

## INTRODUCTION

This Information Transfer Meeting (ITM), sponsored by the Alaska OCS Region of the Minerals Management Service, is the seventh major information meeting since 1978. This ITM was focused on the lease sale areas of Cook Inlet and the Beaufort Sea. Over fifty speakers presented updates of on-going MMS-funded and other related studies over a broad spectrum of topics, including Physical Oceanography, studies of Fates and Effects of Contaminants, studies of Protected Species, other Biological studies, and Social and Economic studies.

Two panel discussions were also held. The first panel discussion featured presentations on the North Slope Borough's (NSB) Bowhead Whale Research. Participants in this panel included: Thomas Albert, Ph.D., and J. Craig George of the NSB, Department of Wildlife Management (DWM); Thomas Napageak, Chairman of the Alaska Eskimo Whaling Commission (AEWC), Maggie Ahmaogak, Executive Director of the AEWC, Fred Kanayurak, President of the Barrow Whaling Captains Association, and George Ahmaogak, Village Liaison for the Arctic Slope Regional Corporation. A second panel was convened to provide comments from panel members and the audience on the Alaska Environmental Studies Program: Processes, Program, and Priorities. Panel members included: Thomas Albert, Ph.D., NSB, DWM; Vera Alexander, Ph.D., Director of the Coastal Marine Institute at the University of Alaska, Fairbanks; Patricia Longley Cochran, Executive Director of the Alaska Native Science Commission; Cleve Cowles, Ph.D., Chief of the Environmental Studies Section for the MMS, Anchorage; Joy Geiselman, Ph.D., Assistant to the Center Director, U.S. Geological Survey, Biological Resources Division; Glenn Gray, Project Analyst for the Division of Governmental Coordination for the State of Alaska; Ray Jakubczak, Ph.D., Health, Safety, and Environmental Supervisor for BP Exploration (Alaska), Inc.; Susan Saupe, Science Coordinator for the Cook Inlet Regional Citizens Advisory Council; and Paul Stang, Regional Supervisor for Leasing and Environment for the MMS, Anchorage.

The ITM was attended by over 190 persons representing local, state, and federal government agencies, universities, industry, the private sector, and the general public. This document includes abstracts of presentations, edited summaries of panel discussions as well as the agenda and a list of participants.

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**JOHN GOLL**

**Regional Director  
Alaska OCS Region  
Minerals Management Service**

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Good morning. I would like to make a few brief introductory remarks and welcome everyone to our Information Transfer Meeting (ITM). Regrettably we have not had these meetings every year like some of the other MMS Regions, although we may in the future. As you may have noticed, the agenda is quite full. We will be moving at a pretty good pace through the meeting. There may be time for questions during some of the presentations. But if not, we really encourage discussion during the lunch hour and breaks. We would also like to receive comments about the frequency and structure of these meetings.

The ITM this year is primarily focused on the Beaufort Sea and Cook Inlet. These are two areas where there is still a substantial amount of oil and gas activity. In the Beaufort, we see a good deal of near-term activity, but we will be delaying the beginning of our next sale process until the autumn. This would mean that our next Beaufort sale will be about a year later than we had planned. In Cook Inlet, it is unlikely that we will be seeing near-term Federal activity, but a state sale is scheduled for this spring. There is still interest among companies for future operations in Lower Cook Inlet. Eventually, there might be activity in both Federal and state waters.

I would like to introduce some of the people that we have with us at this meeting. Our Scientific Committee advises us on our Environmental Studies Program and is refocusing how they approach things a little bit. In the past, it has been primarily on a national scale, but we are trying to get them more involved in some regional aspects. We have three members of the Scientific Committee at this meeting: Dr. Lee Husky, Professor of Economics at the University of Alaska Anchorage; Dr. Will Schroeder, Professor and Coordinator of Marine Science Programs at the University of Alabama; and Dr. Joe Niebauer who was formerly Professor of Marine Science at the University of Alaska in Fairbanks and is now a Senior Scientist with the Department of Atmospheric and Oceanic Sciences at the University of Wisconsin. So if you have any questions on the ultimate direction in which MMS studies might be headed, please ask one of those three.

We are also very pleased to have some participants from the North Slope with us over the next couple of days. Thomas Napageak, who is the Chairman of the Alaska Eskimo Whaling

The first of those projects is the Northstar project. This development straddles Federal and state leases, the majority of which are on the state side. The development itself, located northwest of Deadhorse, takes place in state waters on a man-made gravel island with a buried pipeline extending to shore. There are five Federal agencies and the North Slope Borough who are involved in the preparation of the final Environmental Impact Statement (FEIS) which is actually being written by Dames and Moore under direction of the principal agency, the

Commission (AEWC) from Nuiqsut, will be with us along with Maggie Ahmaogak, the Executive Director of the AEWC, Fred Kanayurak, the President of the Barrow Whaling Captains Association, and George Ahmaogak, Village Liaison, Arctic Slope Regional Corporation. They will all be participating in a panel this afternoon. Joseph Kaleak, the AEWC Commissioner from Kaktovik was not able to make it today. Dr. Tom Albert, who is the Senior Scientist for the North Slope Borough (NSB), and Craig George, also with the NSB Dept. of Wildlife Management, will also participate on that panel.

After all of the presentations are made over the next three days, members of a diverse closing panel will try to summarize what they heard and give us some advice on where we should be going. Invited panelists are: Dr. Tom Albert from the NSB Dept. of Wildlife Management; Dr. Vera Alexander who is the Director of the MMS/UAF Coastal Marine Institute; Patricia Cochran, the Executive Director of the Alaska Native Science Commission; Dr. Joy Geiselman who is the Assistant to the Center Director for the U.S. Geological Survey, Biological Resources Division; Glenn Gray with the Division of Governmental Coordination for the State of Alaska; Dr. Ray Jakubczak, Health, Safety, and Environmental Supervisor for BP Exploration (Alaska), Inc.; and Susan Saupe, Science Coordinator for Cook Inlet Regional Citizens Advisory Council.

So, we have a lot to do. Please so a lot of discussion among yourselves and any of the MMS staff who are here. Again, welcome! I will now introduce Paul Stang, Regional Supervisor, Leasing and Environment.

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**PAUL STANG**

**Regional Supervisor  
Alaska OCS Region  
Minerals Management Service**

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Good morning. I am glad to be here and to see so many of you. After 20 years of leasing and exploration on the Alaska Outer Continental Shelf (OCS), and adding about \$6.5 billion to the Federal treasury from that leasing, we are now at a turning point, at a different place than where we have been before. Actual development is on the horizon; we are moving quickly into that. Low oil prices are changing how we have to look at things. As such, our whole office is shifting its focus. We will see a much stronger focus on concerns about issues and processes regarding the first few, and perhaps subsequent, development projects.

U.S. Army Corps of Engineers. The MMS is one of the cooperating agencies.

This is an interesting time because just three days ago the EIS team completed the final details of that FEIS and issues that Federal and state agencies and the North Slope Borough were discussing in preparation for its publication in February. If all goes according to plan, that would lead to construction of the gravel island and laying of the pipeline in the winter of 2000. Production would begin in 2001, with a projected estimate of about 145

million barrels for that reserve. That will be the first would be the first production that we will see in Alaska in Federal waters.

The second project is BP's Liberty project which lies totally within Federal waters. It is on one tract in Foggy Island Bay, seven miles east of the Endicott Development. It contains an estimated 120 million barrels of oil. The track here is a little slower. We are in process of working on the draft Environmental Impact Statement (DEIS) of which MMS is the lead agency. The Corps is a cooperating agency, but really all of the other agencies are involved in the Liberty team too. At this time, we estimate that the DEIS will be completed in mid-1999 and the FEIS in late 1999 or early in 2000. BP has proposed construction for 2001.

So, this is a transition from what was basically a leasing program for 20 years into these two development projects, which lends itself to a very different focus. The whole office has to think "development" and what that means. It is a much more geographic-specific issue than leasing a whole Planning Area, and the Environmental Studies Program is critical in this transition process. While we continue to look more broadly, we must also look more precisely and be more focused in our studies and in our concerns.

The Environmental Studies Program has been an essential part of MMS' Oil and Gas Program for a long time. To date we have spent well over one-half billion dollars nationally, and one-quarter billion dollars in studies here in Alaska. The program is not quite as large as it used to be, but it is still substantial. What you are going to talk about today is quite important to us. Likewise, it is important for us to understand your perspectives in order to have a really good information exchange. So, if there are any question, speak up. This is an "Information Transfer Meeting."

At this point I would like to turn the meeting over to Dr. Cleve Cowles, who is the chairman of this conference. His presentation is entitled "Studies, Planning, Process, Programs, and Priorities."

MMS's planning process is participatory; we seek public input from a variety of sources. Our reviewers and contributors come from a variety of points of view. We send the plan out to more than 200 organizations in the state, including government agencies, environmental groups, industry, academia, advocacy groups, village and tribal councils or organizations, and subsistence user groups. The planning process is an annual cycle that entails obtaining input, preparing drafts of proposed studies by March or April, seeking comments on the studies from stakeholders, revising and updating the plan by about June, and a final review by national headquarters. At any given time, we are planning for the future, at least one or two fiscal years ahead. By November, our Scientific Committee discusses the plan with us, and by about January a final plan is ready for distribution.

The plan is then implemented through three main pathways:

1. Portions of the approved funding and approved studies are contracted directly from our office.

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## **CLEVE COWLES, PH.D.**

**Chief  
Environmental Studies Program  
Alaska OCS Region  
Minerals Management Service**

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We have just heard some presentations on the schedules and major activities that the Alaska OCS Region has on its plate for the next couple of years. I will attempt to give you a feel for how we administer the Environmental Studies Program and some of our priorities in a general sense. Then we will have two days of presentations from a diverse spectrum of scientists who are currently performing or who have recently completed studies. Then on Thursday, we will have a concluding panel made up of various stakeholders in our program who will hopefully have some ideas and comments based on what they will have seen and heard in the previous two days, and also an opportunity for anyone in attendance to give us their suggestions.

The purpose of the Environmental Studies Program is to define information needs and implement environmental studies regarding development of Federal offshore submerged lands. To paraphrase, we are trying to obtain information for environmental impact assessment both in a pre-lease and post-lease orientation.

An additional goal includes obtaining environmental studies products which are useful to the decision-making process. Obviously, the basic result of a study is its data and conclusions. A report is the first step towards moving information into decision making. We also seek to obtain journal articles, syntheses, books on diverse topics, databases, maps, etc. So we attempt to get products that are going to help in the environmental assessment and permit review processes for which we are responsible.

Another goal is to monitor and detect any potential effects that may be occurring from exploration and development.

2. We issue a request for proposal or establish interagency or cooperative agreements with other agencies to conduct certain studies.

3. We also have a cooperative agreement or program with the University of Alaska in Fairbanks (UAF) to institute a Coastal Marine Institute (CMI) where we tap into the expertise of the scientists at the University of Alaska Fairbanks.

MMS also have protocols for sharing information and providing a sense of our priorities to the U.S. Geological Survey (USGS), Biological Resources Division (BRD) with both national agreements and local protocols on guiding and implementing studies. The BRD has a sector of its budget which is dedicated to providing support to the MMS OCS studies needs.

Each of these implementation approaches has its own concurrent cycle or process running at about the same time.

Additionally, the MMS/UAF Coastal Marine Institute (CMI) has its annual proposal solicitation, review, and award sequence of events. Proposals are reviewed and decisions made as to the

deserving proposals by a technical steering committee which is made up of representation from the state, the MMS, and from the university. There is also external peer review involved with that proposal process. There is a set of framework issues in the cooperative agreement with the university to which the investigators or scientists at the university respond. These are general statements of the types of scientific issues that confront Alaska OCS decision makers on a general basis. We also ask the investigators to look at the Alaska Environmental Studies Plan and see if any of their research interests can address specific studies in the plan.

One of the unique features of the CMI is that we require matching funds to be provided for every dollar that MMS contributes. The researchers must find another non-Federal dollar to match as part of the overall project. So we use our Federal funds to leverage and get a "bigger bang for our buck." The CMI cooperative agreement is a very valuable part of our program. We obtain the world-class expertise of the university researchers. We leverage our funds. We provide an educational opportunity for the citizens of Alaska through the opportunity for students to work on these projects.

Similarly, with the USGS/BRD, we have a protocol by which we attempt to dovetail our planning process with the BRD's implementation needs. We exchange information with the BRD about our priorities. They provide us with information on their capabilities and interests in doing specific studies for us.

Besides those more formal linkages of our program, we have informal and semi-formal linkages with key players in the

We currently have about 33 or 34 on-going studies in a variety of disciplines: physical oceanography, fates and effects of contaminants, protected species, socioeconomics, and some multidisciplinary and support-types of activities. There are roughly five to seven studies in each of these categories, except in protected species where there are nine studies on-going right now. Five of the studies on the list are "new starts"; three of which the Alaska OCS Region will be seeking to implement through its contracting process and the BRD will be working with us on two of them to get the study going. The total budget this year is about \$3.1 million; 55% of that will go towards new starts. Eleven other studies are being conducted by the CMI investigators. Protected species is the category that has been allocated the most funding (36%); physical oceanography and fates and effects categories receive about 27%; social and economic studies about 14%; and for biology and multidisciplinary studies about 16%. We have a small percentage of our funds which we use for logistics support and meetings such as this.

From a geographical point of view, the Beaufort and Chukchi regions currently receive the largest allocation; about 64%. Cook Inlet receives about 20%. Then we have a group of studies which are region-wide in their application at about 16%. So you can see that we are leaning more toward studies-allocations to the arctic.

Also included in our Annual Studies Plan are our proposed studies. We currently have about 20 proposed studies in our plan. They are again in the same spectrum of categories of studies

arctic research arena. Such as the Arctic Research Commission, the Polar Research Board of the National Research Council, and the Cook Inlet Regional Citizens' Advisory Council. We encourage project-level coordination with scientists funded under our program and other non-Federal scientists, and also to seek information from sources of traditional knowledge wherever we can in helping them get their studies done. We have other contacts with NOAA's Coastal America Program; the Arctic Council's Working Group on Conservation of Arctic Flora and Fauna (CAFF), Arctic Monitoring and Assessment Program (AMAP), Kachemak Bay National Estuarine Research Reserve, and international contacts and others. As you look through the agenda you will see the products of these different associations and linkages in the diversity of our sources of presentations.

One of our goals is to seek productive and positive relations with the local communities where these studies take place and oftentimes have some bearing on the jurisdictions and activities within local communities in the Alaska coastal villages. We attempt wherever possible and wherever most appropriate to develop study objectives and methods in conjunction with the people in the villages. We seek their informed support and endorsement of our studies. We guarantee confidentiality. For example, if we have a socioeconomic study that interviews people, we assure them that their sources will be protected. We acknowledge and use traditional knowledge wherever we can. We get that information back to the people that helped us out as much as possible.

mentioned previously. We have gone ahead and attempted to group them into two very "definitive" classifications: "Higher" and "Lower" Estimated Draft Rankings. These are mainly for the sake of discussion in terms of whether each is of higher or lower priority for future implementation. We would like input from you regarding these proposed studies and their rankings.

It is unlikely that very many of the future proposed studies will get funded in any one fiscal year because our on-going studies are likely to consume a major portion of the expected budget. So there will be some major decisions as to which study is going to be funded. After we distribute our plan and as we approach the springtime, between now and April, we will take the information we have available in terms of public comment and what are the critical decisions and issues that are facing us and work out a more refined ranking among the staff and managers of the office. We certainly appreciate any suggestions in relation to that.

We have a number of other activities in the program which we do besides just planning and implementing studies. We sponsor Information Transfer Meetings such as this, or synthesis projects such as the preparation of reports or books that collect a larger body of information. We attempt to integrate studies in such a way that one product of a study can move into another to avoid duplication and to maximize the sharing of information between studies. We support logistics and equipment among studies. For example, we have a 36 ft research vessel which we used recently in Cook Inlet. We anticipate it being used in the Beaufort Sea studies. We support information management and retrieval. If there is a study that we have done and you need a copy or need to

know more about it, we will help find it. Our Environmental Studies Program in Herndon, VA maintains Environmental Studies Program Information System or ESPIS which is accessible on the World Wide Web and do key word searches and obtain abstracts of different studies. This is certainly a first place to start, as well as contacting the Alaska OCS Region office.

Our program has been quite successful over the years and part of that is due to some basic foundations and our philosophy of managing the program. As I mentioned we stay focused on our mission: we seek to do quality science and we consider and respect the local communities and their role in the studies process. We are always interested in product delivery as many of our contractors and principal investigators know. We also attempt to coordinate and cooperate with other programs as much as possible. There is a record of accomplishment.

We have a few minutes so I think I would like to mention some of the things that are on the meeting agenda. I may overlook some things, but there are a few that are worth highlighting and I would like to mention them to you. For those of you who have followed our program over the years, you will recognize some studies and like me, you will be glad to hear that

Another important study underway sets a standard for working closely with local communities and subsistence users and that is the "Bowhead Feedings II." We have done previous work on bowhead feeding in the eastern Beaufort Sea and we now have another major study on-going there where we sought and obtained, and are very happy to get the help from the whale hunters at Kaktovik. Also, the scientists of the North Slope Borough helped in reviewing that study and serve on the scientific review board. I think that is an important effort and we are pleased in how it is working out. We thank the whale hunters for their help.

