction-related behaviors);
- Migration;
- Health; and
- Subsistence.

For the 11 high-importance marine mammal stocks, three resource attributes — feeding, reproduction, and health — were considered as potentially affected by oil and gas activities.

The working group then identified the important linkages between oil and gas activities and the 11 high-importance marine mammal stocks and their attributes. The current level of understanding of each stock's attributes and how those attributes could be affected by oil and gas activities was, in general, highest for the pinnipeds and the sea otter, and lowest for the cetaceans. Among all 11 stocks, the most commonly identified information need was related to

location: namely, the distributions of the stocks and locations of feeding, migration, and reproduction areas within the Basin and especially in relationship to the Sale 92 Area.

Major discussions during the working group sessions centered around three topics: (1) the need for studies to support MMS decisions regarding the granting of permits for pre-lease-sale seismic surveys in the Sale 92 Area, (2) the spatial boundaries that should be considered by the proposed studies, and (3) the need to link resource concerns and proposed studies to the needs of the MMPA, ESA, and NEPA.

Very early on, a discussion was initiated regarding the prioritization of data needs. It was pointed out that while leasing and development of the Sale 92 Area is dependent on a number of issues, regardless of the outcome of these issues, MMS can receive a permit request for pre-lease seismic exploration. Indeed, seismic surveys would certainly be the first major activity in the area should issues be resolved to allow for development of the lease-sale area. Therefore, it was strongly argued and subsequently agreed upon by the working group, that studies addressing the impacts of seismic surveys should receive highest priority for funding.

Issues related to the spatial scale that should be considered by the study profiles were discussed primarily with regard to three potential oil and gas-related activities: seismic surveys, accidental oil spills, and tankering on the Gulf of Alaska coast. Both seismic surveys and oil spills have the potential to affect marine mammal stocks outside the sale area proper. Seismic surveys have the potential to affect animals throughout the Basin, regardless of survey location, whereas permit applications for seismic surveys may be requested for any portion of the Basin. Accidental oil spills were also acknowledged to have the potential for affecting marine mammal habitats outside the Sale 92 Area, especially in the event of a catastrophic accidental release.

Finally, the known or presumed distributions of marine mammal stocks in the Basin is not restricted to the sale area, but includes other portions if not all of the Basin as well as areas beyond. The importance of Unimak Pass as a major corridor used by all listed cetaceans traveling between the Basin and the Gulf of Alaska was brought up on several occasions. Oil and gas production in the Basin would also require the construction and operation of storage and transportation facilities on the southern coast of the Alaska Peninsula, as well as tankering in the Gulf of Alaska of products from those facilities.

The third major area of discussion was related to the need to show what kinds of questions would be asked by the three major environmental regulations: MMPA, ESA, and NEPA. In other words, what are the questions that would be asked under each of these statutes when determining whether oil and gas development in the Basin could adversely affect marine mammal stocks in the Basin? Examination of these questions would help direct and prioritize study needs.

Work Group Findings

Nine study profiles were developed to address marine mammal issues in the Sale 92 Area and the North Aleutian Basin as a whole (Table 5 and Appendix C, Section C.5). These studies would provide important baseline information on the distribution, movements, and migration

patterns of marine mammal stocks within and through the Basin and their occurrence within the Sale 92 Area. The nine study profiles focus on nine of the 11 marine mammal stocks identified by the working group as having the highest importance for research and study profile development. Two stocks, the beluga whale Bristol Bay stock and the northern fur seal eastern North Pacific stock, are not directly addressed by the study profiles. No study profile was developed for the beluga whale because it was felt that the Bristol Bay stock would only be affected in the event of an accidental oil spill. Thus, study profiles for this stock could be developed at a later time. No study profiles were developed for the northern fur seal because satellite-tagging studies of this species are currently underway.

These nine study profiles were prioritized with regard to the anticipated sequence of activities that would occur with oil and gas development of the Sale 92 Area and to MMS needs for preparing defensible NEPA analyses. These activities and needs, in chronological order, are:

1. Pre-lease seismic exploration,
2. Lease-sale EIS-related analyses,
3. Project development, and
4. Oil and gas production.

Three study profiles were identified for immediate startup (by FY 2007-2008), five studies for startup by FY 2008-2009 to support lease-sale- and EIS-related analyses, and one study for startup by the beginning of oil and gas development within the sale area (Table 5).

TABLE 5. Study Profiles Developed by the Marine Mammals Working Group

Study Profile	Start (FY)	Duration (year)	Total Cost (\$)
Distribution, abundance, and habitat use of North Pacific right whales	2007-2008	4	3,190,000
Seasonal acoustic monitoring of right whales and other endangered cetaceans	2007-2008	4	720,000
Abundance, distribution and seasonal movements of humpback, fin, and other cetaceans	2007-2008	4	845,000
Health assessment of stranding marine mammals	2008-2009	4	875,000
Steller sea lion seasonal distribution and diet	2008-2009	3	450,000
Steller sea lion seasonal habitat use	2008	3	940,000
Harbor seal and spotted seal seasonal distribution	2008	4	1,355,000
Seasonal distribution and abundance of Pacific walrus	2008	3	660,000
Seasonal distribution and abundance of northern sea otter	2009	3	1,270,000
Total			10,305,000

5 CONCLUSIONS AND RECOMMENDATIONS

Plenary speakers and meeting participants emphasized the critical importance of resources in the North Aleutian Basin, including human subsistence resources, commercial fisheries, and internationally important bird and marine mammal populations and habitats. Despite the importance of these resources, a number of topical areas were identified where basic information was lacking or incomplete. Critical information needs included:

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

In general, meeting participants found that current information is insufficient to address oil and gas leasing issues. The study profiles that were developed at the meeting represent the highest-priority studies identified by the working groups.

Some of these information needs can be addressed by systematically evaluating existing data collected by various agencies with an eye toward characterizing distribution, status, and trends and looking for patterns of change that could indicate effects of environmental perturbations over the last few decades. These types of analyses could be particularly important for assessing the effects of leasing, exploration, development, and production activities related to oil and gas development. Study profiles were developed in these areas, and, if funded, could represent an important first step for the program. Such studies include:

- Compile historical information about seismic surveys and fishery information in the North Aleutian Basin;
- Evaluate potential for space-use conflicts between fishery activities and oil and gas development activities within the Sale 92 Area; and
- Compile North Aleutian Basin socioeconomics data.

Some data needs are critically important because there is little Basin-specific information on the topic, the resource is considered of vital importance, and the information is needed as early as possible in the lease-exploration-development-production timeline. On the basis of information gathered at the meeting, Argonne staff identified two topics that fit these criteria: (1) studies of the endangered North Pacific right whale and (2) studies of subsistence patterns. Three study profiles are related to these topics:

- Distribution, abundance, and habitat use of North Pacific right whales,
- Seasonal acoustic monitoring of right whales and other endangered cetaceans, and
- North Aleutian Basin subsistence.

The North Pacific right whale is an endangered species with critical habitat in the Basin, specifically in the Sale 92 Area. Data are needed early because the species is potentially affected by seismic surveys that could occur within the next few years. Subsistence resources are vitally important to residents of the areas and could be affected by all aspects of oil and gas development including leasing and exploration. These study profiles are of greatest importance in the earliest phases of the North Aleutian Basin leasing program.

Assessments of the effects of oil and gas development activities in the North Aleutian Basin could greatly benefit from development of a high-resolution model of the Basin that represented important physical processes. Such a model would be useful for predicting the fate and effects of oil spills or other contaminant releases and could also be linked to information collected on other resources in the Basin to better understand the underlying bases of distributions, seasonal patterns of use, population trends, and changes in status. Although a fully developed high-resolution model would be useful now, it will be most critical several years from now for use in the assessments of development and production plans. Study profiles related to modeling physical processes include:

- Implementation of a meteorological buoy;
- Mesoscale meteorological modeling;
- Physical oceanography field program; and
- Modeling of circulation.

Other study profiles that were developed at the meeting will be useful for developing a monitoring program of the effects of oil and gas development in the North Aleutian Basin. To be most effective, these studies should start sometime prior to the initiation of oil and gas activities in order to establish baseline data.

Studies and the environmental assessment program they support will be greatly strengthened by strong communication among principal investigators and MMS staff and integration of studies to the extent possible. Studies should focus on hypothesis testing and employ robust statistical design using appropriate sample sizes and data quality objectives identified before the studies are implemented. Standardization of common data needed by several programs, avoidance of duplication of effort, and development of a Web-based data system using standard metadata procedures would maximize the usability of results and make the results available to a wider group of potential users.

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APPENDIX A

**REGISTRANTS AND WORKING GROUP MEMBERS
OF THE NORTH ALEUTIAN BASIN INFORMATION STATUS
AND RESEARCH PLANNING MEETING**

TABLE A-1. Registrants of the North Aleutian Basin Information Status and Research Planning Meeting

Name	Affiliation
Tom Ahlfeld	Minerals Management Service
Randy Alvarez	Bristol Bay Native Association
Jeffry Anderson	U.S. Fish and Wildlife Service
Scott Anderson	Lake and Peninsula Borough
Tina Anderson	Aleutians East Borough
Robyn Angliss	National Marine Fisheries Service
Eric Barnhill	Bering Sea Fishermen's Association
Carrie Beck	Alaska Department of Fish and Game
John Bengtson	National Marine Fisheries Service
Shelby Booth	Bristol Bay Borough
Brad Boschetto	Shell Oil Co.
Peter Boveng	National Marine Fisheries Service
Sharon Boyette	Aleutians East Borough
Judy Brady	Alaska Oil and Gas Association
Heather Brandon	Alaska Department of Fish and Game
Reid Brewer	University of Alaska Sea Grant
James Browning	Alaska Fisheries Development Foundation
Casey Buechler	Minerals Management Service
Colleen Burgh	U.S. Environmental Protection Agency
Doug Burn	U.S. Fish and Wildlife Service
Mike Burwell	Minerals Management Service
Lynn Carlson	Lake and Peninsula Borough
Molly Chythlook	Bristol Bay Native Association
Phil Clapham	National Marine Fisheries Service
Cleve Cowles	Minerals Management Service
Wayne Crayton	Minerals Management Service
Jennifer Curtis	U.S. Environmental Protection Agency
Doug Dasher	Alaska Department of Environmental Conservation
Chris Dau	U.S. Fish and Wildlife Service
Brian Davis	Private consultant
Angela Doroff	U.S. Fish and Wildlife Service
Matthew Eagleton	National Marine Fisheries Service
Lisa Eisner	National Marine Fisheries Service

Table A-1 (Cont.)

Name	Affiliation
Diana Evans	North Pacific Fisheries Management Council
Julian Fischer	U.S. Fish and Wildlife Service
Cathy Foy	National Marine Fisheries Service
Joel Garlich-Miller	U.S. Fish and Wildlife Service
Duane Gill	Minerals Management Service–Scientific Committee
Karen Gillis	Bering Sea Fishermen’s Association
Ed Glazier	Impact Assessment Inc.
Jeff Gleason	Minerals Management Service
Larry Gorenflo	Argonne National Laboratory
Stephen Grabacki	Graystar Pacific Seafood
Glenn Gray	Aleutians East Borough
Paul Grundholt	Aleutians East Borough
Justine Gundersen	Aleutians East Borough
Kelly Harrell	Friends of Bristol Bay
John Hayse	Argonne National Laboratory
Kate Hedstrom	University of Alaska
Adelheid Herrmann	Native American Fish and Wildlife Society
Ihor Hlohowskyj	Argonne National Laboratory
Warren Horowitz	Minerals Management Service
Steve Howell	Cook Inlet Regional Citizens Advisory Council
Gary Hufford	National Weather Service
Yulia Ivashchenko	Sea Star Scientific
Allison Iversen	Alaska Department of Natural Resources
Gary Johnson	Aleutians East Borough
Walter Johnson	Minerals Management Service
James Kendall	Minerals Management Service
Gunnar Knapp	University of Alaska
Brenda Konar	University of Alaska
Yvonne Kopy	Bristol Bay Borough
John Krummel	Argonne National Laboratory
Kathy Kuletz	U.S. Fish and Wildlife Service
Liz Labunski	U.S. Fish and Wildlife Service
Kirk LaGory	Argonne National Laboratory
Ron Lai	Minerals Management Service

Table A-1 (Cont.)

Name	Affiliation
Bill Larned	U.S. Fish and Wildlife Service
Terri Lomax	Alaska Department of Environmental Conservation
Wieslaw Maslowski	Naval Postgraduate School
Molly McCammon	Alaska Ocean Observing System
Peter McRoy	University of Alaska
Rob McWhorter	Argonne National Laboratory
Doug Mecum	National Marine Fisheries Service
Phil Mundy	National Marine Fisheries Service
Mary Lynn Nation	U.S. Fish and Wildlife Service
Tom Newbury	Minerals Management Service
Richard Newman	Minerals Management Service
Debbie Nigro	Bureau of Land Management
David Osterback	Aleutian Pribilof Islands Association
Nikos Pastros	Confederated Salish-Kootenai Tribes of Flathead Nation
Robert Pawlowski	Alaska Fisheries Development Foundation
Mike Petrusa	Alaska Department of Fish and Game
Karen Pletnikoff	Aleutian Pribilof Islands Association
Richard Prentki	Minerals Management Service
Ann Rappoport	U.S. Fish and Wildlife Service
Lorrie Rea	Alaska Department of Fish and Game
Kate Reedy-Maschner	Aleutians East Borough
Dan Rosenberg	Alaska Department of Fish and Game
Lisa Rotterman	Minerals Management Service
Susan Savage	U.S. Fish and Wildlife Service
Will Schroeder	Minerals Management Service–Scientific Committee
Whit Sheard	Pacific Environment
Mike Sigler	National Marine Fisheries Service
Brad Smith	National Marine Fisheries Service
Caryn Smith	Minerals Management Service
Tiel Smith	Bristol Bay Native Corporation
Ron Stanek	Alaska Department of Fish and Game
Paul Stang	Minerals Management Service
Chris Stark	Bering Sea Fishermen's Association
Rick Steiner	University of Alaska Anchorage

Table A-1 (Cont.)

Name	Affiliation
Charla Sterne	U.S. Fish and Wildlife Service
Elisabeth Stull	Argonne National Laboratory
John Trent	U.S. Fish and Wildlife Service
Della Trumble	Aleutians East Borough
Ian Voparil	Shell Oil Co.
Barbara Wallace	Minerals Management Service
Sharon Warren	U.S. Department of the Interior
Kate Wedemeyer	Minerals Management Service
Fred West	Alaska Department of Fish and Game
Dee Williams	Minerals Management Service
Margaret Williams	World Wildlife Fund
Mike Williams	National Marine Fisheries Service

TABLE A-2. Members of North Aleutian Basin Working Groups

Name	Organization
Oceanography, Ecosystems, and Fate and Effects Working Group	
Anderson, Tina	Aleutians East Borough
Burgh, Colleen	U.S. Environmental Protection Agency
Eisner, Lisa	National Marine Fisheries Service
Hartung, Daniel	Minerals Management Service
Hedstrom, Kate	University of Alaska, Fairbanks
Horowitz, Warren	Minerals Management Service
Hufford, Gary	National Weather Service
Johnson, Walter	Minerals Management Service
Lai, Ron	Minerals Management Service
Maslowski, Wieslaw	Naval Postgraduate School
McRoy, Peter	University of Alaska
Mundy, Phil	National Marine Fisheries Service
Newman, Richard	Minerals Management Service
Prentki, Dick	Minerals Management Service
Schroeder, Will	Minerals Management Service–Scientific Comm.
Smith, Caryn	Minerals Management Service
Sterne, Carla	U.S. Fish and Wildlife Service
Stull, Elisabeth	Argonne National Laboratory
Socioeconomics and Subsistence Working Group	
Alvarez, Randy	Bristol Bay Native Association
Brewer, Reid	University of Alaska Sea Grant
Burwell, Mike	Minerals Management Service
Cowles, Cleve	Minerals Management Service
Davis, Brian	Consultant
Glazier, Ed	Impact Assessment Inc.
Gorenflo, Larry	Argonne National Laboratory
Kopy, Yvonne	Bristol Bay Borough
Livingston, Caleb	Not stated
Logusak, Frank	Aleutian Pribilof Islands Association
Osterback, David O.	Aleutian Pribilof Islands Association
Pletnikoff, Karen	Aleutian Pribilof Islands Association
Reedy-Maschner, Kate	Aleutians East Borough

Table A-2 (Cont.)

