OCS Study
MMS 2007-002

Alaska OCS Region

Proceedings of a Workshop on Chukchi Sea Offshore Monitoring in Drilling Area

Anchorage, Alaska

November 1-3, 2006

MMS

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

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WORKSHOP SUMMARY

The "Chukchi Offshore Monitoring in Drilling Area (COMIDA)" planning workshop, November 1-3, 2006, held in Anchorage, Alaska was a small workshop planned for approximately 50 attendees to help initiate design of the proposed MMS COMIDA monitoring project. Invitations were sent to over 150 scientists and stakeholders, including local and regional governments, tribes, native associations, oil industry, and environmental groups on the Alaska OCS Region mailing list. In addition to those to the Alaska OCS Region mailing list, invitations went to approximately 50-name-requested scientists. Over a hundred scientists and stakeholders attended with 77 registering. The registered participants are listed in Appendix B. The purpose of the meeting was to briefly review existing research; to identify information needs; and to recommend research monitoring concepts, experimental designs, and scope of field studies to address MMS needs for environmental monitoring of potential Outer Continental Shelf oil and gas exploration and development. Specifically, the workshop will provide input to a COMIDA Phase II environmental monitoring field program proposed for FY 2008.

The first day of the workshop focused on talks on MMS and other oil/gas plans and activities in the Chukchi Sea and invited presentations on environmental background, knowledge, and monitoring issues. Summaries of these talks including questions and answers are provided in the "Introduction" and "Setting the Stage" of this report. Copies of the presentations are in Appendix C. On the second day the workshop split into four working groups: Physical Oceanography & Fate and Effects; Biology, including benthos, fish, and waterfowl; Protected Species; and Socioeconomics and Subsistence. These working groups developed Task Profiles specific to Monitoring Effects of Chukchi OCS Oil and Gas Exploration and Development. Working group participants are listed in Appendix B. On the third day, the four working groups presented to the entire workshop and led discussion of their resulting Task Profiles. Thirteen monitoring study profiles were developed by four working groups, were presented to and discussed by the workshop on the third day and submitted to MMS for consideration. The workshop profiles with transcribed discussions are in "Study Profiles."

Several participants continued to work on task specific profiles after the workshop ended and provided these improved profiles to MMS. These post-workshop profiles have not been incorporated into the workshop proceedings but have been accepted as part of the peer review of workshop results. The workshop profiles, post-workshop profiles and other review comments are being used to revise and prioritize COMIDA study profiles for entry into the Alaska Annual Studies Plan process. The Alaska Annual Studies Plan will also be widely available for review.

WELCOME

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Welcome to the Chukchi Offshore Monitoring in Drilling Area (COMIDA) Workshop. Monitoring has a specific meaning to MMS. The Outer Continental Shelf Lands Act, as amended provides specific background and perspectives on MMS environmental research monitoring:

> "Subsequent to the leasing and developing...the Secretary...shall monitor...designed...*to provide time series and data trend information* which can be used for comparison with any previously-collected data *for the purpose of identifying any significant changes in the quality and productivity of such environments,* for establishing trends..."

At this workshop we are looking for mission relevance, "good science," and broad involvement. The "O" in COMIDA is for "**O**ffshore." In addition, we want to avoid duplication and ultimately we will look to maximize integration among monitoring tasks. We anticipate an overall projected COMIDA budget of $5-7 million, subject to availability of funds.

COMIDA FRAMEWORK AND EXPECTATIONS

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The purpose of the Chukchi Offshore Monitoring in Drilling Area (COMIDA) Workshop is to briefly review existing research; to identify information needs; and to recommend research monitoring concepts, experimental designs, and scope of field studies to address MMS needs for environmental monitoring of potential Outer Continental Shelf oil and gas exploration and development. The MMS will use the results of the workshop to plan its proposed COMIDA monitoring study. The first day of the workshop will focus on talks on MMS and other Oil/Gas plans and activities in the Chukchi Sea and invited presentations on environmental background, knowledge, and monitoring issues. On the second day the workshop will split into four working groups: Physical Oceanography and Fate and Effects; Biology, including benthos, fish, and waterfowl; Protected Species; and Socioeconomics and Subsistence. These working groups will develop Task Profiles specific to Monitoring Effects of Chukchi OCS Oil and Gas Exploration and Development. The working group facilitators will provide specific Task Profile template to work from. On the third day, the four working groups will present to the entire workshop and lead discussion of their resulting Task Profiles.

CHUKCHI SEA PLANNING AREA UPDATE

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This talk summarizes previous Outer Continental Shelf leasing and exploratory drilling in the Chukchi Sea Planning Area, and describes current planning effort and potential post-sale activities. Portions of the current Chukchi OCS Planning Area were offered in 4 previous sales, Sales 97 and 109 in 1988 and Sales 124 and 126 in 1991. The 483 tracts leased totaled about 2.7 million acres at cost of a half billion dollars in high bids. About 100,000 line miles of 2-D seismic were taken and 5 exploratory wells were drilled, plugged, and abandoned. All leases returned to the Federal government.

Now, oil industry is now ready to try again. Because of high industry interest, MMS has proposed a new Oil and Gas Lease Sale in the Chukchi Sea. Scoping issues for the sale Environmental Impact Statement (EIS) were identified in winter 2006 meetings as: accidental oil spills and oil spill response; disturbance of the bowhead whale migration; need to protect subsistence way of life; contamination of sediments, water column, and food chain; climate change; limited baseline data; and cumulative effects. A draft EIS was issued just prior to this workshop. The sale would occur in 2007. The proposed sale will exclude the nearshore spring lead systems and may be further modified by the Secretary's 25-mile buffer in the 5-Year Proposed Program for 2007-2012.

Post-lease exploration/production plans will undergo multiple NEPA of review and consultation. If needed, MMS could impose: timing of operations, locations of surface operations, and locations of sea floor equipment. The MMS also has specific operating rule and regulations to provide additional environmental protection, such as Pollution Prevention Program requirements, shallow hazards surveys, 3rd-party platform verification, and emergency plans, including one for oil-spill response.

Discussion:

Joel Garlich-Miller: Is there a summary of the subsistence concerns raised at the scoping meeting in 2006?

Fred King: There is a scoping report which is available on the MMS website. That is the basis for our subsistence analysis within the document itself. We tried to focus on those species and areas of concern.

Kate Wedemeyer: Is there a time period for evaluation of exploration plans and development plans? And what about the monitoring information?

Fred King: We get the exploration plan and then there is an adequacy review. There is then 30 days for NEPA analysis. At the end of that time period, we have to approve or disapprove of the plan. The time period for the production plan is 120 days. But we would expect for the first plan that we would be doing a full EIS so at that point the clock stops and you go into an environmental impact analysis and regular process which means you have the draft reviews, hearings and scopings, etc.

From my perception, if there were a monitoring plan, you would want to get out there prior to too much being done to get your baseline data. Then you would want to do monitoring during both exploration and development, if it occurs. One of the problems that you have is trying to guess where they are going to drill. The companies may or may not use previously tapped wells. There are a lot of undiscovered resources, undrilled resources.

Lynda Shapiro: How long do we have to develop a baseline survey for leases in 2007, 2009, and 2010? We are unlikely to see exploration before then. These studies should include a component of interannual variability.

Dick Prentki: The lease sale is in late 2007; they could have their leases by 2008. They could be out there drilling in 2008.

Fred King: If there were leases in 2007 I would expect that the companies are going to want to do more work. Based on timelines, the leases and drilling won't happen until probably 2009 or 2010. That doesn't say it could not happen but most likely companies after they get their leases are going to do some evaluation, like requirements for shallow hazards seismic, before they come in with exploration plans.

CHALLENGES FOR DEVELOPMENT IN THE CHUKCHI SEA

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The remote location and severe conditions in the Chukchi Sea present difficult challenges to all operations. Offshore development under similar conditions has not occurred as-yet anywhere in the world. The Barents Sea north of Norway and Russia is probably the closest analog to the Chukchi Sea. New strategies and technologies will be needed to install infrastructure and operate year-round in this high-cost area. Because existing infrastructure is hundreds of miles away, a new support facility will probably be constructed on the Chukchi coast. Offshore fields are likely to be designed with a hub platform as a processing facility surrounded by subsea wells. Subsea wells and other seafloor equipment will become increasingly common in deeper water areas because it is more cost-effective than installing large platforms. Subsea wells and pipelines represent technical challenges, considering the number of installations required, the short open-water season, and the potential for seafloor ice gouging. The overland oil pipeline to TAPS will

be 250 miles long will cross several large rivers in NPR-A. The cost for initial development in this remote area will be $5 billion or more, and it will be justified by an oil discovery of at least 1 billion barrels. However, the first five exploration wells drilled on large prospects in the Chukchi did not find this prize. The new offshore field will have to operate year-round and maximize oil recovery by re-injecting produced gas. Although the Chukchi could hold large natural gas resources, there is no transportation system to move gas to market so gas production could be delayed for 20 to 30 years. If the technical and commercial challenges can be overcome by the first oil field, smaller nearby fields could be developed in the Chukchi and in NPR-A along the pipeline corridor.

Discussion:

Tom Weingartner: Is there offshore development on the Russian side?

Jim Craig: No. There is talk about exploration on the Russian side of the Chukchi. There was exploration near Wrangell Island but no seismic work was done nor wells drilled. The Barents Sea, off northern Norway, is the closest area with potential development on the Russian side.

ONGOING ENVIRONMENTAL STUDIES CONTEXT PAST STUDIES AND FISCAL YEAR (FY) 2007 PROPOSED STARTS

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The MMS has not targeted the Chukchi Sea Outer Continental Shelf (OCS) for environmental studies for over a decade, because of lack of both OCS leasing and industry interest. That has now changed. During the last period of Chukchi activity, MMS had spent about 9.3 million dollars on 16 Chukchi-specific studies, and about $139 million on applicable Alaska OCS environmental and socioeconomic studies. For Fiscal Year (FY) 2007, MMS is procuring five studies either inclusive to or including the Chukchi area:

- Assessing the Cumulative Extent of Offshore Human Activities in the Alaskan Arctic
- Monitoring Marine Birds of Concern in the Eastern Chukchi Nearshore Area
- Monitoring the Health of Subsistence Harvested Bowhead Whales
- Pinniped Movements and Foraging
- Arctic Fish Ecology Catalogue

This Chukchi Offshore Monitoring in Drilling Area (COMIDA) workshop will provide input to a COMIDA Phase II environmental monitoring field program proposed for FY 2008.

LONG TERM MONITORING IN THE CHUKCHI SEA: AN INDUSTRY PERSPECTIVE

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Seismic Activities in 2006

Shell Offshore Inc. (SOI), ConocoPhillips Alaska Inc. (CPAI) and GX Technology (GXT) all conducted seismic activities within the Chukchi Sea Lease Area 193 this summer. ConocoPhillips and Shell are doing 3-D seismic and GXT is doing 2-D seismic. GXT conducted a speculation shoot, so their data are not necessarily proprietary. The actual locations for the activities for SOI and CPAI are proprietary because it is a pre-lease sale activity. Both companies exceed a monetary level that precludes them from partnering on such leases. So there will not be any diagram showing where the track lines were for those surveys.

The basic project schedule started in mid-July with different operators coming out of the chute earlier than others. There is still one operator out there acquiring data as of this date: GXT.

There was another activity scheduled for 2006 to move through the Chukchi and that was the U.S. Coast Guard cutter Healy. Their operations were cut short with a tragic accident. One thing that the Healy was going to do was to deploy a couple of HARP (high frequency acoustic recorders) units for the Alaska Department of Fish and Game's Marine Mammal Group. They ended up in Dutch Harbor and CPAI worked with Fish and Game and others to get the units deployed off Pt. Barrow.

The first thing all the companies did was to verify their sound signatures from the seismic vessels. Initially, the companies used a model to understand the propagation of sound from the air gun arrays. The field activity was to confirm what those models were telling us as far as exclusion zones. In most cases, the verification test showed anywhere from twice the distance from the ship for some operators. The lessons learned from that is that the more data you have in the model the better the model will be. In the ConocoPhillips model, we were able to get some subsurface data into the model but most others couldn't. The bottom line is that we needed more data.

Mitigation and Monitoring Program

At the Open Water Meeting in April, there was a lot of concern from the whalers about minimizing the number of vessels in the Chukchi area. All of a sudden you have three operators they all want to shoot seismic and of course the angst was pretty high.

So industry was asked whether the operators could share one seismic vessel. Obviously that couldn't happen due to the proprietary nature of the data prior to a lease sale. So operators had

their own seismic vessels. But they did combine efforts to reduce the number of support vessels, whether it was supporting the seismic vessel for crew or food, sharing aircraft. We shared aircraft for nearshore aerial surveys and shared the costs for setting up communications centers in each village.

We monitored around the seismic vessels to minimize disturbance to marine mammals, which is standard protocol when doing seismic operations. There were marine mammal observers on all support vessels. The concern there was that there hasn't been a lot of data collected in the Chukchi Sea for a number of years. So let's get opportunistic observations of marine mammals everywhere that we are moving in the Chukchi.

We also conducted dedicated vessel surveys. We actually pulled a Passive Acoustic Monitor (PAM) array. We got in three surveys, although not complete because of ice conditions. We did attempt to try out this technology to see if we could hear marine mammals calling. The system does not allow for you to actually localize or to determine from what direction the animals are calling. If they are within a few kilometers you can detect them if they are calling.

This technology is undergoing a lot of research and development right now by an industry group called the Joint Industry Program. It is a group of international industry companies that are investing in a lot of research. So there is the potential for some modifications and advancements in the acoustic monitoring arena.

We also worked with Dr. Chris Clark of Cornell University to place some acoustic net arrays, or popup hydrophones off the coastal villages.

Nearshore Aerial Surveys

Nearshore aerial surveys were conducted twice a week basically between Barrow and Point Hope. With the help of National Marine Mammal Laboratory with Robyn Angliss and Robert Suydam and others, we developed a transect in a saw tooth pattern for the flights. We flew at an altitude of 1,000 feet. During the beluga hunt in July, we flew higher to minimize disturbance. The surveys started in July and are complete except for GXT. We had three observers: one observer on either side looking out the bubble window and one recording data. We had two pilots. The aircraft also coordinated with other agencies doing surveys.

There was an NSF-funded study, the SNACS Program, which is a feeding study going on off of Point Barrow. Shell was able to help them out by flying some transects for them when they couldn't get out.

Vessel Based Surveys

We used Conoco's chase boat M/V *Torsvik* for the towed Passive Acoustic Monitor (PAM). We had two observers on board. We had one technician to work the acoustics equipment and two marine mammal observers. When there was a lot of daylight, there were two crews working. With the PAM, we conducted three surveys this summer. They weren't totally complete this year because the ice was really heavy this year. At the times we tried run these surveys and deploy the

buoys, we ran into significant ice and had to back off. We ran ten 50-nmi transects with the objective of trying to estimate the number of marine mammals in this area. Transects were selected to cover different types of habitats.

Stakeholder Engagement

Stakeholder engagement is key for any industry doing work but particularly on the North Slope. This spring there were a number of community meetings at which Shell and Conoco participated. We attended the Alaska Eskimo Whaling Commission (AEWC) mini-convention in March to roll out our programs. The National Marine Fisheries Service held an Open Water Meeting in April this year at which the "rubber met the road" with regards to expectations for mitigation and monitoring. Agencies and industry each had a different understanding of what they wanted to see. The lesson learned there was that we really need to get things figured out a lot earlier than the Open Water Meeting, especially when you want to get your boats out in July. Consequently we had a second Open Water Meeting just last week with NMFS and MMS. In that meeting we reviewed what we have done to date in 2006. But the real emphasis of that meeting was to get everyone talking about what we need to do next year. We don't want to be in the same situation next year with everyone scrambling for boats. Qualified technicians are hard to get. Equipment can be hard to get if you have to build it. So I think we had an excellent dialogue last week. We have already started moving forward on our plan for next year.

We also attended an AEWC meeting last week at which we presented the results of our findings to the Commissioners.

Both companies will be going back to communities this fall and winter to review this summer monitoring study results. Currently our consultants are working on pulling that data together. LGL is the consultant that is doing the work for the majority of the operators in the Chukchi but then they are also doing work in the Beaufort. So you can imagine they are scrambling to at least get our 90-day report pulled together. Then there will be another report that contains all the additional research and monitoring data.

Communication Centers

Barrow was the hub for communication with seismic operators. All of the information came in to Barrow. Each village had their call center that communicated with Barrow: Point Lay, Wainwright, and Point Hope. The Barrow Communication Center was manned full time while the villages were manned part time. There were updates every six hours. Each village had a map showing where the boats were. It was very important to have an Inupiat on board each source vessel so that they could communicate with the call centers. That was key and worked well for us this year.

Recommendations for future data collection in the Chukchi Sea

Industry doesn't expect that all the agencies will go out there and collect all the baseline data that is necessary. Industry does feel that we have a place at the table and we want to be there. We see that there are multiple stakeholders involved: industry, NSB, MMS, NMFS, NMML. All are interested in collecting good baseline data in the Chukchi Sea. We encourage that collaboration to get a solid multi-year monitoring program pulled together.

We appreciated what MMS showed on the 2007 efforts by MMS. We did provide some feed back to MMS on how we felt about the 2007 program. You may want to include multiple subsistence species of interest to local communities in your program.

One of our recommendations would be to expand the Bowhead Whale Aerial Survey Program (BWASP) effort into Chukchi either in 2007 or 2008. MMS has done a great job with that program in the Beaufort Sea.

We would also recommend coordinating with other agencies and research entities such as the North Pacific Research Board, the Alaska Ocean Observing Program, and the U.S. Geological Survey. There is a lot of interesting work going on out there. Everyone seems to have a little piece of the pie. If we can all come together and get one whole pie that would be great.

Integrated Project Planning

When people find out that industry is going out into the Chukchi, they get concerned that they are going to see structures all of a sudden. However, there are a number of steps in the planning process that must be taken prior to any development. At ConocoPhillips, we have an Integrated Project Planning process. First the resource must be identified that is where seismic activity would begin. Then a number of steps have to be taken. But what is the key with this whole process is engagement: establishing relationships, getting out to the communities, letting them know what you are doing. It is always easier to talk to someone if you know them and have some level of trust there. You can be frank. So engagement with communities and key stakeholders, like your scientists, and agencies is really important for us.

Then there is the Study Component. Speaking for Conoco, in our model for onshore, which is our primary activity in Alaska, we are very focused on developing regional baseline studies even if we do not know where drilling will take place. It is very important that we have an understanding of the area in which we want to operate and that we start collecting baseline data. For example, in the NPR-A, we have six years of data from all different disciplines but we don't have any development there. So it is very important that we understand the environment in which we are operating, so that when we go forward with development we can integrate mitigation measures within that plan. We can talk to the engineers and let then know where the key areas are to avoid or have some other kind of mitigation measure if possible.

Then we have the permitting process. We spend a lot of time and resources prior to the permitting stage for any exploration and appraisals leading to development. Then once you are operating, you must do compliance monitoring.

Discussion:

Evelyn Brown: When I was asked to give a talk at this meeting, I started reviewing the literature, especially for the North Sea area on offshore oil platforms. There was information on behavioral impacts on fish and also smaller organisms. I am wondering if you just look at the apex community and there is a change, is it a response to your activities or is it the impacts on the food resources? Should you be expanding some of your monitoring studies to animals lower on the food chain?