In 1997, we had a workshop in Barrow on the influences of seismic exploration on bowhead whales. It was very valuable meeting where we received information from the whale hunters and whaling captains on their observations of whale behavior under the influence of seismic exploration.

We recently completed a tagging study of beluga whales in cooperation with Canadian scientists which I think shed a lot of new light and some interesting information on the fall and summer movements and behavior of beluga whales in the Arctic.

We continue to have very productive support from the USGS/BRD in terms of diversity of studies: seabird colony monitoring, the Alaska Marine Mammal Tissue Archival Program, polar bear recovery population models, Cook Inlet shorebirds, Chukchi Sea studies of marine mammals, particularly walrus, and other monitoring of seabirds in the Chukchi Sea.

We are also looking at the twelfth year of our Bowhead Whale Aerial Survey Project of which many of you are familiar. That project, in addition of giving us a good, consistent database on the bowhead whale migration in the fall, has also set a standard for safety in arctic aerial survey flights. That project has developed new methods of tracking aircraft using satellite linkage.

they are getting done. For example, recently we are completing major studies of water and sediment quality in Cook Inlet. Those studies have served to help resolve issues regarding the status of the Cook Inlet environment, which as you know is an extremely important estuary from a commercial fishing standpoint and its usefulness to the people of the Cook Inlet region. Those studies are very important in helping us to better understand the status of the inlet.

Another project that has been on-going for 14 years, and recently completed, was the COZOIL Model. This models the trajectory of the oil and the movement and weathering of hypothetical oil spills in the surf zone and nearshore areas. That project recently came to a point where we now have a model which is really user friendly. It can be run in Windows 95 or Windows NT. You can obtain this model and run it on your individual computer. Like all models as soon as we have completed it, we also know what else we need to do to make it better. We will have a presentation on that at this meeting. But we are very pleased to say that after 14 years, we have all of the different pieces together and working, and it is useful for analysts.

I am also very pleased to say that within the last year, we awarded a contract to complete a book synthesizing more than 160 socioeconomic studies and other research that has been done on the Alaska coastal area on social and economic issues related to oil and gas development. That is an important effort and we are glad to see that get going.

Last but not least, we have also renegotiated our cooperative agreement with the CMI for another five years and we are looking forward to further productive and very helpful scientific support from the University on our program.

This completes my overview. I would like to thank Dr. Tom Newbury and Tim Holder of MMS, and the MBC staff for helping to organize this meeting. They have been very supportive and the meeting will be very successful based on their efforts.



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## **CIRCULATION OF THE NORTHCENTRAL CHUKCHI SEA SHELF: RECENT STUDIES AND GENERAL OVERVIEW**

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The Coastal Marine Institute (CMI) was created in 1993 and has been extremely successful and productive from our point of view. It has given us a chance to work cooperatively in a program that is very important to Alaska.

The first study, "Circulation on the Northcentral Chukchi Shelf" is supported by the CMI with matching funds from a number of sources including the Japanese government. These studies are all essential to modeling the trajectories of contaminants in the arctic and give us new insight into how this system works.

The goal of this program is to determine the circulation over the north central shelf of the Chukchi Sea and its relationship to other portions of this shelf, through year-long current measurements and hydrographic cruises (in conjunction with the Japanese Marine Science and Technology Center (JAMSTEC) and with additional support from the Office of Naval Research, and the National Science Foundation.

The findings show that the mean flow is northeastward over the outer shelf and opposite to the prevailing winds. The mean flow is forced by the sea level gradient between the Pacific and Arctic Oceans.

The flow transports water from the western Chukchi Sea (Russia) to the northeast Chukchi Sea (and eventually into the Alaskan Beaufort Sea). The fate of this water depends upon its density. Apparently that is highly variable, depending upon a number of factors. The salinity in particular is very variable and this determines the depth to which the water is transported. The carbon and nutrient load of this water might be high and important in sustaining the marine mammals in the northeast Chukchi Sea. Large numbers of walruses, seals, etc. inhabit this region seasonally. Contaminants carried by this flow could affect the health of the northeast Chukchi Sea ecosystem.

The variability of the mean flow is large on synoptic and interannual time scales. Variability is forced by winds; horizontal

Finally, we have a proposed study that is just under review, that will look at the under-ice current measurements in the nearshore Beaufort Sea. The goal of this program is to determine the current structure beneath the land-fast ice in the vicinity of the Northstar and Liberty offshore oil development fields: what are the magnitudes of the currents and how do these change with

water density gradients, especially in winter due to variations in spatial patterns of sea ice production. These findings have significant implications on the scales and physical processes that could be incorporated into pollutant transport models.

Interannual variability in winter water density is very large. Water density variability affects the depths to which contaminants will be carried into the Arctic Ocean (the eventual sink for Chukchi water masses) and their eventual dispersal around the Arctic Ocean.

The second study is entitled, "Modeling the Circulation of the Chukchi Shelf." This project examined interannual variability in the wind-driven circulation on the Chukchi Shelf using a simple two-dimensional circulation model forced by standard forecasted wind products. Numerical experiments were conducted using wind fields between 1981-1995. The results were consistent with the inferences drawn from direct observations. The model predicted that the Bering Strait inflow into the Chukchi Sea splits along three branches: northwest, central, and northeast Chukchi Sea. The model and observations agreed very well in the Bering Strait and northeast Chukchi Sea area, but overestimated the magnitude and duration of wind-forced current reversals. It was poorest in the western Chukchi Sea where there is probably substantial density-forced circulation which the model cannot treat.

This model provided a conceptual understanding of why the Siberian Coastal Current is deflected offshore on the Siberian coast and into the interior of the Chukchi Sea. Deflection is a consequence of the interaction between the Arctic-Pacific sea-level gradient, the wind-induced sea level slope over the Bering-Chukchi Sea, and pressure gradients related to variations in water density.

A third study, "Circulation, Thermohaline Structure, and Cross-shelf Transport in the Alaskan Beaufort Sea" was done in cooperation with Professor Knute Aagaard of the University of Washington. The goal of the project was to determine the mean transport, and cross-shore and vertical scales of the mean flow field. The study also looked at the magnitude of the transport variability, the temporal-spatial scales of this variability, and the relationship between flow and temperature and salinity (T/S) variations and the surface wind field. These measurements provide first-order observations useful for guiding pollutant transport model development.

The project involved year-long current meter measurements along the Alaskan Beaufort continental slope (with JAMSTEC, Canada, and the University of Washington). Moorings were deployed in 1998 and will be recovered in summer 1999. This program will be supplemented by data from Dr. Weingartner's SCICEX99 program which will include high resolution T/S mapping along the Beaufort Sea slope.

the formation and breakup of the land-fast ice? The results of this project will assist with the design of oil spill contingency plan development.

Year-long current measurements will be made between the summer of 1999 and summer 2000 using acoustic Doppler current profilers moored to the seabed. Currents throughout the water

column will be measured to about 0.5 m beneath the sea ice. This study presumably will receive cooperation from the Alaska Dept. of Environmental Conservation and British Petroleum.

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## CLIMATE STATES OF THE ARCTIC OCEAN

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We identify two regimes or two climate states of the arctic water and ice dynamics which correspond to an anti-cyclonic and a cyclonic circulation of the arctic atmosphere and polar ocean. During the anti-cyclonic regime of circulation the Arctic Ocean is "cold and salty," and is driven by winds generated by the Arctic High with a "cold and dry" atmosphere. During the cyclonic regime the Arctic Ocean is "warm and fresh" and is under the influence of the cyclonic winds induced by low atmospheric pressure propagating to the Arctic from the North Atlantic (intensification of the Icelandic Low). In this case the atmosphere over the Arctic is "warm and wet." Shifts from one regime to another are forced by changes in location and intensity of the Icelandic Low and the Siberian High. Wind-driven ice and water motion in the Arctic alternates between anti-cyclonic and cyclonic circulation, with each regime persisting for 5-7 years (period is 10-15 years). We test the idea of two regimes of circulation using observational data, 2-D and 3-D coupled ice-ocean models. We carried out several simulations of ice and water dynamics for 1946 through 1993, for 1973 through 1997 using different atmospheric data sets, different initial and boundary conditions. Preliminary results revealed significant differences among atmosphere, ice, and ocean processes during the anti-cyclonic and cyclonic regimes in the Arctic Ocean and particularly in the Beaufort and Chukchi Seas. Based on existing data and results of numerical experiments, we conclude that during the anti-cyclonic circulation regime the prevailing processes lead to increases in atmospheric pressure in the Arctic, in ice concentration and ice thickness, river runoff, and surface water salinity—as well as to

We describe the current status of this project and some initial results for calendar year 1987 on a coarse-resolution grid, stressing sensitivity to sea-ice formulation. Finally, we also discuss immediate future plans for fine-resolution simulations, code parallelization, and performance validation.

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## PHYSICAL-BIOLOGICAL NUMERICAL MODELING ON ALASKAN ARCTIC SHELVES

**Henry J. Niebauer, Ph.D.**

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decreases in air temperature, wind speed, number of storms, precipitation, permafrost temperatures, sea level along the coastline, and surface water temperature. During the cyclonic circulation regime the prevailing processes lead to increased air and water temperatures, wind speed, number of storms, open water period, and heights of wind waves, and to decreases in ice thickness and ice concentration, river runoff, atmospheric pressure, and water salinity.

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## A COUPLED ICE-OCEAN MODEL OF THE ARCTIC OCEAN USING SATELLITE-DERIVED FORCING FIELDS

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Ph.D., and Jennifer Francis, Ph.D.**

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In 1995, we completed a project with a coupled/ice-ocean model of the Beaufort and Chukchi Seas. We have now extended these simulations in a number of respects. First, improved atmospheric forcing fields have been obtained by reanalysis of the TOVS satellite data in the Arctic. Preparation of a basin-wide set of surface forcing fields for the years 1985 through 1994 has been completed. We have also made substantial improvements to the coupled ice-ocean model. The ocean model is now finite-difference in all three dimensions, has a free sea surface, and utilizes a new advection scheme and time-stepping contributed by our colleagues from UCLA. The sea-ice momentum equations have also been rewritten by Paul Budgell to use the same gridding as the ocean (Arakawa-C) and to use an improved elliptic solver. For the ice thermodynamics, we are investigating several options. These include a Hibler-like version from our colleagues at AWI (Germany), a Parkinson-Washington code from Bill Chapman (UIUC), and a new implementation due to Doug Martinson (LDEO).

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The site of this numerical modeling study is the Arctic shelves north of the Bering Strait and north coast Alaska. Physical (including sea ice), biological and chemical oceanographic conditions in both summer and winter are such that several types of both natural and man-derived "particles" (e.g., primary production or phytoplankton, detritus, petroleum, mining, radionuclides, etc.) may interact, aggregate, and ultimately be transported deeper into the ocean, into the Arctic halocline, onto the shelf bottoms, and into the benthic and marine mammal ecosystems. In this study, we numerically model the generation, flux, and fate of primary production phytoplankton particles, and their interaction with each other and with physical processes such



as stratification and convection. This physical interaction has been simultaneously modeled with both primary production and the aggregation of phytoplankton. The results suggest that two main sources or pathways or processes for the formation and flux of particles are brine rejection from ice formation in fall and winter, and aggregation in primary production blooms in spring and summer. Available hydrographic data have been used for initial and boundary conditions and for verification. Verification from limited data is reasonably good.

## **OIL SPILL MODELING: STATE-OF-THE-ART**

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The state-of-the-art in oil spill modeling is summarized, focusing primarily on the years 1990 to the present. All models seek to describe the key physical and chemical processes that transport and weather the oil on and in the sea. Current insights into the mechanisms of these processes, and the availability of algorithms for describing and predicting process rates are discussed. Advances are noted in the areas of advection, spreading, evaporation, dispersion, emulsification, and interactions with ice and shorelines. Knowledge of the relationship between oil properties, and oil weathering and fate, and the development of models for the evaluation of oil spill response strategies are summarized. Specific models are used as examples where appropriate.

In the future, increasing computational power will continue to strengthen oil spill models, allowing more physical and chemical detail, and more direct coupling to hydrodynamic and meteorological models. However, there is no direct correlation between computational capacity alone and the quality of model results. Further research and development are necessary to further our understanding in some fundamental areas.

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## **COZOIL (COASTAL ZONE OIL SPILL MODEL), IMPROVEMENT OF MODEL AND LINKAGE TO GRAPHICAL USER INTERFACE**

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This presentation discusses the latest Windows implementation of an oil spill model originally developed in 1988 for Minerals Management Service. Improvements have been made to the user interface, display of model inputs and outputs, and to the openness of the system to external data. The charge of the original model was to “develop, test and verify an oil spill surf zone mass transport model.” The model known as the MMS Smear Model, or COZOIL integrated algorithms for the oil-shoreline interactions with a comprehensive coastal database of shore characteristics for Alaska. In 1997, MMS contracted to modify the existing COZOIL to eliminate some of the model's restrictions and to update the Graphical User Interface (GUI) to facilitate easier set up of the model runs and display of the model results. The final system is a fully compatible Windows application that incorporates all of the features and user interface technology of the Windows operating system. The system operates in a Windows 95 or Windows NT (32-bit) environment. The FORTRAN COZOIL was recompiled with the latest generation of 32-bit FORTRAN compilers and linkages to the ArcView GIS were developed so that model data and results may be integrated with existing GIS databases for the region.

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## **MAPPING COOK INLET TIDE RIPS USING LOCAL KNOWLEDGE AND REMOTE SENSING**

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Tide rips are strong tidal currents that occur where water masses converge. Cook Inlet drift gillnet fishermen often focus their effort at tide rips because salmon are known to concentrate there. Tide rips are also a potential key area for spilled oil to converge and submerge. Because of these features, Cook Inlet fishing groups have asked the Minerals Management Service (MMS) to consider excluding Cook Inlet tide rip areas from

upcoming oil and gas leases. MMS initiated this study in order to precisely map tide rips in Cook Inlet, provide statistics on the consistency of rip locations, and develop an information base that could help lessen conflicts between local fishermen and the offshore oil industry. Local knowledge of tide rips and their use by fishermen will be gathered through a series of workshops. Tide rip locations will then be mapped using a two-pronged approach. First, satellite-borne Synthetic Aperture Radar (SAR) imagery will be collected using Radarsat I in the summers of 1998 and 1999. These imagery data will be simultaneously ground-truthed with the help of local fishermen and using aerial surveys. Second, once an accurate method of identifying tide rips using SAR imagery has been developed, historical imagery (1992-97) will be examined to determine the consistency or variability of rip locations at different tide stages and among and within years. The results of this work will be entered into an ArcView database, interpreted, summarized, and presented to expert (scientific publications/meetings) and local stakeholder audiences (workshops and posters).

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**THREE DECADAL TIME-SERIES  
MONITORING OF TRACE-ELEMENTS  
IN NEARSHORE SEDIMENTS,  
ALASKAN BEAUFORT SEA**

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Time-series variations, at 10-year intervals since 1977, are assessed for the concentrations of Cu, Cr, Ni, Zn, V, Pb, Cd, and Ba in surficial oxidized muddy sediments of the nearshore Beaufort Sea (east Harrison Bay/Simpson Lagoon to west Camden Bay), Alaskan Arctic. No significant difference in the concentrations of all elements, except V and Ba, is identified for the past 30 years. Compared to 1977, a 34% increase in V is observed in 1985-86 and 1997, while a 64% increase in Ba is noted from 1985-86 to 1997. The precise sources of the V and Ba contaminants are unknown. However, the excess Ba could be from barytes used in petroleum drilling fluids in the study area. Preliminary analysis shows no regional trend in the distribution pattern of any element.

In 1997 total mercury (THg), methyl mercury (MeHg) and As were added to the monitoring program. These elements have concentrations close to or lower than levels in uncontaminated marine sediments. The down-core increasing concentrations of MeHg are probably related to the increased methylation of Hg in progressively more anoxic sediment sections. Snyder-Conn et al. (1997) have reported relatively high local concentrations of Hg in onshore snow samples in the Prudhoe Bay region. However, in our study no anomalous Hg values were detected in sediments of the Bay or its vicinity. Statistical analysis of the 1997 data indicates significant covariances of all elements except Cd, Hg, and Ba with the organic carbon and clay contents in the muds, suggesting large proportions of most elements are partitioned in the adsorbed and/or organically-chelated phase.