Name	Organization
Socioeconomics and Subsistence Working Group (Cont.)	
Sivarng-Livingston, Sharon	Not stated
Stanek, Ron	Alaska Department of Fish and Game
Trent, John	U.S. Fish and Wildlife Service
Trumble, Della	Aleutians East Borough
Wallace, Barbara	Minerals Management Service
Way, Ruthie	Minerals Management Service
Williams, Dee	Minerals Management Service
Fish and Fisheries Working Group	
Ahlfeld, Tom	Minerals Management Service
Anderson, Jeffry	U.S. Fish and Wildlife Service
Booth, Shelby	Bristol Bay Borough
Buechler, Casey	Minerals Management Service
Eagleton, Matthew	National Marine Fisheries Service
Evans, Diana	North Pacific Fisheries Management Council
Grundholt, Paul	Aleutians East Borough
Gundersen, Justine	Aleutians East Borough
Hayse, John	Argonne National Laboratory
Herrmann, Adelheid	Native American Fish and Wildlife Society
Jacobsen, Dick	Aleutians East Borough
Johnson, Gary	Aleutians East Borough
Knapp, Gunnar	University of Alaska
Konar, Brenda	University of Alaska
Olsen, Myra	Lake and Peninsula Borough
Schrof, Steve	Alaska Department of Fish and Game
Sigler, Mike	National Marine Fisheries Service
Stark, Chris	Bering Sea Fishermen's Association
Voparil, Ian	Shell Oil Co.
Wedemeyer, Kate	Minerals Management Service
Birds Working Group	
Castellini, Mike	University of Alaska
Dau, Chris	U.S. Fish and Wildlife Service
Fischer, Julian	U.S. Fish and Wildlife Service

Table A-2 (Cont.)

Name	Organization
Birds (Cont.)	
Gleason, Jeffery	Mineral Management Service
Kendall, Jim	Mineral Management Service
Krummel, John	Argonne National Laboratory
Kuletz, Kathy	U.S. Fish and Wildlife Service
Larned, Bill	U.S. Fish and Wildlife Service
Nigro, Debbie	Bureau of Land Management
Rosenberg, Dan	Alaska Department of Fish and Game
Savage, Susan	U.S. Fish and Wildlife Service
Schroeder, Mark	Mineral Management Service
Sterne, Charla	U.S. Fish and Wildlife Service
Marine Mammals Working Group	
Angliss, Robyn	National Marine Fisheries Service
Beck Eischens, Carrie	Alaska Department of Fish and Game
Bengston, John	National Marine Fisheries Service
Boschetto, Brad	Shell Oil Co.
Boveng, Peter	National Marine Fisheries Service
Burn, Douglas	U.S. Fish and Wildlife Service
Clapham, Philip	National Marine Fisheries Service
Garlich-Miller, Joel	U.S. Fish and Wildlife Service
Gundersen, Butch	Aleutians East Borough
Hlohowskyj, Ihor	Argonne National Laboratory
Ivanshchenko, Yulia	Seastar Scientific Consulting
Kendall, Jim	Minerals Management Service
Mack, Stanley	Aleut Corporation
Monnett, Charles	Minerals Management Service
Rotterman, Lisa	Minerals Management Service
Smith, Brad	National Marine Fisheries Service

APPENDIX B

**SPEAKER BIOGRAPHIES AND PRESENTATIONS
GIVEN AT THE NORTH ALEUTIAN BASIN INFORMATION
STATUS AND RESEARCH PLANNING MEETING**

SPEAKER BIOGRAPHIES

John Bengtson is Director of the National Marine Mammal Laboratory, Alaska Fisheries Science Center, National Marine Fisheries Service/NOAA, in Seattle. John is trained as a wildlife ecologist, having earned an M.S. (reproductive biology of crabeater seals) and Ph.D. (ecology and behavior of manatees) from the University of Minnesota. He started his graduate studies at the University of Alaska-Fairbanks, in 1975, studying Arctic fox movements at Prudhoe Bay. For the past 30 years, he has studied wildlife in Alaska (ringed, bearded, spotted, ribbon, and harbor seals; northern fur seals; sea otters; Arctic fox), Antarctica (crabeater, leopard, Weddell, and Ross seals; Antarctic fur seals; chinstrap, gentoo, and macaroni penguins), and Florida and Belize (American kestrels, manatees). An underlying motivation for much of his research has been to investigate the natural variation and ecological patterns in the interactions among marine mammals, birds, and their environment. Trying to understand how climate change is affecting and altering high latitude ecosystems has become an increasingly important part of this research in recent years.

Dr. Bengtson has been active in international treaty and research organizations concerned with Antarctic and Arctic wildlife research and conservation. He was Convener of the Group of Specialists on Seals for the Scientific Committee on Antarctic Research (SCAR), and was Chairman of SCAR's Antarctic Pack Ice Seals Program, a research initiative involving scientists from nearly 20 nations. He was a founding member and Convener of the international Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR) Ecosystem Monitoring Program, and he is currently Co-Chair of the U.S./Russia Marine Mammal Working Group, an organization that has promoted collaboration and coordination of research between these two countries since the early 1970s. He has served on many U.S. governmental delegations to meetings of the Arctic Council's Conservation of Arctic Flora and Fauna Working Group, U.S./Russia Environmental Agreement, CCAMLR, Antarctic Treaty, and Antarctic Seals Convention.

During the past decade, John has been a leader in implementing new initiatives under the U.S. Marine Mammal Protection Act, which in 1994 was amended to provide for cooperative agreements between the National Marine Fisheries Service and Alaska Native organizations to co-manage marine mammal populations used for subsistence purposes. He participates in several committees and forums where Alaska Natives and federal biologists work together to address issues of mutual concern pertaining to conservation, research, education, and resource management of marine mammals.

Phillip Clapham oversees large whale research at the National Marine Mammal Laboratory in Seattle, where his work focuses on population biology, behavioral ecology, and conservation management. He has more than 25 years of experience with cetaceans, and at one time or another has worked with most species of whales in various places worldwide. Prior to his current position, he worked at the Northeast Fisheries Science Center in Woods Hole, Massachusetts. He remains associated with the Smithsonian Institution (National Museum of Natural History) in Washington, D.C., and for many years directed a long-term study of individually identified humpback whales at the Center for Coastal Studies in Massachusetts. He holds a Ph.D. in zoology from the University of Aberdeen (Scotland), and has advised several governments and

other bodies on whale research and conservation. Dr. Clapham has served on the Board of Governors of the Society for Marine Mammalogy, and is a member of the U.S. delegation to the International Whaling Commission's Scientific Committee. He edits for three scientific journals, and has himself published four books and about 100 peer-reviewed papers on whales and other cetaceans.

Cleve Cowles, Ph.D., is the Chief, Environmental Studies Section (ESS), Alaska Outer Continental Shelf (OCS) Region, Minerals Management Service (MMS). His responsibilities include leadership of MMS Alaska Environmental Studies Program. Cleve has been with the BLM/MMS Alaska OCS Region since 1979, serving as Wildlife Biologist (Endangered Species), Chief of the Environmental Studies Unit (1983–1994), Acting Chief of the Social and Economic Studies Unit (1992–1994), and ESS Chief since 1995. Collateral responsibilities have included serving as the MMS Technical Representative to the OCSEAP program (1983–1992), to the MMS/UAF Coastal Marine Institute (1994–present), and recently to the North Slope Science Initiative and to the Pacific Northwest Cooperative Ecosystem Studies Unit. He received his B.S. in Wildlife Science from the University of Maine (1969) and M.S. (1974) and Ph.D. (1979) in Fisheries and Wildlife Sciences at Virginia Polytechnic Institute and State University. Design and analysis of management decision systems, environmental research monitoring, cooperative project development, and information applications to decision making continue as his career interests. He has authored or coauthored articles in *Journal of Environmental Management*, *Arctic*, *Journal of Mammalogy*, *Journal of Wildlife Management*, and elsewhere.

Christian P. Dau is a wildlife biologist with the Migratory Bird Management Division of the U.S. Fish and Wildlife Service in Anchorage, Alaska. He has been with the Service for over 30 years, primarily involved with tundra waterbird studies. Studies have centered on ecology of geese and sea ducks in western and southwestern Alaska. He spent 9 years on the Yukon-Kuskokwim Delta and 16 years on the southern Alaska Peninsula serving as biologist for the Yukon delta and Izembek National Wildlife refuges. Chris has bachelor's degree in zoology from Fresno State College and a master's degree in wildlife management from the University of Alaska-Fairbanks.

Brian Davis is a Cultural Anthropologist living in Anchorage. He has a B.A. in Anthropology from the University of Notre Dame, and an M.A. in Anthropology from the University of Alaska Fairbanks, with a focus on cultural and historic aspects of subsistence resource use. From 1999 to 2006, Davis worked for the Alaska Department of Fish and Game, Division of Subsistence, as a researcher, project lead, and Program Coordinator. Since 1993, Davis has worked on archaeological and natural resource projects with Alaska Native organizations in the Aleutians, Kodiak, Southeast Alaska, and the Bristol Bay region.

Angela Doroff is a wildlife biologist with the U.S. Fish and Wildlife Service in Anchorage, Alaska. She began her work on sea otters in 1985 and has since worked in Alaska, California, and the Commander Islands, Russia. She has worked on damage assessment studies for four years following the 1989 *Exxon Valdez* oil spill in Prince William Sound. Since then she has been conducting sea otter population assessment studies, development of conservation plans, international coordination, sea otter health and condition studies, and outreach activities. She is the species contact for the International Union of the Conservation of Nature's otter working

group. Ms. Doroff has an M.S. degree in wildlife ecology from the University of Wisconsin, Madison, and a B.S. degree in biology from the University of Minnesota, Minneapolis.

Diana Evans of the North Pacific Fisheries Management Council graduated from the University of California, Berkeley (B.A. Geography and Linguistics), and received her M.S. in Geography from King's College London, University of London, in 1998. She has worked as National Environmental Policy Act specialist and fishery analyst for the North Pacific Fishery Management Council since 2002, and is currently the staff representative to the Council's ecosystem committee. She previously worked as a consultant on fishery environmental impact statements for National Marine Fisheries Service in Alaska and Hawaii.

Edward W. Glazier has been involved in various forms of social science research along the coastal zone of the U.S. since 1978. He earned a B.A. in anthropology from the University of North Carolina at Wilmington with a senior paper on dietary patterns among Algonkian tribes living along the Mid-Atlantic coast during the 11th century. His master's thesis in sociology at East Carolina University examines socio-cultural dimensions of the *Exxon Valdez* oil spill. His doctoral dissertation in sociology at the University of Hawaii at Manoa describes socioeconomic aspects of small boat fishing in the Main Hawaiian Islands, and explains why Native Hawaiian fishermen persist despite the various social forces and factors that constrain them at the beginning of the 21st century (the setting and situation is described in *Hawaiian Fishermen*, 2007, Wadsworth-Thomson Publishers). Dr. Glazier's tenure at Impact Assessment Inc., began during its 1989-1990 study of the *Exxon Valdez* oil spill. His work on OCS Study MMS 2004-038 is summarized in "Toward Mitigating Problems at the Fisheries-Oil Development Interface: The Case of the Salmon Drift Gillnet Fishery in Cook Inlet, Alaska," recently published in *Human Organization*, Volume 65, Number 3 (Fall 2006). Edward is Research Director for the Pacific Islands Office of Impact Assessment, Inc., where he is engaged in various maritime social science research projects in Alaska, Hawaii, and the Western Pacific.

Larry Gorenflo holds advanced degrees in anthropology (M.A., University of Michigan) and geography (Ph.D., University of California, Santa Barbara). His interest focuses on the relationship between humans and their natural environment, emphasizing how people adapt to their natural and cultural surroundings. Through exploring patterns of human adaptation with a range of analytical methods, including geographic information system technology and statistical analysis, Dr. Gorenflo's research emphasizes identifying spatial patterns of human behavior and, often, the impacts of this behavior. He has conducted research and published on human adaptation in Latin America and the Caribbean, Oceania, Africa, and the United States (including Alaska), as well as at a global scale.

John Hayse received his Ph.D. in Zoology from Miami University in 1991. He has 20 years of experience in marine and freshwater ecology. Since 1991 he has served as an ecologist in Argonne National Laboratory's Environmental Science Division. Recent and ongoing project activities include evaluations of impacts to aquatic ecosystems from hydropower operations, training environmental project managers to prepare ecological risk assessments that conform to U.S. EPA guidance, and assessment of the ecological consequences of renewing the Trans-Alaska Pipeline System right-of-way and of the MMS's proposed oil and gas leasing program for the outer continental shelf. Current research includes development of individual-based models to

evaluate effects of hydropower operations on survival and growth of trout and endangered fish populations.

Ihor Hlohowskyj received his Ph.D. in Zoology in 1986 from Miami University. He has over 25 years experience in aquatic and terrestrial ecology, ecological risk assessment, and environmental impact assessment. He has worked on a variety of projects throughout North America and abroad. His work has included the identification and training of methods for assessing potential climate change impacts on African fisheries, ecological risk assessments at military training facilities, risk assessment training for the Department of Defense and U.S. Department of Energy, and ecological evaluations of wind energy development on federal lands in the western U.S. His current activities include development of biomonitoring guidelines for the U.S. Navy, assessing the impacts of energy corridor designation on federal lands in the western U.S., and assessment of ecological impacts from oil, natural gas, and alternate energy leasing and development on the Outer Continental Shelf. Dr. Hlohowskyj is the author of over 100 journal articles, book chapters, reports, and conference publications.

Gunnar Knapp is a Professor of Economics at the University of Alaska-Anchorage Institute of Social and Economic Research, where he has worked since receiving his Ph.D. in Economics from Yale University in 1981. Dr. Knapp has written numerous research reports on the economy of Alaska and the management of and markets for Alaska natural resources. For the past 15 years he has been actively involved in research on markets for and management of Alaska fisheries, including salmon, pollock, crab, and halibut.

John Krummel received his Ph.D. in Ecology from Cornell University in 1978. His early work focused on integrated pest management and agro-ecosystems. Upon joining the staff of Oak Ridge National Laboratory in Tennessee, Dr. Krummel joined forces with several other staff scientists to initiate a landscape ecology program that developed many of the early concepts and tools of this emerging area of study. Dr. Krummel joined Argonne National Laboratory in Illinois in 1986 and continued work in spatial analysis and ecology. He helped develop a geographic information systems laboratory that became an integral part of a large program in environmental assessment. A key part of Dr. Krummel's current work is assisting federal land management agencies in resource planning, such as resolving energy-environment issues in Alaska.

Kathy Kuletz has lived in Alaska for 32 years, and has spent over 20 years studying and surveying marine birds. She has served as principal investigator for studies involving seabird diet, productivity, habitat use, and population trends. Most of this work has been with the U.S. Fish and Wildlife Service out of the Anchorage office of Migratory Bird Management. She received her Ph.D. from the University of Victoria, B.C., her master's from the University of California, Irvine, and her B.S. from California Polytechnic State University at San Luis Obispo. Dr. Kuletz is a member of the Groundfish Fisheries Ecosystem Plan Team and the Short-tailed Albatross Recovery Team. She is currently principal investigator for the North Pacific Pelagic Seabird Observer Program. Her other work experience in Alaska has been as a commercial salmon fisher, and her husband, son, and brother still fish in Bristol Bay.

Kirk LaGory received his Ph.D. in Zoology from Miami University in 1984. He has over 20 years experience in environmental assessment and over 30 years experience in ecological research. He has worked on a wide variety of projects examining the impacts of human activities on terrestrial, aquatic, and wetland ecosystems and threatened and endangered species. Recent projects include developing operational strategies to minimize the effects of hydropower operations on endangered fishes of the Colorado River basin while maintaining generation capabilities; determining priorities for geomorphology research in the Colorado River Basin; developing an inventory, monitoring, and research program for the North Slope of Alaska; evaluating the effects of the Trans-Alaska Pipeline System on ecological resources; evaluating the effects of oil shale and tar sands development on ecological resources; assessing the status and habitat use of protected species in New Hampshire; identifying indicator species to assess the effects of forest management practices; and assessing the impacts of nuclear power plant license renewal on ecological resources. He was a coauthor of the Council on Environmental Quality's guidance for considering cumulative impacts in NEPA assessments. He is the author of over 80 journal articles, book chapters, reports, and conference publications.

William Larned works for the U.S. Fish and Wildlife Service in Soldotna, Alaska. He received his B.S. in Aeronautical Science from Embry-Riddle Aeronautical University and an M.S. in wildlife biology from the University of Connecticut. He has served as a wildlife biologist/pilot for the U.S. Fish and Wildlife Service for over 30 years. From 1992 to the present he has been based in Region 7's Waterfowl Management Division, and worked statewide, primarily conducting population assessments for listed waterfowl species (spectacled and Steller's eiders) and other sea ducks. He has also conducted aerial surveys for ducks, geese, swans, loons, grebes, and other waterbirds in Alaska, Mexico, and Russia. Mr. Larned has designed and conducted aerial waterfowl surveys throughout southwest Alaska annually since 1992. Before coming to the U.S. Fish and Wildlife Service, he was the Area Wildlife Manager for the Maryland Wildlife Administration (1972–1976). From 1976 to 1984 he conducted waterfowl population assessments in eastern and south-central U.S.; Saskatchewan and Manitoba, Canada; and Mexico. He served as biologist, pilot, enforcement officer, and fire management officer in Kenai National Wildlife Refuge, Kenai Peninsula, Alaska, from 1984 to 1992.