Caryn Rea: That is a good question and we get asked that a lot. There have been studies elsewhere in Norway, and a scientist by the name of Art Popper has looked at impacts of seismic work on fish. In those studies there were no deleterious effects from seismic arrays (air guns). But I alluded to the Joint Industry Program, that group will be looking at that finer scale information in a controlled experiment, what are the effects of air gun arrays on fish or prey.

PHYSICAL OCEANOGRAPHY OF THE CHUKCHI SEA SHELF

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The circulation and water mass properties of the Chukchi Sea shelf are affected by the mean northward flow through Bering Strait, the winds, and thermohaline processes. The latter are primarily a consequence of the melting and freezing of sea ice and secondarily associated with freshwater runoff. On average the flow is northward across the shelf and principally proceeds along three branches guided by the bathymetry: Herald Valley in the west (Russian EEZ), Barrow Canyon in the eastern, and across the central shelf through the Central Channel. The mean flow opposes the prevailing winds and is primarily forced by the sea level slope between the Pacific and Arctic oceans. Current variations are mainly wind-forced, but baroclinic forcing, associated with upstream dense water formation in coastal polynyas might occasionally be important. Current speeds are 5 – 15 cm s^{-1} over the much of the shelf, but are much swifter (50 – 100 cm s^{-1}) in Herald Valley and Barrow Canyon. Dynamical arguments and numerical models suggest that the bulk of these flows continue eastward along the outer shelf and continental slope. These imply that western Chukchi waters are carried across the outer shelf and into the US EEZ. The flow is presumably eastward along the shelfbreak but eddies shed by current instabilities and wind-forced flow reversals may cause the shelfbreak current to episodically break up and shed shelf water into the interior basin. Numerical models indicate that the flow is counterclockwise around Hanna Shoal in the northeast Chukchi so that outer shelf water is carried back onto the shelf east of the shoal where it joins the outflow through Barrow Canyon. The models imply that the circulation over the shoal is sluggish, suggesting that this may be a recirculation zone that traps materials. Mesoscale circulation fields often develop along ice edges

resulting in the formation of small scale eddies (~10 – 20 km) and meanders. These mesoscale flows, while transitory, may be quite effective in mixing waters on the shelf.

Shelf water mass properties are primarily established by Bering Sea processes, including cross-shelf transport of nutrient-rich waters from the Bering basin, river runoff, and advection from the Gulf of Alaska. On the Chukchi shelf water mass properties are influenced by exchange with atmospheric heat exchange and vertical and horizontal mixing. Winter water mass modification depends crucially on the fall and winter winds, which control seasonal ice development. An extensive fall ice cover delays cooling, limits new ice formation, and results in little salinization. In such years, Bering shelf waters cross the Chukchi shelf with little modification. In contrast, extensive open water in fall leads to early and rapid cooling, and if accompanied by vigorous ice production within coastal polynyas, results in the production of high salinity (>33) shelf waters. In spring the shelf is strongly stratified due to ice melt and the inflow of low salinity waters from Bering Strait.

The Chukchi shelf is subject to enormous interannual variability due to alterations in the transport and properties of water flowing through Bering Strait, variations in the wind field, and changes in the extent and duration of the shelf ice cover.

Discussion:

Robert Suydam: You and your colleagues have done a great job of improving our understanding of the physical oceanography in the Chukchi Sea. Most of the water flow patterns you showed were really for the bottom water. Given oil and gas activity in the Chukchi Sea and the potential for spills, what do we know about surface layers and how the movements of the surface might affect oil?

Tom Weingartner: That was one of the topics that I chose not to talk about in this talk. It is something that we can bring up in the break out session tomorrow. It is a really good question. There are a few studies that suggest that the ice drift, at least, is moving east to west or from the northeast to the southwest across the Chukchi shelf. Which then implies that the water is moving in a direction opposite to the ice. The question is, then, how thick is that boundary layer between the ice and the measurements that we are obtaining. It is a really good question that I don't have a good answer for you.

GRANULOMETRY, ORGANIC CARBON AND TRACE METALS IN SEDIMENTS OF CHUKCHI SEA

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The continental shelf of the Chukchi Sea is among the densest sampled margins of the world for sediments. The granulometry consists of a matrix of gravel to mud and their admixtures, with a

broad across the shelf, east to west, fining of sediments. Particulate organic carbon (POC) range from <0.5% to 1.5%. Mass balance for POC indicates accumulation rates of 2.03 and 1.2 mg cm^{-2} y^{-1} for productive and less productive regions, respectively. There is an east to west across the shelf increase in $\delta^{13}C$ and a decrease in C/N in POC, which are related to a east to west increase in the depositional flux of marine-derived (as opposed to land-derived) POC.

Concentrations of selected trace metals (Mn, Cu, Cr, Co, Zn, Ni and V) in gravel-free sediments were analyzed at 31 locations. The Chukchi Shelf metals are correlated with sediment silt and clay contents and not with the POC. Comparison of the mean metal contents in muds of the Chukchi Sea with those of the circum-arctic shelves shows relatively lower levels of most metals in the Chukchi. Comparison of the metals levels in sediments of the outer shelf and the inner shelf off the Red Dog mine dock shows no evidence of Zn pollution from the shipping operations of the Pb-Zn ore concentrates. The concentrations and accumulation rates of the metals will serve as a baseline to monitor metal pollution in the Chukchi.

No discussion.

THE HISTORY OF THE MINERALS MANAGEMENT SERVICE MONITORING PROGRAMS IN THE BEAUFORT SEA: EXTRAPOLATION TO THE CHUKCHI SEA

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Extensive oil and gas development and production activities started on the North Slope of Alaska, near Prudhoe Bay in the mid-1970s. The first offshore development in the Beaufort Sea began in the mid-1980s with the construction of the Endicott production island and causeway system. More recently (in 2000) production began at Northstar Island, and an additional offshore production site is proposed at the Liberty prospect in the nearshore Beaufort Sea. There has been concern about the long-term effects of the current oil and gas developments, as well as, long-term effects associated with future offshore lease sales and exploration activities. Historical chemical, biological and physical oceanographic data have been collected in the region over several decades. The sensitivity of the region adjacent to Northstar and Liberty, and the highly variable and complex environmental conditions, made further monitoring necessary. In response to interagency reviews, environmental impact statements (EISs) and development and production plans, the U.S. Department of Interior, Minerals Management Service (MMS) initiated the Beaufort Sea Monitoring Program (BSMP) in 1984. In 1999 MMS initiated the Arctic Nearshore Impact Monitoring in the Development Area Programs (ANIMIDA and cANIMIDA) as long-term studies for monitoring potential impacts of the Northstar and Liberty developments. ANIMIDA Phase I included hydrocarbon and metals chemistry measurements in sediment and tissue samples, as well as acoustic measurements adjacent to the Northstar and Liberty sites. Phase II of the ANIMIDA Program was initiated in 2000 and incorporated seven tasks including hydrocarbon and metal chemistry studies, suspended sediment studies, an assessment of subsistence whaling at Cross Island, biota contaminant assessment, and a study of the "boulder

patch" area. The cANIMIDA Program continued periodic monitoring into 2006. An overview of the history of the MMS monitoring programs in the Beaufort Sea, and a summary of the primary findings to date will be presented.

Discussion:

Paul Stang: The cANIMIDA program had definitive projects, Northstar and Liberty, so you knew where to monitor. The Chukchi won't have definitive locations until you almost have a development project in hand. The challenge that the group faces is what is the appropriate level of monitoring at this stage in the OCS oil and gas process? What should we do, and what should we save for when we know where? There are two different issues: 1) we have a very broad area where we are offering leases and we don't know where the lease may be purchased or where exploration will occur; and obviously we don't know where development will take place. So how do you approach monitoring when you are in that phase? And then what do you do differently when you get to an actual site for a development project? These are important questions because the primary use for all of this information is for our EIS and future Lease Sales in the Chukchi and for any development projects that would come along. So as you are thinking about what recommendations to make to MMS, those are key questions to keep in mind.

John Brown: Just to add to that, not really a response but more food for thought, one of the major criticisms that we received from our scientific review board as part of this overall process, that we only had one year of predevelopment data. Granted we had Beaufort Sea Monitoring Program data going back to the 1980s but the technology had changed greatly from 1986 to 1999. The measurement technologies for organic contaminants and in some cases inorganic contaminants changed as the state-of-the-art changed which made it very difficult to make a valid comparison to the historical data. So don't miss an opportunity to establish a good baseline even though we don't know where the developments are going to occur as we did in the Beaufort Sea.

Evelyn Brown: Why not use cores to establish a baseline?

John Brown: We did do that. I presented very limited coring data. In the Beaufort there were no good depositional environments. We had a couple of depositional pockets or basins where we could do some coring. We are not sure once again, what the Chukchi will yield. We know that the nearshore coastal area is highly erosional. It looks like there are some depositional areas offshore. So to answer your question, yes it would be good to look at coring as a method of looking back through time to see what the baseline is. But you have to have the right place. And coring tends to be expensive too. The Chukchi Sea may be different and we may want to consider this.

John Goll: Following up on Paul Stang's statement and what was just said, it may not be as bleak with regard to the whole Chukchi Sea. I think what the charge to the group should be is two parts: 1) the general area, we don't know exactly where things might be but look at that one chart that Fred King or Jim Craig showed of where the leases were in the past. If we have to guess those would be the areas. The charge is twofold: One is a general approach as was done for the Beaufort, historically. Two is to help design, even though we don't know exactly where, for a

year from now, assuming that the sale occurs, after that we will know where the companies bid. Also help us in designing how to concentrate on those areas when we exactly know where they are, a general approach to help us design something specific.

THE BENTHIC FAUNA OF THE NORTHEASTERN CHUKCHI SEA

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Our knowledge of the benthic fauna along Alaskan arctic shelves is largely based on a series of intensive surveys between the 1970s and early 1990s in the Bering, Chukchi and Beaufort Seas under the federally sponsored Outer Continental Shelf Environmental Assessment Program (OCSEAP) managed by MMS/NOAA. The massive datasets collected under these programs were recently (Dunton et al., 2005) synthesized under the Arctic Shelf Basin Interactions (SBI) project sponsored by NSF. This synthesis revealed "hot spots" of high benthic biomass in several regions of the Chukchi Sea, particularly in the northeastern sector between Pt. Lay and Icy Cape (Fig.1). Hanna Shoal, which lies about 200 km west of Pt. Lay, is characterized by average biomass values that exceed 360 g m^{-2}, nearly an order of magnitude higher than just east of Pt. Barrow. Infaunal and epifaunal biomass at individual sampling sites in this area range from 99.1 to 838 g m^{-2} (Table 1). The high abundance of bottom fauna is correlated with high pelagic primary production as reflected by integrated chlorophyll *a* concentrations above 150 mg m^{-2}, most of which reaches the seabed ungrazed. Unfortunately, relatively few stations have been

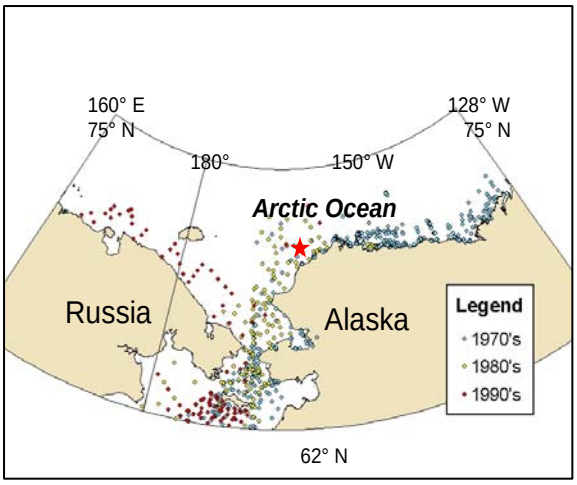

Figure 1. Location of benthic biomass stations compiled for the SBI synthesis project. The star denotes an area of high benthic biomass in the northeastern Chukchi Sea (Dunton et al., Deep Sea Research II 52: 3462-3477).

Table 1. Benthic biomass station means compiled from a variety of biological studies in the western Arctic.

Latitude	Longitude	Date	Depth (m)	Biomass (g m^{-2})
71.2	-163.08	8/28/1973	50	421.1
70.65	-162.633	8/11/1976	38	125.9
71.21	-162.33	9/2/1986	47	269.1
71.17	-161.96	9/2/1986	47	272.9
71.17	-161.95	8/28/1970	45	838
70.83	-161.74	9/2/1986	43	611.7
70.51	-160.9	9/1/1986	23	125.5
71.39	-160.29	8/30/1986	47	306.7
71.38	-160.25	8/30/1973	50	588.5
70.84	-160.04	8/30/1986	46	379.9
70.88	-159.51	8/30/1986	31	387.3
70.96	-158.99	8/29/1986	27	99.1

sampled in the northeastern Chukchi Sea compared to other arctic regions. However, the benthic production in this area is directly linked to utilization by higher trophic levels, including marine mammals and seabirds. The generally high benthic biomass in the northeastern Chukchi Sea is thought to be a result of advective processes that provide an organic carbon and nutrient subsidy from more productive southern shelf systems in the northern Bering and Chukchi Seas.

Discussion:

Sathy Naidu: Is there a breakdown of the benthic biomass by species?

Ken Dunton: To some extent that is in the NODC database in terms of the breakdown of the biomass into at least family. It depends on the investigator as to how far it was broken down.

Jackie Grebmeier: Howard Feder has published some of this data for the northeast Bering Sea. That data is in a peer-reviewed publication. It is hard to quantify some of that information on maps but the data are there.

Sathy Naidu: The Chukchi is very productive. These data would be useful.

Ken Dunton: The investigators didn't treat the data in the same way.

PELAGIC-BENTHIC COUPLING AND ECOSYSTEM DYNAMICS IN THE CHUKCHI SEA

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The shallow continental shelves and slope of the Amerasian Arctic are strongly influenced by nutrient-rich Pacific waters advected over the shelves northward from the northern Bering Sea into the Chukchi Sea and Arctic Ocean. The duration and extent of seasonal sea ice, seawater temperature, and water mass structure are critical controls on water column production, organic carbon cycling, and the strength of pelagic-benthic coupling that supports the underlying rich benthic faunal communities. Pelagic-benthic coupling can be evaluated by studying biogeochemical sediment processes on various time scales. For example, sediment metabolism and tracers, such as sediment chlorophyll, can be an indicator of weekly-to-seasonal carbon depositional processes, while benthic faunal populations can act as multi-year, long-term integrators of a variety of marine processes. The tight pelagic-benthic coupling observed in the northern Bering and Chukchi seas between seasonal water column carbon production processes and underlying short- and long-term benthic carbon transformation processes provide a "footprint" in the sediments of persistent ecosystem events and subsequent time series changes (Grebmeier et al. 2006a). Biological community structure and carbon cycling over the shallow

shelves influence the level of carbon and recycled nutrients entering the Arctic Basin via shelf-basin exchange mechanisms, such as advective transport, eddy dynamics, and down-canyon material transport.

The shallow shelf ecosystems in the Chukchi Sea are expected to be vulnerable to environmental change, particularly as sea ice extent declines and seawater warms (Grebmeier et al. 2006b). Both primary and secondary production are enhanced in specific regions, with the northern Bering and Chukchi Seas sustaining some of the highest water column production and soft-bottom benthic faunal biomass in the world ocean. In addition, these organic carbon-rich Pacific waters are advected into regions of the nearshore Chukchi Sea that have lower primary productivity on an annual basis. These near shore areas are intimately tied to nutrients and advected particulate organic carbon from the Pacific influenced Bering Shelf-Anadyr water. Sediment metabolism and tracers indicate seasonal differences in carbon supply at shelf and upper slope stations compared to basin stations, whereas benthic biomass provides an interannual pattern of carbon deposition. Barrow Canyon, at the interface of the Chukchi and Beaufort Seas outer shelf and slope, is a key conduit for transformed Pacific water and associated organisms that transit to the deep Arctic Basin. Given the short food chains and dependence of many apex predators on sea ice, recent reductions in sea ice in the Pacific-influenced sector of the Arctic has the potential to cause an ecosystem reorganization that may alter this benthic-oriented system to one more dominated by pelagic processes.

References:

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Grebmeier, J.M., J.E. Overland, S.E. Moore, E.V. Farley, E.C. Carmack, L.W. Cooper, K.E. Frey, J.H. Helle, F.A. McLaughlin, and S.L. McNutt. 2006. A Major Ecosystem Shift Observed in the Northern Bering Sea, *Science* 311:1461-1464.

Discussion:

Sathy Naidu: Why the transition from a pelagic to benthic system when going from Bering Sea to the Chukchi Sea? As we all know the Bering Sea is a benthic pelagic system. For some reason or other north of the Bering Strait it becomes a benthic system predominately. What happened to the pelagic component?

Jackie Grebmeier: From the northern Bering Sea northward, when you start getting the blooms, the amount of carbon is huge, and the zooplankton populations aren't necessarily there, the large ones, to graze down. And the temperatures are cold. South of St. Lawrence Island the top to bottom temperature is –1.6. Metabolically the zooplankton can't keep up with the productivity. On those very shallow shelves the carbon is just descending down it is such a huge amount. We have zooplankton up there otherwise we wouldn't have bowhead whales there. But in composite there is way more going down in that shallow water system. When you pull back the ice, the idea is that there will be more primary production. I am not sure. I am not convinced on that because you increase wave fetch, turbulence, and wind mixing. That is you have two hypotheses:

enhanced production and not. That is what drives that system. The zooplankton can't keep up with the huge production.

Ken Dunton: On the Beaufort Sea coast, you have a lot more zooplankton in relation to benthic biomass. That is a good question, Sathy and a good answer, Jackie.

Sathy Naidu: Inaudible.

Jackie Grebmeier: South of the St. Lawrence Island there is a drastic change. That is why you get those depositional centers. You move from that to the middle shelf, which is more of a mirror to the southern Bering Sea that tends to have more of the zooplankton signatures and less of the benthos. There is a paper by Ken Coyle that is coming out where he looked at time series data of the infaunal. There is not much change going on there but the benthos are not the primary component compared to the north. So the northern Bering is tied into the Arctic oscillation, whereas the southern Bering ties in to the Pacific decadal oscillation. There is the difference between the Arctic and sub Arctic front.

Ken Dunton: The food web of the Bering Sea is not as tightly coupled north of St. Lawrence Island. You can look at stable isotope composition and they start spreading out again.

OIL AND FISH, DO THEY MIX?

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In order to detect affects of oil development and offshore drilling activities on fisheries resources, an appropriate monitoring plan must be put into effect that can distinguish between natural and man-made perturbations. The key to an appropriate plan is carefully addressing required temporal and spatial scale as well as monitoring key life processes. It is important to track reproductive and growth rates as well as species diversity in addition to the traditional measurements on distribution and abundance because changes in rates can have delayed impacts on population dynamics and community structure that would be difficult to explain without rate measurements. In addition, oil pollution is known to have sublethal impacts affecting growth and reproduction. The fish communities in the Arctic are in a state of flux due to climate change imbedded within natural climatic fluctuations. In addition, there is significant seasonal variability in distribution and abundance with inter-annual drift in the timing of key life history events such as spawning, larval drift, and migration. Therefore, careful consideration must be given to temporal spacing of monitoring observations to capture the seasonal, inter-annual and decadal variations. Spatial scale is an important consideration because migrational routes, spawning and feeding areas, and key larval drift regions vary among species. In addition, offshore oil platforms are known to induce a localized ecosystem, similar to that of an island, which may disappear

rapidly with distance from rigs. Productivity in these localized areas may be higher than the surrounding waters and may become favored locations for apex predators and fishing. Because it will impossible to measure every species, everywhere, and all the time, it would be prudent to identify some key, representative species and communities to monitor and design monitoring at appropriate spatial and temporal scales for them. Transects bisecting the proposed drilling regions will also be key to observing localized changes due to drilling activities. The best monitoring plan will result from careful consideration and the development of an implementation plan that links measurements of fish with those required for oceanography, plankton, and the apex community. A full year of implementation development would likely be required.