The analysis of the findings was used to perform preliminary tests of the study's four hypotheses, using the first year's data. The outcomes of this hypothesis testing are as follows: 1) the surface sediments of Outermost Cook Inlet and the Shelikof Strait are potential traps for contaminants from oil and gas production activities in upper Cook Inlet; 2) the concentrations of metals and organics (i.e., PAHs) in sediments in Outermost Cook Inlet and Shelikof Strait have not increased significantly over the past 25 to 50 years; 3) the composition (source[s]) of metals in the sediments of Outermost Cook Inlet

**SEDIMENT QUALITY IN DEPOSITIONAL  
AREAS OF SHELIKOF STRAIT AND  
OUTERMOST COOK INLET**

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Due to the need to definitively examine the distribution and environmental risk of anthropogenic chemicals (i.e., metals, and petroleum hydrocarbons, including PAHs) in advance of any future oil and gas E&P activities that could potentially affect the Lower Cook Inlet and Shelikof Strait, MMS contracted Arthur D. Little, Inc. (ADL) to undertake a two-year study in the region. The objectives of the study were to: 1) evaluate the Shelikof Strait and Outermost Cook Inlet as potential depositional areas or "traps" for oil industry contaminants; 2) determine whether contaminant concentrations in sediments of these areas pose an environmental risk; 3) determine whether contaminants in these areas have accumulated relative to pre-industry concentrations; and 4) determine whether any increases can be correlated with specific discharge events or activities (e.g., the *Exxon Valdez* oil spill).

A field and analytical program was designed to collect data to test hypotheses. The design of the field and analytical program for the first year focused on the study of the bottom sediments of the region, as the focal point of any long-range contaminant deposition. The design was intended to obtain both chemical (i.e., exposure) and biological (i.e., effects) data on surface sediments. It also was directed at looking at historical deposition in the study area through the use of dated sediment cores. Finally, in the first year, an exploratory effort was initiated to look at bottom-feeding fish, their contaminant burdens, and sublethal "biomarker" measurements that indicated their exposure to contaminants.

and Shelikof Strait do not appear to have changed over the last 25 to 50 years. The composition of hydrocarbons in sediment cores show subtle changes in Outermost Cook Inlet over the past 25 to 50 years, but these changes do not appear to be correlated with petroleum production activities or spills; and 4) the current concentrations of metals and PAHs pose no significant risk to the biota and the benthic environment of Outermost Cook Inlet and Shelikof Strait. A final assessment will only be possible after completion of the two-year program, but for now it appears that

the degree of current risk is very low and is similar to unimpacted coastal regions in Alaska and elsewhere.

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## **INTERACTION BETWEEN MARINE HUMIC ACID AND POLYCYCLIC AROMATIC HYDROCARBONS IN LOWER COOK INLET AND PORT VALDEZ, ALASKA**

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We have sought to understand the role of sediment organic matter and, specifically, humic acid on the tendency of Alaska marine sediments to adsorb polycyclic aromatic hydrocarbons (PAH) and thereby reduce the bioavailability of PAH to marine organisms. Marine humic acid is naturally occurring organic material of variable composition which tends to coat the surface of mineral particles. We isolated and characterized PAH and humic acid from a suite of intertidal and subtidal sediments from Kachemak Bay and Port Valdez, Alaska. Geochemical characterization of sediments and humic acids showed that the humic acids' chemical composition is non-uniform, probably reflecting differences in both source materials and post-depositional alterations. This result indicates that the measured concentrations of PAH are largely unrelated to the properties of the humic acid from the same sediment. It is more likely that the amounts of PAH to which sediments are exposed control observed concentrations. Experiments which measured the ability of humic acid extracted from these sediments to adsorb phenanthrene showed marked differences among sediments with humic acid from subtidal sediments having 6.3 to 45 times greater sorptive capacity than humic acid from intertidal sediments. This greater sorptive capacity appears to be related to the greater degree of condensation and oxidation in the humic acid from subtidal sediments.

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## **PHENANTHRENE ADSORPTION BY JAKOLOF BAY SEDIMENTS**

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Aromatic hydrocarbons are of special concern as environmental contaminants because they are among the most toxic, mutagenic, and carcinogenic petroleum components. Sediments are an important reservoir for polycyclic aromatic hydrocarbon (PAH) contamination in marine systems and are a source of exposure for benthic organisms. Adsorption of three aromatic hydrocarbons by intertidal sediments from Jakolof Bay, Alaska was investigated in order to better understand the processes responsible for persistent sedimentary PAH contamination. This presentation focuses on findings for phenanthrene, since most results were similar for benzene, naphthalene, and phenanthrene. Phenanthrene was rapidly and strongly adsorbed. Adsorption was not completely, rapidly reversible by suspension of the sediment in clean seawater. Longer adsorption reaction times led to less desorption. Adsorption partition coefficients did not vary with phenanthrene concentration. This indicates that all sites for adsorption on the sediment surface were equivalent and that availability of adsorption sites did not limit adsorption over the concentration range studied. The strong and partly irreversible adsorption of phenanthrene by these sediments indicates that adsorption could contribute to the persistence of aromatic hydrocarbon contamination.

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## **MICROBIAL DEGRADATION OF AROMATIC HYDROCARBONS IN MARINE SEDIMENTS**

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This study examined how adsorption to marine sediments affects the bioavailability of aromatic hydrocarbons. Sediment slurries were used to study microbial mineralization of the aromatic hydrocarbons, phenanthrene and naphthalene, added at low concentrations. Populations of phenanthrene degraders were found to be naturally present in low numbers in sediments collected in Cook Inlet. Two types of experiments were performed, abiotic extraction assays and biotic mineralization assays (bioassays). In abiotic experiments, both phenanthrene and naphthalene became more resistant to chemical extraction with time and increasing organic carbon content. In bioassays the percent phenanthrene or naphthalene mineralized decreased with increasing sediment concentration and in general with increasing organic carbon content of the sediment. However, the organic carbon content of the sediments did not entirely explain the differences seen in mineralization of these aromatic hydrocarbons. Sediments aged abiotically for 30 days with phenanthrene showed lowered mineralization rates in bioassays. However, the mean mineralization rate for phenanthrene (in both unaged and aged experiments) was greater than that predicted from sediment free controls implying utilization of sorbed substrate (either directly or following desorption). In contrast the mean mineralization rate for naphthalene was less than that predicted from sediment free controls implying that some of the naphthalene extracted in abiotic experiments was biologically unavailable. The organic carbon content of the sediment appears to strongly control adsorption of these aromatic hydrocarbons and, therefore, their bioavailability. Because natural populations of aromatic hydrocarbon degraders are low and because bioavailability generally decreased in the presence of sediment, especially in sediments with high organic carbon compounds, it is predicted that if spills occur in Lower Cook Inlet these compounds are likely to persist for decades.

## **MMS BOWHEAD WHALE AERIAL SURVEY PROJECT**

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Each year since 1987, the Minerals Management Service (MMS) Bowhead Whale Aerial Survey Project has used MMS personnel to monitor the fall migration of bowhead whales across the Alaskan Beaufort Sea. The goals of the ongoing program are to: 1) provide real-time data to MMS and National Marine Fisheries Service on the general progress of the fall migration of bowhead whales across the Alaskan Beaufort Sea, for use in implementing overall limitations on seasonal drilling and geological/geophysical exploration; 2) monitor temporal and spatial trends in the distribution, relative abundance, habitat, and behaviors (e.g., feeding) of endangered whales in arctic waters; 3) provide annual analyses of long-term interyear trends in the water depth (or north-south positioning) of the migration axis of bowhead whales; 4) provide an objective wide-area context for management interpretation of the overall fall migration of bowhead whales and site-specific study results; and 5) record and map beluga whale distribution and incidental sightings of other marine mammals.

The general ice cover during September and October 1997 was extremely light, with the pack ice more than 200 miles north of the shoreline during most of the September-October field season. The very high number of individual bowhead whales counted ( $n = 1,655$ ) during Fall 1997 was likely due to unavoidable recounting of large aggregations of feeding and/or milling whales that appeared to remain in the same area for several days. The project also observed 398 beluga whales, 9 gray whales, 8 bearded seals, 311 ringed seals, 50 polar bears, and 8 sets of polar bear tracks in 1997 during 123.62 hours of survey. Preliminary power analyses of ANOVA for both water depth and distance from shore ( $\alpha = 0.05$ ) were performed. This past field season (1998), the pack ice was again far offshore and the total number of bowheads counted was 1,050, again likely due to some repeat counting between days of feeding and milling whales.

Aerial surveys indicated that most bowheads avoided an area of radius roughly 20 km around the seismic vessel when airguns operated. In contrast, bowheads were often seen well within 20 km at times when no airguns operated. Received levels of seismic pulses at 20 km vary, but typically do not exceed 130-140 dB re 1 (Pa as measured on an rms basis over the pulse duration). Only one bowhead was seen by boat-based observers

## **MARINE MAMMAL AND ACOUSTICAL MONITORING DURING NEARSHORE SEISMIC EXPLORATION IN THE OPEN-WATER SEASON**

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Nearshore seismic programs were conducted east and west of Prudhoe Bay during July to September 1996-97 by BP Exploration (Alaska) Inc. and during July-October 1998 by Western Geophysical. These projects employed smaller arrays of airguns than used for some earlier seismic work in the Beaufort Sea, and used the Ocean Bottom Cable (OBC) method rather than towed streamers. At any one time, seismic work was confined to a relatively small area.

These projects were conducted under the provisions of Incidental Harassment Authorizations (IHAs) issued by the National Marine Fisheries Service (NMFS). The IHAs allowed disturbance to seals and whales, but required monitoring to document disturbance effects, to estimate how many mammals were "taken by disturbance," to implement mitigation measures (temporary shutdown of airguns) when mammals were detected within defined radii, and to assess potential effects on availability of whales and seals to subsistence hunters. Monitoring was done by LGL and acoustical specialists Greeneridge Sciences, Inc. under the sponsorship of BP (1996-97) and Western Geophysical (1998). Monitoring plans and draft reports were reviewed by NMFS, MMS, the Alaska Eskimo Whaling Commission, and the North Slope Borough. Meetings with the whaling captains were held before and after each field season. The monitoring was designed taking into account both previous scientific data and Inupiat views about the likely nature and extent of disturbance effects. Each year, marine mammal observers (biologists and Inupiat) were aboard the seismic vessels at all times. Site-specific aerial surveys were conducted daily (weather permitting) starting 1 September. Extensive acoustic measurement and acoustic monitoring programs were also done.

Seals (mainly ringed seals) showed no consistent changes in behavior when exposed to seismic pulses, and no more than localized avoidance reactions within (at most) a few hundred meters. Seals were often seen within the "shutdown radii," which were usually 150-460 m depending on the airgun configuration in use. The airguns were shut down immediately when seals were seen within those radii.

during the 3 seasons; it was within 100 m of the operating airguns. Acoustic monitoring of bowhead calls in 1996 indicated that bowheads near the operating seismic vessel changed their calling behavior, showed partial avoidance, or (probably) both. These and other related data suggest that there is no one absolute avoidance radius or acoustic threshold. Rather, probability of avoidance diminishes progressively with increasing distance.

Even though most bowheads avoided the area within about 20 km of the operating airguns, there was no conflict with the subsistence whale hunt. The seismic operators limited their work to areas west of Cross Island at times when the Nuiqsut hunters were hunting bowheads near Cross Island.

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## **BOWHEAD WHALE FEEDING IN THE EASTERN ALASKAN BEAUFORT SEA: UPDATE ON SCIENTIFIC AND TRADITIONAL INFORMATION**

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This study was originally conducted in 1985 and 1986 for MMS. It is continuing for another three years of field work in 1999, 2000, and 2001. The summer of 1998 was the first field season, so there are not too many results to discuss as yet.

The purpose of the study is to determine the importance of the eastern Alaskan Beaufort Sea for feeding by bowhead whales. The null hypothesis that we are testing during the study is:

“The eastern Alaskan Beaufort Sea is not a major feeding area for bowhead whales; the population derives very little of its annual energetic requirements from the area.”

One of the reasons why this study was extended another three years is that there was some criticism of the first study in that it was too short that there were only two field seasons, one of which was limited by ice; and that there were difficulties in estimating food availability and consumption.

This study is designed to address those concerns by building consensus at all stages of the planning process and by involving

The Alaska Dept. of Fish and Game (ADF&G) is sampling the stomach contents of harvested whales and other attributes of the harvested whales using the NSB's sampling protocol. ADF&G is also collecting samples for isotopic and fatty acid analysis. The fatty acid analysis of the zooplankton will be compared to the fatty acids found in the whales to determine what whales have been eating recently. The stomach contents and the zooplankton tows near feeding whales tell us what whales are eating right now. Fatty acid analysis integrates what they have been eating over a period of time, weeks or months. The isotopic analysis tells you basically where the animal has been feeding throughout its life cycle.

Through the aircraft-based work, we are doing systematic surveys in the nearshore of the study area, within the 200 m contour to determine how many whales are in the area. We are going to integrate those results with those of the MMS aerial surveys. We are doing behavioral observations to find out what

the stakeholders through meetings and involvement with the project, and by the use of a Scientific Review Board.

The study area for the project begins at the U.S.-Canadian border and extends just to the west of Kaktovik, out beyond the 2,000 meter contour. As a recommendation from the first Scientific Review Board we are limiting most of the studies to the area within the 200 meter contour.

One of the key features of the study is local coordination and input which we feel is critical to the success of the study. We have met with and continue to meet with the Kaktovik whalers, the Alaska Eskimo Whaling Commission (AEWC), and the North Slope Borough (NSB) to obtain traditional information on the feeding, distribution, and habits of bowhead whales. We also seek advice on the project design, especially to coordinate field work with the bowhead hunt so we do not interfere with the hunt. The results and interim findings of the study as it progresses are presented to the Board. At the start of the project, we held meetings and workshops in Kaktovik and Barrow to explain the purpose of the study and to seek local input on how the study should be conducted. We interviewed individuals on a one-on-one basis. In future years, we will have two meetings per year with the Kaktovik whalers, just prior to the field season to coordinate our activities with theirs, on a “not-to-interfere basis.” Then a meeting in winter to present interim findings of the study. The Kaktovik whalers, the AEWC, and the NSB are also part of our Scientific Review Board which is reviewing the progress of the study, the study design, and the results, and also makes recommendations as to how the study should be conducted. We also have some participation in the field work by a resident of Kaktovik on our boat-based crew. Our field crews are coordinating operations with Kaktovik and Nuiqsut whalers through the communications center in Deadhorse.

We are going to accomplish the objectives of the project through a series of study components. Boat-based field work includes using hydroacoustics and zooplankton tows to determine the distribution of zooplankton and the biomass of zooplankton near feeding whales; also to characterize the physical attributes of the water in areas where whales are feeding and in areas where whales are not feeding; and to collect samples for isotopic and fatty acid analysis by other researchers.

the whales are doing in the area, what proportion of the whales are feeding, and their other behaviors. Through aerial photography we will determine how large the whales are and what the population distribution is in the area. Are they all young whales, old whales, is it a mixture of young whales and subadults? Also through reidentification of the whales, we can determine how long some whales are resident in the area.

In addition, there are also some office studies on energetics of bowhead whales. We are archiving satellite imagery to determine of the physical oceanographic parameters. We are also collecting traditional ecological knowledge on most of the above components.

In order to address the objectives of the study we will integrate all of the data we collect. We want to describe the zooplankton in terms of its physical habitat. We will also describe the whale distributions in terms of the biophysical attributes of the

study area, such as, depth, water mass characteristics, and zooplankton distributions.

Bowhead feeding areas will be typified in terms of zooplankton, physical characteristics, and presence of feeding and non-feeding whales.

We will compare the theoretical energetic requirements of bowheads and zooplankton biomasses near feeding bowheads.

We will estimate the amount of feeding in the Beaufort Sea versus other areas and the contribution of various prey taxa to the bowhead diet through stable isotope and fatty acid analyses.

An estimation of the percentage of the study area with suitable feeding habitat for bowheads, insofar as the data permits, will be accomplished.

In the end, we hope to estimate the relative importance of the study area for individual whales and for the population of bowhead whales. We will set bounds on the overall energetic importance of the study area to the population as a whole as estimated from calculated feeding rates and estimated whale-days of feeding within the study area.

A comparison of the results between 1985 and 1986 and 1998, showed that one of the main differences was in ice conditions. In 1985 ice severely limited our ability to work. We did not sample near feeding whales at all. During 1986, we were able to work but the ice was much closer in than it was in 1998. In 1998 the eastern Alaskan Beaufort Sea was ice-free from late July through the September field sampling program. The edge of the pack ice was 200 to 300 km offshore. No ice was encountered during zooplankton sampling.

In 1985 there were no opportunities to sample near bowhead whales. In 1986 small concentrations of feeding bowhead whales were encountered on two or three occasions in the extreme eastern portion of the study area and in nearby Canadian waters. In all cases, bowheads were feeding close to shore (<20m).

However, in 1998 bowhead whales were commonly observed across the entire study area and across the entire Beaufort Sea. Feeding whales were not concentrated in small areas. They were loosely distributed over fairly wide areas. Feeding whales were observed in the study area from early August until we left to field in late September.

In 1986, zooplankton patches near feeding whales were relatively small, 1 to 3 km in length and width and were in nearshore waters. The small (2mm) copepod, *Limnocalanus macrurus*, was the most abundant zooplankter found in the bowhead whale feeding stations in the eastern Alaskan Beaufort Sea in 1986.