Wieslaw Maslowski is an associate research professor of the Oceanography Department at the Naval Postgraduate School, Monterey, California. His research interests include polar and physical oceanography, high resolution numerical ocean and sea-ice modeling, ice-ocean-atmosphere interactions, ocean circulation, sea ice, and climate variability in the Arctic Ocean, sub-polar North Pacific and Atlantic, and their effects on global ocean thermohaline circulation and climate. Dr. Maslowski's recent research focus is on the dramatic decrease of the multi-year sea ice cover in the Arctic Ocean in the late 1990s and 2000s, suggesting accelerated warming trend in the northern polar climate. Results of his studies attribute some of the recent change of sea ice cover to an increased northward advection of heat from the Bering Sea via Pacific Water.

Dr. Maslowski earned his Ph.D. in physical oceanography from the University of Alaska in 1994 and M.S. degree in physical oceanography from the University of Gdansk, Poland in 1987. He is a recipient of the Naval Postgraduate School Special Act Award, NOAA Global and Climate Change Postdoctoral Fellowship, and NASA Global Change Graduate Fellowship. He

has served on the National Academies of Science/National Research Council Committee on A Science Plan for the North Pacific Research Board, NSF Committee for the Bering Sea Initiative and the Shelf Basin Interaction Program, Arctic Region Supercomputing Center Technology Panel, Board of Directors of the Arctic Research Consortium of the U.S., and most recently on several working groups of the Second International Conference on Arctic Research Planning.

Michael F. Sigler received his Ph.D. from University of Washington in 1993 and M.S. and B.S. degrees from Cornell University in 1982 and 1979, respectively. He is currently with the NOAA Fisheries, Alaska Fisheries Science Center in Juneau, where he is a marine biologist. At the Alaska Fisheries Science Center, he has served as the Program Leader of the Habitat and Ecological Processes Research Program and as the principal investigator for several studies including Steller sea lion prey and predation studies, the southeast Alaska Steller sea lion prey study, and shark predation of Steller sea lions. He has been principally responsible for Alaska sablefish assessment, population modeling, and quota recommendations for the past 11 years. He has also served as the project leader of the Alaska sablefish longline survey for 14 years. Dr. Sigler has chaired or vice-chaired stock assessment review panels for New England, Washington-Oregon-California, Canada, and Alaska state and federal fisheries. He has served as analyst for a National Research Council review of NMFS assessment methods and has advised University of Azores (Portugal) and New Zealand scientists on survey methods and population models. He has authored numerous peer-reviewed publications on topics related to fish and marine mammal ecology.

Paul Stang is the MMS's Regional Supervisor for Leasing and Environment in Alaska, a position he took in 1997 after 30 years in Washington, D.C. From 1984 to 1997, he held various management positions at MMS headquarters after seven years as a policy analyst in the Office of the Secretary of Interior. From 1972 to 1977, he served in the coastal zone management and marine ecosystem analysis offices of NOAA. Mr. Stang began his government career with the Navy's Deep Submergence Systems Project in 1967. He has a B.A. in Arts and Letters and a B.S. in Industrial Engineering from Penn State and an M.S. in Ocean Engineering from the University of Miami/Rosenstiel School of Marine and Atmospheric Science.

Elisabeth Ann Stull received her Ph.D. from the University of California-Davis, her M.S. from the University of Georgia, and her B.A. from Lawrence University. Her academic training was in limnology, oceanography, and ecology. Her specialty is primary productivity and plankton community structure. She taught limnology and ecology at the University of Arizona prior to joining the staff at Argonne National Laboratory in 1978. She has over 25 years experience in environmental assessment, preparing assessments of aquatic and marine resources and cumulative impacts. She has directed the preparation of both small and large impact statements, and conducted field research. She has been a program manager and advisor on the requirements of the National Environmental Policy Act. She has prepared assessments of hydroelectric power, coal-fired and nuclear facilities, ocean disposal, hazardous waste incineration, assembled chemical weapons, and high-energy research facilities. She assisted in the preparation of the Council on Environmental Quality guidance on cumulative impact assessment.

Ian Voparil works as a consultant for companies within the Shell Group, offering science-based advice on environmental issues and regulations. Areas of responsibility include oceanography,

ecological impacts of sound in water, risk evaluation, avoidance and mitigation, and spill response. Based in Houston, he has an M.S. and Ph.D. in Oceanography from the University of Maine and worked as a lecturer and researcher at the University of California-Santa Cruz in the Department of Marine Sciences before joining Shell. He has published peer-reviewed literature on the bioavailability of nutrients and contaminants and ecological constraints on digestion. He currently serves on a number of industry technical committees, including the Offshore Operators Committee.



Welcome!!!

North Aleutian Basin
Information Status and Research Planning Meeting

11/28 – 12/1 2006

Dr. Cleve Cowles
MMS AK OCS Region



Primary Goal:

- **Recommend research that will feed the information needs of the agency**



Key considerations


- **Looking for mission relevance, “good science”, broad involvement**
- **Want to avoid duplication**
- **Ultimately looking to maximize integration among projects**

North Aleutian Basin (NAB) Information Status and Research Planning Meeting

Hilton Hotel, Anchorage
November 28 - December 1, 2006

Paul Stang, Alaska Regional Supervisor
for Leasing and Environment

Minerals Management Service
U.S. Department of the Interior



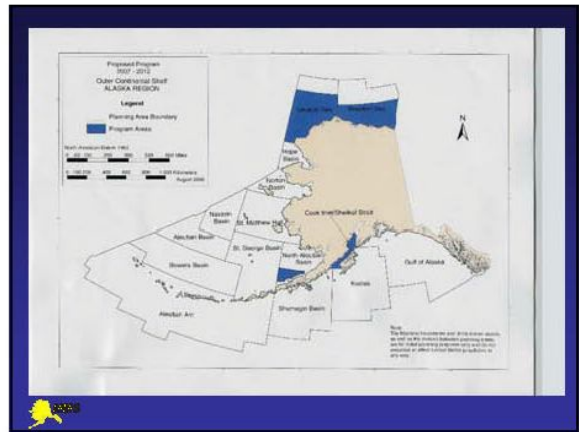
MMS Background: An Ocean & Mineral Agency

- The Outer Continental Shelf
 - off the coast beyond 3 miles
- Oil and Gas Leasing, Regulation, Monitoring, Inspections
- Sand, gravel, gold, other minerals,
- Energy from sun, wind, currents, waves



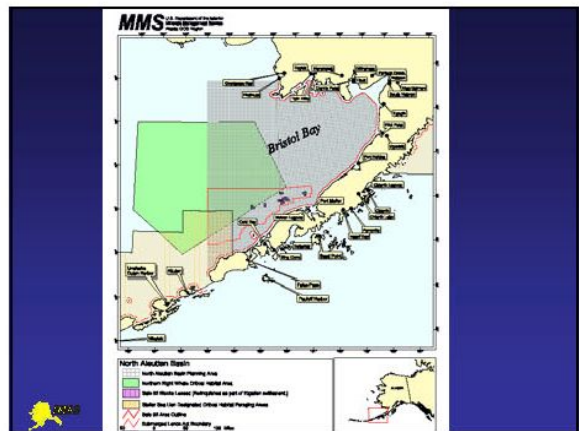
- Royalty Collection and Disbursement

•Environmental & Technical Research


Sales in the 2007-2012 Proposed Program off Alaska

<p>Beaufort Sea 2009 and 2011</p> <p>Chukchi Sea 2007, 2010 and 2012</p> <p>North Aleutian Basin 2010 and 2012 (subject to Pres. Withdrawal)</p>	<p>Cook Inlet 2009 and 2011</p>
---	--


Historic Sale 92 Area

- Last area sale was held in 1988
- Last EIS for NAB area was completed in 1985
- Last MMS study in the area was concluded in early 1990s



Proposed leasing is still contingent on ...

- Inclusion in the Final 5-Year Program
- Removal of current Presidential Withdrawal
- Subsequent pre-sale decisions on whether to actually hold an individual sale in the NAB




OCS Oil and Gas Estimates

Undiscovered Technically Recoverable


Planning Area	Barrels* of Oil Equivalent			Fraction that's oil
	95%	Mean	5%	
Beaufort Sea	0.53	13.14	36.08	2/3**
Chukchi Sea	4.15	29.04	77.36	1/2**
N. Aleutian Basin	0.09	2.29	6.65	1/3**
Cook Inlet	0.06	1.23	3.47	4/5**

*Billions ** Approximate



5-Year Public Hearings/Meetings already held this fall in NAB

Unalaska	Cold Bay
Nelson Lagoon	Anchorage
Sand Point	Goodnews Bay
Naknek	Dillingham



Some Key Concerns raised in meetings on Aleutian Chain

- Effects of noise and oil spills on --
 - Commercial fisheries year round
 - Subsistence
 - Endangered and Threatened Species
 - Other Birds and Mammals
- Right Whale & Stellar Sea Lion Critical Habitats
- Economic Benefits - Jobs & Access to Fuel



Timing Est. of Information Needs for OCS Leasing / Operational Activities

- Fall '07 – Need Studies Info to Start Lease Sale EIS
- 2008 – Start general monitoring in sale area
- 2010 – Lease sale
- 2011* – First Exploration Well & First Discovery
- 2012* – Need Studies Info to Start DPP EIS
- 2012* – Start Monitoring in Development Area
- 2015* – Complete EIS, Approve DPP, Sanction Project
- 2017* – Begin Development Construction at NAB site
- 2020* – Start Oil Production
- 2025* – Start Gas Production (LNG Export)

*earliest possible scenario



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NAB Planning Meeting,
COTR





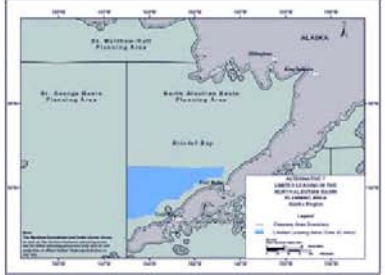

Identifying Information Needs and Research Priorities for the North Aleutian Basin of Alaska

Kirk LaGory
 North Aleutian Basin Information Status and Research Planning Meeting
 Minerals Management Service
 Anchorage, Alaska
 November 29 – December 1, 2006




Meeting Goal

- Recommend research to support an assessment of the potential environmental impacts of oil and gas development in the North Aleutian Basin program area on marine, coastal, and human resources


Studies Will Be Used to Support Assessments Related to Proposed Lease Sales

- Two proposed lease sales—2010 and 2012
- Each requires an assessment of different phases of activities
 - EIS prior to sale
 - Post-lease EA on exploration activities
 - EIS of construction and operations

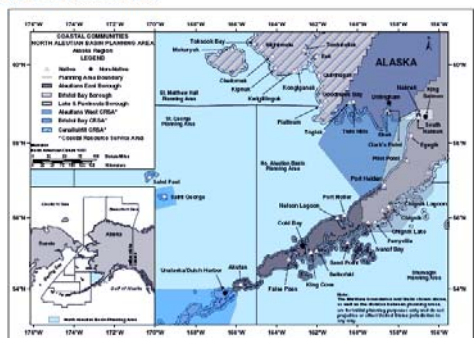



The North Aleutian Basin Contains Important Resources

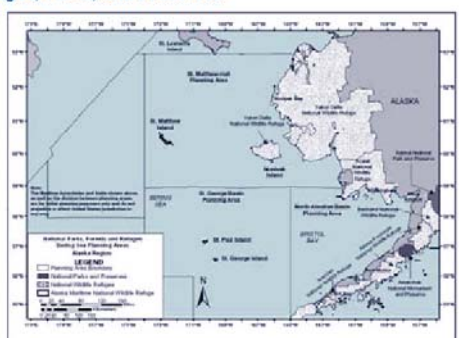

- Ecologically important area
 - Fish and shellfish populations
 - Seabirds and waterfowl
 - Marine mammals, including the endangered northern right whale and Steller sea lion and threatened sea otter
- Coastal communities that depend on resources of the Basin
- Cultural resources
- Commercial fisheries
- Subsistence resources

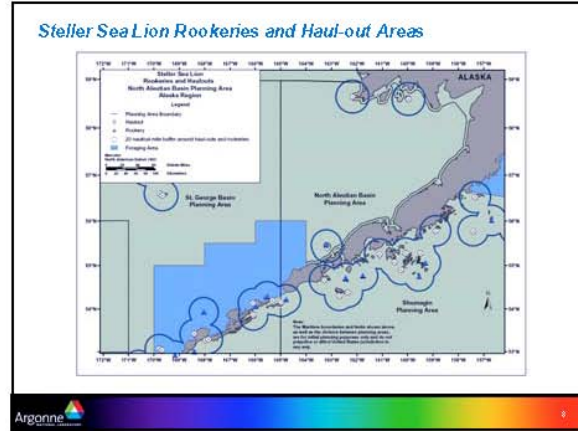
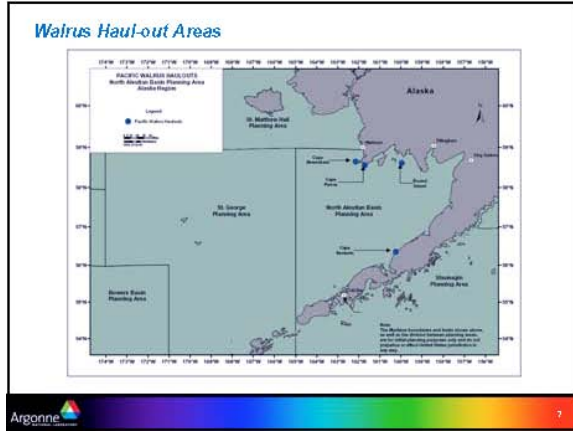


Coastal Communities

Refuges, Parks, and Preserves



- ### Meeting Overview
- Day 1: Presentations by researchers in relevant topical areas
 - Day 2 and 3: Breakout sessions for five working groups
 - Physical oceanography, ecosystems, oil spill fate and effects
 - Socioeconomics, subsistence, local and traditional knowledge
 - Fish and commercial fisheries
 - Birds
 - Marine mammals
 - Day 4: Presentation of working group results
 - **Working Groups are asked to develop specific study profiles**
 - **MMS will prioritize and fund study projects in the area, beginning in FY07**

- ### Elements of MMS Study Profiles
- Need for study and relevance to MMS mission
 - Study objectives including hypotheses to be tested
 - Methods
 - Timing including start date and duration
 - Cost and level of effort

- ### Several Types of Studies Can Be Considered
- Analyses of existing data sets
 - Resource inventories
 - Studies of trends in status and distribution
 - Targeted research to address topical areas
 - Model development
 - Database development

- ### Impact Analysis Terminology
- Oil and Gas Development
 - Activity Phase (e.g., exploration, construction, operations, decommissioning)
 - Activity (e.g., seismic surveys, drilling, trenching)
 - Impacting Factor (e.g., noise, disturbance of substrate, traffic, accidents)
 - Affected Resource (e.g., species, habitats, economy, subsistence use)
 - Affected Resource Attribute (e.g., species life stage, special use areas, jobs, hunting, recreational fishing)

Impacting Factors

- Impacting factors are those aspects of an action that result in impact
- Examples:
 - Noise generated by seismic surveys
 - Habitat disturbance caused by trenching
 - Ship traffic during operations

Argonne 13

Resources

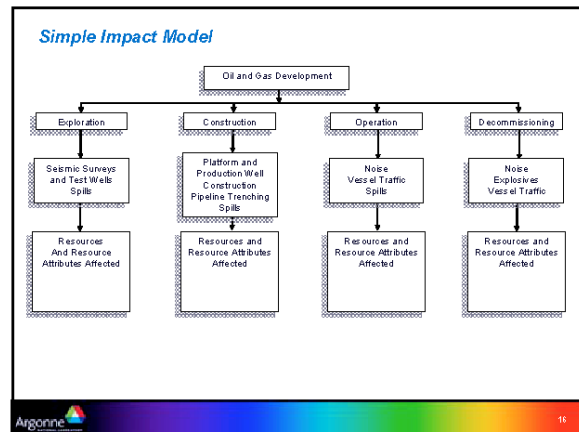
- Resources are biological, physical, cultural, and socioeconomic components of the Basin
- Examples:
 - Sea otter
 - Groundfish
 - Nearshore ecological communities
 - Demographic patterns
 - Subsistence
 - Jobs
 - Public services

Argonne 14

Resource Attributes

- Resource attributes are those characteristics of the resource that are of greatest concern or importance for sustainability
- Examples:
 - Migration pathways
 - Food resources
 - Breeding areas
 - Important life stages

Argonne 15



Considerations for Identifying Information Needs and Recommended Studies

- Need to view North Aleutian Basin as a "system" of interdependent parts
- Focus on important parts (resources) of the system that are relevant to assessment of impacts
 - Which resources could be most affected by oil and gas development actions?
 - Which activities and impacting factors could have the most important effects?
 - What other factors could affect the resources of interest?
- Look for opportunities to identify representative species or groups for study

Argonne 17

We Will Focus on a Series of Questions to Arrive at Study Recommendations

1. What aspects of oil and gas development could affect resources in the Basin?
2. What are the important resources of concern in the Basin?
3. What are the important resource attributes for consideration?
4. What are the most important oil and gas impacts that affect resources of concern?
5. How well do we understand each resource in the Basin and the potential effects of oil and gas development?