Discussion:

Roger Melton: I would encourage you to look at some of the work that has been published by the International Association of Oil and Gas Producers. Particularly on trends of drilling discharges in the North Sea. In the early 1990s those were diesel muds that were discharged on cuttings. The composition of muds has changed over time. There is a 100-page document summarizes all of the monitoring that has been done.

I also caution to avoid interpreting everything to be due to hydrocarbons because really in fine grained sediments you can see changes in the benthic systems both macrofauna and meiofauna due to grain size changes. Obviously, the cascading effects, there is a lot of debate on how much of that has actually been shown, etc. I think that we really do need to do the monitoring to satisfy people's concerns but I also think that there is a broad range of literature that needs to be reviewed. There have been lots of changes in drilling mud chemistry. There is a lot of literature on this.

Evelyn Brown: That is a really good point. I will agree there have been a lot of changes to prevent that. I also did say that these are from the activities not just the hydrocarbon

Greg Durell: I have just a comment. I have been involved with a lot of those North Sea studies that you referred to. And yes, way back when, oil-based mud was a concern. But we are not discharging that anymore. But drilling mud has largely been changed. More harmless muds are used, so produced water became more of a focus. That is being treated better, and reinjected more and more. As you eliminate things, other production chemicals, potential spills change the focus. I think that it very important for discussion tomorrow. What should we expect as far as deliberate discharges? … realign our planning on things that won't be discharged. So are we looking more at accidental discharges for monitoring? Process water is not the biggest concern. On permitting: in production grind and inject technologies are used. In exploration the permitting requirements are very different. Mud discharge is allowed but not oil based muds.

Evelyn Brown: The major point is and I am sure things have improved, but would you know those things about the muds if the monitoring hadn't taken place? Would we have the information about the effects of drilling muds if we hadn't monitored? No. So that is the point. We have to do a really good job. Like you have said, things have changed. I should have added subsea, the processes have changed, industry is doing a better job, now there are other things that have come up so we really …(inaudible)

Dick Prentki: I would like to ask Ted Rockwell a question? What sort of discharges do you expect under the permit?

Ted Rockwell: First of all, I wouldn't assume that there would be a permit. There isn't one now. I think it would be very unlikely to see discharge of production muds and cuttings. I think what we will see is more use of injection. I expect UIC wells, muds and cuttings ground up and reinjected down the hole. So I am not expecting to see applications coming in during production. Exploration is completely different. Right now for the Beaufort Sea General Permit allows muds and cuttings to be discharged. Not oil based and not diesel. But I think in exploration we are likely to see that.

Jim Cimato: I do think it is important for us as we begin to think about research that we might engage in over the next few years is to consider the impact producing agents associated with oil and gas activity. The discussion that we just got into I think is quite important. When we think about exploratory drilling and production drilling, we know that industry trends over the years have been towards using synthetic-based drilling muds. For the most part those aren't discharged. They are recycled and used over and over. So we need to be thinking about that industry practice that has evolved over the years. And produced water when we come to that stage in OCS activity, how is that being managed? Is reinjection what one might expect? Then again let's be thinking about these things in terms of environmental monitoring. What are the expected impact-producing agents from permitted activities and then think also about the accidental occurrence, like an oil spill. Then there are the physical impacts. But we have to talk a little bit more in general about what kinds of impacts that we would expect.

Ted Rockwell: I just want to follow up. I agree completely. One of the things that I think would be very interesting and very important is to start looking at how things are going to be different in the Chukchi. From an NPDES standpoint, if we are looking at subsea wells, and we don't have subsea well completions at all in the Beaufort, is there going to be anything different from a discharge standpoint, from the standpoint of how they are put together, how they are drilled, and how they are going to be maintained and produced? This leads to what needs to be monitored so that we are in a position to be available to issue a permit in a timely manner without having to say we need five years of data.

POPULATION STUDIES OF MURRES AND KITTIWAKES AT CAPE LISBURNE, ALASKA

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Cape Lisburne in the eastern Chukchi Sea supports about 400,000-500,000 common and thick-billed murres and 20,000-30,000 black-legged kittiwakes on about 7 km of 15-200 m-high sedimentary limestone and shale sea-cliffs. About 30% of the murres are common murres and 70% are thick-billed murres. Small numbers of pelagic cormorants, black guillemots, parakeet

auklets, horned and tufted puffins, and glaucous gulls are also present. The colony is the largest seabird rookery in the eastern Chukchi Sea, supporting about half of all murres and kittiwakes breeding north of Bering Strait in Alaskan waters. It is also the northernmost breeding site for several of these cliff-nesting species in Alaska. The Cape Lisburne sea-cliffs and boulder piles also support the largest naturally occurring, unmanipulated concentration of black guillemots in Alaska (about 100 pairs). The colony is one of 10 annual Alaska Maritime National Wildlife Refuge seabird study sites, and murres and kittiwakes have been monitored there during 25 field seasons since 1976 (1976-1981, 1983-1987, 1992-1993, and 1995-2006). Types and amounts of data collected during these NOAA-OCSEAP-, MMS-, USGS-BRD-, and AMNWR-sponsored studies have varied over the years because of varying funding levels. Field seasons were longer in 1976-1979 and 1995-1998 than in 1985-1987, 1992-1993, and 1999-2006 (generally late June - late August vs. mid-July - mid-August).

Based on 1976-2006 boat- and land-based counts, numbers of murres slowly increased at the colony during the mid-1970s – mid-1980s, more than doubled during the mid-1980s – late 1990s, and then declined after 2000. Data collected on murre nesting chronology, productivity, and diets vary from year-to-year. Based on first sea-going dates of chicks, murres laid eggs about 10-12 days earlier in 1995-2005 than they did in 1976-1992. The best information on productivity was obtained in 1995-1998, when both species averaged about 0.7 chicks per egg. Based on general observations, reproductive success also appeared to be relatively good during 1999-2005 (generally 0.5 chicks per egg or better), but based on sea-going weights, chick survival rates may have been poor in 2001, 2003, and 2005 (and possibly 2006). Arctic cod, Pacific sand lance, and small sculpins are the most important prey species taken by murres nesting at colonies in the eastern Chukchi Sea (e.g., capes Lisburne, Lewis, and Thompson).

Numbers of kittiwakes and their nests also increased at Cape Lisburne during the mid-1970s – late 1990s, but the positive trend was limited to the west-facing cliffs. However, land-based counts made during 2002-2006 suggest that bird numbers may now be increasing in this section of the colony. Based on data collected in 1987, 1992, 1995-1998, and 2000-2005, kittiwake eggs usually begin to hatch about 18 July (range 11-22 July). Productivity was lower in 1992-2006 than it was during 1976-1987 (average = 0.5 vs. 0.9 eggs/chicks per nest). This change may be related to increases in sea-surface temperature and the earlier break up, retreat, and dissipation of sea-ice. Arctic cod and Pacific sand lance are the most important prey species taken by kittiwakes nesting at colonies in the eastern Chukchi Sea (e.g., capes Lisburne, Lewis, and Thompson).

Oil spills are the most serious potential threat to murres, kittiwakes, and other seabirds nesting at colonies in the eastern Chukchi Sea and Kotzebue Sound. Other seabirds visiting the region during the ice-free months could also be adversely affected by spills (e.g., shearwaters, fulmars, auklets). Diving birds, particularly alcids, are the most vulnerable species. Human disturbance near the colonies could also potentially threaten nesting birds.

Discussion:

Tom Weingartner: What do the murres eat?

Dave Roseneau: The two really important species for murres are Arctic Cod and sand lance. Sand lance show up about mid-July. And these are juveniles. These are 0, 0+ sometimes 1 age class. There is a huge inshore run that comes into Ledyard Bay and hits the coast. They come downcoast. Thick-billed murres eat a lot of sculpin, fourhorned sculpins, sticklebacks, Arctic

shanny, crangonid and pandalid shrimp. But still cod are very important. Common murres are midwater feeders. They are taking mostly fish in the water column. They do get cod. They will take sand lance. Back in the 1970s there was lots of capelin. Capelin were spawning all along that coast. They are just starting to come back sporadically. At some point, maybe they will be back. They certainly have come back in the Barren Islands in the Gulf. Kittiwakes are heavily dependent on cod and sand lance. If they don't have those two, they have a problem. If cod go early, then they fail early. If the cod is still there, they can still fail if the sand lance show up late or fail to show. They show up about the time chicks are hatching. Kittiwake adults will abandon the chicks and nests if no food shows up.

BOWHEADS, BELUGAS, POLAR BEARS, WALRUSES AND EIDERS OF THE CHUKCHI SEA

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The Chukchi Sea is important for many protected species including bowhead and beluga whales, polar bears, walruses, and eiders. These species use the Chukchi Sea for a variety of activities including migration, staging, feeding, mating, calving, rearing young, and resting. Even though we know that the Chukchi Sea is important for protected species, there are many unknowns including the lack of some of the most basic information. We know little about distribution, abundance, and habitat use of many species, particularly during the summer. We also know little about potential impacts from industrial activity, especially in light of environmental changes due to global warming. I have briefly summarized some of what is known and the most notable data gaps for bowheads, belugas, polar bears, walruses and eiders.

Bowheads migrate through the Chukchi Sea during the spring and autumn as they move between wintering areas in the Bering Sea and summering areas in the eastern Beaufort Sea. Bowheads used to occur in large numbers in the Chukchi Sea during the summer during commercial whaling in the late 1800s. Recent incidental sightings suggest they may again be occupying the Chukchi in the summer as expected with their increasing population size. No surveys have been flown for bowheads in the Chukchi since the early 1990s. Thus, little is known about habitat use (especially feeding, calving and calf-rearing), distribution, or relative abundance. Bowheads are very sensitive to anthropogenic sounds, but no data have been collected on their reactions to industrial sounds in the Chukchi. Other data gaps include: stock structure, ear morphology, hearing abilities, and contaminants levels (particularly polycyclic aromatic hydrocarbons). Critical monitoring needs include an understanding of: short- and long-term impacts from industrial sounds, fate of whales that are deflected from industrial activities, cumulative effects, and industrial effects on bowhead whale prey species.

Two stocks of beluga whales also migrate through the Chukchi Sea. The eastern Beaufort Sea stock migrates between the Bering and Beaufort seas. The eastern Chukchi Sea (ECS) stock

arrives in the Chukchi in late June or early July and spends the remainder of the summer in the Beaufort or northern Chukchi and presumably winters in the Bering Sea. There are no recent population estimates for either stock. Little is known about foraging ecology or winter distribution. Belugas are also very sensitive to anthropogenic sounds but very few data are available on reactions to seismic or other industrial sounds. Nothing is known about impacts, short- or long-term, or cumulative.

Two stocks of polar bears can occur in the Chukchi Sea, the Chukchi Sea stock and the southern Beaufort Sea stock. Typically, animals from the Beaufort Sea stock occur in the northeastern portion of the Chukchi. Many of the Chukchi Sea bears den on Wrangle Island and the Chukotka Peninsula, Russia. There is no recent statistically defendable population estimate for Chukchi Sea polar bears. Basic life history data on sex and age composition, physical condition, productivity rates, are survival rates are lacking.

Walruses occur in the Chukchi Sea primarily in summer and autumn. They migrate north as the ice retreats. Little is currently known about seasonal distribution patterns, important habitat areas, and effects from disturbance or oil spills in the Chukchi Sea. Walruses and polar bears are dependent upon sea ice thus are especially vulnerable to climate warming. Cumulative impacts from industrial activities and climate change are unknown.

All four eider species (King, Common, Spectacled and Steller's) use the Chukchi Sea. Spectacled and Steller's Eiders are listed as threatened. Critical habitat has been designated in Ledyard Bay of the eastern Chukchi Sea for Spectacled Eiders. This area is used for staging, foraging, and molting by Spectacled and King eiders and possibly by Common and Steller's eiders. Little is known precisely about how eiders use the Chukchi Sea or how vulnerable they are to disturbance.

I received assistance with information about: polar bears from Scott Schliebe (USFWS); about walruses from Joel Garlich-Miller (USFWS); and about eiders from Karen Laing (USFWS) and Steffen Oppel (Univ. of Alaska Fairbanks).

Discussion:

Ben Greene: I really appreciated your inventory of scientific needs, your prioritization of data gaps in science, and your listing of knowns and unknowns-- and indicating where we are at in terms of the data that we would like to have; the science that we would like to understand with regards to these very important species. But to me that is skirting the point a little bit: the bottom line is scientifically, we are nowhere close to where we need to be in terms of understanding a given species, much less the interrelations between species. And our industrial activities are moving forward. So to me, and my question is this: are there efforts that you are aware of to design or to rethink management scenarios that deal with limited or lacking data? To me we need to be working towards a precautionary management paradigm that takes in to account what isn't known. That takes in to account the fact that a lot of these data will never be known satisfactorily and yet clearly we are not waiting until all the data are on the table before we move ahead. I would appreciate any comments you may have.

Robert Suydam: Does anyone else want to answer Ben's question? Your points are really good ones. It has been an issue that folks on the North Slope Borough and the AEWC, the folks that live in the NSB, are incredibly concerned about. Changes are happening quickly both in terms of human activity and also natural changes. They are incredibly few data in many cases to make any predictions of what might happen, let alone mitigate any impact that we could mitigate. One of the things that I thought MMS did very well, some don't agree with me, but the development of the programmatic EA had some outstanding stipulations that dealt with the issues that you talked about. This is an area we know incredibly little about. We know very little about the potential impacts of oil and gas activity. A good way to go about protecting those resources and mitigating potential impacts is/was through innovative stipulations. So using a precautionary approach in the Chukchi is important and appropriate. I don't know how we do that given the priorities of the current administration in Washington, D.C.: developing oil and gas is one of their primary concerns. It seems like a lot of the other resources don't get as much attention as they should, in my opinion. So I don't really have an answer to your question. It is a really challenging one: we need oil and gas but need to protect other resources, wildlife, fish, people with unique cultures that we need to protect as well to make sure that they exist well in to the future. Oil and gas may not be here in 30, 40 or 50 years. But hopefully, the other resources, the people, and the unique cultures will be.

CHUKCHI SEA MARINE MAMMALS

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When considering possible impacts of oil and gas activities in the Chukchi Sea, seals and whales are two important groups of marine mammals requiring further research and monitoring.

The four species of "ice seals" (bearded, ringed, spotted, and ribbon seals) inhabiting the Chukchi Sea depend on sea ice for breeding, molting, resting and other vital functions. Sea ice in the Arctic undergoes dramatic seasonal changes in its coverage, has been declining by 2-7% per decade since 1979, and its thickness has decreased by about 40% in the past four decades. The fate of these species is likely tied to the long-term dynamics of the sea ice. Alaska Native communities take approximately 20,000 ice seals annually for subsistence. Yet, the fundamental aspects of stock structure, abundance, and trends of ice seal populations are poorly known, and the possible impacts due to industrial activities are currently difficult or impossible to assess. Therefore, more research is needed to better understand population size and any impacts that may arise from industrial activities.

Bowhead and gray whales are also vulnerable to oil and gas activities in the Chukchi Sea. Gray whales have increased the amount of time they spend in the Chukchi Sea, perhaps a result of warming seas and a reliance on habitats farther north. They may be especially vulnerable to pollution on the sea floor due to their benthic feeding behavior. Bowhead whales are known to avoid some types of industrial or vessel noise, possibly disrupting vital feeding or social functions. These species also may be less resilient to impacts in the near future because of indirect effects on their prey base from loss of sea ice.

The potential environmental impacts on seals and whales from oil and gas activities in the Chukchi Sea include changes in abundance, distribution, behavior, the acoustic environment, and prey availability. Thus, baseline data are needed to evaluate any further changes since both ice seals and cetaceans move widely throughout the 193-lease sale area. Priorities for research and monitoring are seasonal movements and habitat selection, abundance and distribution, and acoustic environment of marine mammals. These priorities can be studied effectively by satellite tagging, aerial surveys (possibly using unmanned aerial systems), and acoustic monitoring of marine mammals.

Discussion:

Dave Roseneau: Just a comment. Back in the 1970s through the mid-1980s, gray whales were very common in nearshore waters at Capes Thompson and Lisburne. We would see dozens a day. It was the place for them. In recent years, for instance this summer with a number of people interested in whales and birds that work at Cape Lisburne, it was typical during a two-month period to see only a dozen animals. That is one change. Another is that back in the late 1970s, in 1978 I flew offshore surveys at Capes Thompson and Lisburne. One of the transects was a straight line from Cape Lisburne to Point Lay. The only place during those years, and the only times, I saw minke whales where the eiders were in the center of Ledyard Bay in the clear water. We never saw them around Lisburne. Now minke whales are fairly common. I've seen groups of 16 right off of the Cape. I've seen killer whales killing them right there. It is more than likely the majority of whales that people see by the radar site are minkes now rather than gray whales. They would come in, when I was running zodiacs fast down that coast, I have to be real careful on calm days, we would go out at night some times, those whales would out their snout almost on the beach rubbing barnacles. I came close to hitting them. Now during those offshore surveys in the old Atomic Energy Commission days, Project Chariot, in one of the chapters it will show a area west northwest of Lisburne where some of the benthic guys showed muddy bottoms. One guy said there are lots of copepods, etc. When I was flying just out of the aircraft defense interface zone, the air force was guiding us with radar, we were within about two miles of that. It is about 70 miles. The one calm day I estimated over two hundred smudges of spouts, and who knows how far they went to the south. They were everywhere. There were lots of gray whales in the good old days. We were used to the Chukchi Sea as being a gray whale place back then.

John Bengtson: Thank you for the information. We would like to see more of it. You are lucky you didn't hit any of those gray whales. I don't think you had a permit for that.

Elise Wolf: I am just curious as to how an Environmental Impact Statement can be out when there are missing baseline data?

Cleve Cowles: Well that sounds like one for me. The National Environmental Policy Act (NEPA) provides for making an environmental assessment based on the information that is available at the time. We get the best information that we can and do the best we can. One of the things about environmental assessment it is like management, it is a science and an art. We take the science and make a projection based on the best analysis that we can and we bring to bear on that analysis feedback and information from a broad-based review both at the organizational level and with the people that are potentially affected. It is not a perfect process but I think it does what the NEPA asks for.