In 1998, the zooplankton patches appeared to be widely distributed in areas where bowhead were observed feeding and patches were ~ 10s of km in size. Species composition was diverse at bowhead whale feedings stations in 1998. At some stations, larger copepods, *Calanus hyperboreus* and *C. glacialis* were the dominant zooplankters while at other stations mysids

also appeared to be major contributors. Few *Limnocalanus macrurus* were observed at any of the bowhead feeding stations.



**OVERVIEW OF CURRENT RESEARCH  
ACTIVITIES OF THE NORTH SLOPE  
BOROUGH DEPARTMENT OF WILDLIFE  
MANAGEMENT RELATED TO MARINE  
RESEARCH**

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The mission of the North Slope Borough (NSB) Department of Wildlife Management (DWM) is to provide a factual basis for: 1) strong local participation in the management of wildlife resources within the Borough, and 2) continued subsistence harvest of wildlife resources. Methods to achieve this mission include documentation of harvest levels of subsistence species, and documenting the natural history and health of these wildlife resources. The Department of Wildlife Management is responsible for helping to assure participation by Borough residents in the management of wildlife resources, to attempt to maintain these resources at healthy population levels, and to assure that residents can continue their subsistence harvest of wildlife resources. Our studies help provide the factual support for the subsistence needs of residents. The broad research categories include: bowhead whale population research, bowhead whale basic biological and harvest documentation research, documentation of harvest levels of all subsistence species (all NSB villages), evaluation of contaminant levels in arctic marine and terrestrial species, beluga whale population, distribution and subsistence harvest research, endangered and threatened eider research. Below is an abbreviated listing of relevant scientific projects (focused on marine resources) conducted by and in association with the DWM.

1. Documenting the subsistence harvest of wildlife (marine mammals, fish, terrestrial mammals, etc.) for each of the eight villages on Alaska's North Slope needed to fulfill nutritional and cultural requirements. Principal Investigators: Harry Brower, Jr., Raynita Taqulik Hepa, Tommy Olemaun.

2. Conducting a visual and acoustic census of migrating bowhead whales off Point Barrow (1981-present).

a) Assisting Native hunters (Eskimo and Chukchi) in Chukotka (Russian Far East) who are returning toward a traditional lifestyle that includes their continuing relationship with the gray whale and their re-establishing a relationship with the bowhead whale. Funded by NOAA. Responsible personnel: Dr. Tom Albert.

b) Preservation and development of the subsistence lifestyle and the traditional use of natural resources by Native people (Eskimo and Chukchi) in selected coastal communities

Principal Investigators: Dr. T. Albert, J.C. George, and R. Suydam.

3. DWM studies of contaminants in Arctic marine animals include:

a) An evaluation of marine mammal consumption and associated exposure to radionuclides and heavy metals in Eskimos of Northwestern Alaska. Dr. Todd O'Hara (NSB DWM) Funding source: Office of Naval Research.

b) Human and chemical ecology of arctic pathways by marine pollutants. Funded by NOAA. Dr. David Norton (Barrow Arctic Science Consortium, BASC), Dr. Todd O'Hara (NSB DWM).

c) The bowhead whale as a potential indicator species for monitoring the health of the western Arctic/Bering Sea ecosystem using blubber, histology, metal, and mineral indices. Funded by NOAA. Dr. Todd O'Hara (NSB DWM) Principal investigator.

d) Support doctoral student regarding trophic level discrimination of arctic marine food webs using heavy metals (mercury and cadmium) and stable isotopes (carbon and nitrogen) in tissues of marine organisms. (Lara Dehn, MS Thesis, UAF in coordination with the DWM).

e) Chemical and histological assessment of heavy metals in tissues of Eskimo harvested marine mammals (bowhead whale, beluga whale, ringed seal, polar bear)(Graduate Student Dr. V. Woshner). Determination of tissue levels of heavy metals in Eskimo harvested marine mammals (bowhead whale, beluga whale, ringed seal, polar bear). In cooperation with Texas A&M University, College Station, TX.

f) Participation in Alaska Marine Mammal Tissue Archival Project (AMMTAP). Cooperating Agencies: National Institute of Standards and Technology (Dr. Paul Becker), NSB DWM (Dr. Todd O'Hara) National Marine Fisheries Service (Dr. Teresa Rowles), U.S. Geological Survey (Dr. Lyman Thorsteinson).

g) Participation in University of Alaska Museum Frozen Tissue Archive University of Alaska Museum (Dr. Gordon Jarrell), NSB DWM (Dr. Todd O'Hara).

4. Beluga whale studies regarding harvest documentation, stock identity, biological sampling, satellite telemetry, migratory behavior, and reproduction. Funding source: Funded by Alaska Beluga Whale Committee (ABWC), National Marine Fisheries Service, and NSBDWM. DWM principal investigator: Robert Suydam (DWM); and L. Lowry, K. Frost, ADF&G, and Dr. G. O'Corry-Crowe, NMFS, La Jolla. Robert is also a major participant in the ABWC.

5. Research in association with Native People of the Russian Far East:

(Inchoun, Lorino, Uelen, Enmelen, New Chaplino, Sireniki) of Chukotka in the Russian Far East: Phase 2.

c) Document the importance of marine mammals and the use of traditional skin boats to Native hunters in the coastal villages of New Chaplino, Sireniki and Enmelen in the Chukotka Region of the Chukotka Autonomous Okrug (Russian Far East). Eskimo Society of Chukotka Dezhneva.

d) Also see 2a, and 2b.

6. Eye lens amino acid racemization as an aid in estimating age in harvested bowhead whales. Principal Investigators: Craig George, NSB DWM and Dr. Jeffrey Bada, Scripps Institution of Oceanography.

7. Examination of Eskimo harvested beluga whales at Point Lay, Alaska regarding age and length structure, food habits, and reproductive status. Contact: Robert Suydam (NSB DWM)

8. Improving assessment methods and estimates of adult bowhead whale survival rate, longevity, and population size. In collaboration with Dr. Judy Zeh, Dept. of Statistics, University of Washington.

9. Serologic sampling of Eskimo harvested marine mammals. Principal Investigators: Dr. Todd O'Hara, C. George, R. Suydam, Dr. Teri Rowles (NOAA).

10. Continued studies on the morphology of the eye and related structures of the bowhead whale, *Balaena mysticetus*. In conjunction with Dept. of Veterinary Anatomy and Cell Biology, School of Veterinary Medicine, LSU.

11. Development of electronic components of a satellite-linked radio tag for use on bowhead whales, and development of a satellite-linked radio tag that can be attached to bowhead whales by Native hunters. Principal investigators: Dr. Tom Albert and Dr. Todd O'Hara, Dr. Oen, Dept. of Arctic Veterinary Medicine, Norwegian College of Veterinary Medicine, Oslo, Norway.

12. Optimization methods for bowhead whale aboriginal whaling management procedures. Dr. Geof Givens, Department of Statistics, Colorado State University.

13. A molecular genetic evaluation of bowhead whales (*Balaena mysticetus*) from the Bering, Chukchi and Beaufort Seas: Phase 2 Dr. James N. Derr and Alejandro P. Rooney (Post Doctoral Student), Department of Veterinary Pathobiology, College of Veterinary Medicine, Texas A&M University (TAMU).

14. Morphometric characterization of skulls from Eskimo harvested bowhead whales. Department of Veterinary Anatomy and Cell Biology, School of Veterinary Medicine, Louisiana State University, Baton Rouge, LA.

25. Breeding biology of Steller's Eiders near Barrow, Alaska. Robert Suydam (NSB DWM), in cooperation with Tim Obritschkewitsh (U.S. Fish and Wildlife Service) and Michele Johnson (graduate student, University of California Davis)

26. Documenting movement (satellite telemetry) of King [REDACTED] and wintering areas. Principal Investigator: Robert Suydam.

15. Determine extent of nesting by Brant geese (using aerial survey) in the area between the Colville River and Barrow on Alaska's North Slope. Institution: ABR (Alaska Biological Research), Fairbanks, AK.

16. Providing technical assistance to Weapons Improvement Program of Alaska Eskimo Whaling Commission by NSB DWM personnel: Dr. Todd O'Hara, Dr. Tom Albert, Craig George.

17. Determination of tissue levels of mercury (inorganic and organic forms) in Eskimo harvested beluga whale, ringed seal, and polar bear. Alaska Division of Public Health (Dr. John Middaugh), NSB DWM (Dr. Todd O'Hara)

18. Histologic and morphometric assessment of sexual maturation in the male bowhead whale. Principal Investigators: Dr. Todd O'Hara, Craig George, Dr. R. Tarpley (TAMU), Debra Miller (Univ. Of Miami).

19. Examination of Eskimo harvested bowhead whales to document tissue damage associated with use of penthrite projectile: Principal Investigators: Dr. T. O'Hara, Dr. T. Albert

20. Examination of Eskimo harvested bowhead whales to relate basic morphometrics (body length, etc.) to estimated age. Principal Investigators: Craig George and R. Suydam.

21. Documenting extent of regional heterothermy, deep body temperature, and thermal conductivity of the blubber in Eskimo harvested bowhead whales as an aid in estimating energetic requirements of bowhead whales. Principal Investigator: Craig George (Ph.D. Thesis).

22. Providing technical assistance to Eskimo Walrus Commission and Alaska Nanuq (polar bear) Commission. Principal Investigator: Charles D.N. Brower

23. Distribution, occurrence and relative abundance of anadromous and freshwater fish in the Dease Inlet, Ikpikpuk River and Teshekpuk Lake Regions of Alaska's North Slope.

24. Development and maintenance of an electronic database of information (length, sex, morphometrics, scaring, hunting data, etc.) associated with bowhead whales harvested by Alaskan Eskimos. DWM Staff.

**Thomas Napageak**

**Chairman**

**Alaska Eskimo Whaling Commission  
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Good afternoon. Thank you for the opportunity to speak before you as a panelist and as the Chairman of the Alaska Eskimo Whaling Commission (AEWC), and a whaling captain from Nuiqsut, Alaska.

I would like to thank the U.S. Minerals Management Service (MMS) for bringing us to this meeting, and I know there is a lot of information that will be given by many people.

**PRESENTATION TO THE UNITED STATES  
MINERALS MANAGEMENT SERVICE  
INFORMATION TRANSFER MEETING**

Let me first introduce the participants from AEWK:

1. Maggie Ahmaogak, Executive Director;
2. Joseph Kaleak, AEWK Commissioner for Kaktovik and Representative for Kaktovik Whaling Captains;
3. Thomas Napageak, AEWK Chairman and Representative for Nuiqsut Whaling Captains;
4. Fred Kanayurak, AEWK Alternate Commissioner for Barrow, and Representative for Barrow Whaling Captains;
5. George Ahmaogak, Sr., Arctic Slope Regional Corporation Village Liaison Officer and Whaling Captain from Barrow;
6. Tom Albert, Senior Scientist, North Slope Borough (NSB) Department of Wildlife (DWM); and
7. Craig George, NSB/DWM.

The AEWK is comprised of ten villages including Little Diomede, Gambell, Savoonga, Wales, Kivalina, Point Hope, Wainwright, Barrow, Nuiqsut, and Kaktovik and we are here representing them.

This meeting is for Information Transfer. In the most recent Draft Environmental Impact Statement process, MMS was complimented for its incorporation of "Traditional Knowledge." We have come a long way of transferring information with each other. Over the years, the AEWK has commented on Lease Sales, Environmental Impact Statements, Incidental Harassment Authorizations, and similar documents related to oil and gas activity in the Beaufort Sea and Chukchi Outer Continental Shelf. AEWK's responsibility, in all cases, is to protect its people's subsistence and cultural activities, especially the subsistence whale hunts.

## **HISTORY OF AEWK**

For those of you not familiar with the Alaska Eskimo Whaling Commission (AEWK), I would like to give you some background.

### **The International Whaling Commission Ban on the Bowhead Subsistence Hunt and the Formation of the AEWK**

In 1977, the International Whaling Commission (IWC) imposed a ban on the Alaskan Eskimo subsistence hunt of bowhead whales. This decision was based on "scientific" information that there were only a few hundred bowhead whales left and that the stock was going to extinction.

Our Whaling Captains told U.S. scientists that their information was wrong and that there were approximately 6,000 to 8,000 bowhead whales living in the Beaufort Sea. The Captains told the scientists that they could not see the whales to count them because the whales swim under the ice.

Since our communities are organized around our subsistence traditions, the loss of a subsistence resource, especially the bowhead whale, would not only represent a great loss of food but also the focus of our culture and social structure.

At the present time, the AEWK believes that the following topics are the most important for the Federal Government and OCS operators to work on with us:

1. Northstar Production/Construction
2. Offshore Oil Spill
3. Monitoring Plans
4. Seismic Operations
5. International Whaling Commission Quota

At this time, I would like to introduce the AEWK Executive Director, Maggie Ahmaogak who will give the AEWK Presentation on the above topics.

Again, I thank you for the opportunity to be here as a panelist and as the Chairman of the AEWK.

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## **PRESENTATION TO THE UNITED STATES MINERALS MANAGEMENT SERVICE INFORMATION TRANSFER MEETING**

**Maggie Ahmaogak**

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First of all, the AEWK would like to thank Minerals Management Service (MMS) for bringing this meeting together. The agenda is overwhelming for us.

The Federal Government refused to listen to our people. The United States did not object to the IWC ban on our bowhead whale subsistence hunt.

The AEWK was formed in August of 1977 to represent the whaling communities in an effort to convince the United States Government to take action to preserve the Eskimo subsistence hunt of the bowhead whale. Ultimately the U.S. agreed to raise the issue at a special meeting of the IWC held in December of 1977.

At that meeting, the United States government promised to undertake a major research effort to provide a better estimate of both the size of the bowhead stock and how many animals are added to the stock each year, known as the "gross annual recruitment rate." The United States also promised to document the Alaskan Eskimo need for bowhead whales based on the subsistence and cultural need of each community.

As a result, the IWC approved a limited quota in 1977 of 18 whales struck for the 1978 bowhead whale harvest. At the same time the AEWK resolved to cooperate to the fullest extent with the

United States scientific research efforts, and to develop a Management Plan to be followed by all the whalers to help improve the efficiency of the subsistence hunt.

Our subsistence whaling communities agreed to abide by these restrictions until it was proven that our estimates of the bowhead whale population were correct. The North Slope Borough (NSB) Department of Wildlife Management (DWM) then undertook principal responsibility for the monumental task of trying to find and count bowhead whales.

My Uncle, Harry Brower, Sr., taught Dr. Tom Albert how to listen for whales under the ice and the bowhead whale census was born.

Today, 22 years and many millions of dollars later, the bowhead whale census off of Point Barrow, as well as on-going work on a new IWC management regime for aboriginal subsistence whale hunting, continue to be carried out by the NSB/DWM, on behalf of the AEWG and National Oceanic and Atmospheric Administration (NOAA).

The subsistence bowhead whale hunt continues to be conducted under the regulation of the IWC through harvest quotas. The quotas are based in part upon bowhead whale population estimates that are supplied to the IWC by the AEWG, the NSB/DWM, and NOAA.

The current bowhead population size estimate is 8,000 whales with a 95% probability that the true population size estimate is between 6,400 and 9,200 whales.

My Uncle Harry Brower would be proud of Dr. Albert and his team to have proven and gotten our quota these past few years.

#### **Displacement of Bowhead Whale Migration by Seismic Noise**

Similarly, in 1992, the AEWG and the North Slope Borough were ignored when we told the National Marine Fisheries Service (NMFS) and ARCO Alaska that seismic noise caused the bowhead whale migration to deflect off shore. As you will recall, this disagreement resulted in a Kuvlum lawsuit.

Recent monitoring data in fact demonstrates exactly the deflection that our Captains described.

I have given you this background for a reason. Twenty two years ago, the Federal Government refused to listen to our people on issues related to the size and health of the bowhead whale population. Yet today, after the millions of dollars the North Slope Borough has had to spend on this, they must acknowledge that our Whaling Captains were right all along.

Again, seven years ago, we were ignored and again millions of dollars were spent to find that, again, our Whaling Captains were right.

Despite this history, when we speak today on issues related to bowhead whale behavior, we continue to be scoffed at or ignored. I ask you, how successful would a bowhead whale subsistence hunter be if he did not have an intimate knowledge of the whale's behavior?

## OCS ACTIVITIES AND LEASE SALES

Over the years of offshore oil and gas exploration in the Beaufort Sea, the AEWG and our Whaling Captains have consistently objected to the use of the Arctic Ocean for oil and gas production. We continue to object to these activities, especially in light of the Federal Government's refusal to allow onshore operations in the Arctic National Wildlife Refuge (ANWR). Onshore operations are immeasurably safer than those undertaken offshore, particularly in the ice-infested waters of the Arctic. Furthermore, an accident in the OCS could destroy the very coastal plain that the protectors of ANWR are seeking to preserve.

Despite our strenuous objections and the complete lack of logic in the Federal Government's decision making, our offshore waters continue to be the focus of oil and gas exploration and now production activities. In fact, after the Gulf of Mexico, the Alaskan OCS is the most important area in the U.S. for oil and gas exploration. Offshore reserves have been proven in the Beaufort Sea and soon will be tapped.

The residents of our coastal and near-coastal villages rely heavily on subsistence hunting in the OCS for our food and our cultural existence. As a result, the AEWG has sought to be involved, to the greatest extent possible, in all planning and implementation processes related to Beaufort and Chukchi Seas oil and gas exploration and development.