Argonne 18

Prioritization

- What makes a resource or resource attribute important?
 - Ecological value
 - *Importance to system*
 - *Sustainability of resource or system*
 - *Rarity*
 - Economic value
 - Societal or cultural value

- What makes an impacting factor important?
 - Duration
 - Magnitude
 - Spatial extent of effect
 - Importance of the resource affected

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... for a brighter future

Developing a Literature Database for the North Aleutian Basin of Alaska

Elisabeth Ann Stull
North Aleutian Basin Information Status and Research Planning Meeting
Minerals Management Service
Anchorage, Alaska
November 28—December 1, 2006

UChicago
Argonne
Office of Biological Resources

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Purpose

- To identify recent literature to support an assessment of the impacts of oil and gas development on natural, cultural, and socioeconomic resources in the North Aleutian Basin

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Many Types of References were Identified and Collected

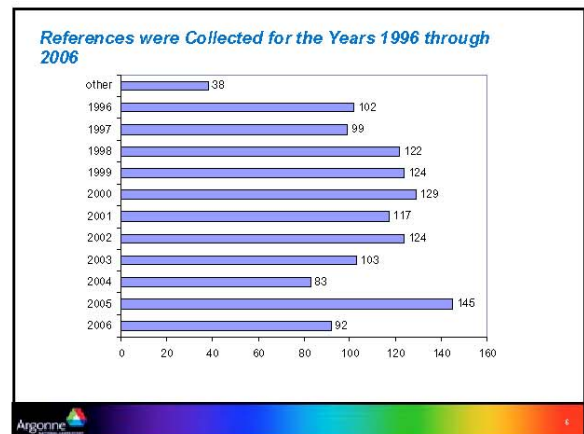
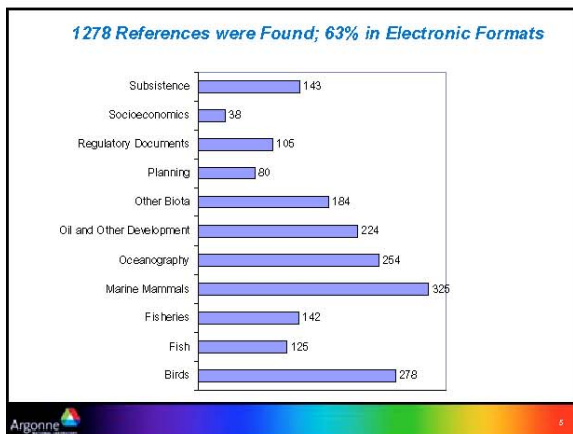
- Workshop and symposium proceedings
- Personal Web pages
- Web pages of non-governmental organizations
- Web pages of governmental organizations
- Environmental impact studies
- Books and articles reporting research results
- Regulatory documents
- Technical reports
- Newspapers and newsletters
- Theses and dissertations

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The Database was Organized into Eleven Topical Areas

- Oceanography (Biological, Chemical, and Physical) and Other Physical Sciences
- Marine Mammals
- Birds
- Fish and Shellfish
- Other Biota and Community/Ecosystem Studies
- Effects of Oil/Gas and Other Development
- Fisheries
- Subsistence, Traditional Knowledge, and Other Related Topics
- Socioeconomics
- Resource and Research Planning
- Studies Related to Regulatory Requirements

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Oceanography (Biological, Chemical, and Physical) and Other Physical Sciences

- Major Topics:
 - Dynamics of the Bering Sea, the Bering Sea ecosystem
 - Interactions between oceanographic regions (Bering Sea, Chukchi Sea, Beaufort Sea)
 - Currents in and around the Aleutian Chain
 - Effects of global warming.
- Little information was found on:
 - Bristol Bay nearshore
 - Benthic and intertidal areas

Marine Mammals

- Major Topics included:
 - Surveys, distribution, abundance, migration and movement
 - Diet and food supply
 - Impact of human activities
 - Population trends
 - Subsistence use and traditional knowledge
- Species most studied:
 - Right, fin, bowhead whales
 - Walrus
 - Sea otter
 - Polar bear
- Geographic Area: Bering Sea and North Pacific
- Little information was found on:
 - Populations in the immediate vicinity of potential oil/gas development activities.

Birds

- Major topics:
 - Waterfowl abundance, distribution, breeding
 - Seabird by-catch
 - Seabird colonies
 - Effects of petroleum spills
 - Contaminant concentrations and effects
 - Subsistence harvest
- Species most studied:
 - Eider species
 - Kittlitz's murrelet

Fish and Shellfish

- Major topics
 - Population dynamics
 - Migration
 - Abundance and distribution
 - Recruitment
- Major species studied:
 - All salmon species
 - King and Tanner crabs
 - Pacific herring
 - Walleye pollock

Other Biota and Community/Ecosystem Studies

- Community and ecosystem studies:
 - Phytoplankton and plankton productivity of the Bering Sea
 - Relationships of groups of organisms to habitats
 - Cumulative impacts
 - Factors structuring communities and ecosystems
 - Benthic organisms
 - Wildlife studies
 - Impact of oil spills on communities and ecosystems

Effects of Oil/Gas and Other Development

- Oil spill history and impacts
 - *Selendang Ayu*
 - *Exxon Valdez*
- Assessments of oil development impacts
- Population abundance after oil spills for birds and mammals
- Effects of disturbance from development activities
- Collisions, both with respect to birds and mammals
- Pollutant concentrations in biota
- Effects of fishing on biota, including birds and mammals

Fisheries

- Major topics are:
 - Stock assessments and recruitment and escapement predictions
 - Fish and shellfish diseases and contamination
 - Effect of other activities on commercial fishing
 - Effect of commercial fishing on birds and mammals
 - Fishery management
 - Regulations
 - Fishery economics
- Major stocks of interest are:
 - Salmon
 - Crabs (king and tanner)
 - Pacific herring
 - Groundfish

Subsistence, Traditional Knowledge, and Other Related Topics

- Major topics include:
 - Subsistence harvest of plant products, fish, birds, and mammals
 - Wild foods: identification and use
 - Surveys of subsistence practices
 - Native management of resources important in subsistence
 - Traditional knowledge of resource abundance, trends, and ecology
 - Regulations

Socioeconomics

- Major topics include:
 - Community descriptions, including population, education, income, housing, government
 - Resource economics
 - Infrastructure development (i.e., harbors, community services)
 - Borough and Native governments and corporations
 - Community planning
 - Developing industries
 - Mineral resources

Studies Related to Regulatory Requirements

- Types of documents include:
 - Regulations
 - Regulatory analysis
 - Environmental assessments and impact statements
 - Endangered Species Act determinations
 - Critical habitat determinations
 - Recovery plans for endangered species
 - Biological Opinions prepared pursuant to the Endangered Species Act

Research and Planning

- Examples include:
 - North Pacific Research Board
 - Bering Sea impacts study (BESIS)
 - Western Arctic shelf-basin interaction study (SBI)
 - Gulf of Alaska Ecosystem Monitoring and Research Plan
 - Eastern Bering Sea (BASIS) coastal research

Conclusions

- There are many recent studies of the Bering Sea area.
 - Research emphasis has been placed on:
 - *Wider regional issues*
 - *Global climate change*
 - *Marine mammal species*
 - *Waterfowl and protected bird species*
 - *Fishery biology and fishery economics*
- There is less research activity in certain areas, such as
 - In areas adjacent to proposed oil/gas development locations
 - Benthic and coastal communities and ecosystems
- You will be able to identify areas which should high priorities for future research related to oil/gas development in the North Aleutian basin.

Potential Financial and Employment Impact from the Development of Oil & Gas in the North Aleutian Basin

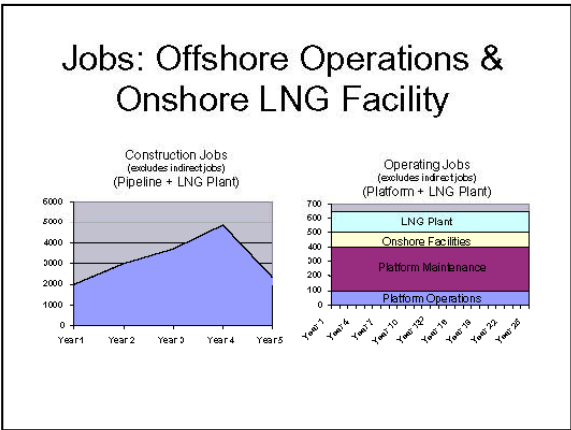
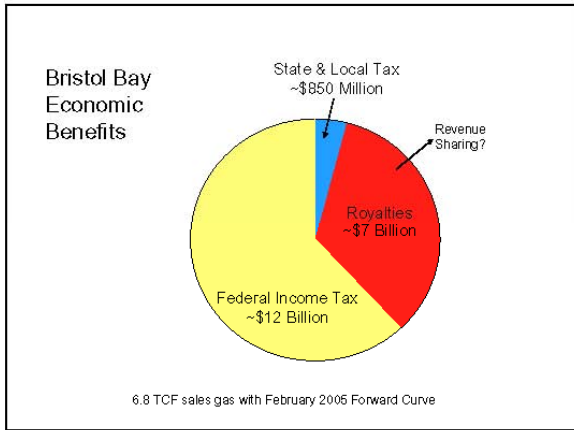
Shell Offshore Inc.
Anchorage, Alaska
October, 2006

The authors acknowledge the significant contribution of employment multiplier information from Professor Scott Goldsmith of ISER, UAA.

What might the project contain?

The map shows Bristol Bay with a scale of 0 to 50 miles. Key components include:

- Offshore Drilling and Production Platform(s) in the bay.
- Local Power sources connected to the platforms.
- LNG tanker to US West Coast Market.
- Natural Gas Liquefaction Facility on land.



Typical Offshore Operations Staffing Profile

Category	Plan (two crews)
Staff Positions	
Offshore Installation Manager	2
Process Team Leader	2
Utilities Team Leader	2
Process Staff Associate	2
Resource Coordinator	2
Marine Supervisor	2
Craft Positions	
Instrumentation Technician	4
Electrician	4
Electronic Technician	4
Mechanic	6
Production Operator	16
Total	46

Comments: Typically 100% of staff positions are Shell employees. Craft positions are resourced with Shell employees and up to 20% contract employees.

Two crews on board at all times (12 hour shifts). Four crews per platform.

Typical LNG Plant Personnel

Operators	32
Operations Line Management	3
Mechanical	15
Civil	5
Electrical	7
Instruments	7
Industrial Cleaning	5
Work Preparation & Planning	1
Field, Office & Advisory Eng.	7
Inspection	2
Materials & Transport	5
Management	4
Economics & Scheduling	2
Technology	3
Laboratory	2
Finance	3
Computing	3
Personnel & Training	4
Office Services	10
Health, Safety, Environment	3
Security	18
Total	141

Shell US Operations Workforce Strategy

- Recruit Talent
- Community & Technical Colleges and Universities
 - Partner with scholarships and outreach programs
 - Participate in Industry Advisory Committees and Organizations (e.g. Center for the Advancement of Process Technology (CAPT), Process Technology Degree Programs
 - Operations leadership involved with schools
- Develop Local Source
 - Focus on schools in areas of operation (Gulf of Mexico, Rockies, Texas, Alaska)
 - Invest in local schools and programs
- Seek Diversity
 - Actively promote our industry in high schools and colleges
 - Fund and participate in programs to attract local talent

Shell US Operations Workforce Strategy

- Retain and Develop Talent
 - Provide rewarding and challenging opportunities
 - Provide training and development assignments in every area of operation
- Provide both Supervisory and Technical Career Paths
 - Technical Operations Professional Program (TOPP), Global Program for Operations Staff Development
 - 20+ TOPP Candidates selected every year from US Ops
- Operations Training & Shell Robert Training and Conference Center
 - Industry's premier training facility with extensive catalogue of industry's best and most current courses

Educational Expectations

<ul style="list-style-type: none"> • Offshore Installation Manager • Process Team Leader • Utilities Team Leader • Process Staff Associate • Resource Coordinator • Marine Supervisor 	<ul style="list-style-type: none"> • Associate to Bachelors Degree • Significant offshore operations experience • Continuing Education <ul style="list-style-type: none"> – In-House courses – Shell / Industry approved CE courses – Shell Leadership Training • Pertinent License as required
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Educational Expectations

<ul style="list-style-type: none"> • Automatic Control Repairman • Electrician • Electronic Technician • Computer Assisted Operations • Mechanic • Operator 	<ul style="list-style-type: none"> • Associate to Bachelors Degree • Continuing Education <ul style="list-style-type: none"> – In-House courses – Shell / Industry approved CE courses
---	---

Support Positions

- Catering Crew
- Helicopter Landing Officer
- Medical Technician
- Clerk / Office Administrator
- Logistics Clerk

Comments: These positions are usually contract positions. Education varies for each job and may require special licenses.

The Job Pyramid*

- For every Oil and Gas Industry worker there are about six positions in the community

* Scott Goldsmith, (2006) Economic Multiplier for Oil and Gas Activities in Alaska
 Institute of Social and Economic Research,
 College of Business and Public Policy
 University of Alaska Anchorage
 3211 Providence Drive - Anchorage, Alaska 99508-8180 UAA
Alison2@uaa.alaska.edu
 907-786-7720

Oil and Gas Contractors

- Health, Safety, Environment
 - Spill Response, Emergency Response
- Well Services
 - Drilling, Coring, Logging, Completion, Production, Re-completion, Abandonment
- Platform Services
 - Equipment Start-up, Maintenance, Renewal, Removal
- Logistics handling
 - Helicopter, Crew Boats, Equipment Barges, etc.
- Pipe and Materials
 - Fabrication, Transport, Loading, Installation, Maintenance, Removal

Community Employment

- Services
 - Hotels, Restaurants, Transportation
 - Emergency (Police, Fire Departments)
 - Infrastructure (Schools, Communications, Power, Transportation, Water and Sewage, Waste Management)
 - Governmental Agencies
 - Real Estate, Construction, etc.
- Goods
 - Food, Fuel, Homes, Vehicles
 - Clothing, Household items, Office Products

Employment and Compensation Impact

Category	Ratio	Total Count	Average Salary per person per year	Total Compensation per Category per year
Operator & Contract Staff	1	650	\$ ** 85,000.00	\$ 55,250,000.00
Community	* 6	3900	\$ ** 38,000.00	\$ 148,200,000.00
Total		4550	\$ 123,000.00	\$ 203,450,000.00

* Scott Goldsmith (ISER) – University of Alaska Anchorage
 ** Based on Kenai Peninsula data, 2005 – 2006