Here in this meeting, we are trying to look further ahead in terms of information that will be useful for managers as time moves on because we know that things change. We are going to put in a program now that will help in the future that will help us keep tabs on the environment as the industry activities may change.

cANIMIDA, TASK 7 DOCUMENTATION OF CROSS ISLAND BOWHEAD SUBSISTENCE WHALING

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The Cross Island Bowhead Whaling Documentation project started in the 2001 field season as task 7 of the Arctic Nearshore Impact Monitoring in Development Area (ANIMIDA) program. The ANIMIDA program, designed to monitor and measure some potential effects of the Northstar and Liberty development prospects, formally ended after the 2003 field season, but the Cross Island (and most other components) have been extended through the 2006 field season as parts of the cANIMIDA program. The Cross Island project focused on the Nuiqsut subsistence on Bowhead Whales in the Beaufort Sea as a gauge to monitor potential effects of the developments. The methodology and results are examples of what can be attained by such a study and set the stage for a discussion on how to approach monitoring of potential effects on human subsistence behavior by industry activities in the Chukchi Sea. Important points to keep in mind are similarities and differences of the Beaufort and Chukchi planning regions, information needs and some possible methods for filling gaps in the data, cost efficient mechanisms to implement a pragmatic monitoring program, and integration of other monitoring programs (such as the Conflict Avoidance Agreement of 2006) into the discussion.

Discussion:

Caryn Rea: Earlier this morning, I talked a little bit about how the 2006 season went. From ConocoPhillip's perspective, the communication centers in the western villages worked well. Barrow was the hub for information and they passed that to the village centers. An example of how we were able to utilize these centers to mitigate impacts to subsistence whalers was during

the beluga whale hunt at Point Lay. We wanted to deploy some research equipment and they asked us not to do that. From that perspective, I thought it went very well. [the Whaling call center (WCC) worked well at Pt. Lay for coordinating seismic boats and whaling vessels.]

One other comment, just a point of clarification, the map that was used from Ecotrust is misleading. I understand why you showed it but there are a lot of dots on that map that are actually well locations that were permitted but not drilled. Just for some perspective, some of these areas are hard to get to in NPR-A. It takes a long time just to build the ice roads to get there. So typically, we maybe end up with two wells a year that we can drill during the winter season.

Michael Galginaitis: I think that with most graphics, what I tend to try to emphasize is to look at what the intent was and general impression of the graphic, The details are often more misleading than illuminating.

PROPOSED COMIDA MONITORING TASK

PHYSICAL OCEANOGRAPHY AND FATES AND EFFECTS GROUP
TASK 1 – DATA MINING

Region: Alaska

Planning Area: Chukchi Sea

Title: **COMIDA Monitoring Task: Data Mining**

MMS Need for Monitoring of Environmental Effects of Chukchi OCS Exploration and Development:

Much Chukchi Sea research has been conducted by other groups since MMS last leased in the Chukchi area. Data from these efforts could help focus MMS monitoring efforts, make them more effective or efficient, or otherwise help prioritize MMS monitoring needs. A quick, focused and phased data mining effort should precede at least physical monitoring tasks.

Period of Performance: FY 2007 is recommended for a phase I if possible.

Description:

Background The original study design for COMIDA Phase I workshop included a small data gathering component/literature search prior to the workshop which was lost when MMS accelerated the planning cycle to two months from 5-7 months. The Oceanography/Fates and Effects working group identified several data issues that merited reinstatement of this component as a data mining effort to either obtain specific data, determine data availability or data suitability for specific uses.

Timing Needs for this monitoring Prior to related monitoring studies, that is in FY 2007 or early FY 2008.

Objectives
Phase I:

1. Determine available Chukchi data sets. Evaluate these data sets for content, comparability (among the other data sets and with potential COMIDA data), geographical coverage, QA/QC, and suitability for transformation into GIS format. Data types of interest include contaminants (metals, hydrocarbons, other), sediment organic carbon, grain size, other sediment characteristics, potential sentinel benthic biota, depositional centers, bathymetry, ice gouging.
2. Evaluate status of available sea beam data. Is it processed? Are there plans to process it? Are there sea beam data sets of the same gouge areas taken over multiple years?
3. Estimate data conversion effort into GIS format and as part of a COMIDA database.

Phase II: (If wanted and funded)

1. Process sea beam data for ice gouge occurrence and recurrence rates (potential JIP)
2. Convert appropriate data sets to GIS and COMIDA format.
3. Improve IBCAO bathymetry with available data for Chukchi Sea

Monitoring Hypotheses (Phase I) *See* the Indicator Matrix for Decision Making

Methods

1. Identify available data sets

Data Sets to be considered: SBI, OCSEAP, NOAA-UAF, Trace metals, sedimentation rates, deposition centers, sea beam data (may need to be processed), meteorology data, Industry; Bathymetric data IBCAO, industry, SBI)

2. Determine Adequacy (QA/QC)
3. Determine suitability for GIS use/conversion
4. Provide "first level" analysis such as
    a. Establish coverage area and identify adequacy of data in that area
    b. Areas suitable or unsuitable for specific monitoring tasks
    c. Identification weakly or strongly populated data sets
    d. Data especially suitable for trend analyses (e.g., comparable methods, longer time frame)

Cost and Level of Effort

Phase I: <$ 100,000 science, no logistics cost

Date information is required:

Draft report should be provided prior to FY 2008. Revised final report incorporating Sale-day leasing results should be provided 60 days after the Chukchi Oil and Gas Lease Sale. Information will be needed to help design other COMIDA tasks.

Physical Oceanography and Fate and Effects Task 1. Data Mining Phase I. COMIDA Indicator Matrix for Decision Making

Task Order	MMS Issue Addressed	Monitoring Hypotheses	Methods	Key Monitoring Result or Parameter for Decision Making
Data Mining	Availability and usefulness of data Monitoring locations Cost effectiveness		Data Mining	Phase I report addressing what is available what needs to be done to it and addressing how much it will cost. Contractor will respond to COTR requests for specific, limited data reviews for monitoring design purposes within 30 days

PROPOSED COMIDA MONITORING TASK

PHYSICAL OCEANOGRAPHY AND FATES AND EFFECTS GROUP
TASK 2 - CHEMICAL AND HYDROCARBON MONITORING

Region: Alaska

Planning Area: Chukchi Sea

Title: **COMIDA Monitoring Task: Chemical and Hydrocarbon Monitoring**

MMS Need for Monitoring of Environmental Effects of Chukchi OCS Exploration and Development:

Contaminants are one of the primary scoping concerns for the proposed Oil and Gas Lease Sale.

Period of Performance: FY 2008-2011

Description:

Background. Absence of an early monitoring program and good baseline has hindered evaluation of cumulative effects in other oil development areas such as the Gulf of Mexico. Earlier MMS/OCSEAP monitoring design workshops for the Beaufort Sea and Bering Sea recommended multiyear contaminant baselines prior to offshore development. The ANIMIDA SRB considered the one-year baseline prior to installation of Northstar to be suboptimal. The Oceanography/Fate and Effects working group considers a multi-year contaminant monitoring to be a priority.

The primary contaminants of concern for offshore oil and gas are metals and hydrocarbons. Information presented at the COMIDA Workshop indicates a significant amount of metal data, but a lack of modern hydrocarbon data.

Timing Needs for this monitoring. As soon as possible after data mining has identified gaps, etc. The task should start before exploratory drilling returns to the Chukchi, with preferably two years of data before drilling. This timing may allow for possible coordination with an expected EMAP Arctic effort in the Chukchi.

Objectives
Establish baseline to be able to detect changes
Sources of contaminants (lower level issue; identify seeps)
Time trends (future measurements and cores)
Initial food web effects

Monitoring Hypotheses
See matrix

Methods
Use results of data mining task to fine tune contaminant list, sampling locations, and sentinel benthic organisms.
Rigorous statistical design when establishing baseline

Sampling: fine grain sediments and biota locations at risk (near point sources) and control sites (not near Red Dog but a few south of the area). Initially: ~50 sites, ~10 cores analyze 3 cores)
Core sediment samples for long term record
Limited sourcing of contaminants
Choose and monitor sentinel benthic organism(s)
QC/QA inter-lab comparisons

Cost and Level of Effort
Field Work: 2 weeks
Core analysis: 10 per core=>80 samples, $1,500 per sample=> ~$150,000
Biota: 50 samples $1000/sample=$50,000
Geochronology: $20,000
Add in rest of scientific cost $300,000 over 2 years
Ship time: $25,000 per day for 2 weeks => $350,000 (investigate interagency or industry)
Plus Ship transit costs from Dutch (One way: 4-5 days) or Nome (One way: 2 days)
Level of effort: 2-year baseline (2^{nd} year may be able to decrease effort)

Total for with 2 years sampling: 1.58 million

Date information is required:
Reports needed by end of project

Physical Oceanography and Fate and Effects Task 2. Chemical and Hydrocarbon Monitoring. COMIDA Indicator Matrix for Decision Making

Task Order	MMS Issue Addressed	Monitoring Hypotheses	Methods	Key Monitoring Result or Parameter for Decision Making
Chemistry	Will offshore oil exploration and development in the Chukchi OCS result in increased or chronic pollution from industrial sources?	H1. The concentrations of organic (H1a) and metal (H1b) chemicals of concern in sediments and biota do not show any increase as a result of the exploration or development. H2. Concentrations of organic (H2a) and metal (H2b) chemicals of concern adjacent to exploration and development sites do not pose an ecological risk to marine organisms as determined by sediment quality benchmarks. H3: Oil and gas industry activities in the will not result in an increase in tissue concentrations of PAHs, metals and exposure/response biomarkers in biota. H4: Concentrations of metals and PAH in tissues of indigenous benthic invertebrates are not different from the regional background, which reflects concentrations of bioavailable contaminants from natural and anthropogenic sources. H5: The concentrations of organic (H5 a) and metal (H5b) chemicals of concern in sediments do not show any trend within the sediment cores as a result of past and present oil exploration, development, and production activities.	Summer sampling of surficial sediments and sediment cores with analysis for metals, grain size, TOC, PAHs, saturated hydrocarbons, and steranes and triterpanes Corresponding radionuclide dating of both surficial sediments and sediment cores. Summer sampling for biota from impacted and reference sites for analysis by one or more of the following methods/parameters: bile FAC, CYP1A, PAHs, SHCs, S/Ts and metals.	Annual interpretative report with tabulated data on sediment levels of chemical analyses will be provided, with statistical tests of potential interannual significant differences. Contractor will alert MMS COTR of any important trends or changes.

PROPOSED COMIDA MONITORING TASK

PHYSICAL OCEANOGRAPHY AND FATES AND EFFECTS GROUP
TASK 3 – PHYSICAL SUPPORTING DATA

Region: Alaska

Planning Area: Chukchi Sea

Title: **COMIDA Monitoring Task: Physical Supporting Data**

MMS Need for Monitoring of Environmental Effects of Chukchi OCS Exploration and Development:

MMS is developing a monitoring strategy for environmental effects of oil and gas exploration and development in the Chukchi OCS. Interannual and seasonal variability in the Chukchi is very high and there is a need to distinguish oil and gas effects from those related to variability in the physical environment or from local effects of global warming. This task would provide that context to other monitoring tasks and also greatly improve our understanding of first order physics in the NE Chukchi Sea.

Period of Performance: FY 2008-2011

Description:

Background . Our understanding of the circulation in NE Chukchi Sea should be verified with better data. We suspect it is an area of recirculation but we know it has high interannual and seasonal variability. We know that ice regime—duration, seasonality, location of the ice edge, and ice thickness are being affected and changed by global warming. Monitoring the oceanographic conditions during other monitoring activities may be necessary to separate effects of oil and gas activities from those specific to the state of the physical environment.

Timing Needs for this monitoring. This task needs to be concurrent with other COMIDA monitoring for which it will provide physical environmental data.

Objectives
Resolve temporal and spatial variability of physical and chemical processes
Resolve circulation features
Provide Context for other tasks

Monitoring Hypotheses See Matrix

Methods
Year round mooring deployments (with ADCPs with bottom tracking, arctic winch (CTD), ice thickness (ULS). Addition of sediment traps, turbidity sensor, passive acoustics, and chemical sensors would require multiple moorings at each site.

Full hydrographic survey upon mooring deployment for mooring parameters.

Transect ADCP data as available.

Cost and Level of Effort
5-10 moorings dependant on data mining/other studies: $120,000 per physical mooring
$120,000 per chemical/acoustic mooring
Ship time: Initial deployment: 1 day per mooring to deploy
Turnaround: 1 day to recover + 1 weather day + 1 day to redeploy (per mooring)

Deploy in this initial program for two years.

Total cost $1,750,000- $2,350,000/first year, at least $3,000,000 to $4,200,000 for 2 years if mooring instruments can be reused. BUT without chemical/acoustic moorings.

Date information is required:

An interim and final report would be needed (year 1 and year 2 data). Care will need to be taken to make sure useful oceanographic data is made available as timely as possible to other COMIDA tasks.

Physical Oceanography and Fate and Effects Task 3. Physical Supporting Data. COMIDA Indicator Matrix for Decision Making

Task Order	MMS Issue Addressed	Monitoring Hypotheses	Methods	Key Monitoring Result or Parameter for Decision Making
Physical and Chemical Moorings	Provide physical environmental context for other COMIDA studies	Observed biological/chemical difference or effect is not an due to changes in the physical environmental	Multiyear moorings that monitor ice and water conditions and chemistry.	Annual interpretative report with statistical analysis of data . Contractor will alert MMS COTR of any significant changes between years.

PROPOSED COMIDA MONITORING TASK

BIOLOGY GROUP
TASK 1 - BENTHOS

Region: Alaska

Planning Area: Chukchi Sea

Title: **COMIDA Monitoring Task: Biology -Quantitative Benthic Characterization in the COMIDA Study Area**

MMS Need for Monitoring of Environmental Effects of Chukchi OCS Exploration and Development:

There is a need for baseline quantitative benthic population data to evaluate the potential impact of oil and gas exploration and development on benthic community structure and productivity. It is essential to determine the key industrial development-associated stressors that affect the benthic fauna in the northern Chukchi Sea in order to minimize impacts on benthic populations. We need to identify the key habitat condition indicators of disturbance, such as changes in faunal dominance and diversity, sediment composition, and organic carbon content that define the potential anthropogenic impacts on the benthic assemblage. Monitoring of select upstream and downstream "hot spots" of high benthic abundance and biomass relative to regions of resource development are required to differentiate potential impacts of oil and gas development relative to natural variability.

Period of Performance:
Phase 1: FY 2008-2013 for baseline
Phase 2: FY2014- continued monitoring of select sites and sentinel benthic indicator Species.

Description:

Background. Our knowledge of the benthic fauna along Alaskan arctic shelves is largely based on a series of intensive surveys between the 1970s and early 1990s in the Bering, Chukchi and Beaufort Seas under the federally sponsored Outer Continental Shelf Environmental Assessment Program (OCSEAP) managed by MMS/NOAA. The massive datasets collected under these programs were recently (Dunton et al., 2005) synthesized under the Arctic Shelf Basin Interactions (SBI) project sponsored by NSF. This synthesis revealed "hot spots" of high benthic biomass in several regions of the Chukchi Sea, particularly in the northeastern sector between Pt. Lay and Icy Cape. Hanna Shoal, which lies about 200 km west of Pt. Lay, is characterized by average biomass values that exceed 360 g m^{-2}, nearly an order of magnitude higher than just east of Pt. Barrow. Infaunal and epifaunal biomass at individual sampling sites in this area range from 99.1 to 838 g m^{-2} . The high abundance of bottom fauna is correlated with high pelagic primary production as reflected by integrated chlorophyll *a* concentrations above 150 mg m^{-2}, most of which reaches the seabed ungrazed. Unfortunately, relatively few stations have been sampled in the northeastern Chukchi Sea compared to other arctic regions. However, the benthic production in this area is directly linked to utilization by higher trophic levels, including marine mammals and seabirds. The generally high benthic biomass in the northeastern Chukchi Sea is thought to be a result of advective processes that provide an organic carbon and nutrient subsidy from more productive southern shelf systems in the northern Bering and Chukchi Seas.

Timing Needs for this monitoring. Phase I monitoring should be initiated as soon as possible in FY2008 in order to establish a benthic community baseline before any exploration activities are initiated. These studies will allow an evaluation of the potential impacts of oil and gas exploration on benthic population structure, biomass and habitat structure. These Phase I activities will allow the determination of select time-series sites and key indicator species for continued monitoring during exploration and development periods. Key habitat characteristics (fauna, sediment type) that are highly sensitive to anthropogenic activities (biological "hot spot" sites) will be identified for focused studies.

Phase II studies will occur coincident will occur initiate of oil exploration and will include time-series monitoring of these select sites and identified benthic indicator species to allow for the detection of changes related to anthropogenic activities versus natural variability.

Objectives

1. To evaluate offshore Chukchi Sea petroleum exploration and development impact on benthic community structure and productivity.
2. To identify key stressors to the benthic fauna in the northern Chukchi Sea.
3. To identify key habitat characters tics (fauna, sediment type) that define sites that are highly sensitive to anthropogenic activities.
4. To locate "hot spot" areas characterized by high benthic biomass that are critical feeding areas for upper trophic level organisms.

Monitoring Hypotheses

H1: There is no impact on benthic community structure and productivity by oil and gas exploration.
H2: Key environmental stressors, such as sediment disturbance, chemical contamination, change of light field due to sediment resuspension via development activities will have no impact on benthic communities.
H3: Oil and gas exploration and development will have no downstream impacts on sensitive benthic biological communities.

Methods

1. standard quantitative methods for infaunal and epifaunal surveys, including abundance, community structure and biomass
2. use tracers of food web connectivity, e.g., stable isotopes, fatty acids,
3. standard methods for sediment collection and analyses, including organic carbon and nitrogen content, sediment grain size, C-13 and N-15 content, microbial content, chlorophyll content; need to archive sediments for future contaminant studies necessary for development
4. hot spot benthic sites should be selected upstream, within the proposed area of development, and downstream for time-series studies of quantitative benthic parameters along with a vertical suite of water column measurements
5. possible modern technologies for surveys, such as AUV's, SPI
6. determine and monitor a suite of benthic indicator species
7. retrospective studies for baseline monitoring, such as data in NODC OCSEAP databases, NCAR/EOL

Cost and Level of Effort:
Phase 1:
Science: Three years of annual benthic sampling and analysis: $750K/year
Two years of data synthesis and integration: $500K/year
Subtotal: Science: $3.25M

Logistics (note: this is on site ship time, exclusive of transit)\
Subtotal logistics: Phase 1-3 years, annual ship support, 30 days, $25K/day=$750,000/year, $2.25M

Phase 1 Total: $5.5 M

Phase 2:
Science: Annual benthic sampling and analysis: $300K/year,
Logistics: Annual ship support, 15 days, $25K/day=$375,000/year

Phase 2 Annual cost: $675K/yr

Date information is required:

Progress reports, with tabulated benthic and sediment data, are required annually, along with summary overview statements.

A final, summative report for Phase 1 will be submitted to COTR on September 30, 2013.