Over the years, the AEWG has commented on all Lease Sales, Environmental Impact Statements, Five-Year Plans, Incidental Take and Incidental Harassment Authorizations, and similar documents related to oil and gas activity in the Beaufort and Chukchi OCS. In all cases, our responsibility for protecting our people's subsistence and cultural activities forms the context for our comments.

Since the early 1980s, the AEWG has worked with the United States Congress, MMS, NOAA, and the National Marine Fisheries Service, as well as oil and gas industry operators in Alaska, to help address issues related to the interaction of OCS oil and gas operations with the bowhead subsistence hunt.

We also have worked with the agencies and operators to help to develop exploration programs, including monitoring plans under the Marine Mammal Protection Act, that minimize the potential for conflicts between subsistence hunters and operators.

In all of our interactions on the issues, the AEWG seeks to maintain a cooperative approach, except in cases where we have been unable to convince other parties to give appropriate weight to our communities' concerns. The North Slope Borough has and continues to support the AEWG on these matters.

Given the potential devastation that could occur along Alaska's northern coast in the event of an offshore oil spill, it is in everyone's best interest to maximize the level of protection and required contingency equipment.

Requirements for available standby equipment and other contingency planning should not be reduced until BP has had an opportunity to demonstrate the effectiveness of its equipment and

At the present time, the AEWG believes that the following topics are the most important for the Federal Government and OCS operators to work on with us:

### 1. Northstar Production

BP (Alaska), Inc.'s interest in the Northstar prospect means that in all likelihood we will see production in the Alaska OCS in the very near future. For our people, this means that the noise impacts and exploration risks we have fought so hard to mitigate now will be joined by the risk of oil spill as oil is transported from the site to shore.

Mitigation measures will need to be developed to address construction and production impacts as they come to light. Of most immediate concern, however, the AEWG feels very strongly that the Federal Government and the State of Alaska must maintain the most rigorous possible oil spill contingency and clean up requirements for the present time and for the immediate future.

Because residents in the coastal villages of Alaska rely so heavily on subsistence hunting for food, any discharge in the Alaskan OCS that diminishes the use of subsistence food resources will be damaging to these villages.

In Native subsistence communities, such as the AEWG's ten subsistence whaling villages, the negative impact can be even more devastating if the subsistence activity is lost for any significant period of time.

Since our communities are organized around our subsistence traditions, the loss of a subsistence resource, especially one as important as the bowhead whale, would represent not only a loss of food, but the loss of the principal focus of our culture and social structure. The social and psychological effects of this type of loss can be profound. Therefore, it is imperative to seek all available means of ensuring that our subsistence resources and activities are protected.

BP recently argued to the Alaska Department of Environmental Conservation that the State's oil spill contingency requirements should be relaxed.

BP's arguments were based on opinion and its conclusions are untested in the field. You may recall the "gray whale rescue" that took place off of Barrow in the late 1980s, during which an Arctic-class icebreaker was unable to provide assistance due to its inability to move through the heavy shorefast ice. In fact, it was Native residents of Barrow, based on their knowledge of the ice, who successfully carried out the rescue.

contingency planning during a typical Arctic winter, including movement through multi-year shorefast ice.

Without such a real-world demonstration, no one has any way of knowing where the weaknesses lie in BP's proposed equipment inventory and oil spill contingency plan.

The AEWG strongly encourages MMS to work with the AEWG, the North Slope Borough, the State of Alaska, and BP and

its contractors to stage such a demonstration at the earliest possible date. This will give us the opportunity to identify and address issues with equipment and/or the contingency plan. Until information from such a real-world demonstration is available, it is impossible to make decisions on what level of preparation—short of the greatest level possible—could be adequate.

## **2. Monitoring Plans**

The AEWEC believes that MMS and NMFS should continue to require monitoring plans for all OCS activities undertaken during the fall bowhead whale migration, whether the bowhead subsistence hunt is in progress or not.

These monitoring plans should continue to be subject to stringent and independent peer review by scientists who are familiar with arctic waters and bowhead whale behavior. The North Slope Borough and NSB cooperating scientists should continue to be part of the peer review panels.

Finally, all monitoring activities, whether undertaken by MMS or private industry contractors, should be coordinated in order to maximize the scope and usefulness of the information gathered. For the same reason, each year's monitoring plan should be prepared so as to build on data gathered in previous years.

## **3. Seismic Operations**

While Northstar is focusing attention on production-related issues, on-going exploration activities, particularly seismic noise remain of great concern to our whaling captains and crews.

The AEWEC, a number of our Captains, and the North Slope Borough Department of Wildlife Management have presented extensive testimony and comments on noise effects, both in public meetings and in written form.

As noted above, our Captains have argued for a number of years that industrial noise, especially seismic noise, causes migrating bowhead whales to deflect offshore.

Our Captains also report bowhead whales becoming “skittish” and more difficult to hunt. Scientists refer to this

However, this information was given no weight in the conclusions to Chapter 9. In addition, the Corps neglected to include discussions of important research literature and results, including a great deal of information contained in its own Biological Assessment, Appendix B of the DEIS.

The continuing refusal by Federal agencies to take account of the information our Whaling Captains and scientists provide is a deep insult to our people and remains a very serious stumbling block to true cooperation between our communities and the Federal government and oil and gas operators.

## **4. International Whaling Commission Quota Regime**

Finally, the IWC quota regime is a critical part of our bowhead subsistence hunt today, regulating how many whales are available to our communities each year and providing for international oversight of our hunting activities and the environmental circumstances surrounding our hunt.

behavior as a “change in surface behavior.” What this means for our subsistence hunt, is that when there is industrial noise in the Beaufort Sea, the bowhead whale begins to become more difficult or even impossible to hunt before it is displaced offshore.

This impact does not show up in most research, because the research usually is done from airplanes and the focus is on location, not behavior.

It appears to us that the MMS has begun to pay a little bit more attention to this information and to the “traditional knowledge” of our people. However, overall Federal agencies have a very long way to go in understanding the true depth of our people’s knowledge of the Arctic, based on countless generations of direct experience.

We were extremely disappointed to see the almost complete lack of regard given to our people’s knowledge in the recent Draft Environmental Impact Statement (DEIS) prepared by the Army Corps of Engineers for the Northstar Project.

While the Corps clearly stated its intent to include “Traditional Knowledge” in its assessment of impacts, in our view, the Corps’ actual analysis and its conclusions fell far short of that stated intent. Instead, that traditional knowledge, when it was included, was either discounted or ignored in the final conclusions.

In Chapter 2 of the DEIS, the Corps acknowledged the superior understanding of the bowhead whale that our people demonstrated during the early years of the IWC quota regime. However, our superior understanding of the behavior of our bowhead whales and other arctic resources in the presence of industrial activity, and the threats to our resources and our traditional lifestyle from these activities were given no weight in the final analysis.

In Chapter 9 of the DEIS, the Corps provided a very cursory treatment of the impacts of industrial noise on subsistence resources and hunting. In this chapter, the Corps acknowledged statements provided by our Whaling Captains and North Slope Borough scientists concerning the serious impacts on bowhead whales and our subsistence due to industrial noise.

Under this regime, the bowhead whale subsistence hunt is regulated through a Cooperative Agreement between the U.S. Department of Commerce and the AEWEC, entered pursuant to the Marine Mammal Protection Act. Subsistence harvest levels for the bowhead are set pursuant to the terms of the International Convention for the Regulation of Whaling, 1949, and the U.S. treaty obligations are implemented through the NOAA/AEWEC Cooperative Agreement.

Under the IWC regime, the AEWEC is allowed to strike only a limited number of bowhead whales each year. For 1999, that number is 75. In addition, we must calculate an “efficiency rate” for our hunt each year and report it to the IWC.

The efficiency rate is the percentage of whales landed in a year from the total quota for that year. Therefore, every whale that is “struck but lost” during the hunt reduces the efficiency rate for that year.

When the IWC conducts its periodic review of our subsistence quota, it factors our efficiency rate into its decision on the level of quota that we will be allowed in subsequent years. If our efficiency rates drop, the IWC is inclined to reduce our quota.

When industrial noise interferes with our hunt and causes us to lose a whale, for any reason, that whale is deducted from our quota for the year and is factored into our efficiency rate.

The longer travel distances caused by displacement due to industrial noise not only increase the risk for our hunters, these distances also increase the risk that meat and muktuk will spoil or that a whale will be lost. If a whale spoils during towing, it counts as a “landed” whale and therefore does not reduce our efficiency rate. However, the whale also counts against our quota, meaning that the meat from that whale is permanently lost.

Similarly, if a whale must be cut loose because it is taken far from shore, and ice or weather conditions prohibit the crew from bringing it ashore, we have lost a quota strike. In this case, the whale meat is lost permanently and our efficiency rate is reduced because the whale is counted as struck but lost.

Again, if an attempt is made to take a “skittish” whale and the whale’s unusual behavior causes the crew to be unable to track it or to complete the take, that whale counts as a struck but lost whale. The meat is lost and the strike is counted against our efficiency rate for the year.

These events are all facts of life for our Whaling Captains. Our Captains do not always discuss them, because they are not asked about the quota when they are asked about oil exploration and development impacts. Also, we have learned to live with the quota—for now—as a fact of our life, just like the sea ice and the weather. However, just as the MMS and other agencies must take sea ice and weather into account when they evaluate the impacts of industrial activity on our traditional subsistence lifestyle, they also must take the IWC quota regime into account.

Given the potential for noise impact to completely disrupt the traditional subsistence bowhead hunt for at least one of our villages, it is critical that the Corps provide a thorough and detailed discussion of these noise impacts, including interviews with our Whaling Captains, the combined effects of noise and the IWC quota regime, and the references provided by the North Slope Borough to reliable literature.

## **CONCLUSION**

On behalf of the AEW, we appreciate the opportunity to continue to work with you on these issues that are so important to our people.

Thank you for the opportunity to make these comments.

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## **PRESENTATION BY BARROW WHALING CAPTAINS ASSOCIATION**

**Fred Kanayurak**

**President  
Barrow Whaling Captains Association  
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Good afternoon. For those of you who do not know me, my name is Fred "Simik" Kanayurak, Alternate Commissioner for Barrow and also the President of the Barrow Whaling Captains' Association. I am here as Alternate to Mr. Burton Rexford, Vice-Chairman of AEWK who cannot be here because of illness.

I was born in Barrow, and have been a whaling captain since 1985. Prior to becoming a whaling captain, my experiences as a participant in whaling activities started when I was about 11 or 12 years old. My late father, Bud Kanayurak, a whaler himself passed on his experiences and their great respect for the bowhead whale. My participation with my father, uncles, brothers, and other relatives have given me experiences to respect the bowhead whale, as well as knowledge of the treacherous ice conditions.

Bud Kanayurak, my father; Uncles Al Hopson, Sr., Steven Hopson, Sr., Lee Suvlu, Joseph Ahgeak, Ned Nusunginya, and other close relatives were highly respected leaders in our community as Native Village of Barrow councilmen and as whalers during the old days when we were not imposed with a quota system, and we had tribal or self management of our subsistence bowhead hunts.

In Barrow, there were 47 registered whaling captains in 1998. Each captain has a crew averaging five to eight persons. If you multiply eight times 47, you have 376 actual whalers in Barrow.

In 1997 we were struck by ice 50 miles wide. Crews drifted in the ocean and it took courage, leadership, and teamwork to recover the people and equipment.

In the past, the Barrow Whaling Captains Association has gone on record opposing all Lease Sales (both Federal and State) and exploration activities in the Beaufort and Chukchi seas. In fact, on July of 1997, the Barrow whalers and Barrow residents protested the MMS hearing on Lease Sale 170 held in Barrow, Alaska. Despite our objections and oppositions, the lease sales continue and now we have oil development in the Beaufort Sea.

Our whalers have testified and provided comments to communicate our "Traditional Knowledge." We know the ice

My name is Joseph Kaleak, the AEWK Commissioner for Kaktovik and representing the Kaktovik Whaling Captains' Association.

My first three-year term as the AEWK Commissioner for Kaktovik was from 1990 until 1993 and I served a second three-year term from 1996 to 1999.

conditions, how strong the ice is when it builds up in ridges, how the ice reacts to weather, how the sea currents carry the ice. Knowing these, we are concerned about man-made islands being constructed to drill for oil.

During the hearings on the Northstar Project, with the concurrence of our fellow Barrow Whaling captains, Eugene Brower, Van Edwardsen, and I made comments about accepting and respecting requests and testimonies made by our fellow whalers, if any seismic activities or drilling was to proceed. There were several whaling captains from Barrow that visited and observed the immediate environment of the projected Northstar Project. The presentation for the Northstar Project as well as the active oil spill recovery team by Alaska Clean Seas was very impressive. With more communications and education passed on to other whaling captains and mostly respect for the great bowhead whale, we came to conclusion that working together on possible offshore drilling could be made possible.

There are still lots of negotiations, understandings, precautions to be addressed and made acceptable to whaling captains as well as the community as a whole before the drilling activity could be fully accepted.

The bowhead whale is the vital marine resource that enhances our Eskimo culture, traditions, and activities year round. Without this great mammal, the Eskimos could not have survived in the Arctic.

I would like to share a map with you, showing where the Barrow whalers have harvested their whales in 1997 and 1998, both Spring and Fall for your information. The maps were made through the cooperation of the AEWK and the North Slope Borough, thanks to our fellow whaling captain Harry Brower, Jr.

Thank you for the opportunity to be a panelist for this meeting.

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## **PRESENTATION BY AEWK COMMISSIONER FROM KAKTOVIK**

**Joseph Kaleak**

**Commissioner  
Alaska Eskimo Whaling Commission  
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*Note: Mr. Kaleak was unable to attend and give his presentation in person.*

I was born in Barrow, Alaska, and I am married to Lucy Gordon of Kaktovik and have five children.

I started whaling when I was about 12 years old in Barrow with my father. Now I am a whaling captain, and have my own whaling crew. I have taught my crew and my family, so they could keep on whaling.



LGL Whale Feeding Habitat Studies started last fall. This project was conducted on the east side of Kaktovik. My observations and from the other whaling captains observations is that this project did not affect too much our Fall whaling during the open water season. That was because our subsistence whaling activities were done before they started on the Bowhead Feeding Studies.

The Kaktovik Whaling Captains Association would like to state that they do not like to see seismic or exploration activities in the OCS at any time, especially during subsistence whaling.

Our captains have made many statements and written many affidavits over the years explaining how the bowhead whales move away from shore and become harder to find then there is seismic or exploration activity. If we find whales, they are skittish. We have trouble tracking them because they do not swim in their normal way, and they are much harder to take because we do not know when they will surface or dive. This makes it very much more difficult and more dangerous for us to take our whales for our village. We think it is much better if seismic and exploration activities wait until we finish our Fall bowhead subsistence hunting activities.

Thank you for the opportunity to be here and discuss issues of mutual concern and transfers of information.

Subsistence is very important to us. We aim to maintain it. The AEWG is the only management authority in the entire United States that self-manages a marine mammal—the bowhead whale. There is no other management group like this within a native community that manages any other species. This is the first of its kind. We struggled very hard to work with the Federal government to let us manage the bowhead whale through cooperative agreements with the National Oceanic and Atmospheric Administration (NOAA). That was a great

**PRESENTATION BY  
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I appreciate the opportunity to talk to you today. I must apologize that I do not have a written paper like the rest of my colleagues. I was called to attend this meeting on a very short notice.

What I want to talk about are the experiences that we have had related to Outer Continental Shelf (OCS) situations, oil and gas activities, and also the current fights in the International Whaling Commission (IWC). The quota fights the previous presentations by the Alaska Eskimo Whaling Commission mentioned.

As a former mayor of the North Slope Borough—I am probably the only mayor that served three terms—I went through a lot of experiences with the Oil and Gas Divisions, environmental impact statements, the IWC, the AEWG, activities with the State of Alaska, the Department of Natural Resources, the Federal government, Minerals Management Service (MMS), and the National Marine Fisheries Service (NMFS).

We have gained a lot. We have come a long way. And I want to thank the MMS for having this Information Transfer Meeting with its focus on the future. I think what we are discussing here today including some of the scientific presentations, is looking towards that future.

The AEWG was formed as a non-profit association. They are constantly looking for funding to keep the organization alive. They also receive funding from the native corporations of the North Slope. AEWG has fought very hard from the beginning to deal with the quota that was placed upon us. It was very difficult for our people. We had never gone through this type of experience and had no national laws or state laws at that time. We were left alone on our own to survive and live the basic subsistence way of life. Now that the Alaska Native Claims Settlement Act has come into being, we have now changed into a cash economy. But in those days, we were in that subsistence life style.

undertaking. The AEWG has formulated regulations for the whaling captains to abide by. It has developed the cooperative agreement with NOAA. And they also developed cooperative agreements with the member delegates to the IWC where they are allocated their quota on a year-by-year basis.