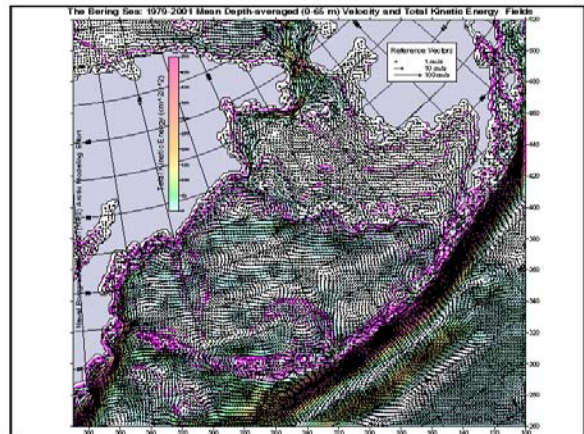
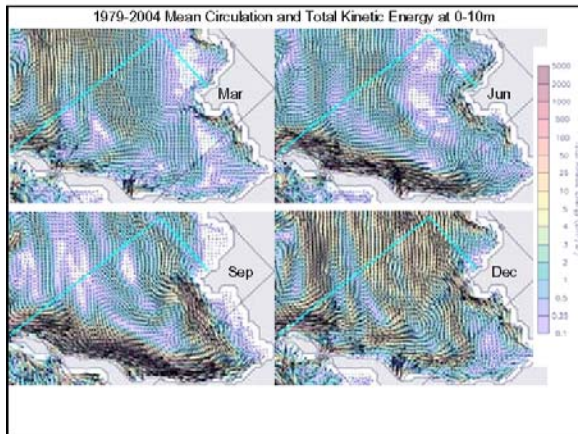
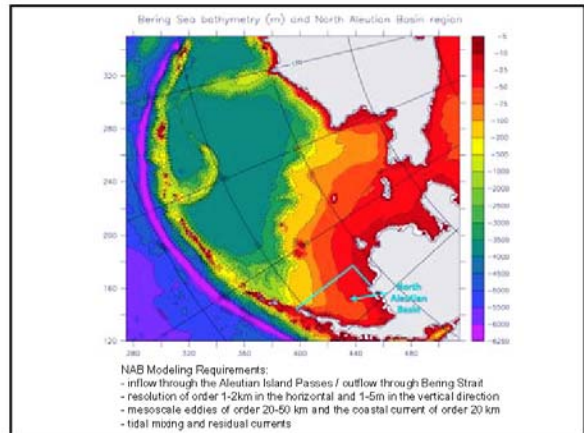
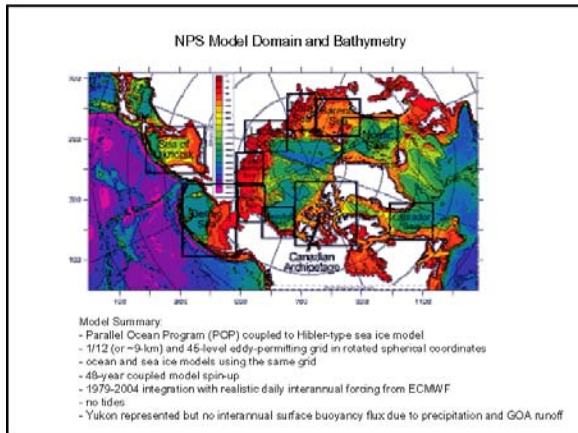
Circulation, Water Mass Distribution, and Transports in the North Aleutian Basin - Model Results

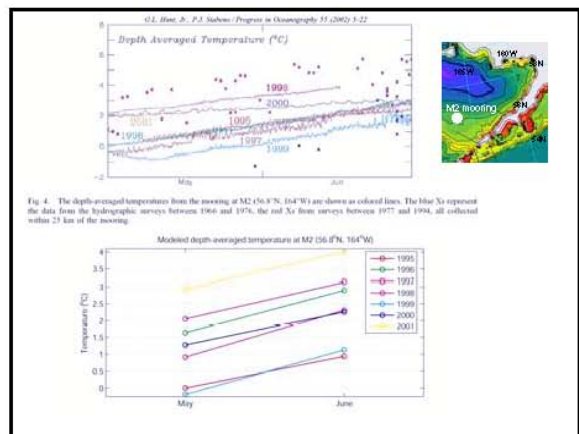
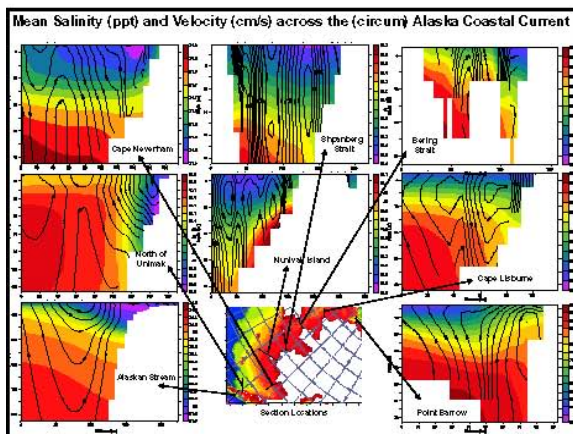
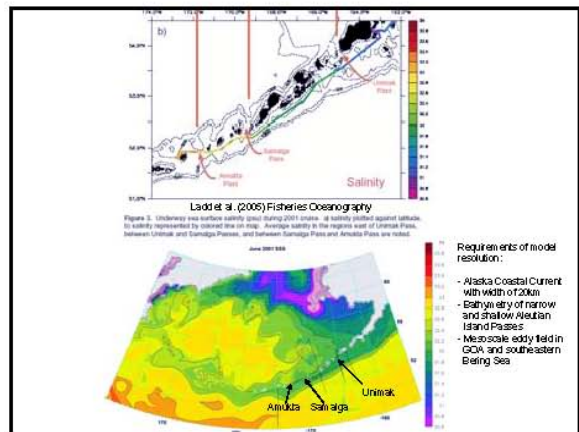
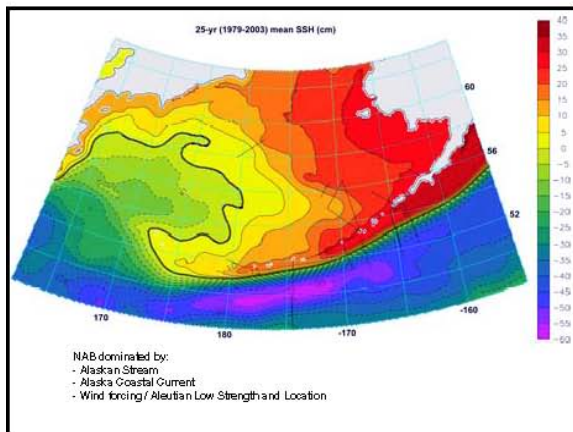
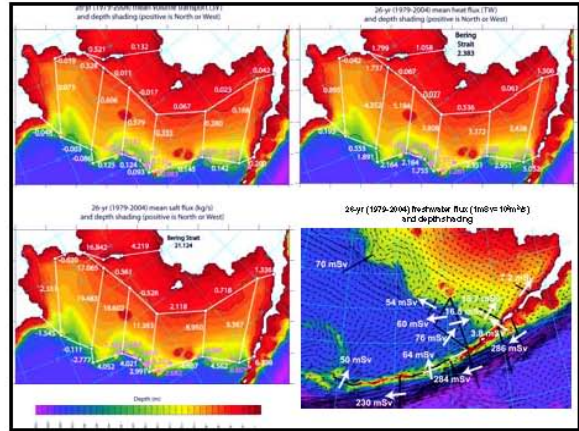
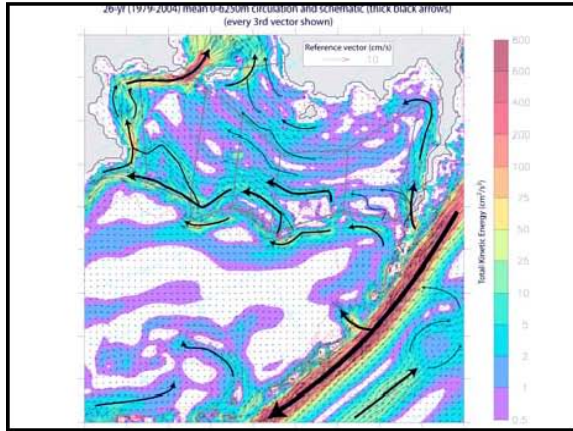
Wieslaw Maslowski
Naval Postgraduate School

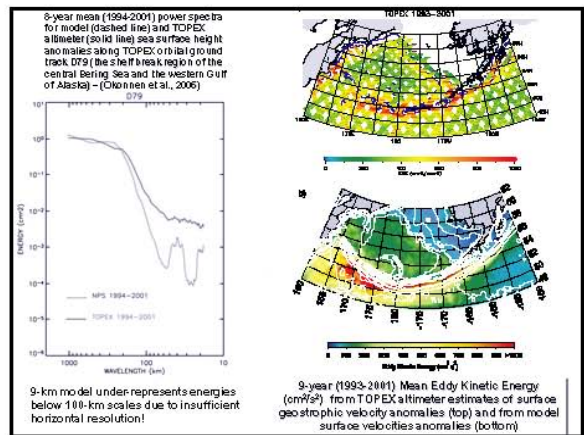
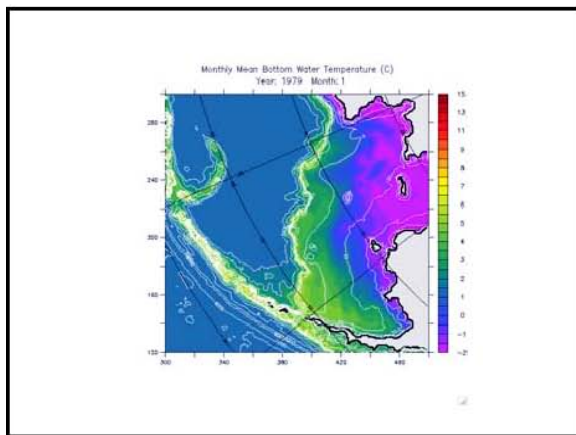
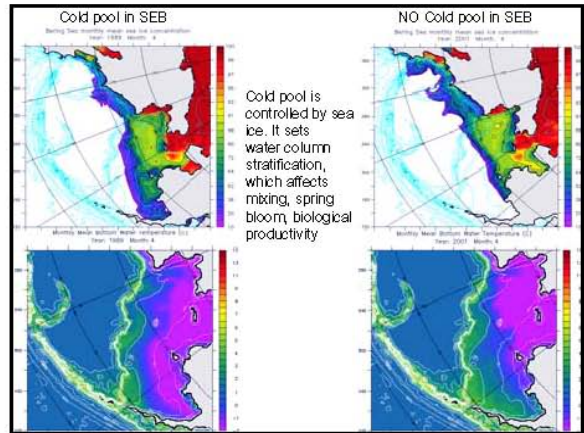
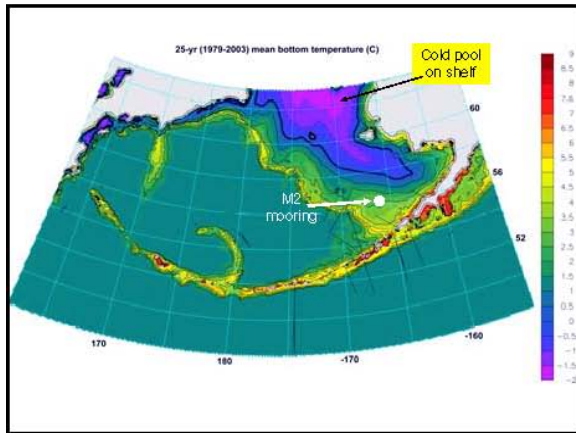
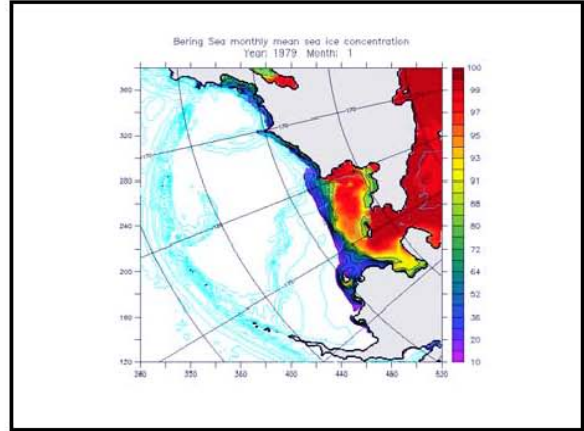
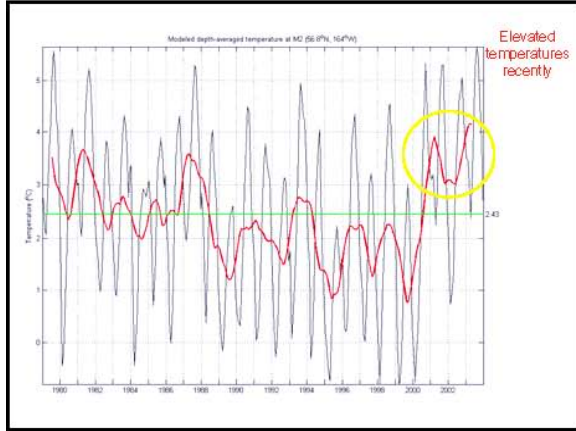
Collaborators:	J. Clement	-	NPS
	S. Okkonen	-	UAF
	J. Jakacki	-	IOPAS

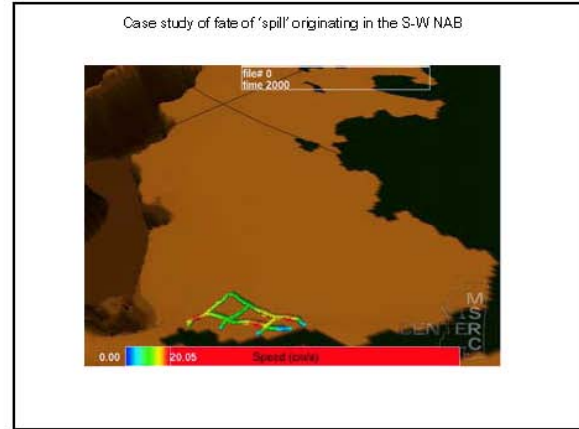
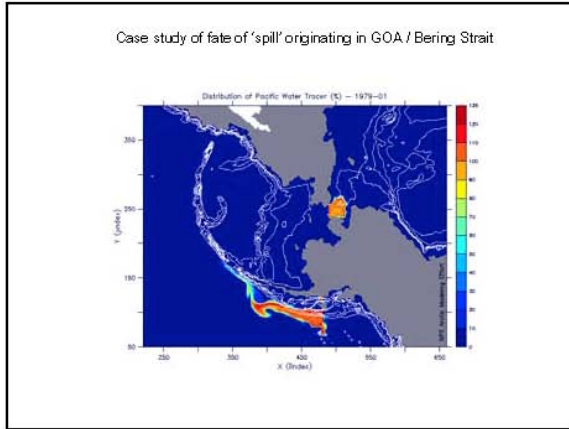
North Aleutian Basin Information Status and Research Planning Meeting, Anchorage, AK, 11/28-12/01/2006

- ## Outline
1. Domain Requirements for Study
 2. Mean, Seasonal and Interannual Circulation
 3. Mass and Property Transports
 4. Salinity and Temperature Distribution
 5. Sea Ice Conditions, Variability, and Impacts
 6. Fate of Tracers
 7. Summary










- ### Summary
- Limited data exist in the Northern Aleutian Basin (NAB)
 - Additional observations, especially upstream and within NAB region, are needed for model validation and improvement
 - NAB is a challenging region for ocean modeling
 - Regional ice-ocean models exist with reasonable skill in simulating NAB mean state and variability
 - narrow and shallow Aleutian Island Passes
 - shallow NAB shelf
 - Alaska Coastal Current of order 20km
 - mesoscale eddies of order 20-50km
 - Bering Slope Current
 - Realistic high resolution interannual atmospheric forcing is necessary
 - Effect of tides on mixing and circulation should be accounted

- ### Computational Approach
- Modern computer technology allows for realistic multi-decade integrations of the Pan-Arctic region at scales of order 0(10km) horizontally and 0(5m) vertically or better (www.oc.nps.navy.mil/NAME/name.html)
 - Multi-decade simulations with prescribed realistic atmospheric forcing allow studying interannual-to-interdecadal variability of ocean circulation and may provide guidance to field programs (Maslowski et al., 2000)
 - Limited predictions are possible using models with one-way coupling of the atmosphere to the ice and ocean (Maslowski et al., 2001)
 - Decadal hindcasts at eddy-resolving grid for NAB are achievable at present
 - A regional (NAB-centered) climate model should allow seasonal-to-annual forecasts




Marine Fish Abundance and Distribution in the MMS North Aleutian Basin Program Area (southeast Bering Sea)

- Michael Sigler
- Program Leader, Habitat and Ecological Processes Research (HEPR) Program




NOAA Fisheries Service
Alaska Fisheries Science Center



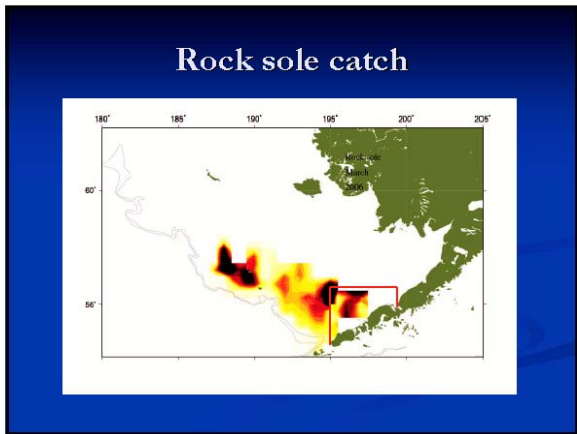
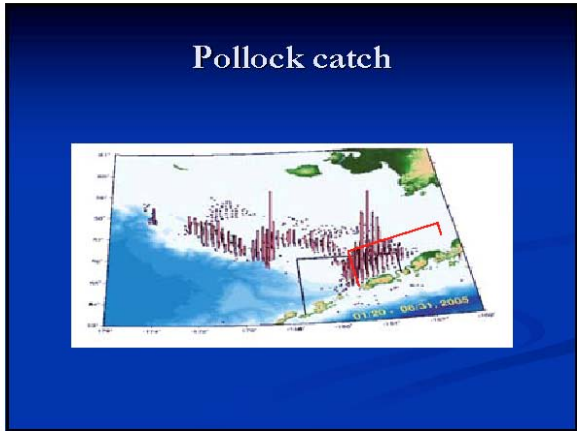