Biology Task 1. Quantitative Benthic Characterization in the COMIDA Study Area. COMIDA Indicator Matrix for Decision Making

Task Order	MMS Issue Addressed	Monitoring Hypotheses	Methods	Key Monitoring Result or Parameter for Decision Making
Biology-Task 1. Benthos: "Quantitative benthic characterization in the COMIDA study area"	1. Will offshore Chukchi Sea petroleum exploration and development impact benthic community structure and productivity? 2. What are the key stressors to the benthic fauna in the northern Chukchi? 3. What are the key habitat characteristics (fauna, sediment type) that define sites that are highly sensitive to anthropogenic activities? 4. Where are the "hot spot" areas characterized by high benthic biomass that are critical feeding areas for upper trophic level organisms?	H1: There is no impact on benthic community structure and productivity by oil and gas exploration. H2: Key environmental stressors, such as sediment disturbance, chemical contamination, change of light field due to sediment resuspension via development activities will have no impact on benthic communities. H3: Oil and gas exploration and development will have no downstream impacts on sensitive benthic biological communities.	1. standard quantitative methods for infaunal and epifaunal surveys, including abundance, community structure and biomass 2. use tracers of food web connectivity, e.g. stable isotopes, fatty acids 3. standard methods for sediment collection and analyses, including organic carbon and nitrogen content, sediment grain size, C-13 and N-15 content, microbial content, chlorophyll content; need to archive sediments for future contaminant studies necessary for development 4. hot spot benthic sites should be selected upstream, within the proposed area of development, and downstream for time-series studies of quantitative benthic parameters along with a vertical suite of water column measurements 5. possible modern technologies for surveys, such as AUV's, SPI 6.determine and monitor a suite of benthic indicator species 7. retrospective studies for baseline monitoring, such as data in NODC OCSEAP databases, NCAR/EOL.	To track impacts of oil and gas development tabulation and evaluation of the following data are required: • benthic infauna and epifauna abundance and biomass • indicator species susceptible to select development stressors (e.g., sediment resuspension, chemical contaminants) • sediment parameters, e.g., sediment grain size, organic carbon content • select indicators of trophic status, interactions and connectivity, e.g., stable isotopes • statistical evaluation of interannual and spatial measurements • time-series studies of key benthic indicator species (e.g., biomass, abundance, diversity) • historical records of benthic faunal and sediment characteristics Contractor will alert MMS COTR of any important trends or changes.

PROPOSED COMIDA MONITORING TASK

BIOLOGY GROUP
TASK 2 - FISH

Biology Task 2. Chukchi Sea Forage Fish. COMIDA Indicator Matrix for Decision Making

Task Order	MMS Issue Addressed	Monitoring Hypotheses	Methods	Key Monitoring Result or Parameter for Decision Making	Estimated cost and level of effort	Cooperative Efforts
"Chukchi Sea Forage Fish"	Will oil spills during offshore oil development and production in the Chukchi Sea change forage fish abundance or distribution?	**H1:** Abundance and distribution of individual forage fish populations will not be affected by oil spills during offshore oil development in the Chukchi Sea. Indicator species are capelin, sandlance and Arctic cod.	**H1:** Baseline surveys to compare to historical survey data and to characterize current forage fish abundance and distribution in the Chukchi Sea. Post-oil spill survey to characterize forage fish abundance and distribution in the Chukchi Sea. The baseline surveys will be conducted annually at previously sampled sites between 70 and 72 deg N inside the lease area during 2007-2009. For capelin and sandlance, may use combination of aerial surveys and groundtruthing (beach seines). For Arctic cod, may use combination of bottom trawl and acoustic-midwater trawl surveys. For juvenile salmon, may use surface trawl surveys. The surveys will use standard fish abundance survey methods to allow comparability between baseline and historical surveys.	Annual interpretive report with tabulated data on forage fish populations with statistical tests of comparisons. Contractor will alert MMS COTR of any important trends or changes.	$900K per survey year during ice-free period of 2007-2009 for logistics and $200 K for science. $4000K for one survey during ice-covered period for logistics and $200 K for science. $100 K for analysis of historical data.	Marine mammal aerial surveys include fish aerial surveys. RUSALCA, Shelf-Basin Initiative, NOAA. NOPP.
		H2: Genetic composition of individual forage fish will not be affected by oil spills during offshore oil development in the Chukchi Sea. **H3:** Concentrations of metals and PAH in	Tissue samples for genetics and metals and PAH collected immediately before and after exploratory drill sites. Standard genetic and analytic chemistry methods.		$300K per species for the 3 indicator species is $900 K total for the genetic samples and $300 K for contaminant analyses. $200 K	

Task Order	MMS Issue Addressed	Monitoring Hypotheses	Methods	Key Monitoring Result or Parameter for Decision Making	Estimated cost and level of effort	Cooperative Efforts
		tissues of forage fish from the Chukchi Sea are not different from the regional background, which reflects concentrations of bioavailable contaminants from natural and anthropogenic sources.			for logistics.	
		H4: Amount of forage fish accepted for subsistence use will not change after an oil spill in the Chukchi Sea.	Surveys of subsistence use for baseline when development plan submitted and one survey post-spill.		$100 K before and $100 K after for logistics and $50 K per sampling period for science	
	Will discharges during offshore oil development and production in the Chukchi Sea change forage fish physiology?	**H1:** Concentrations of metals and PAH in tissues of forage fish from the Chukchi Sea are not different from the regional background, which reflects concentrations of bioavailable contaminants from natural and anthropogenic sources.	Tissue samples for genetics and metals and PAH collected during oil development and production when development plan submitted and triennially thereafter. Standard genetic and analytic chemistry methods.		For each survey: $300K per species for the 3 indicator species is $900 K total for the genetic samples and $300 K for contaminant analyses. $200 K for logistics.	Industry. Benthic biologists and physical oceano-graphers.
		H2: Physiological indicators of stress in forage fish will not be affected by discharges during offshore oil development in the Chukchi Sea.				
		H3: Growth, diet, and reproduction in forage fish will not be affected by discharges during offshore oil development in the Chukchi Sea.	Standard methods collected during baseline abundance and distribution surveys.		$100K per survey year	

Task Order	MMS Issue Addressed	Monitoring Hypotheses	Methods	Key Monitoring Result or Parameter for Decision Making	Estimated cost and level of effort	Cooperative Efforts
		H4: Forage fish abundance and distribution will not change as a result of impacts on their prey of discharges at oil development sites during offshore oil development in the Chukchi Sea.	Conducted simultaneously with baseline data for forage fish predators (whales, birds).			Marine mammal and seabird biologists
		H4: Amount of forage fish accepted for subsistence use in the vicinity of development sites will not be changed by discharges during offshore development and production in the Chukchi Sea.	Surveys of subsistence use for baseline when development plan submitted and triennially thereafter.		Baseline addressed above. Triennial sampling of $100 K for logistics and $50 K per sampling period for science	
	Can the effect of climate change be differentiated from the short-term and cumulative effects of oil production and development?	**H1:** Changes in forage fish abundance and distribution are due to climate change rather than effects of oil production and development. Changes in forage fish abundance and distribution regionally are the same as changes in the lease blocks.	Sample Chukchi shelf every ten years.		$900K per survey year during ice-free period for logistics and $200 K for science.	MMS physical oceano-graphers and cetacean biologists. NMML. RUSALCA, Shelf-Basin Initiative, NOAA. NOPP.
		H2: Changes in forage fish abundance and distribution are not due to cumulative effects of offshore development and production in the Chukchi Sea. Changes in forage fish abundance	In addition, more intensive sampling will be conducted at development sites.		$90 K for additional ship time at development sites and $30K for science.	

Task Order	MMS Issue Addressed	Monitoring Hypotheses	Methods	Key Monitoring Result or Parameter for Decision Making	Estimated cost and level of effort	Cooperative Efforts
		and distribution regionally are the same as changes at the development sites.				
	Will seismic testing during offshore oil development in the Chukchi Sea change forage fish migration, sensory capability, buoyancy, predator avoidance or prey detection?	**H1:** Forage fish migration is not affected by seismic testing during offshore oil development in the Chukchi Sea. **H2:** Forage fish sensory capability is not affected by seismic testing during offshore oil development in the Chukchi Sea. **H3:** Forage fish buoyancy is not affected by seismic testing during offshore oil development in the Chukchi Sea. **H4:** Forage fish predator avoidance is not affected by seismic testing during offshore oil development in the Chukchi Sea. **H5:** Forage fish prey detection is not affected by seismic testing during offshore oil development in the Chukchi Sea.	RFID tagging study on OOS marine cables for salmon. Cage fish before, during and after seismic testing with camera observation system.		$20,000 K for cable and $300K for tagging (logistics). $60 K for science. $100 K for logistics and $50 K for science.	IOOS, oceano-graphers. Industry.
	Will oil and gas development affect the "hot spot" areas	**H1:** Forage fish abundance and distribution is not	Focal area surveys that enumerate prey where upper trophic level organisms aggregate (could use		$50 K for logistics for prey sampling. $50 K for science.	Marine mammal and seabird

Task Order	MMS Issue Addressed	Monitoring Hypotheses	Methods	Key Monitoring Result or Parameter for Decision Making	Estimated cost and level of effort	Cooperative Efforts
	characterized by high biomass that are critical feeding areas for upper trophic level organism? Other focal species beside forage fish are salmon (migration for seismic) and demersal fish species (seismic and oil spill).	affected by offshore oil development in the Chukchi Sea.	satellite telemetry to locate and track upper trophic level organisms). In marine mammal and seabird studies with telemetry and tracking, sample prey at locations where these upper trophic level organisms concentrate.		(Per study).	biologists.

PROPOSED COMIDA MONITORING TASK

BIOLOGY GROUP
TASK 3 - BIRDS

Region: Alaska

Planning Area: Chukchi Sea

Title: **COMIDA Monitoring Task: Biology - Effects of Onshore and Offshore Development on Birds**

MMS Need for Monitoring of Environmental Effects of Chukchi OCS Exploration and Development:

Will development adversely affect marine bird populations (keeping in mind the requirements of the Endangered Species Act and the Migratory Bird Treaty Act)?

Period of Performance: FY 2008-2011

Description:

Background. Basic information on when and how long birds are in the area, and foraging information, is necessary to better define parameters used to model the impacts of perturbations and ultimately population level effects. These studies will complement previous and ongoing studies of individual bird species, and will rely on information from benthic, ecosystem and fish studies that include food species for birds. In addition, where feasible, bird observations be made from industry vessels or vessels or aircraft used for other studies (e.g., marine mammal surveys).

Timing Needs for this monitoring. Basic information on bird distribution, abundance, timing of use, and foraging information needs to be collected immediately so that more specific monitoring surveys can be designed. Specific monitoring surveys should then occur before exploration as a baseline, and continue during exploration and development.

Objectives. To monitor effects of offshore and onshore exploration and development on birds

Monitoring Hypotheses

1. Effects of Offshore Operations on Birds

H1A: Marine birds will be disturbed and/or excluded from foraging areas, either exceeding allowed take for listed species, [or affecting survival or productivity of other marine birds?].

H1B: Marine bird mortality will increase due to collisions with lighted structures or vessels.

H1C: Marine bird mortality will increase due to chronic pollution.

H1D: Marine bird mortality will increase due to large-scale oil spill events.

2. Effects of Onshore Operations on Birds

H2: Human trash attracts foxes and avian predators

Methods. H1A. Understand distribution, abundance, diet, and foraging habitats/conditions of marine bird species. For spectacled eiders and some other species, understanding the proportion of populations using the proposed lease area will be important to defining risks; such information will be used to develop subsequent surveys. Such surveys will monitor birds in appropriate areas with dedicated aerial and ship-based surveys, supplemented with information from other projects. Monitor prey distribution in concert with benthic, ecosystem and fish projects.

H1B. Observations. Monitor collisions, with attention to lighting, natural conditions and weather.

H1C. Observations of direct oiling of birds in water or on land, testing birds for contaminants, testing for contaminants in prey species.

H1D. Methods for H1D not complete.

H2. Observations, site-specific surveys, and food-habit studies.

Cost and Level of Effort. $300,000-$350,000 for first 3 years, and lower costs after that. The cost of logistics would be about $200-225K, and the remainder would be for science.

Date information is required:
Start initial work in 2008. Information needed by 2011.

Biology Task 3. Birds 3A - Effects of Onshore and Offshore Development on Birds. COMIDA Indicator Matrix for Decision Making

Task Order	MMS Issue Addressed	Monitoring Hypotheses	Methods	Key Monitoring Result or Parameter for Decision Making
Biology - Birds 3A Effects of Onshore Operations on Birds	Will development adversely affect bird populations keeping in mind sideboards of the Endangered Species Act and the Migratory Bird Treaty Act?	**H1:** Human trash attracts foxes and avian predators.	Observations, site-specific surveys, and food-habit studies.	Annual interpretive report with tabulated data on predator populations will be provided, with statistical tests of potential interannual significant differences. Contractor will alert MMS COTR of any important trends or changes.

Biology – Birds 3B - Effects of Onshore and Offshore Development on Birds. COMIDA Indicator Matrix for Decision Making

Task Order	MMS Issue Addressed	Monitoring Hypotheses	Methods	Key Monitoring Result or Parameter for Decision Making
Biology - Birds 3B Effects of Offshore Operations on Birds	Will development adversely affect marine bird populations (keeping in mind the requirements of the Endangered Species Act and the Migratory Bird Treaty Act)?	**H1:** Marine birds will be disturbed and/or excluded from foraging areas, either exceeding allowed take for listed species, [or affecting survival or productivity of other marine birds?]. **H2:** Marine bird mortality will increase due to collisions with lighted structures or vessels. **H3:** Marine bird mortality will increase due to chronic pollution. **H4:** Marine bird mortality will increase due to large-scale oil spill events.	1. Understand distribution, abundance, diet, and foraging habitats/conditions of marine bird species. Monitor in appropriate areas with dedicated aerial and ship-based surveys, supplemented with anecdotal information from other projects. Monitor prey distribution. 2. Observations. Monitor collisions, with attention to lighting, natural conditions and weather. 3. Observations of direct oiling of birds in water or on land, testing birds for contaminants, testing for contaminants in prey species.	Annual interpretive report with tabulated data on bird populations will be provided, with statistical tests of potential interannual significant differences. Contractor will alert MMS COTR of any important trends or changes.

PROPOSED COMIDA MONITORING TASK

BIOLOGY GROUP
TASK 4 - ECOSYSTEM

Region: Alaska

Planning Area: Chukchi Sea

Title: **COMIDA Monitoring Task: Biology - Characterize the Chukchi Sea Ecosystem**

MMS Need for Monitoring of Environmental Effects of Chukchi OCS Exploration and Development:

The Chukchi Sea ecosystem is not well understood. The purpose of this task is to characterize the Chukchi Sea ecosystem is to provide the ability to determine if changes to the ecosystem are the result of oil industry activities or seasonal, inter-annual, long term climatic variability, or other anthropogenic activities. The task will also improve understanding of structural systems in the Chukchi Sea (e.g., areas of high/low productivity, high/low currents, coarse/fine sediment structure, shallow/deep water). With a better understanding of ecosystem and related structural systems, MMS will have the ability to identify key species and key processes to focus monitoring efforts and make efficient use of limited funds.

The majority of this task's efforts will be coordinating, integrating, and augmenting efforts from the biological monitoring tasks (water column, benthos, epi-benthic biota (fish and invertebrates), demersal/pelagic fish, sea birds, and marine mammals). The task will secondarily interact with fate and effects tasks.

Period of Performance: FY 2008-2013

Description:

Background. Knowledge of the Chukchi Sea ecosystem is not extensive. Some knowledge of the trophic levels is available, but developing a better understanding of the ecosystem is critical to provide the ability to determine if changes to the ecosystem are the result of oil industry activities, natural seasonal, inter-annual, and climatic variability, or other anthropogenic activities.

The task will add value to the initial baseline characterization and future monitoring efforts by increasing focus, limiting overlap, and augmenting efforts with broad scale methods (satellite, aircraft sensors), and *in-situ* sensor equipment (e.g. SPI, CTD, AUV).

Timing Needs for this monitoring. To best characterize the ecosystem, characterization efforts need to be completed prior to exploration and development before impacts from construction occur. The task will need to be ongoing at some level over the life of the project. The level of effort may be reduced in subsequent years if key indicator measurements of biological, chemical, or physical parameters can be determined.

Objectives

1. Understand the food web structure and linkages of the Chukchi Sea ecosystem.

2. Determine the current spatial structure of the ecosystem in the Chukchi Sea.
3. Understand seasonal, inter-annual, and long-term climate change impacts on the ecosystem.

Monitoring Hypotheses

H1: The baseline food web structure and pathways are not significantly affected by oil industry activities.

H2: Oil industry activities do not have a significant impact on the spatial structure of the ecosystem.

H3: Variability in ecosystem parameters induced by oil industry activity is not significantly detected against the background of natural seasonal, inter-annual, and climatic variability.

Methods

1. Remote sensing of surface water color and turbidity from satellite data (currently more affordable but not high quality data, however, quality is continually improving).
2. Remote sensing of surface water color, turbidity, and temperature using low altitude (<1,000 ft) using sensors.
3. Collect water column data (phytoplankton, zooplankton, turbidity, fluorescence, and nutrients) samples to ground truth remote sensing.
4. Remote sensing of sea ice cover and thickness from satellite data on as fine a temporal and spatial scale as possible.
5. Sea state/roughness collected from satellite data on as fine a temporal and spatial scale as possible.
6. Use ships of opportunity to collect water quality data.
7. Use tracers of food web connectivity, e.g. stable isotopes, fatty isotopes.
8. Incorporate data from traditional biological censusing methods for infauna, epi-benthic fauna, demersal/pelagic fish, sea bird and marine mammal populations.
9. Benthic sampling with Sediment Profile Imaging (SPI).
10. Bathymetry, sub-bottom profiling, water quality, and video with Autonomous Underwater Vehicle (AUV) both under ice and in open water.
11. Use of low altitude remote sensing to monitor surface fish, sea birds, and marine mammal populations.

Use of satellite tags on birds, fish, and mammals to track population movements.

Cost and Level of Effort

With satellite and aircraft sensor data collection, the total program cost estimate is:

Logistics:	$445,000
Science:	$810,000
TOTAL:	$1,255,000

Logistic needs:

1. Satellite image and data collection
2. Aircraft image and data collection.
3. Ground truth data collection:
    a. Ship time
    b. Equipment (e.g. CTD, grabs, nets, SPI
    c. AUV
    d. Incorporate traditional biological census techniques from other tasks.

Date information is required:

Initial report is due prior to oil and gas exploration activities. Annual reports are due through the length of the contract.