We also needed to find out how many whales were literally out there. The IWC told us that our quota was reduced due to the endangered status of the bowhead whale. That is why we unified,

and worked with the North Slope Borough, worked with AEWG and the rest of the whaling captains and their associations, to go find out that answer. To take science into our own hands and to work with the professionals to find out those answers. And by God, like Mrs. Ahmaogak has stated, we succeeded. This was due to the cooperative nature of all of the people involved in the North Slope. I am glad that it happened because it helped us with the management of the bowhead whale.

To understand how many bowhead are out there, we must understand the 2-2 population. You have heard today reports of another study by the NSB Dept. of Wildlife Management. There are two stocks of bowheads. There is the Alaska bowhead that migrates across the Alaskan coastal areas near the 10 villages. There is another separate stock on the Chukotka side. The IWC often ask which stock are you referring to? Is it the Alaskan stock, is it the same stock? Or are there two stocks. So now we are starting to find out and do additional research and go above and beyond to answer the questions ourselves. Whether we are hunting the same stock or a different stock. We are working with the Russian natives too to find out the answer. It is a big undertaking.

These are the steps that we had to take as the AEWG. On the one hand, we are trying to protect our subsistence way of life and our subsistence bowhead whaling, fighting for our quota. In process we were involved in international politics where we meet and lobby all of the international members of the IWC, the Japanese, Russian, British, Norwegians. We were very successful using our science to justify sustainable whaling. We are fighting to keep our quota, to maintain our subsistence life style and also to do more studies in cultural and nutritional values. How many whales does the Eskimo really need to be able to sustain their culture and their nutritional needs. That was another scientific document.

But on the one hand we have to fight IWC quota and then on the other hand we have Lease Sale 140 and Lease Sale 170. We are trying to keep our oceans in tune and environmentally safe. We are doing everything we can to protect our shorelines. That is why the whaling captains are adamant about saying that

One of the other issues that we kept mentioning during the EIS process, was the need for OCS impact assessment. The city of Kaktovik near the Canadian border, the city of Nuiqsut, the city of Barrow, the North Slope Borough, and all of these governmental organizations kept giving public testimony of the need for coastal impact statements. Somehow, along the chain of command, it did not get into the draft EIS. Nor was there any need or any interest by anyone or government agency to introduce legislation to make amendments to the Outer Continental Shelf Act. Then they formed an Oil and Gas Policy Council a few years ago. They now recommend an amendment to the OCS Act to provide for coastal impact statements.

As you know the oil revenue is dropping right now, and the state of Alaska's revenue sharing formulas of are constantly coming down. Some of these city governments are almost bankrupt. And here they have OCS meetings going on, impact statements, exploration, production, now that we are dealing with production they have to constantly deal with this type of situation and impact to the communities. Where does the funding come from? From the State of Alaska? No. From the Federal

we do not agree with any OCS development. When we fight these OCS fights and make public testimony, it is frustrating. Through the years at public hearings, we have testified and submitted written statements. But when the draft EIS is issued—and in my personal view of it, it is poorly written—none of our statements are included. We go through the comment period. We keep hearing this issue about “traditional knowledge.” By God, there is traditional knowledge. We keep pounding on it for the EIS. But then when the final EIS, traditional knowledge gets left out.

We have worked over the years with the MMS. Worked over the years with the oil industry and the operators. We pounded on tables and asked why is this information on traditional knowledge left out? We just spoke about it at the draft EIS public meetings and provided public testimony. When the final EIS is issued, why isn't it in there? Whaling captain after whaling captain kept going to all of these lease sales and yet with then final EIS comes out, their statements are not written. Why?

It reached the point where the whaling captains in their frustration, did not want to attend any more OCS meetings. In fact at the last meeting, if you recall, on Lease Sale 170, the Barrow Whaling Captains boycotted the public meeting that was held for the draft EIS. The very fact that the information that they had publicly testified wasn't even included. So you can understand the frustrations.

But over the years now, we have come a long way and MMS has awakened. I have to commend them. It took a lot of pounding on tables. But now they are starting to see the light of how important traditional knowledge is to us and it is starting to be incorporated in their documents.

Let's talk about mitigation. How do you expect to mitigate something when we lose our subsistence way of life? What type of lifestyle are we going to live? What are the mitigation measures we are going to receive? A sack of flour, pork chops? There are a lot of social issues that need to be addressed. We constantly comment on it.

government? No. They have no one to turn to. So now the recommendation of the Oil and Gas Policy Council is to introduce legislation to provide coastal community impact funding for all of the city governments and non-profits, and also organizations such as AEWG to receive this type of funding. But what we do understand is that the funding that was there before goes to the State of Alaska but it never directly got into the local communities and used for public purposes for community impacts. It just went into the Permanent Fund.

These are some of the difficult experiences that we have worked on very hard. I wanted to comment on the monitoring programs that you have heard about today. I have attended a lot of those monitoring programs, especially the aerial and seismic. The EIS's are inconclusive as to how that seismic noise is affects the bowhead whales or how far they are displaced. We kept insisting on the need for monitoring programs. The need is there for good science to answer that question so that when I see a draft EIS it has conclusions, results, good scientific documents that are a result of the monitoring. I was one of those persons at the meetings in Seattle who said that we need quality scientific documents subject

to peer review. No one likes poor science that is inconclusive. We pay critical attention because we have learned about it. We manage some of it. But monitoring, I guarantee you, has to be done. We all need to protect. If we do all of our jobs together as professionals, biologists, or scientists, it must be a good quality document, because it is our fate out there. It belongs to the public and it has to be environmentally sound exploration and production.

Your assistance is needed. I am glad to be here as part of this Information Transfer Meeting. I am very honored to be here. We have worked so long in collaboration with the Dept. of Wildlife Management of the NSB, the AEWG, Arctic Slope Regional Corporation, and a lot of other organizations. We have learned a lot. We have come a long way. We are still going to be vigilant to whatever is going to happen in the future. We will be there to make public comment. Whenever we need to protect our interests we will be there. We are all connected, coordinated, and we communicate often. We are a tightly knit organization. I think it is going to remain that way but we want to extend it out to you. We want to work with the State of Alaska. We have done wondrous things by dealing with the MMS. Now they are starting to accept our statements in the EIS now. Even with the Incidental Harassment Permits that the NMFS issue to operators. We need to see these Conflict Avoidance Agreements written up between the operators and the whaling captains. That is why the Kuvlum litigation happened. Everyone wanted to be in the water at the same time with no rules, no communication, nothing. And here the subsistence whalers are trying to get their whales and the operators want to be out there at the same time as our subsistence hunt. We pounded on the table about Incidental Harassment Take permits issued to operators. We kept saying unless the Oiler-Whaler Agreement or the Conflict Avoidance Agreement is made by and between the whaling captains associations and the

A study of Beaufort Sea beluga behavior was conducted between 1993 and 1997 using satellite-linked time-depth recorders. Belugas were live-captured using seine nets and hoop nets and "tagged" in the delta of the Mackenzie River, Northwest Territories, Canada. Satellite-linked time-depth recorders and transmitters ("tags") were used to obtain detailed behavioral data, to study migration routes from summer to winter areas, and to study habitat preferences and habitat use. The results of these studies document summer and fall behavior of Beaufort Sea belugas. Most males tagged in early summer in 1993 and 1995 moved into the Canadian Arctic archipelago in August. A few still transmitting later moved westward into Alaskan waters. Fall migration routes into Alaskan and Russian waters were obtained from 10 animals. All generally moved westward across the Alaskan Beaufort Sea, ultimately reaching Wrangel Island in the western Chukchi Sea. Those animals that were tracked into November and December continued their migration south towards the Bering Strait along the coastal shelf of Chukotka, Russia. These results suggest that the fall migration route for Beaufort Sea belugas is along the Russian rather than Alaskan coast of the Chukchi Sea. All animals made frequent dives to depths of 400-600 m, some as deep as 1275 m. The tagged belugas moved rapidly through heavy pack ice.

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## **SATELLITE TRACKING OF BELUGA WHALES IN THE**

operators, do not issue that permit until there is an agreement. They have done that before. But we kept insisting to the NMFS, just hold you horses, don't issue that permit until the conclusion of negotiations for Conflict Avoidance Agreements in the OCS area. They took our suggestion! And along comes a successful Oiler-Whaler Agreement, or Conflict Avoidance Agreement with the operators, BP, Western Geophysical, whomever is the operator out there. And they have worked out great and avoided litigation. I think we need more of that. We have come a long way fighting for those items that we are so concerned about.

It has been a tough learning process. But we will still be here trying to work with each and every one of you. We thank you for the opportunity to be a part of this Information Transfer Meeting. I hope you go out of this room knowing that we gave you a message. We aim to work closely with you and we are going to be protecting our interests. We are here to help. I am sure you are too. Let's all make this a wonderful world to live in. Thank you.

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## **TAGGING AND SATELLITE TRACKING OF BELUGA WHALES**

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## **CENTRAL ARCTIC OCEAN**

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In Alaska, the Bering Sea population of beluga whales comprises four stocks, based on summering distributions and genetic distinctness. One of those stocks occurs in the eastern Chukchi Sea from mid-June until at least mid-July. In June, belugas may be located in Kotzebue Sound, and then they are thought to travel further north along the coast and spend time near Omalik Lagoon, approximately 75 km south of Point Lay, and along the barrier islands of Kasegaluk Lagoon, stretching to the north and south of Point Lay. It is a mystery where belugas travel once they leave the vicinity of Kasegaluk Lagoon.

During 26 June - 1 July 1998, in cooperation with the residents of Point Lay, five adult beluga whales were caught and satellite-tagged in Kasegaluk Lagoon off Point Lay. This included four males and one female ranging from 398-440 cm. The belugas were caught by entangling them in large-mesh nets set across channels in the lagoon. Once caught, a beluga was moved into very shallow water near shore where it was restrained with a small-mesh hoop net placed over its head. One-half-watt satellite-linked depth recorders (SDRs) were attached using two nylon pins bolted through the cartilaginous dorsal ridge. The SDRs transmitted data each time the beluga surfaced. These data were then received by earth-orbiting satellites.

Signals from these five belugas were received from 13-101 days. One male remained in the vicinity of Icy Cape, 80 km north of Point Lay, until the SDR stopped functioning only two weeks after tagging. Another traveled to Point Barrow, where its tag also stopped transmitting two weeks after tagging. The other three belugas made movements of more than 2,000 km, and reached 80°N latitude and 133°W longitude almost 500 km northwest of Banks Island. This required travel through 700 km of 9-10/10ths ice cover. Two of these whales then returned to the Point Barrow area along different tracks, followed by another trip to an area west of Banks Island at approximately 133°N. They spent several weeks here before once again heading southwest towards Barrow. The last SDR failed on October 7th.

This study by the Alaska Beluga Whale Committee demonstrates the benefits of cooperation between local residents

Aerial surveys of ringed seals (*Phoca hispida*) were conducted in the Beaufort Sea from Point Barrow to Barter Island during late May-early June 1996-1998 using previously established survey protocols. We surveyed approximately 9,000 linear km of transects covering an area of 7,449 km<sup>2</sup>, and sighted 6,154 seals in 3,582 groups. Estimated observed densities ranged from 0.36 seals/km<sup>2</sup> in sector B1 to 1.39 seals/km<sup>2</sup> in sector B4. Sector B4 had the highest density of total seals on both fast and pack ice in all three years. Only sectors B3 and B4 were surveyed in all three years, making among-year comparisons possible. In sector B3, the raw density of ringed seals on fast ice, based on standard strip transect analysis, was highest in 1998 (0.83 seals/km<sup>2</sup>) and lowest in 1996 (0.57 seals/km<sup>2</sup>). In sector B4, the density on fast ice was also lowest in 1996 (0.67 seals/km<sup>2</sup>), and similar in 1997 (1.17 seals/km<sup>2</sup>) and 1998 (1.16 seals/km<sup>2</sup>). On pack ice, the estimated densities were similar in all three years in sector B3 (0.81 to 0.92 seals/km<sup>2</sup>), but quite variable in sector B4 (1.17 seals/km<sup>2</sup> in 1996; 2.37 seals/km<sup>2</sup> in 1997; 1.57 seals/km<sup>2</sup> in 1998). Densities for sectors B3 and B4 in 1996-1998 generally fell within the range of estimated densities for 1985-1987.

During 1997 surveys, an additional observer collected data using line transect methods. Line transect analysis produced an overall density estimate of 0.90 seals/km<sup>2</sup> (SE=0.072, CV=7.96), with a 95% confidence interval for estimated density of 0.77 to 1.05 seals/km<sup>2</sup>. This was not significantly different than the strip transect density estimate of 0.89 seals/km<sup>2</sup> (SE=0.067).

Preliminary covariate analyses were conducted to examine the effects of weather and habitat variables on seal counts. Ice type and deformation, melt water, time of day, distance from shore and from the fast ice edge, and longitude were all found to affect the observed density. Cloud cover, date, and wind chill had

and scientists in conducting research in the Arctic. It has provided the first information on where belugas from the eastern Chukchi stock go after they leave coastal areas near Kasegaluk Lagoon. Similar cooperative efforts in the future can greatly expand our knowledge about belugas in other regions of Alaska.

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## MONITORING DISTRIBUTION AND ABUNDANCE OF RINGED SEALS IN NORTHERN ALASKA

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no significant effect on observed ringed seal density in these years. Seal counts declined as ice deformation increased. Predicted density was greatest at midday (1200-1300 hrs) and declined late in the day. Observed seal density increased with distance from shore and from west to east within the survey area. On pack ice, observed density declined with distance north of the fast ice edge. On fast ice, observed density was highest at intermediate distances from the edge. It is likely that the interaction of distance from shore and distance from the edge complicates this relationship.

We recommend that future surveys be conducted using standard strip transect methods described in the previous MMS-ADF&G protocol. Efforts to develop methods for covariate analysis should be continued.

This is a cooperative project funded primarily by the U.S. Department of the Interior, Minerals Management Service, with additional support being contributed by the Alaska Department of Fish and Game, the National Marine Fisheries Service, the University of Alaska, and the North Slope Borough.

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## MODELING THE SOUTHERN BEAUFORT SEA POLAR BEAR STOCK

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We modeled the female portion of the Southern Beaufort Sea polar bear stock with a Leslie transformation matrix using the best available life history and harvest data. Age-specific rates of reproduction and mean litter sizes were based on capture data. Age-specific survival rates were based on radio-telemetry. Harvest records from Alaska and Canada provided estimates of the size and composition of the harvest. We used the stable age population structure to start the model. We incorporated the annual variation and the measurement error inherent in the life history and harvest parameters by using bootstrapping and Monte Carlo methods to generate a set of parameters for each model year. We ran 500 iterations of the stochastic model for 30 model years. We modeled perturbations to the population by removing bears from the population in year zero. We also modeled latent effects by depressing cub production and survival over a number of years following the initial perturbation. Recovery time was defined as the model year when the model population regained the initial population size. Median recovery times from an initial removal of 30 bears ranged from 5 years (no latent effects), to 15 years (5% depression of cub production and survival over 5 years). Recovery times were strongly dependent upon the number of bears removed, the magnitude of the latent effects, and the persistence of the latent effects.

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## **POLAR BEAR RESEARCH IN THE BEAUFORT SEA**

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Polar bears (*Ursus maritimus*) occur year-round in northern Alaska. Recent analyses of data collected from bears followed by satellite radio telemetry have shown that polar bears occurring between Barrow, Alaska and the Tuktoyaktuk peninsula of Canada may actually be members of two different populations rather than one as previously suspected. Ongoing studies are assessing relative probability distributions of bears representing the southern Beaufort and eastern Chukchi populations. Pregnant female polar bears occupy dens from early November to early April in order to provide a mild microclimate for neonates. Half of the population occupies widely scattered dens on land. We now have developed a digitized map showing the highest probability land denning habitat in northern Alaska. This map will allow managers to avoid these important habitats as they plan land development projects. In limited tests, forward looking infrared has been 100% successful in seeing denning bears through the surface of the snow. This method, if results hold up through larger sample sizes, may be the most important management tool ever developed to protect denning polar bears. Additional tests of the system on collared bears will be attempted during the coming year. A new model for estimating numbers and survival rates of polar bears will soon be completed. Early results suggest larger numbers of bears and a faster rate of population growth through the 1980s than previous estimates. Paradoxically, that result contrasts with recent projection models based upon age structure data. We are presently trying to resolve that paradox. Polar bears may be an indicator of the overall health of the arctic marine ecosystem. They may, for example, be among the first species affected by habitat changes due to global warming or other large-scale phenomena. New studies evaluating changes in recruitment of polar bears and indices of productivity in ringed seals, their principal prey, are being started to assess future large-scale changes.