Outline

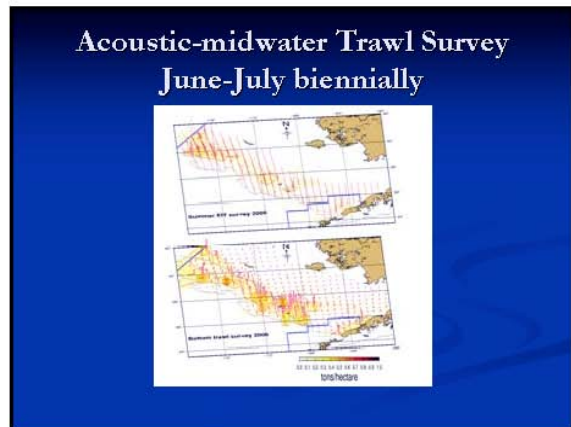
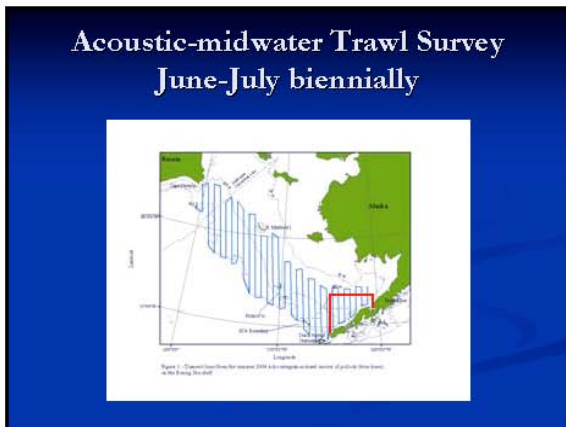
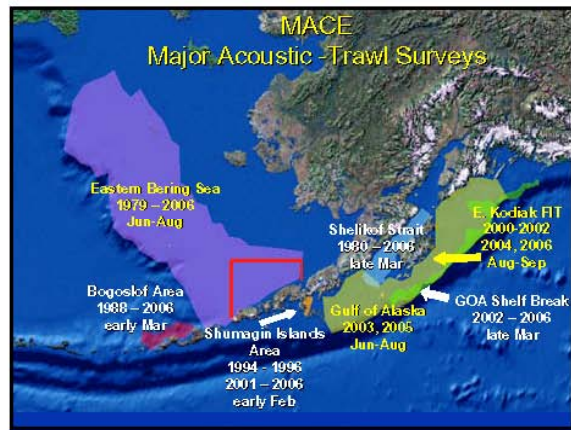
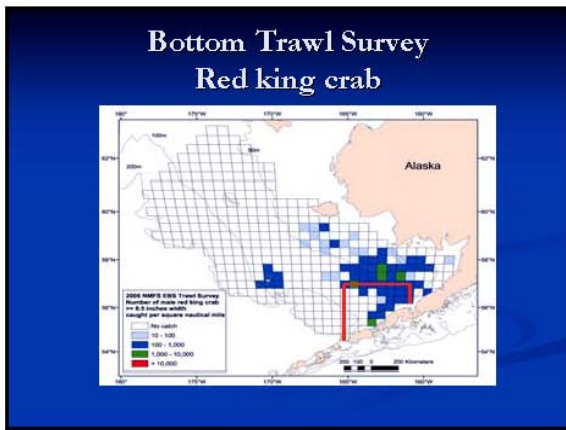
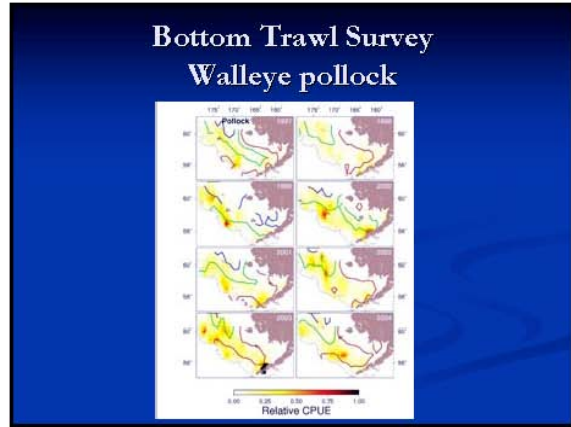
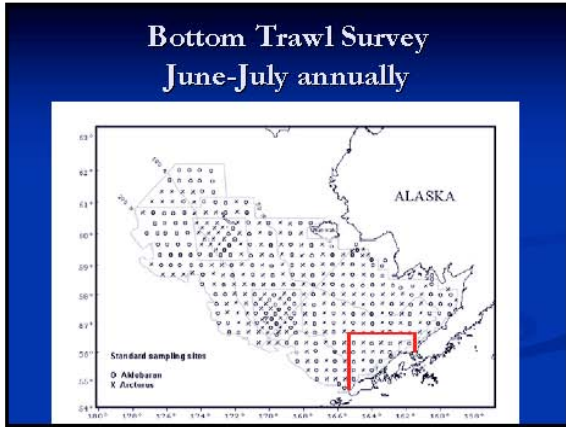
- What information is available?
- What information is needed for this area?
- What uncertainties should be addressed first?

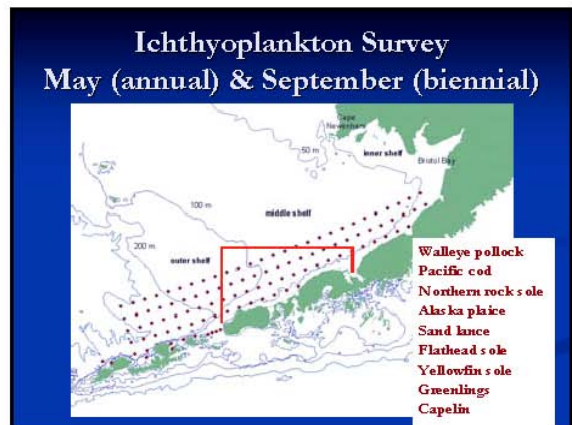
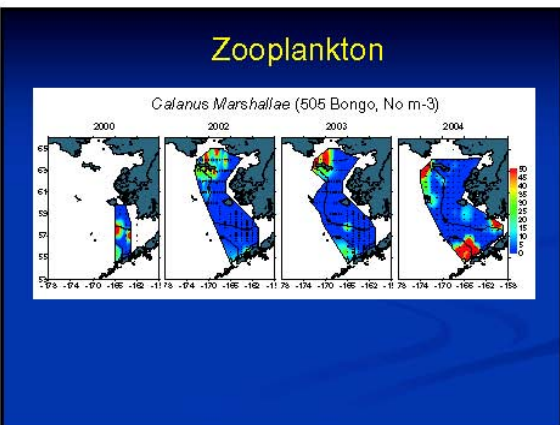
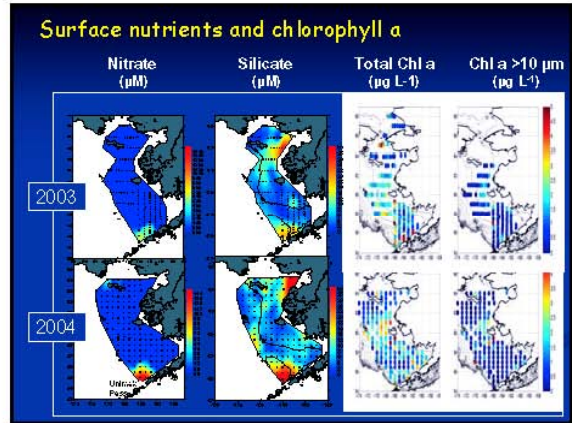
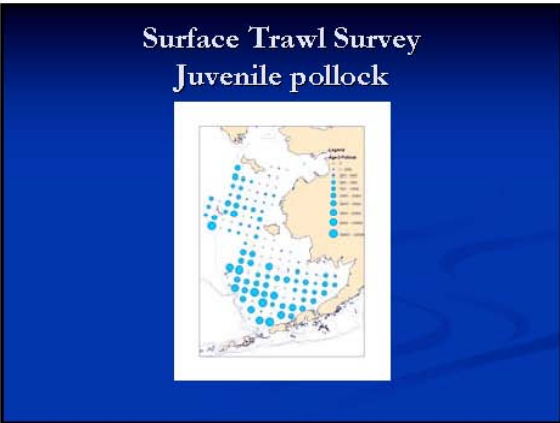
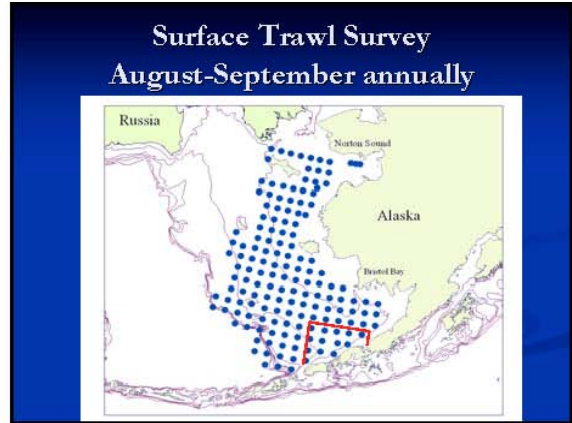
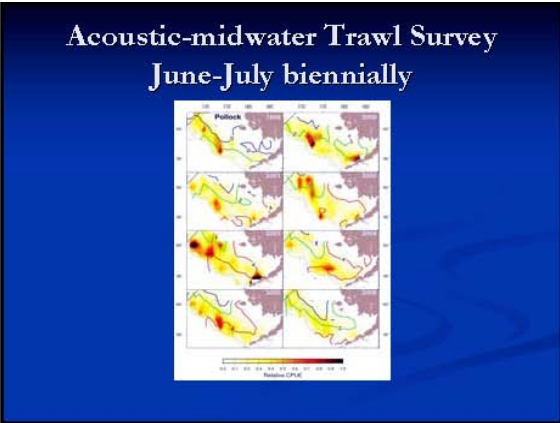


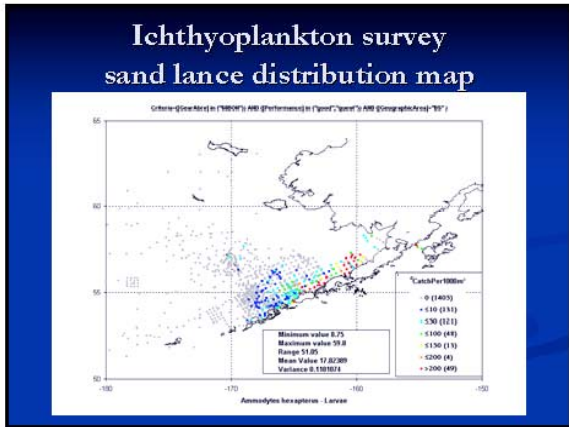
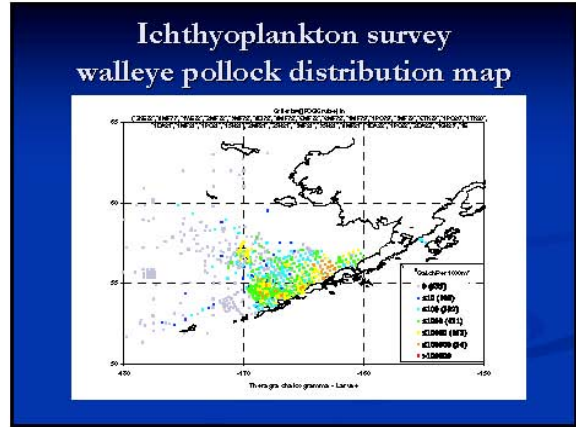
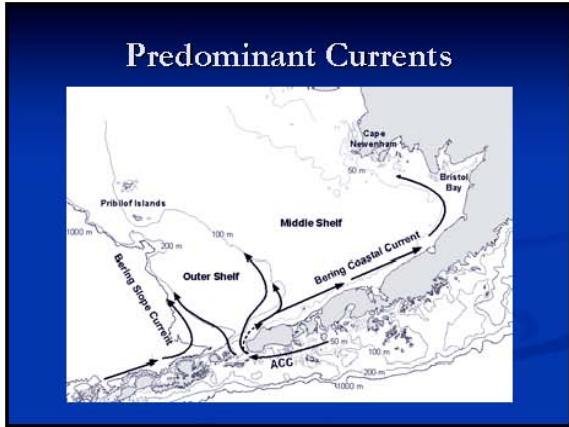
What information is available?

- Fisheries data
- Survey data









What information is needed for this area?

Seasonal distribution and condition of nearshore (juvenile and spawning) fish

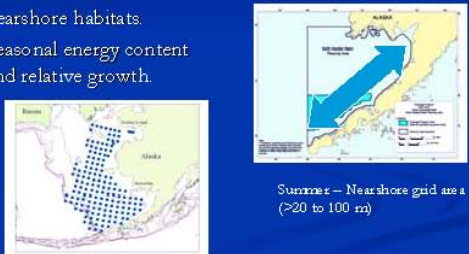
- Seasonal use by habitat type of nearshore (<20 m)
- Seasonal energy content and relative growth

Capelin

Cod and pollock

Seasonal distribution and condition of juvenile Pacific salmon and pollock

- Seasonal use of nearshore habitats
- Seasonal energy content and relative growth.

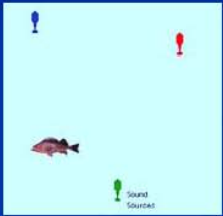


Summer – Near shore grid area (>20 to 100 m)

Fall – Nearshore and offshore grid


Seasonal fish distribution

- Track individual adult fish (e.g. cod) from autonomous, widely-spaced moorings.
- Describe seasonal distributional shifts.

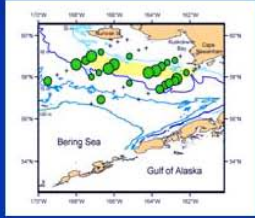



Ichthyoplankton Monitoring

- Ichthyoplankton abundance in May and Sept.
- Relate to physical oceanographic conditions.



Juvenile flatfish


Bering Sea Fish Catalogue

Build web-based access to extensive NOAA databases (1975-present).



What uncertainties should be addressed first?

- Nearshore and juvenile fish, including ichthyoplankton
- Seasonal abundance and distribution



Federal Fisheries in the North Aleutian Basin

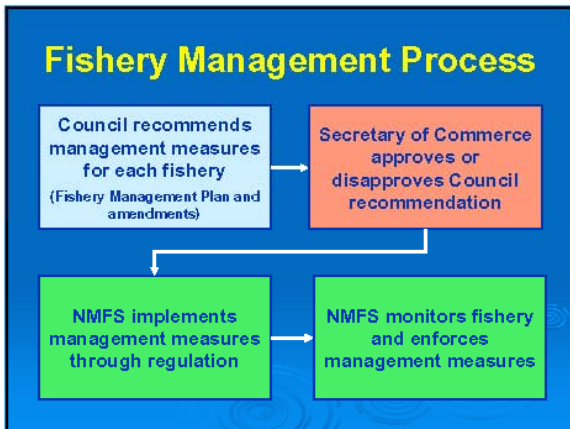
Diana Evans

North Pacific Fishery Management Council

November 27, 2006

Plan for talk

- Background
 - the Council
 - Federal fisheries management
- Fishery distribution within the proposed Sale 92 area of the North Aleutian Basin
 - Groundfish
 - Halibut
 - Crab
 - Scallop



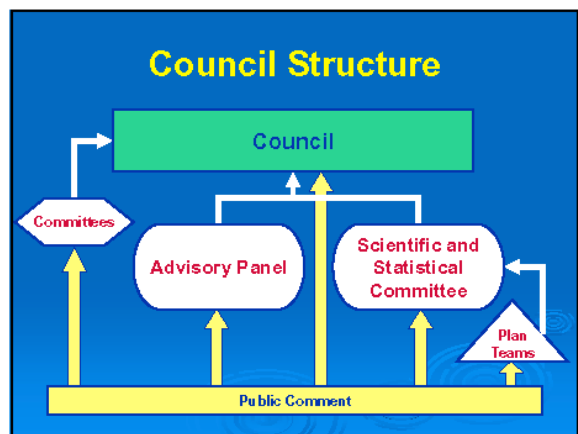
What is the Council?