Biology Task 4. Characterize the Chukchi Sea Ecosystem. COMIDA Indicator Matrix for Decision Making

Task Order	MMS Issue Addressed	Monitoring Hypotheses	Methods	Key Monitoring Result or Parameter for Decision Making
Biology - Ecosystem- "Characterize the Chukchi Sea Ecosystem in order to detect and distinguish future changes resulting from oil industry activities, natural variability, and other anthropogenic effects.	Understand the food web structure and linkages of the ecosystem. Determine the current spatial structure of the ecosystem in the Chukchi Sea. Understand seasonal, inter-annual, and long term climate change impacts on the ecosystem.	H1: The baseline food web structure and pathways are not significantly affected by oil industry activities. H2: Oil industry activities do not have a significant impact on the spatial structure of the ecosystem. H3: Variability in ecosystem parameters induced by oil industry activity is not significantly detected against the background of natural seasonal, inter-annual, and climatic variability.	1) Remote sensing of surface water color, turbidity, and temperature from satellite data. 2) Remote sensing of surface water color, turbidity, and temperature using low altitude (<1,000 ft) using sensors. 3) Collect water column data (phytoplankton, zooplankton, turbidity, fluorescence, nutrient) samples to ground truth remote sensing. 4) Remote sensing of sea ice cover and thickness from satellite data on as fine a temporal and spatial scale as possible. 5) Sea state/roughness collected from satellite data on as fine a temporal and spatial scale as possible. 6) Use ships of opportunity to collect water quality data. 7) Use tracers of food web connectivity, e.g. stable isotopes, fatty isotopes. 8) Incorporate data from traditional biological censusing methods for infauna, epi-benthic fauna, demersal/pelagic fish, sea bird and marine mammal populations. 9) Benthic sampling with Sediment Profile Imaging (SPI). 10) Bathymetry, sub-bottom profiling, water quality, and video with Autonomous Underwater Vehicle (AUV) both under ice and in open water. 11) Use of low altitude remote sensing to monitor surface fish, sea birds, and marine mammal populations. 12) Use of satellite tags on birds, fish, and mammals to track population movements.	Annual interpretative report with tabulated data on ecosystem parameters. Data will be analyzed with multi-variate analysis to measure interactions between remote sensing data (e.g. sea state, color, SST, plankton, fish, sea birds, marine mammals, chlorophyll, CTD, currents) with 'ground truth' data (e.g. nutrients, phyto and zooplankton population, fish (trawls, gill, and fyke nets), benthic infauna, SPI, and sediment chemical and physical characterization. Data analysis will be employed to differentiate ecosystem changes resulting from oil industry activities, or natural seasonal, inter-annual, and climatic variability, or other anthropogenic activities. Contractor will alert MMS COTR of any important trends or changes.

PROPOSED COMIDA MONITORING TASK

PROTECTED SPECIES GROUP
TASK 1 – TAGGING STUDIES

Region: Alaska

Planning Area: Chukchi Sea

Title: **COMIDA Monitoring Task: Seasonal Distribution and Abundance of Marine Mammals - Tagging Studies**

MMS Need for Monitoring of Environmental Effects of Chukchi OCS Exploration and Development:

Data on the seasonal distribution, abundance, and habitat use are necessary to assess and manage anthropogenic risks on marine mammals. Information on these ecological parameters in the Chukchi Sea is lacking or out of date, especially in light of ecological changes that have occurred in recent decades. This study will provide information for lease sales, MMPA authorizations, ESA consultations, NEPA analyses, and as documentation in the approval of exploration and/or development plans. In addition, several marine mammal species in the Chukchi Sea are important to Alaska Natives for subsistence. It will also contribute information useful for developing mitigation strategies to reduce impacts to the marine mammal populations from proposed oil and gas exploration and development activities.

Period of Performance: FY 2007 – FY2012

Description:

Background. Having a good understanding of the seasonal distribution, abundance, and habitat use of marine mammals in the Chukchi Sea is fundamentally important to evaluating the potential environmental impacts associated with oil and gas exploration and development and other anthropogenic activities. This information is necessary to evaluate the potential impacts of proposed industrial development on marine mammal populations and to formulate effective mitigation strategies. Reliable, up-to-date information of this type is currently unavailable for most marine mammal populations in the Chukchi Sea.

Over the past two years, the oil and gas industry has become increasingly interested in exploring and possibly developing petroleum resources in the Chukchi Sea. This new interest has increased the urgency to collect better information on the distribution and abundance of marine mammals in Lease Sale Area 193 for the purpose of impact assessment and mitigation.

To be most effective and efficient, a broad collaboration, including agencies, industry, and stakeholders, would be required to execute this monitoring plan. The monitoring activities described in this study profile follow the recommendations of the Ocean Research Priorities Plan (ORPP) being developed by the Committee on Ocean Policy's Joint Subcommittee of Ocean Science and Technology (JSOST). The monitoring goals are in line with two of ORPP's near-term priorities: understanding climate change and instrumentation. Furthermore, the COMIDA products generated by these efforts could be integrated into another near-term ORPP priority: CAMEO (Comparative Analysis of Ecosystem Organization). This study profile is one of three

interrelated efforts focusing on marine mammal distribution and abundance that support these broad objectives.

Timing needs for this monitoring. Exploration activities in Lease Sale Area 193 started in 2006 and are expected to continue through at least 2012. Therefore, the monitoring described in this study profile needs to be initiated as soon as possible, and to be undertaken from 2007 through 2012. Information regarding the seasonal distribution, abundance, and habitat use of marine mammals across the planning area is required for assessing potential impacts and mitigating disturbances associated with proposed exploration and development scenarios. (Conducting this monitoring task in conjunction with ongoing exploration activities is recommended in order to take advantage of existing logistical investments and operations, and to maximize opportunities for inter-agency, industry, and stakeholder cooperation.)

Objectives. The overarching objective of the three interrelated study profiles (tagging studies, aerial surveys, acoustic assessments) is to obtain information on the seasonal distribution, abundance, and habitat use of marine mammals in the Chukchi Sea. Through the use of radio telemetry and/or data loggers (e.g., satellite, GPS, oceanographic, RFID, acoustic), this study will:

1. Obtain information on seasonal distribution and movements of marine mammals in the lease sale area.
2. Identify habitats of potential importance to marine mammals (e.g., feeding, resting, calving/pupping, denning).
3. Use tag data to better design acoustic and aerial surveys and to provide sightability corrections for population estimates.

Monitoring Hypothesis

H1. Marine mammals are distributed and select habitats throughout the MMS Chukchi Sea Program Area independent of oil and gas exploration and development activities.

Methods

1. Deploy instruments on a sufficient sample from each of the following species annually: polar bears; walruses; bearded, ringed, spotted, and ribbon seals; bowhead, gray, and beluga whales.
2. Use GIS and probability-based models to define important habitats, identify migration pathways, and stratify population abundance surveys.
3. Use generalized linear models to estimate sightability correction factors for aerial surveys.
4.

Cost and Level of Effort

Budget: $2,000,000 annually

Science needs:

- Satellite tags
- Argos satellite data processing
- Travel, food and lodging expenses

Logistical needs:

- Tagging skiff
- Ship support
- Aerial reconnaissance support

Total costs over 6 years are estimated to be approximately $12.0M.

Date information is required:

- Annual summary reports due each year.
- Final report to MMS due December 2013.
-

Provisional budget for COMIDA marine mammal tagging

Science				
	Tags	$	Argos	Per year
Gray	15			
beluga	25			
bowhead	20			
polar bear	25			
walrus	30			
ringed	25			
spotted	25			
bearded	25			
ribbon	25			
	215	$860,000	$215,000	$1,075,000
Logistics				
Travel		$30,000		
Equipment		$45,000		
Supplies		$30,000		
Ship		$750,000		
Helicopter		$200,000		
Fixed-wing		$75,000		$1,130,000
Other				
Personnel		$195,000		$195,000
			Total	$2,400,000
			5-year total	$12,000,000

PROPOSED COMIDA MONITORING TASK

PROTECTED SPECIES GROUP
TASK 2 – ACOUSTIC ASSESSMENTS

Region: Alaska

Planning Area: Chukchi Sea

Title: **COMIDA Monitoring Task: Seasonal Distribution and Abundance of Marine Mammals - Acoustic Assessments**

MMS Need for Monitoring of Environmental Effects of Chukchi OCS Exploration and Development:

Data on the seasonal distribution, abundance, and habitat use are necessary to assess and manage anthropogenic risks on marine mammals. Information on these ecological parameters in the Chukchi Sea is lacking or out of date, especially in light of ecological changes that have occurred in recent decades. This study will provide information for lease sales, MMPA authorizations, ESA consultations, NEPA analyses, and as documentation in the approval of exploration and/or development plans. In addition, several marine mammal species in the Chukchi Sea are important to Alaska Natives for subsistence. It will also contribute information useful for developing mitigation strategies to reduce impacts to the marine mammal populations from proposed oil and gas exploration and development activities.

Period of Performance: FY 2007 – FY2012

Description:

Background. Having a good understanding of the seasonal distribution, abundance, and habitat use of marine mammals in the Chukchi Sea is fundamentally important to evaluating the potential environmental impacts associated with oil and gas exploration and development and other anthropogenic activities. This information is necessary to evaluate the potential impacts of proposed industrial development on marine mammal populations and to formulate effective mitigation strategies. Reliable, up-to-date information of this type is currently unavailable for most marine mammal populations in the Chukchi Sea.

Over the past two years, the oil and gas industry has become increasingly interested in exploring and possibly developing petroleum resources in the Chukchi Sea. This new interest has increased the urgency to collect better information on the distribution and abundance of marine mammals in Lease Sale Area 193 for the purpose of impact assessment and mitigation.

To be most effective and efficient, a broad collaboration, including agencies, industry, and stakeholders, would be required to execute this monitoring plan. The monitoring activities described in this study profile follow the recommendations of the Ocean Research Priorities Plan (ORPP) being developed by the Committee on Ocean Policy's Joint Subcommittee of Ocean Science and Technology (JSOST). The monitoring goals are in line with two of ORPP's near-term priorities: understanding climate change and instrumentation. Furthermore, the COMIDA products generated by these efforts could be integrated into another near-term ORPP priority: CAMEO (Comparative Analysis of Ecosystem Organization). This study profile is one of three

interrelated efforts focusing on marine mammal distribution and abundance that support these broad objectives.

Timing needs for this monitoring. Exploration activities in Lease Sale Area 193 started in 2006 and are expected to continue through at least 2012. Therefore, the monitoring described in this study profile needs to be initiated as soon as possible, and to be undertaken from 2007 through 2012. Information regarding the seasonal distribution, abundance, and habitat use of marine mammals across the planning area is required for assessing potential impacts and mitigating disturbances associated with proposed exploration and development scenarios. (Conducting this monitoring task in conjunction with ongoing exploration activities is recommended in order to take advantage of existing logistical investments and operations, and to maximize opportunities for inter-agency, industry, and stakeholder cooperation.)

Objectives. The overarching objective of the three interrelated study profiles (tagging studies, aerial surveys, acoustic assessments) is to obtain information on the seasonal distribution, abundance, and habitat use of marine mammals in the Chukchi Sea. Specific objectives include:

1) Assess the year-round seasonal occurrence of cetaceans and pinnipeds through collecting information on calls in the western Beaufort and Chukchi Seas.
2) Collect information on ambient and anthropogenic sound in a variety of locations in the Chukchi Sea.
3) Use a hydrophone array to estimate relative abundance of marine mammals.
4) Compare current bowhead whale, beluga whale, bearded seal and other marine mammal occurrence during the spring with data collected in the 1980s, 1990s, and 2001 to determine whether changes in migration timing or residence times have occurred.
5) Use acoustic recorder tags to collect information on received sound levels and behavior of both cetaceans and pinnipeds.

Monitoring Hypotheses

H1. Marine mammals are distributed and select habitats throughout the MMS Chukchi Sea Program Area independent of oil and gas exploration and development activities.

Methods

1) Acquire sufficient autonomous recorders based on a proven design, modified for cold, shallow water deployment to record from 0-1000 Hz for 365 days per deployment.
2) Deploy instruments, refurbish and redeploy them annually (coordinate, if possible, with deployment of moorings for oceanographic measurements).
    a. Deploy sufficient instruments that can collect data for 3months to 1 year to evaluate locations and movements within Lease Sale Area 193.
    b. Deploy sufficient instruments for the short term (spring only) off Point Barrow to facilitate a comparison between current and past occurrence of bowhead whales, beluga whales, and bearded seals.
3) Analyze annual acoustic data for cetacean and pinniped calls.
    a. Determine seasonal occurrence by species.
    b. Assess inter-annual differences.
    c. Assess anthropogenic noise in the study area.
    d. Compare animal behavior to received sound levels.

Cost and level of effort

Year 1 (2007): Ramp-up (study design, equipment purchase, and placement of few instruments to start collecting information in key spots)

HARPS (or other appropriate directional recorder) + moorings & release: $50K each X 12 = $600K
Pop-ups (or other appropriate non-directional recorder): $30K each X 20 = $600K
Travel/planning: $100K
Staffing: $350K (salary, benefits, overhead for one experienced PhD + 2 junior staff)
Acoustic tags: $5K X 20 = $100K
(Add-in costs for passive acoustics devices to place on or near oceanographic moorings if desirable)
Total estimated = $1.75M

Years 2, 3, 4, 5 (2008-2011): Full field season

Refurbish & replace equipment as needed: $300K
Shipping, deployment, travel: $250K
Staffing: $350K (salary, benefits, overhead for one experienced PhD + 2 junior staff)
Acoustic tags: $100K
Total estimated: $1M annually

Year 6 (2012): Analysis, submit for publication

Staffing: $350K (salary, benefits, overhead for one experienced PhD + 2 junior staff)
Total estimated: $350K

TOTAL COST: $6.1M over 6 years

PROPOSED COMIDA MONITORING TASK

PROTECTED SPECIES GROUP
TASK 3 – AERIAL SURVEYS

Region: Alaska

Planning Area: Chukchi Sea

Title: **COMIDA Monitoring Task: Seasonal Distribution and Abundance of Marine Mammals - Aerial Surveys**

MMS Need for Monitoring of Environmental Effects of Chukchi OCS Exploration and Development:

Data on the seasonal distribution, abundance, and habitat use are necessary to assess and manage anthropogenic risks on marine mammals. Information on these ecological parameters in the Chukchi Sea is lacking or out of date, especially in light of ecological changes that have occurred in recent decades. This study will provide information for lease sales, MMPA authorizations, ESA consultations, NEPA analyses, and as documentation in the approval of exploration and/or development plans. In addition, several marine mammal species in the Chukchi Sea are important to Alaska Natives for subsistence. It will also contribute information useful for developing mitigation strategies to reduce impacts to the marine mammal populations from proposed oil and gas exploration and development activities.

Period of Performance: FY 2007 – FY2012

Description:

Background. Having a good understanding of the seasonal distribution, abundance, and habitat use of marine mammals in the Chukchi Sea is fundamentally important to evaluating the potential environmental impacts associated with oil and gas exploration and development and other anthropogenic activities. This information is necessary to evaluate the potential impacts of proposed industrial development on marine mammal populations and to formulate effective mitigation strategies. Reliable, up-to-date information of this type is currently unavailable for most marine mammal populations in the Chukchi Sea.

Over the past two years, the oil and gas industry has become increasingly interested in exploring and possibly developing petroleum resources in the Chukchi Sea. This new interest has increased the urgency to collect better information on the distribution and abundance of marine mammals in Lease Sale Area 193 for the purpose of impact assessment and mitigation.

To be most effective and efficient, a broad collaboration, including agencies, industry, and stakeholders, would be required to execute this monitoring plan. The monitoring activities described in this study profile follow the recommendations of the Ocean Research Priorities Plan (ORPP) being developed by the Committee on Ocean Policy's Joint Subcommittee of Ocean Science and Technology (JSOST). The monitoring goals are in line with two of ORPP's near-term priorities: understanding climate change and instrumentation. Furthermore, the COMIDA products generated by these efforts could be integrated into another near-term ORPP priority: CAMEO (Comparative Analysis of Ecosystem Organization). This study profile is one of three

interrelated efforts focusing on marine mammal distribution and abundance that support these broad objectives.

Timing needs for this monitoring. Exploration activities in Lease Sale Area 193 started in 2006 and are expected to continue through at least 2012. Therefore, the monitoring described in this study profile needs to be initiated as soon as possible, and to be undertaken from 2007 through 2012. Information regarding the seasonal distribution, abundance, and habitat use of marine mammals across the planning area is required for assessing potential impacts and mitigating disturbances associated with proposed exploration and development scenarios. (Conducting this monitoring task in conjunction with ongoing exploration activities is recommended in order to take advantage of existing logistical investments and operations, and to maximize opportunities for inter-agency, industry, and stakeholder cooperation.)

Objectives. The overarching objective of the three interrelated study profiles (tagging studies, aerial surveys, acoustic assessments) is to obtain information on the seasonal distribution, abundance, and habitat use of marine mammals in the Chukchi Sea. Specific objectives include:

1. Document the distributions and densities of marine mammals from June to November.
2. Determine the areas that are most important to marine mammals during critical seasons of their annual life history cycles such as molting, calving/pupping, and feeding.
3. Integrate with acoustic and satellite telemetry monitoring programs to more fully evaluate the seasonal distribution, abundance, and habitat use of marine mammals.

Monitoring Hypotheses

H1. Marine mammals are distributed and select habitats throughout the MMS Chukchi Sea Program Area independent of oil and gas exploration and development activities.

Methods

1. The studies will use aerial surveys from a variety of platforms using sensors and sighting methods chosen to take full advantage of recent technological developments and maintain backward compatibility with historical surveys.
2. Aerial line transect surveys will be flown in the Chukchi Sea Program Area monthly from June to November (i.e., includes ice-covered and open periods).
3. Unmanned aircraft systems (UAS) will be tested for performance relative to conventional, manned aerial surveys. If successful, these systems will be implemented, particularly for offshore areas that pose safety risks to pilots and observers.
4. Multi-spectral sensors will be employed during periods when ice is present, to increase coverage and detectability for seals and walruses.
5. Results will be compared with those from previous surveys in the Chukchi Sea.

Cost and Level of Effort

1. The aerial line transect and multi-spectral surveys will require $2.5M annually, inclusive of aircraft charters.
2. UAS tests will require $1.2M in year 1; costs in subsequent years dependent on configuration of successful implementation.
3. Collaborations with industry and other agencies are expected to offset some of these costs.

Total costs over 6 years are estimated to be approximately $13.4M.

PROPOSED COMIDA MONITORING TASK

SOCIOECONOMIC/SUBSISTENCE GROUP
TASK 1 – IMPACT ASSESSMENT FOR OFFSHORE SUBSISTENCE HUNTING

Region: Alaska

Planning Area: Chukchi Sea

Title: **COMIDA Monitoring Task: Socioeconomic/Subsistence**
Task 1: Impact Assessment for Offshore Subsistence Hunting

MMS Need for Monitoring of Environmental Effects of Chukchi OCS Exploration and Development:

Prospects for offshore oil/gas exploration and development in the Chukchi Sea create an opportunity for adverse impacts on coastal subsistence hunting activities, which could potentially be disrupted by industrial noise, environmental discharge of contaminants, or oil spill. The MMS thus needs to establish an early baseline in the area and to monitor any significant changes in subsistence activities over time. In particular, monitoring efforts should be directed toward the hunt for marine mammals, including bowhead and beluga whales, walrus, polar bears, and seals.

Period of Performance: FY 2008-2011

Description:

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

Timing Needs for this monitoring. Monitoring should be established as soon as possible, since seismic activity has already taken place.

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

Monitoring Hypotheses
H1: Offshore subsistence hunting patterns in the vicinity of Wainwright and Point Lay do not vary significantly from year to year.
H2: Variation in offshore subsistence hunting patterns are not related to offshore oil and gas activities

Methods

1. Community Engagement – Will involve issue nomination and/or confirmation from the NSB Fish and Game Management Committee and community representatives.
2. Capacity Building – Establish a protocol or mechanism to facilitate community participation and a meaningful role in monitoring efforts.
3. Team Construction - Identify a team to take on the technical aspects of the monitoring program.
4. Field Work – Establish procedures for systematic observations and data collection, including:
    a. harvesting patterns and numbers;
    b. locations of strikes, with direction and distance from shore
    c. number of hunting groups and composition
    d. duration of hunting activities by active days
    e. length of hunt and area searched
    f. estimated costs per unit effort
    g. report of any accidents or mishaps
    h. report of weather conditions and ice conditions
5. Analysis and Reporting – Analyze collected data and provide a summary report at the end of each hunting season, with review opportunities by respective host communities to achieve collaborative results
6. Forward Linkage – Assess Task I results in preparation for Task II studies (with likely expansion of participant communities and objectives to include near-shore hunting activities).