The U.S. Fish and Wildlife Service has conducted a comprehensive aerial waterfowl survey to determine distribution and trends of waterfowl breeding populations on Alaska's North Slope annually since 1986. This survey has been flown in late June and early July, which was appropriate for the primary target species (pintail ducks and greater white-fronted geese) and several other waterfowl species. This timing was not optimal for king, common, and spectacled eiders, the males of which typically depart the breeding grounds in mid- to late June. The brightly-plumaged males are used in the survey to indicate a breeding pair, as the drab females are not easily seen from the air. With the proposal to list spectacled and Steller's eiders under the Endangered Species Act, an earlier survey was initiated in 1992 to better address the eiders. The Eider Survey seems to be

## **MARINE MAMMALS: INCIDENTAL TAKE DURING SPECIFIC ACTIVITIES**

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Since the first geologic surveys took place on Alaska's North Slope in the late 1950s, oil and gas industry exploration, development, and production activities have expanded into polar bear habitat. ARCO Alaska announced a discovery at Prudhoe Bay State No.1 in 1968. This development led to the discovery and development of other oil fields; by 1997, 12 separate oil fields on Alaska's North Slope were producing. The entire developed area of the Prudhoe Bay oil field encompasses an area of 250 square miles. In 1981 the Marine Mammal Protection Act was amended to allow the incidental, but not intentional, take of small numbers of marine mammals during specific activities at specific geographical areas. The Fish and Wildlife Service issued implementing regulations to allow the incidental take of small numbers of polar bears and Pacific walrus during oil and gas industry activities on the North Slope of Alaska. The regulations allow the Fish and Wildlife Service to monitor oil and gas industry activities and polar bear activities related to that activity. After five years of regulations in place, incidental take regulations are reissued and monitoring activities reported.

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## **AERIAL WATERFOWL SURVEYS OF THE NORTH SLOPE OF ALASKA CONDUCTED BY THE U.S. FISH AND WILDLIFE SERVICE**

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generally well-timed for king and spectacled eiders, while the standard survey typically has higher numbers for the later-migrating Steller's eiders. Neither survey accurately assesses common eiders, which nest along the coast and on barrier islands. Population indices for 1993 to 1998 averaged 7,357 birds for spectacled eiders and 12,333 for king eiders, with no significant trend detected thus far for either species. These indices are observable birds extrapolated from a 4 percent systematic sample, with no adjustment for detectability or observer bias, as the required studies have not been conducted. Steller's eider indices (from the standard breeding pair survey) fluctuated widely about a mean of 1,339 birds, also unadjusted for detectability. We present also distribution maps showing relative breeding densities for each species. In 1998 we also conducted a survey to describe

the molting distribution of sea ducks in early August in North Slope coastal habitats. Molting activity, primarily of oldsquaws, along the Beaufort coast west of the Colville River was concentrated largely in Elson Lagoon, Dease Inlet, and Smith Bay, where we estimated approximately 53,000 oldsquaw ducks. Very few eiders (nearly all common eiders) were observed along the western Beaufort coast. Data for the Beaufort coast east of the Colville River has not yet been analyzed.

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## **SPECTACLED EIDERS IN THE BEAUFORT SEA: DISTRIBUTION AND TIMING OF USE**

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As part of the planning for offshore oil fields in the Beaufort Sea, e.g., Northstar and Liberty, several issues have been raised regarding potential threats to spectacled eiders (*Somateria fischeri*). These types of oil fields introduce potential impacts that have not previously been viewed as significant threats to spectacled eiders on the North Slope; e.g., marine oil spills; spills of other substances transported to, stored, or used on the drilling islands; and collision of migrating birds with islands or facilities. Evaluation of the magnitude of these threats necessitates knowledge of the distribution and timing of use of the Beaufort Sea by spectacled eiders.

Spectacled eiders make little use of the Beaufort Sea until the onset of molt- or post-breeding migrations. Departing eiders may be found in the Beaufort Sea continuously from mid-June through at least mid-September. Males depart rather synchronously in mid-June. Some may travel overland to the Chukchi Sea. Harrison Bay is the area within the Beaufort Sea of most frequent use; some birds may linger here for 7-10 days. While in the Beaufort, male spectacled eiders average 10 km

The objective of this study is to compile detailed information describing the locations, timing, and nature of oil and gas related and other human activities in the Alaskan Beaufort Sea between 1979-1998. This information will be stored in an ArcView database and an application will be developed to analyze and display this information graphically, particularly in regards to

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The study is still in its early stages and is scheduled to be completed in 2000. The resulting ArcView database is planned to be used to assess concerns expressed by subsistence hunters and others living within the coastal villages of the Beaufort Sea about the possible effects that oil and gas activity, particularly seismic activity, drilling, and oil and gas support vessel activities, may have on the behavior of marine mammals, especially the bowhead whale.

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## **DISTRIBUTION OF COOK INLET BELUGA WHALES IN WINTER**

offshore. Female spectacled eiders depart the breeding areas asynchronously. Birds leave the nesting areas from late June through mid-September. In contrast to males, most female spectacled eiders appear to migrate via the Beaufort Sea, transit it more quickly, and use areas farther offshore (average 20 km). For females, Harrison Bay area is also the most regularly used portion of the Beaufort Sea.

When the entire North Slope distribution of spectacled eiders is considered, it appears that most (between half and two-thirds) of the birds breed west of Barrow and thus probably never use the Beaufort Sea. Some of the birds from the western Arctic Coastal Plain (ACP)(east of Barrow) likely also migrate directly to the Chukchi. Most spectacled eiders from the eastern portion of the ACP appear to use the Beaufort Sea. There appears to be little use of marine waters east of the Milne Point region or of the coastal lagoons of the central Beaufort. The potential impact of greatest concern with respect to spectacled eiders would be an oil spill of sufficient magnitude (or lack of restraint) that substantial oil reached Harrison Bay.

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## **REFERENCE MANUAL AND GIS GEOSPATIAL DATABASE OF OIL - INDUSTRY AND OTHER HUMAN ACTIVITY (1979 -1998) IN THE BEAUFORT SEA**

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*Note: Mr. Wainwright was unable to attend and his presentation was given by Mr. Warren Horowitz of the MMS.*

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Beluga whales (*Delphinapterus leucas*) commonly occur in Cook Inlet during summer and autumn (May through October). However, little information is available on their distribution during the winter. Ten aerial surveys were conducted in Cook Inlet from 12 February through 14 March 1997. Some surveys were extended to include waters near the lower Kenai Peninsula, Shelikof Strait, Kodiak Island, and Yakutat Bay. Most of the survey effort was devoted to search surveys along and within about 3 km of coastlines; however, sets of parallel transects were flown in Cook Inlet, Kamishak Bay, and Yakutat Bay. A total of 160 individual beluga whale sightings were recorded during 9,406 km of survey effort; 150 sightings were recorded in the middle portion of Cook Inlet from the west side of Kalgin Island (60°20'

N) to just north of the East Foreland (60°50' N), and 10 belugas were recorded near the Hubbard Glacier in Yakutat-Disenchantment Bay (60°15' N, 39°33' W). Four other species of cetaceans were sighted: harbor porpoise (*Phocoena phocoena*), 30 individuals; Dall's porpoise (*Phocoenoides dalli*), 11 individuals; killer whale (*Orcinus orca*), 3 individuals; and fin whale (*Balaenoptera physalus*), 3 individuals. Other sightings included two pinniped species--Northern sea lion (*Eumetopias jubatus*), 594 individuals; harbor seal (*Phoca vitulina*), 450 individuals--and sea otters (*Enhydra lutris*), 784 individuals.

## **SEA OTTER (*Enhydra lutris*) POPULATION STATUS: COOK INLET, SOUTH ALASKA PENINSULA AND KODIAK**

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Sea otters in North America occur from the Aleutian Islands to California. More than 90% of the world's sea otter population can be found along coastal Alaska (Rotterman and Simon-Jackson 1988). Three separate stocks of sea otters have been identified in southeast, southcentral, and southwest Alaska. These stocks were determined to be separated by genetic differences or geographic isolation (Gorbics and Bodkin, in prep.). The worldwide population of sea otters in the early 1700s has been estimated at 150,000 (Kenyon 1969) to 300,000 (Johnson 1982). In the 19th century, extensive commercial hunting of sea otters drastically reduced their numbers. In 1911, international protection was given to the few remaining animals existing worldwide. It is believed that only 7 small isolated populations persisted in Alaska at the time of international protection in the following areas: the Rat and Delarof Island groups in the Aleutian Island chain; Bristol Bay, Sandman Reefs and the Shumagin Islands along the Alaska Peninsula; the Kodiak Archipelago; and Prince William Sound (Kenyon 1969). Numbers have generally increased and distribution has expanded since that time. Currently, sea otters occupy most of their historic range within Alaska, although there are some areas of discontinuity.

For the Cook Inlet, south Alaska Peninsula and Kodiak Archipelago areas, the following are the most recent surveys results available: (1) an aerial survey conducted in 1986 which included portions of the Alaska Peninsula including Perryville to Unimak Pass on the south side of the Peninsula resulting in an abundance estimate of 15,958 (C.V.=0.312) sea otters (Brueggeman et al. 1986); (2) a helicopter survey conducted in 1989 along the southern coast of the Alaska Peninsula from Cape Douglas to Castle Cape resulting in an abundance estimate of 8,445 (C.V.=0.155) sea otters (DeGange et al. 1994); (3) a small boat survey conducted in the summer of 1993 in lower Cook Inlet including Kachemak Bay resulting in an abundance estimate of 5,914 (C.V.=0.267) sea otters (Agler et al. 1995), and (4) an aerial survey of the Kodiak Archipelago conducted in 1994 resulting in an abundance estimate of 9,738 (C.V.=0.269) sea otters (Gorbics et al. in prep.). Additionally, in conjunction with the 1986 Alaska Peninsula abundance survey, minimum uncorrected counts were made of animals in the Sanak, Pavlof and Shumagin Islands providing an additional 1,877 animals. Combining these results in an estimated abundance of 41,932 (C.V. = 0.150) for the Cook Inlet, Alaska Peninsula and Kodiak Archipelago area.

Several categories of human-caused mortality have been identified for sea otters in this region. Although limited

monitoring has been conducted of the interactions between sea otter and commercial fisheries activities, it is believed that interactions resulting in serious injury or mortality are minimal (NMFS 1993). Coastal commercial or industrial development and increases in fishing activities including shellfisheries increase the potential for negatively impacting habitat used by sea otters throughout Alaska. Interactions of sea otters with nearshore discharge of seafood processing waste, oil and contaminant spills will likely continue to increase. Contaminants including organochlorine pesticides have been documented in sea otter habitat and sea otter tissues in several locations including Kodiak and Prince William Sound although the extent and source of this contamination is currently unknown.

Activities associated with the exploration, development, and transportation of oil and gas have the potential for adversely impacting sea otters and their habitat in Alaska. In southcentral Alaska, estimated mortality due to the *Exxon Valdez* oil spill is approximately 3,905 sea otters (range 1,904-11,157) spill-wide (DeGange et al. 1994). Ongoing research on the post-spill recovery of sea otters has found that densities of sea otters are up to an order of magnitude lower in areas of where oiling was most severe and persistent, and where sea otter mortality was high, suggesting that complete recovery has still not occurred (Holland-Bartels et al. 1996).



The average annual harvest by Alaska Natives (1989 to 1998) in the Cook Inlet, Kodiak and South Alaska Peninsula area for the past five years is 127 animals (Gorbics and Comerci, in prep.). This is substantially less than the sustainable level of harvest calculated by the USFWS (Gorbics et al. 1998) or the Alaska Sea Otter Commission, a coalition of Alaska Native hunters and artisans (ASOC, 1998).

Sea otter populations in these areas of Alaska are believed to be stable or growing. They are not listed as depleted or strategic under the Marine Mammal Protection Act or threatened or endangered under the Endangered Species Act.

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## **NORTH PACIFIC AND BERING SEA CARRYING CAPACITY: A HINDCAST AND A LOOK AT CHANGES AHEAD**

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The declines in sea lion and harbor seal numbers, as well as other top consumers, may have resulted from “top down” or “bottom up” controls. We used stable carbon isotope ratios in whale baleen as a means of testing the hypothesis that climate change has driven a decrease in ecosystem carrying capacity. Recent findings in both laboratory and natural environments indicate that the carbon isotope ratios of phytoplankton are an accurate measure of cell growth rates and by extension, primary productivity. Once incorporated into phytoplankton, the isotope ratios are conservatively transferred into zooplankton and then to feeding whales.

Baleen from bowhead whales feeding in the Bering Sea provides a multi-year record of isotope ratios in zooplankton prey and by proxy, the phytoplankton. By using baleen plates from 35 whales archived and recently taken by native hunters, an isotopic record was constructed that extends from 1947 to 1997. From this, we infer that seasonal primary productivity in the North Pacific was higher over the period 1947 - 1966 and then underwent a decline that continues to the most recent samples (1997). Isotope ratios in 1997 are the lowest in 50 years and indicate a decline in the Bering Sea productivity of 35 - 40 percent from the carrying capacity that existed 30 years ago. This decrease may have resulted from climate change leading to a shallowing of the North Pacific mixed layer and lowered advection of nutrients into the euphotic zone. It is also reflected in zooplankton biomass and is very likely implicated in the decline of marine mammal populations in the western Gulf of Alaska and Bering Sea.

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## **STUDIES OF ARCTIC KELP COMMUNITIES**

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During the 1997 open-water and 1998 winter seasons, BP Exploration (Alaska) Inc. sponsored an extensive survey of the Stefansson Sound Boulder Patch. The primary objective was to characterize potential Boulder Patch habitat in areas that could be affected by the offshore portion of the proposed Liberty Development. Specific objectives were to: 1) document the absence or presence of Boulder Patch communities at the planned site of a production island and on three candidate pipeline routes, and 2) estimate the distribution of Boulder Patch

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Dense populations of highly productive kelp beds are known throughout the marginal seas of the Arctic Ocean, reaching their maximum development at depths between 2 and 15 m. There are only a few dominant genera that characterize arctic kelp communities: these include *Laminaria*, *Alaria*, and *Agarum*. The occurrence of kelp is primarily limited to the availability of rock substratum, but where rocky bottoms occur, biomass can range from 0.4 kg/m<sup>2</sup> fresh weight in the Beaufort and Laptev Seas to 1.0-1.8 kg/m<sup>2</sup> in the Canadian Archipelago and Barents Sea. In cold sub-Arctic regions, standing crops of 10-40 kg/m<sup>2</sup> have been reported for kelp from parts of the Nova Scotian shelf and the northern Norwegian coast. Rates of primary productivity are high, and in many coastal areas kelp productivity equals or exceeds phytoplankton production, supporting rich and diverse benthic communities, such as the Boulder Patch in the Beaufort Sea, Alaska. Measurements of annual production in arctic kelp based on blade growth can range from 10-20 g/m<sup>2</sup> carbon in the Beaufort Sea to over 75 g C/m<sup>2</sup> in the Barents Sea and Canadian Archipelago. Variations in productivity are mainly related to availability of suitable substratum and underwater irradiance. Accurate determination of the distribution of kelp communities over large scales is limited to geophysical (side scan and multi-beam sonar) and ROV video surveys. Significant gaps in knowledge that relate to oil and gas exploration (e.g., in the Beaufort Sea) are associated with the impact of nearshore construction activities on kelp productivity and include: 1) more precise and comprehensive information on the distribution of kelp beds, and 2) the effects on sediment transport and re-suspension on water column light attenuation.

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## **SONAR AND VISUAL SURVEY OF THE STEFANSSON SOUND BOULDER PATCH**

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### **Overview**

habitat along fifteen North-South transects that encompassed a large region surrounding the project site.

### **Methods**

The survey program consisted of two phases. The first, conducted during the 1997 open-water season, included an initial dive calibration, an extensive side scan and multi-beam sonar survey, and an attempt to verify the sonar findings using a

remotely-operated underwater vehicle (ROV). The verification effort was hampered by extremely poor visibility in the water column, prompting additional ROV work to be undertaken through the sea ice in April 1998.

The equipment utilized for the sonar survey included a SeaBat 9001 Multibeam Echo Sounder, an EdgeTech 260-TH Side Scan Sonar system, an ISIS side scan sonar digital data acquisition system, and a Trimble 4000 RS GPS receiver. The side scan sonar system served as the primary tool for identifying areas of the sea bottom with the potential for supporting Boulder Patch communities. The multi-beam sonar system was employed to obtain bathymetric data along the track lines, and to map sea floor features that included apparent boulders. Both the summer and winter ROV programs were conducted using a Benthos MiniRover Mark II equipped with a video camera and underwater lights.

The sonar data were used to classify the sea bottom beneath each track line according to target concentration. Four categories were employed: "None", "Light" (less than or equal to 10%), "Moderate" (greater than 10% but less than or equal to 25%), and "Heavy" (greater than 25%). The latter two categories satisfy the requirement for hard substrate prescribed in the Arctic Biological Task Force (ABTF) definition of Boulder Patch habitat: "kelp attached to boulders in concentrations of greater than 10% in 100 m<sup>2</sup>." Visual verification in the form of ROV video footage was used to determine whether the requirement for kelp colonization also was fulfilled.

## Results

Of the 118 nautical miles of track line surveyed along fifteen North-South transects and three short intermediate lines in Stefansson Sound, 25% was found to contain target concentrations in excess of the 10% threshold specified in the ABTF definition of Boulder Patch habitat. An additional 10% was characterized by target concentrations greater than zero but less than or equal to 10%, while the remaining 65% contained no hard substrate. The heaviest target concentrations were found to lie to the north and northwest of the planned Liberty Island site. The ROV video footage confirmed the presence of kelp at all locations where the target concentrations exceeded 10%.