Responsibilities under MSA:

1. Prepare a Fishery Management Plan for each fishery under its authority
2. Submit amendments to FMPs as necessary
3. Conduct public hearings to allow all interested persons to be heard regarding FMPs and their implementation
4. Review stock assessments and harvest specifications

Council membership

- 11 voting members
 - (1) NMFS RA;
 - (3) WA, OR, AK State Fishery Dept heads;
 - (5) AK 'at large' seats appointed by AK governor;
 - (2) WA 'at large' seats appoint by WA governor
- 4 non-voting members (USFWS, USCG, PSMFC, Dept of State)



Fishery Management Plans (FMPs)

- BSAI Groundfish
- GOA Groundfish
- BSAI King and Tanner Crab
- Alaska-wide Scallop
- Alaska-wide Salmon
-
- Halibut



Setting Harvest Levels

	Optimum Yield ¹ and Overfishing Levels	Actual annual harvest levels
Groundfish	Council	Council
Crab	Council	State of Alaska
Scallop	Council	State of Alaska
Halibut	International Pacific Halibut Commission	International Pacific Halibut Commission

¹expressed as a range

North Aleutian Basin area



Pink polygon represents Sale 92



Groundfish



Overlap with N. Aleutian Basin



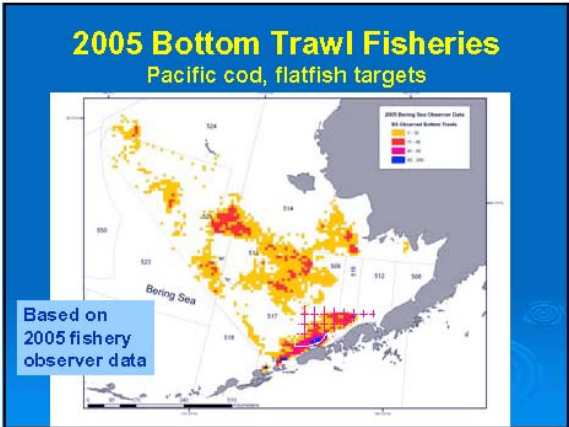
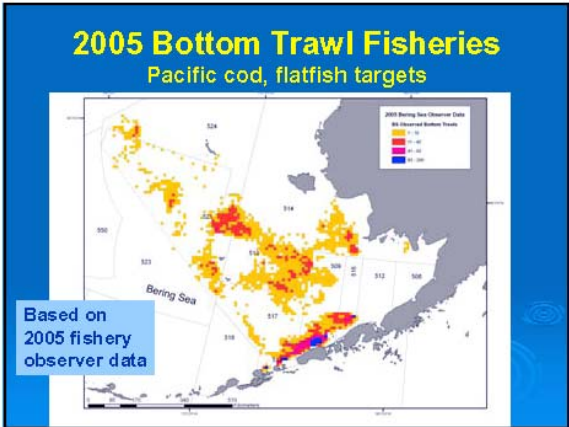
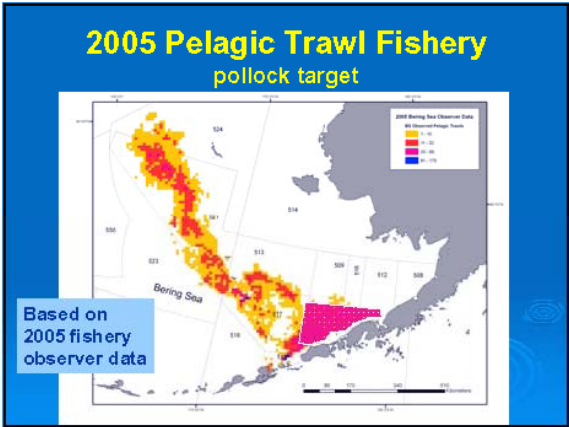
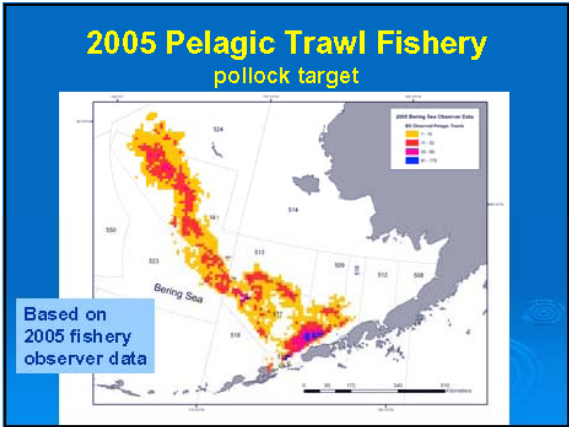
Groundfish fisheries

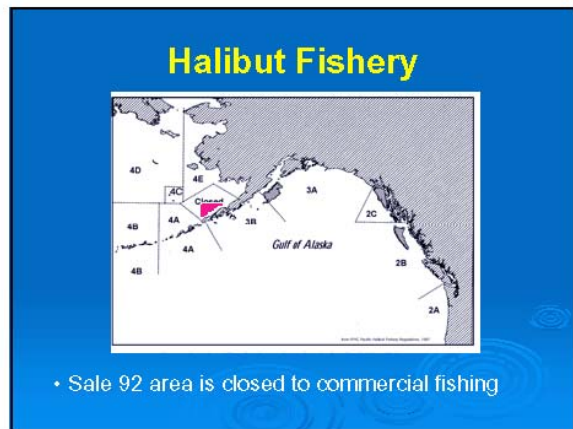
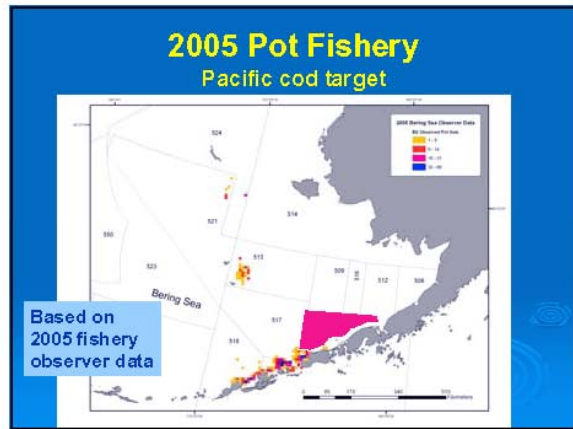
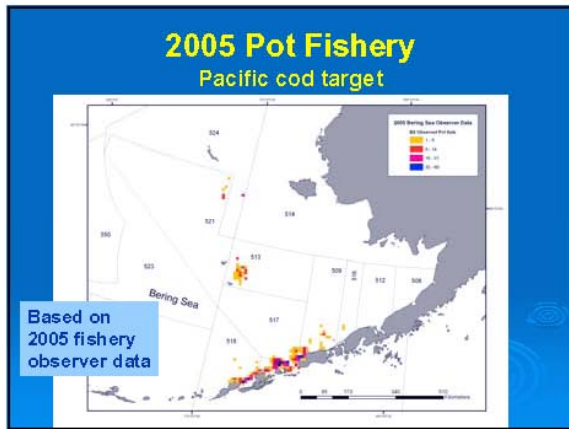
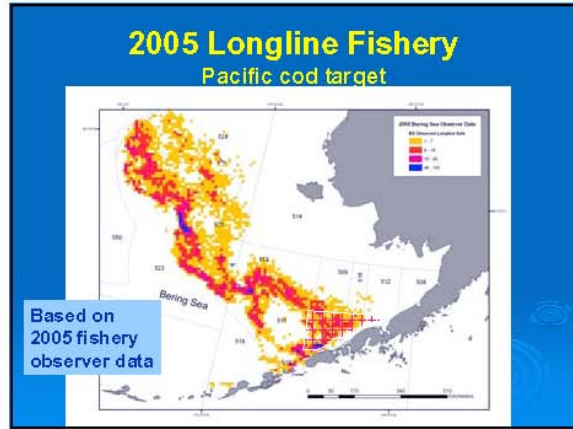
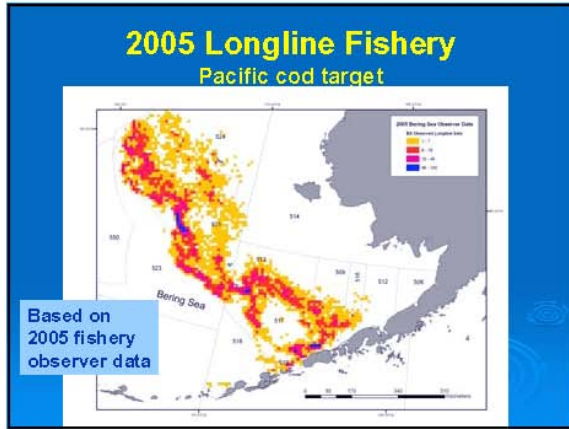
> Target fisheries occurring in the area:

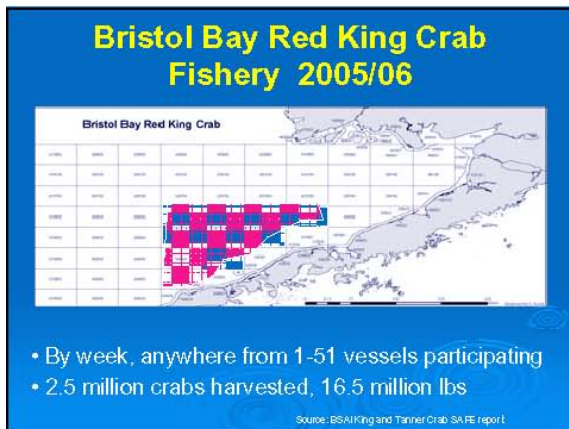
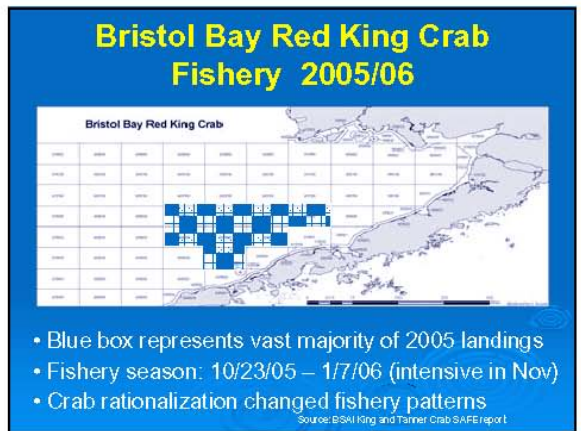
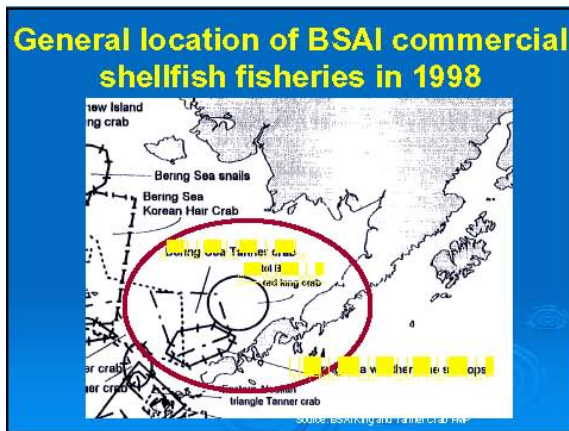
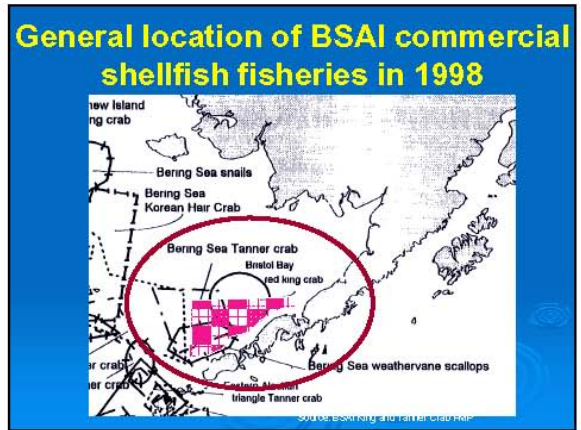
Trawl	Longline	Pot
Pollock Pacific cod Flatfish - Yellowfin sole - Rock sole - Flathead sole	Pacific cod	Pacific cod

Fishery Harvest - 2005

	Harvested in 509, 516, 512	% of total BSAI harvest
Pollock trawl	317,089	21%
Pacific cod trawl	26,023	40%
Pacific cod longline	13,300	11%
Pacific cod pot	4,727	28%
Yellowfin sole trawl	6,674	7%
Flathead sole trawl	2,292	55%
Rock sole trawl	20,418	14%



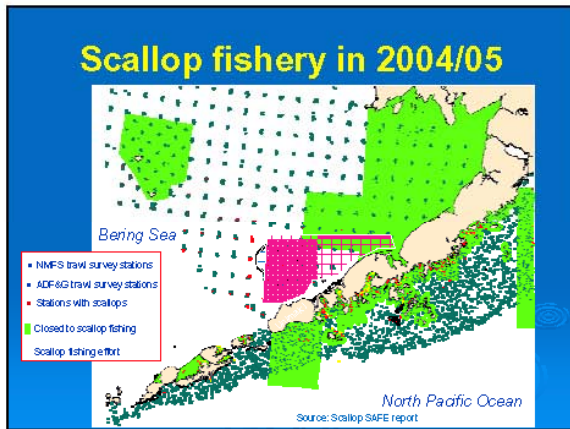
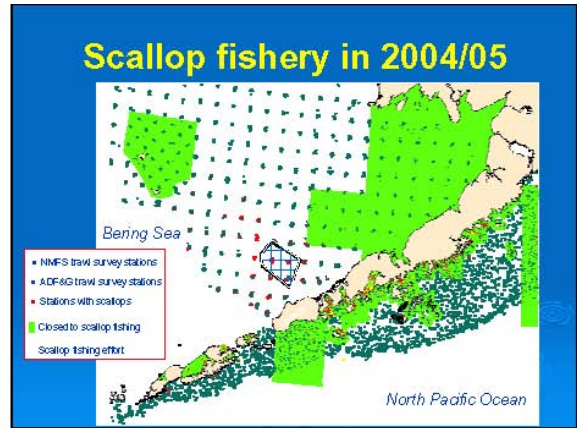
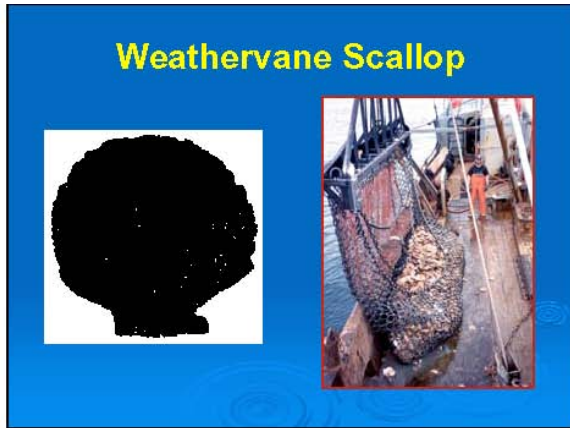




Bering Sea Tanner crab

- Fishery closed 1997-2004
- 2005 – no overlap
 - Fishery occurred west of the North Aleutian Basin
- Early/mid-1990s, some incidental harvest of Tanner crab in BBRKC fishery

Source: BSAI King and Tanner Crab SAFE report



- ### Bering Sea scallop fishery
- Fishery occurs north of Unimak Island
 - stock occurs over a wide area at low densities
 - Fishing season: July 1 – February 15
 - Voluntary cooperative since 2000
 - 1 vessel fished in 2004/5
- Source: Scallop SAFE report

Bering Sea Area scallop fishery summary statistics

Season	Number vessels	GHR ceiling (lbs meat)	Dredge hours ^a	Catch ^a (lbs meat)	Duration of fishery
2000/01	3	200,000	3,355	205,520	
2001/02	3	200,000	3,072	140,871	7/1-11/1
2002/03	2	105,000	2,038	92,240	9/5-1/6
2003/04	2	105,000	1,020	42,590	7/1-7/18
2004/05	1	105,000	275	10,050	7/1-7/13
2005/06					12/13-1/11

^aConfidential data released by vessel operators

- 2% of total Alaska scallop catch for 2004/5

Source: Scallop SAFE report

Potential Impacts of North Aleutian Basin Oil & Gas Development on Commercial Fisheries:

What Do We Know? What Research is Needed?