Cost and Level of Effort: $300,000/year

Date information is required:
Annual reports are due each year in which the study is funded within 3 months of the conclusion of fieldwork.

PROPOSED COMIDA MONITORING TASK

SOCIOECONOMIC/SUBSISTENCE GROUP TASK 2 – IMPACT ASSESSMENT FOR NEARSHORE SUBSISTENCE HUNTING

Region: Alaska

Planning Area: Chukchi Sea

Title: **COMIDA Monitoring Task: Socioeconomic/Subsistence Task 2: Impact assessment for nearshore subsistence hunting**

MMS Need for Monitoring of Environmental Effects of Chukchi OCS Exploration and Development:

Prospects for offshore oil/gas exploration and development in the Chukchi Sea create an opportunity for adverse impacts on coastal subsistence hunting activities, which could potentially be disrupted by industrial noise, environmental discharge of contaminants, or oil spill. The MMS thus needs to establish an early baseline in the area and to monitor any significant changes in subsistence activities over time. In particular, monitoring efforts should be directed toward the hunt for fish and migratory birds.

Period of Performance: FY 2010-2013

Description:

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

Timing Needs for this monitoring. Monitoring should be established as soon as possible after initiation of Task I.

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

Monitoring Hypotheses
H1: Nearshore subsistence hunting patterns in the vicinity of Barrow, Wainwright, Point Lay, and Point Hope do not vary significantly from year to year.
H2: Variations in nearshore subsistence hunting patterns are not related to offshore oil and gas activities

Methods

1. Community Engagement – Will involve issue nomination and/or confirmation from the NSB Fish and Game Management Committee and community representatives.
2. Capacity Building – Establish a protocol or mechanism to facilitate community participation and a meaningful role in monitoring efforts.
3. Team Construction - Identify a team to take on the technical aspects of the monitoring program.
4. Field Work – Establish procedures for systematic observations and data collection, including:
    a. harvesting patterns and harvest levels;
    b. harvest locations, with direction and distance from shore
    c. number of hunting groups and composition
    d. duration of hunting activities by active days
    e. length of hunt and area searched
    f. estimated costs per unit effort
    g. report of any accidents or mishaps
    h. report of weather conditions and ice conditions
5. Analysis and Reporting – Analyze collected data and assess linkages with other relevant environmental data to provide a summary report at the end of each hunting season, with review by respective host communities to achieve collaborative results.
6. Forward Linkage – Assess Task II results in preparation for Task III studies (objectives to include onshore hunting activities).

Cost and Level of Effort: $500,000/year

Date information is required:

Annual reports are due each year in which the study is funded within 3 months of the conclusion of fieldwork.

PROPOSED COMIDA MONITORING TASK

SOCIOECONOMIC/SUBSISTENCE GROUP
TASK 3 – IMPACT ASSESSMENT FOR ONSHORE SUBSISTENCE HUNTING

Region: Alaska

Planning Area: Chukchi Sea

Title: **COMIDA Monitoring Task: Socioeconomic/Subsistence**
Task 3: Impact Assessment for Onshore Subsistence Hunting

MMS Need for Monitoring of Environmental Effects of Chukchi OCS Exploration and Development:

Prospects for offshore oil/gas exploration and development in the Chukchi Sea create an opportunity for adverse impacts on coastal subsistence hunting activities, which could potentially be disrupted by industrial noise, environmental discharge of contaminants, development of infrastructure, or oil spill. The MMS thus needs to establish a baseline in the area and to monitor any significant changes in subsistence activities over time in collaboration with other state and federal agencies. In particular, monitoring efforts should be directed toward cumulative effects on hunting, employment, and general social systems.

Period of Performance: FY 2012-2015

Description:

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

Timing Needs for this monitoring. Monitoring should be established as soon as possible after initiation of Task II.

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

Monitoring Hypotheses
H1: Community subsistence hunting patterns in the vicinity of Barrow, Wainwright, Point Lay, and Point Hope do not vary significantly from year to year.
H2: Variation in community subsistence hunting patterns is not related to oil and gas development activities

Methods

1. Community Engagement – Will involve issue nomination and/or confirmation from the NSB Fish and Game Management Committee and community representatives.
2. Capacity Building – Establish a protocol or mechanism to facilitate community participation and a meaningful role in monitoring efforts.
3. Team Construction - Identify a team to take on the technical aspects of the monitoring program.
4. Field Work – Establish procedures for systematic observations and data collection, including:
    i. harvesting patterns, harvest levels, and distribution patterns
    j. harvest locations, with direction and distance from shore
    k. number of hunting groups and composition
    l. duration of hunting activities by active days
    m. length of hunt and area searched
    n. estimated costs per unit effort
    o. report of any accidents or mishaps
    p. report of weather conditions and ice conditions
5. Analysis and Reporting – Analyze collected data and assess linkages with other relevant environmental data to provide a summary report at the end of each hunting season, with review by respective host communities to achieve collaborative results.

Cost and Level of Effort $500,000/year

Date information is required:
Annual reports are due each year in which the study is funded within 3 months of the conclusion of fieldwork.

SUMMARY OF THE DISCUSSIONS FOLLOWING THE PRESENTATION OF STUDY PROFILES

Physical Oceanography and Fate and Effects Session

Dr. Richard Prentki chaired the breakout session and gave the presentation of the Physical Oceanography and Fates and Effects study profiles which included: data mining, chemical and hydrocarbon monitoring, and collection of physical supporting data. During Dr. Prentki's presentation he asked about data availability from the Shelf Basin Interaction Study. Dr. Jackie Grebmeier explained that the data is all publicly available on the SBI website: www.sbi.utk.edu.

Biology Session

Kate Wedemeyer chaired the Biology breakout session. That group developed four study profiles: 1. Quantitative Benthic Characterization of the Comida Study Area, 2. Chukchi Sea Forage Fish, 3. Effects of Onshore and Offshore Development on Birds, and 4. Characterization of the Chukchi Sea Ecosystem.

Dr. Jackie Grebmeier presented the first study profile on "Quantitative benthic characterization in the COMIDA study area". After the presentation, Dr. Evelyn Brown suggested that it would be a good idea to have a map of the Chukchi Sea area to show where potential monitoring/sampling sites would be located.

Kate Wedemeyer responded that one of the things that her group requested was to have another day to work on the integration of sampling locations and effects as pointed out by Dr. Brown.

Mike Sigler presented the study profile for Forage Fish.

After Mr. Sigler's presentation Dr. Evelyn Brown commented on lessons learned from the Exxon Valdez Oil Spill. The first lesson learned was that they lacked background data for fish tissue and pathology. Dr. Brown further commented that fisheries biologists have failed to recognize is that disease is part of the ecosystem. There are naturally occurring disease organisms. Some of the metals and stress imposed by any anthropogenic activity or pollution can affect the disease. This is superimposed over the background of naturally occurring disease and stress. Therefore Dr. Brown thought that it is important to add histopathological evaluations in the baseline sampling. Dr. Brown stated that this type of work is kind of expensive to do but there are naturally occurring lesions and parasites. One of the observations made during EVOS studies was that oil would cause the gut parasites to move into the muscle tissue, leaving the gut devoid of parasites.

Dr. Robert Suydam mentioned that many people who live along the Chukchi Sea have been really concerned about impacts from seismic survey activities on the food that marine mammals eat. Dr. Suydam asked if the group was looking primarily at salmon. There aren't that many salmon in the area, and they are not important for marine mammals in the area. Dr. Suydam stated that emphasis should be given to the impacts of seismic survey activity on cod and other

marine mammal food, including zooplankton. Dr. Suydam reiterated that a lot of people on the North Slope are really interested in that question.

Kate Wedemeyer thanked Dr. Suydam for his comment. Ms. Wedemeyer explained that the group did discuss the subject. The entire biology group emphasized forage fish because they are key to other components of the ecosystem. But when we were discussing the effects on migration or trying to get a sense of a particular issue and impact, then we looked at other species of fish. Salmon was one of those species. Salmon is a species that MMS has to do an Essential Fish Habitat Evaluation on.

An unidentified audience member asked about what funding this program would require?

Jokingly, Mike Sigler said: "I bet we spent more money that you did." However, Mr. Sigler did say that a realistic estimate for a broad scale marine fish survey in that region is several hundred thousand to a million dollars. For fish tissue samples, they are $100 to $300 per sample depending upon the parameter needed. To do one broad scale survey in the area is at least several hundred thousand to maybe a million dollars.

Kate Wedemeyer added that the group did generate cost estimates but as Mike Sigler and many in the biology group, pointed out is that we have to combine the logistics. Ship time and sampling support can be combined between studies. It makes a big difference in the costs. Ms. Wedemeyer again stated that they could use another day to do the integration of various studies.

Karen Laing presented the study profile for Effects of Onshore and Offshore Development on Birds. There was no discussion following her presentation.

Dr. Evelyn Brown presented the Characterization of the Chukchi Sea Ecosystem study profile.

Dr. Sathy Naidu asked a question about ecosystem modeling costs and if that would be outside of the basic science. Dr. Brown responded that those costs were estimated at about $250, 000. It would be less expensive because you wouldn't have the costs for logistics, it would simply be computers and data crunching time. Dr. Brown did mention that she was uncomfortable in putting price tags on studies until an actual study plan is developed.

Protected Species Session

Dr. John Bengtson presented three profiles for the Protected Species group. The group developed three profiles on the seasonal distribution and abundance of marine mammals: Tagging Studies, Acoustic Assessments, and Aerial Surveys. There was no discussion following his presentation.

Socioeconomics/Sociocultural Session

Mr. Dee Williams presented three study profiles for the Socioeconomics and Sociocultural session: Impact Assessment for Offshore Subsistence Hunting, Impact Assessment for Near-Shore Subsistence Hunting, and Impact Assessment for Onshore Subsistence Hunting. Following Mr. Williams's presentation Ms. Elise Wolf asked if the Phase I would start in 2007. Mr.

Williams said that even though it said 2008 on paper, the wording was that it should start as soon as possible because seismic survey activity is already underway. So the sooner it can happen would be the scientific preference.

Ms. Wolf asked if it would be continued every year, into 2010 and that if the first community would be Point Lay? Mr. Williams replied yes. Mr. Williams went on to say that there is an overlapping phase where Phase I would be at least three years. The plans for Phase II would be drafted in the third year. These are general plans. Regarding communities, the idea was that fieldwork efforts should be initiated around the two communities. Wainwright and Point, Lay that are imagined to be closest to future development activities.

Ms. Wolf continued to say that those are onshore activities, and the seismic survey and other activities will affect all of the subsistence use from Pt. Hope to Barrow. Ms. Wolf questioned the reasoning for limiting a subsistence assessment to only two communities when onshore activities will not start until much later.

Mr. Williams responded that the major impetus for disruption right now would be vessel traffic and noise propagation. To the degree to which those are far offshore it becomes a question of which communities are closest in proximity to the activity.

Ms. Wolf asked that, theoretically, if there is disturbance in the northern Barrow area and bowhead whales, for example, move farther south and Pt. Hope is able to take more animals, isn't there an advantage to really include all of these communities and the changes and differences in their subsistence patterns?

Mr. Williams responded that he could not dispute that it would always be preferable to cover everywhere. The group imagined that they had to prioritize where they would want to begin the monitoring effort and have the longest collection of data that would likely to be most constructive in answering the long-term questions. These factors, along with the limitation of funds, are the context in which they selected the communities.

Ms. Wolf also brought up the issue of climate change. She stated that all of these communities are experiencing climate change. If data collection is limited to two communities, then the observations that you could potentially have from other communities and how they could interrelate with these other types of studies that are occurring, would be lacking. It would seem to be important data to include.

Mr. Alex Macleod mentioned that the importance to be gained from the group's discussion was that these are studies that are for "the community." So they wanted to establish what would be important to them- the community, what is involved in gaining their trust. You cannot just go in to all four communities and say, "Here do it. This is what we want you to do." The group wanted to establish the capacity building. They started off with something simple- proposing two communities that were thought to be most likely impacted. Then the tasks were divided into phases. As trust was gained, and the community gained the capacity to do the work for themselves, the effort could be expanded to additional communities. You can take it onshore and see what the impacts are going to be on communities as development and operations begin.

Ms. Wolf went on to say that this is a topic within which she has some education, and was sorry to belabor the point. She said that you are going to lose trust by not going into these communities. She could not predict that completely, but if you ignore Pt. Hope, and Barrow is already getting covered, you are going to be leaving out a community in the initial part of your phases. They are going to be wondering why. This is a very active community. Ms. Wolf commented that you are taking a risk by saying you are gathering trust by ignoring a community. It is not going to be seen that way. It is unlikely that it is going to be seen that way.

Mr. Dee Williams stated that he appreciated the comment. He continued to say that they are concerned about obtaining data from as broad an area as possible and engaging every community that we can. He did not mean to represent this as exclusion to Pt. Hope. MMS has other studies and other means of engaging communities and data collection. MMS also has ongoing community outreach efforts and scoping. So there is not an exclusion dimension.

To Mr. Williams, the question is: Where do you initiate your first effort of fieldwork? If there is ample funding and ample community interest to participate in these kinds of activities early on, then MMS is adaptive and flexible to allow that to happen. Part of the professionalism in dealing with human stakeholders is that you have to be light on your feet. So this is not a concrete statement of what is going to happen. This was presented as a initial reasonable approach that is open to community discussion. This is not a final assertion of what will or not happen.

Dr. Jim Cimato commented that it seemed to him that one of the key things that was going to happen was community engagement. As he understood that discussion, the key to this was to enter into a community to discuss the whole concept and see if we could get them to embrace this and work with us. It could mean that conceivably one community may prove that it is not the place to start. It seems that we need to deal with an open table here of going to the "communities" and see what we can develop. It may be that several communities indicate willingness, a strong desire to be a player and work collaboratively. We will have to go through these steps. Dr. Cimato did not feel that MMS could afford to be exclusionary early on and didn't think that would be the way MMS would start.

Ms. Wolf added that in every one of these discussions and focus groups have discussed the importance of integrating indigenous knowledge and data collection. Therefore, there is a good opportunity to be working in an interdisciplinary fashion with those communities. You are going to want to be onshore talking to these people anyway and collecting data, whether it is tissue samples or whatever.

Dr. Cimato stated that they certainly acknowledged that the local communities could well be inundated with people coming in to conduct surveys. MMS is very mindful of that. That in itself may be a reason to move slowly and move in a more constrained fashion.

Dee Williams added that this integration is part of the systematic process within the Environmental Studies Section of MMS. It is conceived as an interdisciplinary effort. So linkages may occur once "straw man" proposals get created. Right now there is no opportunity to flow between working groups. That connectedness occurs later at other institutional moments.

Dr. Robert Suydam stated that he was pleased that this process would be flexible. He said that starting in Wainwright and Pt. Lay has some merits. But Ms. Wolf's point that impacts are occurring in Barrow presently is incredibly important. Barrow was the hub of where all of the workers on the seismic survey vessels were coming in and going out .The ships were anchored and moving right offshore regularly throughout the summer. There is incredible concern that seismic survey activity is going to deflect bowheads they approach Barrow and make it harder for the hunters. So Barrow is the community that is being impacted by Chukchi Sea activity now. Certainly Wainwright and Pt. Lay have the potential to be impacted by permanent facilities and activities that are going on farther down the line. But certainly better understanding impacts that are presently occurring in Barrow is very important. It wasn't clear if this was captured in the fieldwork components of the study profiles presented here or not. He wasn't sure if the intent was to ask hunters what the impacts or perceived impacts are now. He noticed that there was a section about asking about accidents or mishaps. But it seems important to be explicit about asking hunters what are the impacts or perceived impacts.

Mr. Williams responded that he appreciated the comments and will address the points Dr. Suydam mentioned. Yes, it was intended that there be a more of an interview process in this effort than occurred in ANIMIDA. In Mike Galginaitis's talk he described a little bit some of the opportunities that he had on a limited basis, limited in terms of funding and time. But MMS does hope to actually utilize interview techniques to get more thorough descriptions from hunters about both their perceptions and any thing they can provide by way of empirical data about their experience. There wasn't time to flesh those out in any great detail. They are not finished products, just a "straw man" effort to generate discussion.

Additionally, he wanted to address the flexible nature of social research. That is foundational. MMS relies on stakeholder willingness to participate in their efforts. So it goes without saying that MMS is always subject to host-community interests and input as to how things are going to happen. So MMS can only offer an initial imagination of what we think would be appropriate.

With regard to communities, Mr. Williams said that they are always subject to the response of host-communities about who will host our research efforts. To say that there is a limitation at this point is not actually intended. Barrow is a worthy destination of early monitoring efforts. Part of the challenge there is the population base. Mike Galginaitis gave us some other indications of how easy or difficult it would be to engage Barrow. That is basically how we got to where we are. His final point of emphasis was that the group is not insisting on a particular community or two to get started. This is just what the group imagined as a reasonable way to balance all of the conditions that apply here.

Dr. Suydam commented that working in Barrow could be a challenge to find the appropriate people to interview, in the context of all of the issues that surround Barrow. The reason that he said anything at all was that he felt like the group was trying to justify why Wainwright and Pt. Lay were selected as opposed to being flexible and saying okay maybe we can go someplace else.

Dr. Suydam continued to say that he thought the comment that was made "That you want to engage the communities and have them help you design the study" was very important as well.

That hasn't always been what has happened with MMS and some of the social studies that have occurred on the slope. So Dr. Suydam said he really hoped that MMS would be able to engage the communities and have them help MMS choose the contractor that they are comfortable with and can work with, contractors that have familiarity with the communities and that the people trust. It would be important to involve the community early even at the RFP stage.

Mr. Williams added that one thing that might help facilitate the process. MMS and the community should is work towards a cooperative agreement effort. This would allow more community input into the contractors or research team that gets selected.

Ms. Elise Wolf stated that it had already been mentioned that these "off the top of the head cost estimates", tend to get "cemented." In these study profiles you have limited the examination to communities. Whether or not in the "fine print of it" you are being inclusionary, you have still narrowed it to two locations. And your funding estimates are likely to reflect those two locations. She stated that if it is true that these numbers get solidified at this process, then you have, by default, eliminated funding or made it harder for yourself to get funding or change your numbers later on. If you are going into a place like Barrow, you are talking about a larger community and a more expensive process than you have accounted for with just Wainwright and Pt. Lay.

Dee Williams responded that he would have to reject the premise of the cost estimates being fixed at this point. This is the first attempt to get a handle on the magnitude and scope of various research efforts. There is a lot that happens after this. Part of the process is practical realities of limited funds. It is not an open-ended resource. There is a lot of debate and discussion that goes in to the final budget figures.

Dr. Jim Kendall commented on the budgeting and that, here, MMS is just getting an idea of the potential costs involved. With all of the leveraging opportunities that take place and working with other agencies, MMS just needs an idea of the range of cost; whether it's exactly $500K, $1M, or $300K, is really not important. So don't put a lot of effort in the budget at this point. That is something that MMS looks at and reviews. The important thing is "what needs to be done." What are the information needs, prioritize those, and then worry about the dollars.

General Discussion on Logistics and Processes

An unidentified audience member asked if there was going to be any discussion on a "go forward" plan to get this interagency/industry/stakeholder opportunity pool of money working. As he totaled it up, the "back of the envelope" calculations were about $47 million. That is a lot of money. He would be interested in understanding what the go forward process is so he can take that back to his company and let them know.

Dr. Dick Prentki commented that he would too. Because he was told that there was about $6 million available for studies very closely oriented to COMIDA, which are: monitoring effects of offshore oil and gas in the Chukchi.

Dr. Cleve Cowles added that MMS estimated its investment in this at the number Dick just mentioned. But if there are other participants, MMS certainly would like to find out about them.

As the MMS planning processes go forward there are opportunities then to identify those linkages.

Dr. Prentki said that this last part of the meeting was not really structured but MMS wanted to talk about logistics. Some people in the audience here have done a lot of Chukchi work, etc. "Where do we go for a boat?"

Dr. Tom Weingartner commented that if you have a lot of money you would probably have a lot of boats lined up behind you. He said to consider contacting NOAA. John Calder is trying to run a program in the western Chukchi Sea off a Russian vessel that UAF has used in the past. It would be probably adequate for a lot of these studies, if not all of them. Dr. Weingartner felt that could be a useful partnership but he was unsure of the berthing availability, etc.

The second possibility that Dr. Weingartner mentioned was that there might be some possibilities aboard some Japanese vessels. The *Oshoro Maru* may be working in this area. It is a fisheries research vessel out of Hokkaido University. So it is probably ideal for a lot of fisheries work and some standard hydrography. That is something that he could check on if MMS would like. They have an interest in going up in the Chukchi Sea for a limited period of time as part of their IPY program. But Dr. Weingartner did not know what the status of that is. Again the issue is how many people they could take.

Dr. Weingartner's third possibility may be through the Japan Marine Science and Technology Center. He doubted if any fishing could be done off their vessel. It is has some ice strengthening, but it is not an icebreaker. They generally have a fairly rigorous schedule in their own program. It may not be possible to do a lot off that boat, but there may be opportunities.

Another possibility Dr. Weingartner mentioned is a Canadian vessel, the *Sir Wilfred Laurier* which is a light icebreaker that works annually up over on the Mackenzie Shelf. That may be possible for some limited work as it is doing its transit.

There is a new Arctic ship, the Alaska Regional Research Vessel. It is at this moment on paper. It is not going to be available in the 2008 time frame. It could be available in 2010 to 2012. That new vessel is actually a fisheries/oceanography research vessel. So it combines the capability of doing traditional oceanographic research with fisheries work.

Dave Roseneau mentioned that there is a lot of the work where ice-reinforced vessels are not needed. He has had to look for vessels in the past for work in the Gulf of Alaska and was surprised what he found on the Internet. There was a 250-footer with a "moon pool" that did research out of Hawaii that was going for a pretty good rate. There are some others around if you don't need ice-reinforcement. In Homer, they now have one. It can't be fished off of but you could do side tows and other things like tagging. It is a converted Bering Sea crabber, actually a famous one called the *Time Bandit*. It is now called the *Kittiwake*. It is 100 ft long and 26 ft wide. It has a huge foredeck. It easily converts to a chopper pad to putting Conex type labs on it. It will hold about a dozen scientists in good quarters. For some of the work you might want to think about some of the vessels that are big enough to take the conditions, but not worry about ice.

Dr. Dick Prentki added that another possibility is if oil industry is up there starting to drill, we may be able to work with them and use some of their vessels.

Dr. Robert Suydam stated that industry is doing a lot of work. They have been looking really hard for vessels in the last few years. He mentioned that another thing that might be worthwhile looking into is crabbers. Crab boats aren't necessarily fishing in the middle of summer. They might not be able to do tows off the stern, but they might be a platform that is available and looking for work. In many cases they are ice-reinforced.

Dave Roseneau added that at the Refuge they do have a 125 ft research vessel. It is set up with an A-frame and will do trawls, side tows, CTD work, all of that. It holds 18 people. It is a possibility if there is a window that they don't need it. But a lot of other scientists have been using it now, including sea lion people, etc. It is about $6K per day.

Dr. Dick Prentki asked a question if anyone has been using the Red Dog facilities for staging in the Chukchi. It is closer than some other places. But he wasn't sure if the trace metal people would like to work out there. But it might be a site where you could actually get in and have a dock facility.

Dr. Tom Newbury had a comment related to Robert Suydam's. It is a suggestion that came from Caryn Rea from ConocoPhillips on the first day that the BWASP surveys be extended into the Chukchi. The surveys could be broader than just marine mammal. They could include ecosystem characteristics, remotely sensed data. Dr. Newbury felt that MMS ought to cooperate. MMS could benefit from cooperation by providing the background surveys for the site-specific surveys that are done by industry. This is what MMS does in the Beaufort Sea. There are site-specific surveys around Northstar. The bowhead whale surveys provide the background data for that; the same sort of thing can be provided for the Chukchi Sea.

Dick Prentki thanked Tom Newbury for his comment and then explained how MMS will be using these profiles that were generated by each breakout group. He said that there would probably be two tracks. The specific purpose in trying to lead this COMIDA project down the line, supposedly it may have $6 million available, but it has a very focused monitoring and a limited dollar set. A lot of what has been brought up today will be larger than the COMIDA focus and will require some interagency interactions. MMS can run the smaller set of studies through the MMS Environmental Studies Program. They will clean up some of the study profiles; flesh them out with the dollar amounts. MMS will look for ways where studies can be combined thus resulting in cost savings. Dr. Prentki indicated that there might not be as much savings on ship time as people have talked about. When MMS did their estimate they determined that they would need two weeks, full time, just to do the hydrocarbon/metal work. If biology or other areas are added to the same survey, it would take more time overall. So there might not be as much saving by combining studies as people think. But MMS will look at that; that is one the standard protocols that they do with the studies profiles. MMS will take these profiles and try to improve on them and look at cost savings. However, MMS will be looking at a subset of the studies that will not total a whole lot of money.

In terms of the larger ideas that have been brought at this workshop, COMIDA's charge is monitoring the effects of oil and gas exploration and development in the Chukchi Sea. For that charge, it doesn't include prelease seismic issues. It doesn't include, directly, global warming, only to the extent that it needs to be separated out from the effects of oil and gas. So that is a very narrow focused monitoring.

Dr. Cleve Cowles summarized the procedures for MMS studies planning. Basically MMS begins with the OCS Lands Act, Section 20 where it talks about what the Secretary must know over time. Monitoring is a time series of things that have a plausible link to OCS development. Then through the MMS Studies Program planning process, priorities will be developed and that is in part issue-driven as well as lease-sale driven. A couple of key things that MMS looks at as we go through the planning process are mandate and timing. The sad news is that for some ecosystem components there is not as a strong a mandate to study them as there is for others. Those kinds of influences will affect how these profiles will work their way through the process. Just because something might not show up next year, it doesn't mean it might not show up later.

Timing and mandate are going to be very important. It gets back to time series information, testing hypotheses over time, for things that are plausibly linked to offshore oil and gas development.

Mike Sigler asked Dr. Cowles to give us an example, say for tissue concentrations.

Dr. Cowles responded that post sale is the mandate. In the past, MMS has monitored in the Beaufort Sea probably the most. There they looked at hydrocarbons, trace metals. MMS has a long running program for important and endangered species. When MMS was active in the Bering Sea, sea bird colonies were the focus because there was a very plausible linkage that if you had a disruption of a sea bird colony you would see an impact from an oil spill.

MMS has also monitored in the human arena. MMS funded the Social Indicators Monitoring Study many years ago. That is one study that a lot of people didn't like because it was fairly intense and probably explored areas that we didn't need to.

MMS has had the ANIMDA study that we have heard about. So as our knowledge about the development becomes more and more substantive, things will become more focused. In the Beaufort Sea, there was very broad scale monitoring. The hydrocarbon monitoring sampling went from Harrison Bay all the way over to Camden Bay. Then as MMS learned where the Liberty Platform was going to be, we have had more focused monitoring there. The ANIMDA project conceivably will endure even though funding is tapering down now. There will come a time when, based on the power and the statistical basis for those different tasks, MMS will go back and resample. The Regional Director, John Goll, and the Secretary of the Interior need to know about these and how things are changing over time. It is MMS' job is to keep monitoring linked to the most important things.

An unidentified audience member asked what is the process for prioritization in MMS' planning efforts. Is MMS going to field a scientific committee to help you with that?

Dr. Cowles responded that the study profiles would be presented to the Scientific Committee. They will be asked to review them and give us their opinion on their appropriateness and their feasibility, and any technical concerns or issues they may have. Then MMS determines the way to incorporate the Scientific Committee recommendations. Then a draft recommendation of priorities is presented to what is called the Regional Steering Committee, which consists of the managers of the Alaska Office. All of the Alaska Regional office is informed on what studies are moving forward. It is that group that then endorses the priority recommendations. Next the recommendations go the MMS Headquarters for review. They think about what the Scientific Committee said and their own perspective on what Alaska needs. Eventually, a budget called a National Studies List is created. Then MMS finds out what has made the list and what hasn't. But it is never too late, except for the current fiscal year, to reconsider plans.

Dr. Jim Kendall explained that there were five topics that he wanted to cover: 1) the cart before the horse, 2) prioritization, 3) leveraging, 4) sincerity, and 5) National Ocean Partnership program (NOPP).

Dr. Kendall stated that he has been coming to Alaska for the last couple of years and now understands the importance of logistics, the boats, etc. But until the information-need prioritization process is complete, MMS doesn't really don't know where these studies will go. As an example, several years ago MMS had a similar program of this magnitude starting in the Gulf of Mexico. He was not comparing ecosystems, just comparing the process. The MMS went through a process very much like this one. Of course, when the process began everyone had preconceived ideas of where it was going to go, i.e., what kind of studies would be funded. When they finished this process that Dr. Cowles just described, they ended up with five priorities that had to be funded immediately; three were social science studies, an information search and synthesis, and a physical oceanography study. And everyone went, "how did that happen?" The priorities after the process was complete were different than the preconceived ideas.

There are a lot of checks and balances in the system to not only match the proposed science with MMS' information needs but also to get a lot of input into the process. Dr. Cowles mentioned the MMS Scientific Committee that is chartered under the Federal Advisory Committee Act (FACA). They are non-federal; MMS doesn't pay them. They observe our activities, and offer comments on anything they want. They established an Alaska subcommittee. Some of those members were at the meeting this week. Early next week they are going to be conferring and writing up a report that goes to the full committee. It is incredibly invaluable. It is the first level of peer review.

As for leveraging; there was some discussion of dollars. Dr. Kendall explained that one shouldn't put a lot of effort into it because there is always the potential of leveraging dollars. As he and Dr. Cowles have been told throughout their careers, there is never enough money. But when you review the study profiles and merge them, you put bird people on whale vessels, and add a physical oceanographer, and when they are going out to put in a mooring and to change it out, they are making observations and taking water samples, the price starts to come down.

As for the issue of sincerity funding: There are other potential funding agencies here and industry. They do the exact same thing. You may have heard people say "Wow, we need to start

that." Well, while MMS is doing their prioritization process in the next couple of months, NOAA and ADF&G and industry will be doing the same thing. They say, "Wait a minute, we need to be involved in these two priorities." Dr. Kendall suggests giving Dr. Cowles or himself a call. For example, a couple of years ago MMS wanted to start a study in the Gulf of Mexico, we didn't have funding for the entire project. MMS had the money for the science. NOAA had the money for the ship. All of sudden, this is fantastic study was started.

If there is a particular effort that industry is interested in and they have the logistics and have some sincerity to express, come over and talk to MMS. Priorities start to match up which then factors into a decision to issue an RFP for X dollars for this kind of a study. Let MMS know what kind of boats are needed to do this study and they can direct you to industry that may have vessels available. Money is not exchanged just the bureaucracy is lessened.

The National Ocean Partnership program (NOPP) was established a decade ago to try to get agencies to work together and share resources. MMS has not been a big player in this until recently because, historically, NOPP was more geared toward basic research. But with the new report of the U. S. Commission on Ocean Policy, and the President's Ocean Action Plan, science for management decisions has been elevated. This is not a slam against basic research. But basic research and applied research are now more equal. The NOPP process is more amenable to what MMS is doing. So if you go to the NOPP website, NOPP.org, you are going to see the 2007 Broad Agency Announcement (BAA). It is coordinated by the Office of Naval Research; they are a member of NOPP like MMS and NOAA and other agencies. There are two important themes to this BAA: the Arctic (Chukchi and the Beaufort) and one on marine mammals. So right now there is a solicitation on the street from the Office of Naval Research that is in response to all the federal agencies that are members of NOPP for these proposals.

Once these proposals come in they get externally peer reviewed. (The agencies aren't involved nor are any other scientists affiliated with the proposal involved. It is just like NSF.) The proposals come back with their scoring. Then the agency people sit down and determine which ones can be funded. But one of the evaluation criteria is partnering between academia, a government agency, or industry; there must be two of the three as a minimum.

If an agency research lab partners with an academic organization to put in a proposal, bingo! If industry knows a researcher that is doing work that they would like to do and you want to partner with them and give them some money to sweeten the pot a bit, add that to your proposal, that goes a long ways.

Dr. Cleve Cowles explained further about how the MMS process works, besides the NOPP. If another organization or agency is interested in something that shows up in the MMS study plan for example, one of these profiles generated here, and they communicate with MMS a very specific scope of that interest and would be willing to defray part of the expenses, MMS will give that a lot of consideration.

In fact, write something like that into a study profile and headquarters looks at it more favorably. In fact, for the four or five study profiles that Dr. Prentki described on the first day, we would be

encouraged to find cosponsors or partners. So the success and the survival of a study profile is still somewhat unknown considering the whole scope of work.

So for parties that are interested, please let MMS know. Then as a project unfolds and is pursued as a contract and put out as an RFP, that RFP could be shared with the other cosponsor to make sure that there are portions of it that address the cosponsor's needs. For cosponsors that are nonfederal, MMS will have to get special permission from the Contracting Officer to do that. MMS may not be able to include you directly because you are nonfederal, but will certainly try to structure things so that some goals and objectives are mutually beneficial.

It is a very long and involved process, but it can be done. Cosponsors either help pay the contractor or there has to be some kind of a fund, joint industry project, or reimbursable account somewhere to which contractors can have access. Each one of these things is a different kind of situation depending upon who the cosponsors are.

Through the Coastal Marine Institute (CMI) program at UAF, it is really easy, administratively, to develop joint projects. The difficulty there is that there must be nonfederal matching funds. So MMS releases its study plan in September and sends it to the University. MMS encourages the University to address MMS priorities. So if you come in to the CMI with a study proposal or Letter of Intent that comes very close to one of the studies in the MMS plan, they will look at that very hard; that is a great way to move a project towards funding.

There are a lot of different routes and MMS is willing to work through any of them. It does take commitment and it does take some formality to that. Over the years, MMS has sometimes gone through a lot of work and then found out that there was no co-funding. There have been a couple of cooperative projects where, after someone said they were going to get the money, then it never showed up. So MMS is looking for a solid letters of commitment and then follow up, so we can move together.

Dr. Kendall added a reminder for the other agencies that are here and even industry, it doesn't have to be this fiscal year. Oftentimes MMS will fund a study of three, four, and five years like Dr. Cowles mentioned and where the other partner or entity says, "We can contribute our sincerity in years three, four and five," simply because they didn't have time to plan for it this year or next year.

So MMS is very flexible. These multiyear studies are not funded all at once. You may not be able to put money on the table in 2007 or 2008, but if it is a five-year study and you can get funds for 2009 and 2010 that is just as good.

Also as the number of partnerships increases, that frees up more of MMS'money, to move further down the list of studies. So it is a cascading effect. The sooner agencies or industry come to MMS and say this is my "sincerity", then that allows MMS to look even further down the line and broaden everything. We need to have an open line of communications. There are ways to do things; we just have to be creative.

Dr. Prentki ended the meeting thanking everyone who came and that was a very productive meeting. He appreciated the hard work everyone had done. Dr. Prentki stated further that MMS will try to do the best by the study profiles generated at this workshop.

APPENDIX A – AGENDA
MMS Workshop on Chukchi Offshore Monitoring in Drilling Area (COMIDA)
Anchorage Downtown Marriott
November 1-3, 2006

Wednesday, November 1

INTRODUCTION

8:15 Welcome - Cleve Cowles, Ph.D., Acting/Regional Supervisor for Leasing and Environment

8:25 COMIDA Framework & Expectations - Richard Prentki, Ph.D., MMS

8:40 Update on Chukchi Activities, Plans, and EIS Scoping - Fred King, MMS

8:55 Chukchi Development Scenario - Jim Craig, MMS

9:15 Ongoing Environmental Studies Program Context - Richard Prentki, MMS

9:35 Relevant Industry Monitoring Studies – A. Michael Macrander, Ph.D., Shell Oil, Houston, TX

10:00 Coffee Break

SETTING THE STAGE: Background, Knowledge, and Monitoring Issues

10:15 Chukchi Physical Oceanography - Tom Weingartner, Ph.D. Institute of Marine Sciences, University of Alaska Fairbanks, Fairbanks, AK (IMS/UAF)

10:45 Chukchi Fates and Effects
Metals/Sediment Chemistry - Sathy Naidu, Ph.D., Professor Emeritus, IMS/UAF
History of/Extrapolation from MMS Beaufort Sea Monitoring - John Brown, Exponent, Boston, MA

11:45 Lunch

1:10 Chukchi Biology/Ecology
Benthos - Ken Dunton, Ph.D. University of Texas Austin, TX
Impacts to Marine Fish - Evelyn Brown, Ph.D., Flying Fish, Ltd., Husum, WA
Benthic/Pelagic Coupling - Jackie Grebmeier, Ph.D. University of Tennessee, Knoxville, TN
Seabirds - David Roseneau, Ph.D. U.S. Fish and Wildlife Service, Alaska Maritime National Wildlife Refuge, Homer, AK

3:10 Coffee Break

3:25 Chukchi Protected Species
Protected Subsistence Species - Robert Suydam, Ph.D., Dept. of Wildlife Management, North Slope Borough, Barrow, AK
Other Protected Species - John Bengtson, Ph.D., National Oceanic and Atmospheric Administration, National Marine Mammal Laboratory, Seattle, WA

4:25 Chukchi Subsistence
Subsistence - Michael Galginaitis, Applied Sociocultural Research, Anchorage, AK

SUMMATION AND CHARGE TO BREAKOUT GROUPS

4:55

Thursday, November 2 – Break out Groups

8:30 Four Discipline Break-out Groups

- Physical Oceanography and Fates and Effects
- Biology, including Benthos, Fish, and Waterfowl
- Protected Species
- Socioeconomics and Subsistence

10:00 Coffee

11:30 Lunch

3:00 Coffee

Friday, November 3 General Session

8:30 Charge of the Day

8:45 Presentation and Discussion Physical Oceanography and Fates and Effects

9:45 Coffee

10:00 Presentation and Discussion of Biology

11:00 Presentation and Discussion of Protected Species

12:00 Lunch

1:15 Presentation and Discussion of Socioeconomics and Subsistence

2:15 Coffee

2:30 Chukchi Logistics Issues/Discussion

3:30 Ending Comments

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