By

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Prepared for

Minerals Management Services
"North Aleutian Basin Information Status and Research Planning Meeting"
November 28 - December 1, 2006
Anchorage, Alaska

Important characteristics of commercial fisheries which might be affected by North Aleutian Basin oil and gas development

- These fisheries are very economically significant, with annual wholesale value of close to half a billion dollars.
- Catches, production, prices and value vary widely from year to year
- The fisheries are highly seasonal
- Commercial fishing and processing is overwhelmingly the most important private-sector industry of the region.
 - In the small, predominantly Native villages, salmon fishing is an important source of income and jobs
 - Several towns have major fish processing industries and support industries
- The economic benefits and impacts of the industry extend far beyond the region:
 - A large share of the fishermen are from outside the region
 - A very large share of the processing work force is non-resident
 - Most of the processing industry is headquartered in Seattle.

The fisheries which might be affected by North Aleutian Basin oil and gas development are diverse and complex.

- Multiple fish species
- Multiple types of fisheries (commercial, sport, subsistence)
- Multiple types of participants (families to large corporations)
- Multiple types of fishing vessels (small to very large)
- Multiple management agencies (state, federal, and international)
- The fisheries occur over a wide geographic area
- The fisheries have economic impacts and importance over far wider geographic region extending throughout Alaska and the Pacific Northwest.

Three very different kinds of fishing boats, with three very different kinds of participants, in three very different fisheries—all of which might be affected by North Aleutian Basin oil and gas development.



Bristol Bay drift gillnet salmon



Bristol Bay Red King Crab



Bering Sea Pollock

The Purpose of this Meeting
(from the meeting announcement)

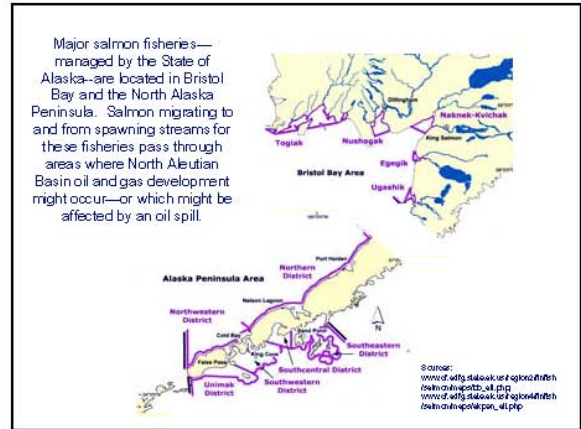
- "... To review the status of available scientific information and advise MMS of additional information that may be needed for a regional environmental impact statement about oil and gas leasing"

How the meeting agenda describes what this meeting will try to do	Corresponding questions that I address in this presentation
--Identify important resources or resource characteristics (receptors) that could be affected by oil and gas development . . .	1. What are major fisheries that might be affected by North Aleutian Basin (NAB) oil & gas development?
--Identify important oil and gas development actions and changes (drivers) that could affect resources of concern --Prioritize drivers based on duration, magnitude, and spatial extent	2. How might NAB oil and gas development affect these fisheries?
--Prioritize receptors based on importance (societal, ecological value), susceptibility to oil and gas development --Identify driver-receptor linkages for high priority drivers and receptors	3. What are measures of "societal importance" for fisheries? 4. What kinds of data do we have for these measures?
--Identify information needs for priority driver-receptor linkages --Prioritize information needs	5. How important are the fisheries which might be affected by NAB oil and gas development, based on available measures? 6. What are the most important research needs for understanding potential impacts of NAB oil and gas development on fisheries?

1. What are major fisheries that might be affected by North Aleutian Basin (NAB) oil & gas development?

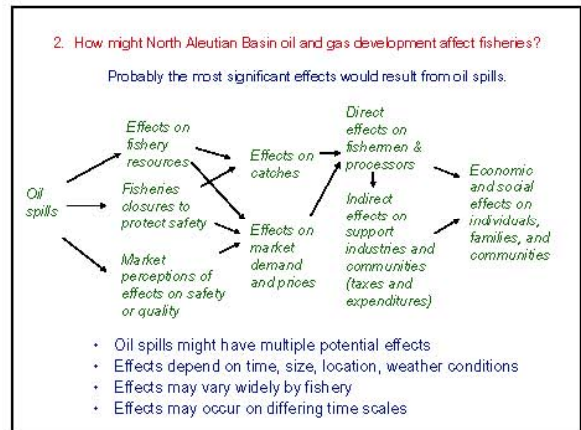
Potentially affected fisheries include—but are not necessarily limited to:

Management	Species group	Species	Fishery
State Government (Policy set by Board of Fisheries; administered by Alaska Department of Fish and Game)	Salmon	Sockeye salmon	Bristol Bay drift gillnet
		Chinook salmon	Bristol Bay set gillnet North Alaska Peninsula (purse seine, drift gillnet, set gillnet)
Federal Government (Policy set by North Pacific Fishery Management Council; administered by National Marine Fisheries Service)	Groundfish	Pollock	BSAI Pollock trawl
		Pacific Cod	BSAI Pacific cod trawl BSAI Pacific cod longline BSAI Pacific cod pot
		Yellowfin sole	BSAI Yellowfin sole trawl
		Rathead sole	BSAI Rathead sole trawl
		Rock sole	BSAI Rock sole trawl
Federal government (delegated to State)	Shellfish	Weatherstone Scallop	Bering Sea Scallop
Federal government (delegated to State)	Crab	Red King Crab	Bristol Bay Red King Crab



Potentially affected fisheries of significant economic importance are not limited to commercial fisheries. Both the guided sport fishing industry and subsistence fisheries are of significant economic importance.

Photo source: http://www.bristolbay.com/booy/boob_1.jpg
<http://img.photobucket.com/albums/v17/ChowderKitchen/p101001.jpg>
http://www.bsa.com/2/entry_center/RedKingCrab.jpg
<http://img.photobucket.com/albums/v17/ChowderKitchen/p101001.jpg>



Oil spills are not the only way in which NAB oil and gas development might affect fisheries. There are a variety of other potential impacts which are probably more likely to occur, but smaller in scale—and relatively easier to assess.

Examples of potential drivers	Examples of potential impacts
Infrastructure development (drill rigs, oil platforms, pipelines, roads, ports, airstrips, energy)	Navigational hazards Areas closed to fishing due to drilling rigs or sub-sea pipelines Reduction in transportation costs and energy costs for fishermen and processors
Marine traffic	Navigational hazards Areas closed to fishing
Population growth	Increased demand for sport fishery resources
Tax revenues	Improvements in fisheries infrastructure

3. What are measures of "societal importance" for fisheries?
- Fisheries are important to society in many different ways.
 - There are many different potential measures of "societal importance."
 - There is no single best measure of "societal importance."
 - There is no single best measure of "economic importance."
 - We can't discuss "importance" without discussing "importance to whom?"
 - Different fisheries are important to different individuals, communities and regions in different ways.
 - The relative ranking of "societal importance" or "economic importance" of different fisheries would not be the same for all measures

Selected economic measures of "societal importance" of fisheries. Many fishery participants would probably argue that these are not the only or necessarily the most important measures of "societal importance."

Concept	Measure
Gross revenues	Ex-vessel value
	Processing value-added
	Support-industry income
Net economic benefit (revenue - costs)	Harvester net income
	Processor profit
	Support industry profit
Participation (number of persons working)	Harvesting
	Processing
	Support industries
Employment (man-months or man-years worked)	Harvesting employment
	Processing employment
	Support industries
Tax revenues	Tax revenue

4. What kinds of data do we have for measures of "societal importance" of fisheries?

- Available data for potential measures of "societal importance" or "economic importance" are limited
- Available data differ for different fisheries depending on who manages them and how they are managed.
- The economic importance of Alaska fisheries extends far beyond the regions in which the resources are located and the fish are caught:
 - Many fishermen and processing workers come from other regions
 - Many fishing boats and processing plants are owned by people from other regions
 - Processing and support industries are often located in other regions
- It is relatively easier to measure the aggregate importance of fisheries than their importance to particular regions or communities

Available economic measures of "societal importance" of fisheries which might be affected by NAB development are limited, particularly measures of importance to particular regions or communities.

Concept	Measure	Availability by fishery	Availability by region or community affected	Availability by fishery and region or community affected	Comments
Gross revenues	Ex-vessel value	Good	Fair	Fair	Data on where revenue are not available.
	Processing value-added	Good	Poor	Poor	Data available for first-wholesale values, but it is mostly confidential at the community level. The region and community which benefit most from processing are not necessarily those where facilities are located, as owners and employees are often non-residents.
	Support industry income	None	None	None	
Net economic benefit (revenue - costs)	Harvester net income	None	None	None	Data on costs are not available. Costs may vary significantly from year to year.
	Processor profit	None	None	None	
	Support industry profit	None	None	None	
Participation (number of persons working)	Harvesting	Fair	Good	Fair	Fishermen must have permits or crew licenses. Crew licenses are not specific to fisheries.
	Processing	None	Good	None	
	Support industries	None	None	None	
Employment (man-months or man-years worked)	Harvesting employment	Fair	Poor	Poor	No harvesting employment data are available. Aggregate number of employment by fishery are available based on numbers of vessel making landings.
	Processing employment	None	Good	None	Data are available on employment by place of work and month. Data are not available on employment by type of fish being processed.
	Support industries	None	None	None	
Taxes	Tax revenue	Good	Good	Good	

5. How important are the fisheries which might be affected by NAB oil and gas development, based on available measures?

The simplest measures of economic importance, and the one for which data are most easily available, are ex-vessel and wholesale value. As a very rough rule of thumb, these fisheries have a combined annual ex-vessel value of about \$200 million and an annual wholesale value of about \$450 million. Values may be significantly lower or higher in some years.

Estimated Lowest and Highest Ex-Vessel and First Wholesale Values of Selected Fisheries Which Might Be Affected by North Aleutian Basin Oil & Gas Development, 2000-2005 (millions of dollars)

Fishery	Ex-Vessel Value		Wholesale Value	
	Lowest	Highest	Lowest	Highest
Bristol Bay drift gillnet salmon	25	60	97	221
Bristol Bay set gillnet salmon	7	17	NA	NA
North Alaska Peninsula sockeye salmon	4	12	NA	NA
BSAI Pollock trawl: Area 309, 316, 312	38	73	156	221
BSAI Pacific cod trawl: Area 309, 316, 312	10	17	19	31
BSAI Pacific cod trawler: Area 309, 316, 312	6	8	11	16
Bristol Bay Red King Crab	55	72	NA	NA
TOTAL	145	299	322	371

Note: Totals are sum of numbers shown in the table (not the lowest and highest values of either for all individual years). Estimates for pollock and Pacific cod fisheries are for 2000-2004. Estimates for BSAI trawl and cod fisheries assume that area 309, 316 and 312 accounted for 25% of BSAI net catches, 49% of BSAI Pacific cod trawl catches, and 21% of Pacific cod trawler catches (these are the shares of the area in the 2005 harvest as reported in DINA's Year Presentation for its meeting on "Federal Fisheries in the North Aleutian Basin"). Estimates of BSAI groundfish values are based on data reported in the BSAI Report to Congress for 2005. Estimates of ex-vessel values for krill and crab are based on CDFW "Final Information" table" data and ADFG's Bristol Bay North Alaska Peninsula catch and price. Estimates of wholesale values are from ADFG CDAR data.

The Bristol Bay Salmon Fishery

- World's largest sockeye salmon fishery
- 1980-2003 average annual catches of 20 million sockeye salmon
- 1980-2003 average annual catch value of \$105 million
- Historically 20-40% of total value of Alaska salmon fisheries



Source: www.dnr.state.ak.us/region2/ba/land/landcontsp/ab_1_1.htm



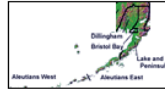
Bristol Bay drift gillnetter

Selected measures of the economic importance of the Bristol Bay salmon fishery

Measure	Fishery	Bristol Bay Salmon Fishery: Selected Economic Measures		
		2003	2004	2005
Ex-vessel value	Drift gillnet fishery	\$37,889	\$26,670	\$30,252
	Set gillnet fishery	\$10,417	\$11,664	\$17,369
	Total	\$48,416	\$77,333	\$97,951
First wholesale value (\$000)		\$111,923	\$178,768	\$221,679
Number of permits fished	Drift gillnet fishery	1424	1411	1447
	Set gillnet fishery	761	795	829
	Total	2,185	2,206	2,276
Estimated harvesting participation		6555	6618	6828
Estimated harvesting FTE employment		546	552	569

Sources: Ex-Vessel Value and number of permits fished: CPEC Basic Information Tables. First wholesale value: ADFG Commercial Operator Annual Reports. Participation estimated based on assumed crew factor of 3.0 persons per permit for both fisheries. FTE employment estimated based on assumption that each person works one month.

In most of the major fisheries, the majority of permit holders live outside the region or outside of Alaska.



Residency of Permit Holders in Selected Fisheries, 2004

Census Area	Bristol Bay Drift Gillnet Salmon	Bristol Bay Set Gillnet Salmon	Bering Sea Red King Crab
Bristol Bay Borough	4%	12%	
Dillingham Census Area	16%	21%	
Lake and Peninsula Borough	4%	5%	
Aleutians East Borough	0.0%	0.3%	
Aleutians West Borough	0.2%	0.2%	
Local areas: Total	23%	39%	
Other Alaska	25%	31%	
Alaska: Total	48%	70%	28%
Other States	52%	30%	71%
Total	100%	100%	100%

Source: Commercial Fisheries Entry Commission, Permit & Fishing Activity Database and Basic Information Tables.

6. What are the most important research needs for understanding potential impacts of NAB oil and gas development on fisheries?

To estimate potential oil-spill related effects, we need to try to answer the following questions. The answer to each question depends on the answers to all the previous questions. The level of uncertainty increases with each question.

Development scenario	Where, when and how might oil exploration and development occur?
Potential for spills	What is the probability of oil spills, by spill magnitude and time of year?
Spill trajectory	What is the probability that spilled oil would reach different locations?
Fisheries closures	What is the probability that oil spills would result in fisheries closures?
Spill effects on resources	What is the probability of long-term effects on fisheries resources?
Effects on catches and prices	How might oil spills affect catches and prices?
Aggregate economic effects	What would be the aggregate economic effects of changes in catches and prices?
Distribution of economic effects	How would these effects be distributed by community and region? What would be their relative significance?

Here is an initial guess at our ability to address these questions through research. For each question, I assume that we know the answers to the previous questions.

Question	Our ability to make specific predictions		Our ability to make probabilistic projections	
	Currently	With further research	Currently	With further research
Development scenario	L	M	L	H
Potential for spills	L	L	L	M
Spill trajectory	L	M	L	M
Fisheries closures	L	H	L	H
Spill effects on resources	L	L	L	L
Effects on catches and prices	L	M	L	M
Aggregate economic effects	L	M	L	H
Distribution of economic effects	L	L	L	M

Given the uncertainty associated with the previous questions, any estimates of the potential oil-spill related economic effects of NAB oil and gas development on fisheries will be highly uncertain.

Community Socioeconomics: North Aleutian Basin

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- The intent of this presentation is to discuss previous MMS socioeconomic research conducted in the NAB, and a theoretical orientation for conducting such work in advance of prospective future OCS development in the region



- IAI's early work in the NAB, now 25 years ago, included a 20-year **forecast of socioeconomic conditions in the absence of OCS development** (see MMS TR-75, subsequently published as *A Systems Approach to Social Impact Assessment, 1985*, Boulder: Westview Press)
- The work was intended as baseline against which development scenarios & OCS-related socioeconomic change could be assessed; forecasts were **based on systematic ethnographic work in communities in AEB & points west**
- Similar work was undertaken by IAI in **Bristol Bay** (see MMS TR-103) & other areas potentially affected by prospective OCS industry activity (see MMS TR-92, 93, 103, 126, 128, 139, 140)

- The research was **organized to enable assessment of long-term social change with/without OCS devel.**
- Three components were involved: (1) OCS development assumptions/scenarios based on industry needs & interests, (2) examination & description of baseline social, cultural, and economic conditions against which OCS-related changes could be assessed **while controlling for other sources of change**, and (3) evaluation of potential socioeconomic effects of OCS development at state, regional & local levels of analysis

- A **systems modeling approach was used to assess relationships between social structural aspects of the communities and agents or forces of change**
- The approach was **applied along many dimensions**: ecology, demography, economics, socio-politics, social networks, education, health care, and religion
- It was attentive to factors such as economic stratification, the effects of external revenue on subsistence practices, and intra-regional variation in effects of involvement in commercial fisheries

- ANCSA was relatively new and a **new(er) economic order** was developing; commercial fisheries were growing and limited entry fisheries were being introduced; technology was improving the efficiency of pursuit of natural resources
- The **dominant source of change was projected to be growth of commercial fisheries & closer integration of local/indigenous society with more formalized systems of social and political interaction**
- This led to **forecasts (working hypotheses)** that then-current trends of social change would extend into 2002 (even in the absence of OCS development)