Between 1 July 1995 and 30 June 1998, the AFTC accessioned tissues from 243 marine mammals representing 20 species, as well as fish and marine invertebrate samples. Frozen tissue loans (n = 28) representing 375 individual animals have been made to ongoing research projects. Other investigators have visited the collection to study marine specimens. Cooperative agreements have been developed or continued with individual collectors and organizations, including the National Marine Fisheries Service, the U. S. Fish and Wildlife Service, the North Slope Borough, the Alaska Marine Mammal Tissue Archival Project (AMMTAP), and an ongoing Alaska Department of Fish and Game subsistence seal harvest project.

The present database structure is being modified to facilitate reporting on the status of projects supported by the Collection. Eventually the database will be congruent with architecture engineered at the University of California's Museum of Vertebrate Zoology thereby facilitating the sharing and joint development of programs.

## Conclusions

1. The locations and densities of Boulder Patch habitat derived from 1997-98 survey evidence general agreement with those reported by prior investigators. Factors that may have contributed to differences include a high degree of local variability in Boulder Patch density, and the availability of more capable sonar and positioning equipment for the 1997-98 survey.

2. Side scan sonar constitutes a reliable and cost-effective means of detecting Boulder Patch habitat, provided that "ground truth" verification data and factors that might preclude kelp colonization (such as insufficient water depth) are taken into consideration.

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## ALASKA FROZEN TISSUE COLLECTION AND ASSOCIATED ELECTRONIC DATABASE

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The Alaska Frozen Tissue Collection (AFTC) is the primary regional archive for frozen zoological samples and a major contributor to biotechnology studies of the North Pacific and Arctic oceans. It has become the world's third largest frozen tissue collection for wild mammals. In addition to expanding the scope of the collection by recruiting contributions of marine mammal, bird, fish, and invertebrate specimens from throughout the North Pacific and Arctic oceans, a collection of approximately 5,000 seals was incorporated. These specimens span three decades of field work by the Alaska Department of Fish and Game, and include samples from throughout Alaska's waters. This is the largest collection of western Arctic and North Pacific seals worldwide.

## THE ALASKA MARINE MAMMAL TISSUE ARCHIVAL PROJECT: AN ARCTIC ENVIRONMENTAL MONITORING RESOURCE

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The cryogenic archival of environmental specimens for retrospective analysis can be an important resource in environmental monitoring programs and for both present and future research on population genetics, pathology, systematics, and toxicology. The Alaska Marine Mammal Tissue Archival Project (AMMTAP) is a joint project conducted by three U.S. government agencies to collect and archive tissues from Alaska marine mammals. The project emphasizes the use of standardized sampling and archival protocols, procedures that minimize contamination of samples during collection, and maintaining a detailed record of sample history. Most of the animals sampled are from Alaska Native subsistence harvests; therefore, the project requires cooperation and collaboration with numerous Alaska Native organizations and local governmental agencies. Through AMMTAP, samples are collected for contaminant monitoring in the Marine Mammal Health and Stranding Response Program. In addition, the project has provided samples and/or data for many research programs, both inside and outside the U.S., on a variety of subjects, including: genetics research, the circumpolar distribution of chlorinated hydrocarbons in beluga whales, baseline levels of trace elements in tissues, the identification of arsenic and mercury species in marine mammal tissues, biomarker research, nutritional studies, and studies on potential human health effects of Alaska Native subsistence foods. The AMMTAP program and selected recent results are described.

### **NATURAL STABLE ISOTOPE ABUNDANCE AS AN INDICATOR OF MIGRATION IN ALASKA ARCTIC COASTAL PLAIN FISHES**

We have been conducting detailed studies of the biology of seabirds in relation to oceanography and forage fish ecology in lower Cook Inlet, Alaska, since 1995. This fortuitously allowed us to document biological effects of the 1997/98 El Niño Southern Oscillation (ENSO) in this region. Anomalously warm sea surface temperatures (SSTs) were observed in the Gulf of Alaska (GOA) beginning in June of 1997, but not in Cook Inlet until September, 1997. Warm temperature anomalies at the surface and at depth persisted until May of 1998, when temperatures returned to average in the GOA and Cook Inlet. Thus, temperature anomalies occurred outside the core window of productivity (June-August) for forage fish and seabirds in both 1997 and 1998. Abundance or production of phytoplankton, zooplankton, fish, and seabirds in lower Cook Inlet varied among years, and overall appeared to be depressed in 1998. We observed a few biological anomalies that might be attributed to ENSO effects: 1) a significant die-off of common murres occurred in March-May of 1998, 2) murres and black-legged kittiwakes were physiologically stressed during the 1998 breeding season, 3) breeding success was lower than usual at colonies in 1998, and 5) phenology of breeding was later in 1998 for both murres and kittiwakes. We presume that seabird die-offs, reduced productivity and delayed phenology were linked to a reduction or delay in food availability, but the mechanism by which

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A dichotomy in the natural stable carbon isotope abundance measured in tissues of obligate freshwater and marine fishes from the Alaskan Arctic coastal plain suggested that the methodology effectively differentiates recent freshwater from marine feeding in migratory fishes. Natural stable carbon isotope ratio of migratory fishes reflected differences of feeding habitat in relation to known life history patterns. Analysis of age-specific isotopic ratio differences in broad whitefish and Arctic cisco suggest that stable isotope methodology can be used as a tool for proxy analysis of fish behavior in present and future Arctic environmental monitoring studies.

### **COOK INLET SEABIRD AND FORAGE FISH STUDIES: BIOLOGICAL EFFECTS OF THE 1997/98 ENSO**

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anomalously warm water temperatures in winter reduce forage fish availability during the summer breeding season for seabirds is not known.

### **COOK INLET MUD IS SAFE TO WALK ON! OVER A MILLION SHOREBIRDS DO IT EVERY YEAR**

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Cook Inlet occurs between the Copper River Delta, a major spring stopover site for migratory birds, and the Yukon-Kuskokwim River Delta, a premier nesting area. The extent of intertidal habitats in Cook Inlet rivals that occurring on

both of these areas yet information on its use by shorebirds has heretofore been unavailable. From February 1997 to present we conducted an assessment of shorebird use of both vegetated and unvegetated intertidal habitats of central and upper Cook Inlet using a combination of aerial and ground surveys to document seasonal occurrence, population size, and critical sites.

Twenty-six taxa of shorebirds were recorded during the study, 17 as migrants and nine as breeders. The vast majority of all birds was recorded using unvegetated intertidal areas, primarily during a three-week period in May, but surprisingly the area was also found to be an important wintering site. During spring we recorded more than 1.5 million shorebird-days of use, primarily by western sandpipers (*Calidris mauri*) and dunlin (*C. alpina*). For western sandpipers we estimated that 25-40% of the global population used upper Cook Inlet. During winter virtually the entire population (~ 20,000 birds) of the nominate form of rock sandpiper (*C. p. ptilocnemis*) resides in upper Cook Inlet, which represents the northernmost wintering site for shorebirds in North America.

Shorebirds concentrated in certain bays within the Inlet. Southern Redoubt Bay was the most important site accounting for 51% of all birds recorded, followed by Tuxedni Bay (20%), Trading Bay (17%), and Susitna Flats (13%). The Western Hemisphere Shorebird Reserve Network recognizes three categories of important

shorebird sites (Hemispheric, International, and Regional) based on numbers of birds or percentages of populations supported. Cook Inlet as a whole qualifies as a Hemispheric Reserve, as would three sites within: Redoubt Bay, Trading Bay, and Susitna

Forage fish surveys were conducted in Cook Inlet and Shelikof Strait in 1997-1998 using hydroacoustics and net capture. The objectives of this study were to characterize forage fish schools and describe biological characteristics of forage fish species inhabiting areas adjacent to potential future oil and gas lease sales. The principal species collected by beach seine and Isaacs-Kidd midwater trawl were Pacific herring, surf smelt, eulachon, Pacific sand lance, and longfin smelt. The trawl was used to verify species composition of schools detected by

weight, sex, age, proximate body composition, diet, and hydrocarbon exposure (P450 RGS). Pacific herring juveniles were the predominant species collected. Preferred diet was Eurytemora, although barnacle cyprids were also consumed. Herring were smaller at age in Cook Inlet compared with other areas of Alaska, and in the late summer were in poor condition (low lipid levels). Several species showed elevated cytochrome P450 activity in both study areas, with no pattern identified. Results suggest that marine conditions may have been suboptimal for production of some forage fish species in this part of lower Cook Inlet in 1997 and 1998. This may have implications for production of forage fish predator populations in the region. Information collected will be used in future OCS leasing assessments in this region.

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## **RECRUITMENT AND SUCCESSION AFTER DISTURBANCES TO THE INTERTIDAL ZONE IN OUTER KACHEMAK BAY**

Flats. An additional two sites (Tuxedni and Kachemak bays) qualify as International Reserves while the Knik/Palmer Flats meet Regional Reserve requirements.

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## **BIOLOGICAL CHARACTERISTICS OF FORAGE FISH IN COOK INLET AND SHELIKOF STRAIT**

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This project evaluated recruitment and succession patterns of invertebrates and algae after they were removed from the intertidal zone during different times of the year. Multiple quadrats were scraped at each of three tidal heights on eight rocky habitat sites in outer Kachemak Bay. The quadrats were revisited throughout the year and percent cover data were collected and compared to control quadrats, or areas that were not scraped clear of organisms. The timing of barnacle recruitment (*Semibalanus balanoides* and *Balanus glandula* in high and mid-intertidal quadrats and *S. cariosus* in low intertidal quadrats) relative to the availability of bare substrate drove recovery rates for quadrats scraped on different dates. Colonization by the dominant algal species, *Fucus gardneri*, in upper and mid-intertidal quadrats were established. Multi-dimensional scaling (MDS) ordination plots show that scraped quadrats had not fully converged with control quadrats by the last sampling date in September 1996. Quadrats scraped in July and October 1994 ordinated furthest from control quadrats compared to those scraped in March 1994 and 1995.

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**DEVELOPMENT AND ASSESSMENT OF  
HAPTOGLOBIN FOR A SENTINEL  
SPECIES, THE PIGEON GUILLEMOT**  
*(Ceppus columba)*

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*Note: Mr. Duffy was unable to attend and give his presentation in person.*

There is a need to develop sentinel species to reflect changes in ecosystems. In these sentinel species, appropriate biomarkers must be characterized and current baselines delineated. Climatic changes and increasing anthropogenic pollution alter the magnitude and routes of exposure for vertebrates living in a variety of environments. After exposure to pollutants such as crude oil or metals, animals may exhibit either an immediate acute response or a more long-term chronic one. Both responses affect various homeostatic mechanisms in vertebrates. Secondary infection or tissue damage may lower the long-term survivorship of the organism and, if widespread, hold consequences for the population.

The use of the acute phase response and related proteins such as haptoglobin has been used as a biomarker of effect in mammals. The acute phase response includes fever and changes in the plasma concentration of several proteins that originate in the liver. The acute phase response is mediated by cytokines, such as interleukin-1 and interleukin-6, which are released by macrophages and other cells. The usefulness of acute phase proteins in birds had not been studied. Over several years, we studied the variation in haptoglobin in pigeon guillemots. Pigeon guillemots (*Ceppus columba*) are well suited as bioindicators of contaminants in neritic food webs because breeding pairs are widely dispersed and feed on nearshore demersal fishes. A dose-response study of pigeon guillemots showed small effects. Further baseline studies of wild populations as sentinel species and dose-response studies will improve the readiness of wildlife and veterinary specialists to interpret the effects of contaminants in the Arctic and how they may vary with global change. (Supported in part by IAB, CMI, and NVP.)

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**MINERALS MANAGEMENT SERVICE  
1970, 1980, AND 1990 CENSUS  
DATABASE**

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**Eric Larson\*, Virgene Hanna, Darla Siver,  
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The Minerals Management Service Census Database contains a broad selection of demographic, employment, income, language, migration, housing, and other data for Alaska places and regions from the U.S. Census of 1970, 1980, and 1990. The database incorporates roughly one thousand census variables for 353 places and twenty-five census areas. The documentation accompanying the database describes the format, source, and definition of each variable. Together, the database and documentation provide an easy way to look at trends in census variables for places and regions in Alaska over the last twenty years.

The database is organized into fourteen blocks. Each block contains a selection of related variables for all three census years. The data blocks can be accessed individually or matched together to combine several different types of variables. The data is available on diskettes and is formatted as data files from the Statistical Package for Social Sciences (SPSS). The data is also available as DBASE data files that are formatted for ArcView geographic information system (GIS) software. Using statistical analysis tools from SPSS on a PC with a Windows operating system, the variables can be displayed, analyzed, and printed in tables and graphs. Using tools in ArcView software on a PC with Windows, the data can also be displayed and printed on regional maps of Alaska.

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**ECONOMIC AND SOCIAL EFFECTS OF  
THE OIL INDUSTRY IN ALASKA,  
1975 TO 1995**

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More than 1,100 ships have wrecked off the coast of Alaska in the past 200 years. One of the greatest losses occurred in September 1871 when 32 whaling ships from New Bedford, Massachusetts stayed too long off the coast of Wainwright, Alaska and were crushed in the early ice. The ships were "parked" three to five abreast over a 20-mile stretch along the coast. These ships were at the end of their whaling season and carried cargos of whale oil and baleen. Michele Hope served as team archaeologist on the "Jeremy Project," the first scientific survey of shipwrecks offshore in Alaska. Scientists and students from the U.S. Coast Guard; U.S. Navy; Minerals Management Service; with additional financial support from NOAA, National Underwater Research Program, and the National Park Service undertook a survey in the Chukchi Sea off the coast of Barrow.

**Jim Calvin**

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The purpose of this seven-part study is to document the socioeconomic impacts of the oil industry in Alaska from pipeline construction in the mid-1970s through the 1986-87 recession and into the 1990s when oil production began to decline. The study focuses on the socioeconomic impacts on the state overall and on six specific areas: the Municipality of Anchorage, the Kenai Peninsula Borough, the Northwest Arctic Borough (NWAB), and within the NWAB, Kotzebue, Noorvik, and Kiana. The study, which is expected to be complete by mid-1999, includes seven research tasks.

Task 1 identifies in general terms how the State of Alaska spent the \$64 billion in total petroleum revenues it took in between 1975 and 1995. Task 2 addresses the impact of revenue on state institutions and infrastructure, such as education, public utilities, housing and transportation. In Tasks 3 and 4, oil industry contributions to non-profit organizations and activities are measured, along with an assessment of the impact of those contributions. Task 5 measures the employment and population impacts of oil industry activity in Alaska. The individual and household-level effects of oil industry activity are addressed in Task 6, including discussion of unemployment trends, household migration, labor mobility, bankruptcies, perceived changes in quality of life, and others. Finally, in Task 7, the study team will analyze Alaska lease sale planning options to mitigate economic fluctuations associated with oil industry activity.

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**CHUKCHI SEA ARCHAEOLOGY AND  
THE JEREMY PROJECT**

**Michele L. Hope**

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The team worked from August 22 to September 4, 1998 off of the U.S. Coast Guard icebreaker *Polar Star*. The team used an underwater remotely operated vehicle (ROV) developed by NASA and Santa Clara University using Mars Pathfinder technology to survey for wrecks from the 19th century whaling industry. Coast Guard and Navy divers were used to verify shipwreck sites located with the ROV. Shipwrecks are among the types of archaeological sites protected by Federal agencies under the National Environmental Policy Act process.

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**SOCIOCULTURAL CONSEQUENCES OF  
ALASKA OUTER CONTINENTAL SHELF  
ACTIVITIES: DATA ANALYSIS AND**

## INTERGRATION

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In 1995, the Division of Subsistence of the Alaska Department of Fish and Game (ADF&G) entered into a three-year cooperative agreement with the US Department of the Interior, Minerals Management Service (MMS) to continue the investigation of the sociocultural consequences of Alaska Outer Continental Shelf (OCS) development, and especially the long-term consequences of the *Exxon Valdez* oil spill. The study's major goals are to analyze and integrate subsistence, economic, and sociocultural data from two previous cooperative agreements with ADF&G and MMS, to collect unique information about socioeconomic change at the household and community levels for *Exxon Valdez* oil spill-affected communities, to cooperate with agencies and community and regional organizations in assessing the occurrence and implications of sociocultural continuity and change, and to effectively communicate study results to local communities and regional organizations. There were several major tasks: develop a database using the results of earlier ADF&G systematic household interviews; conduct a literature review to develop testable hypotheses about sociocultural change and continuity in the oil spill communities; conduct a time-series, multivariate analysis of the data base to investigate these hypotheses; prepare ethnographies of several communities of the oil spill area; produce a series of oral histories in a CD-ROM, Project Jukebox format in several of the oil spill communities; and prepare a final report. Work on the data base and literature review/hypotheses development has been completed. Drafts of three ethnographies are under review. The oral history products, developed in collaboration with the communities of Tatitlek, Chenega Bay, Nanwalek, and Port Graham, will be completed by mid-1999. A preliminary draft of the final report is due in April 1999. The project will conclude in September 1999.

## **EXXON VALDEZ OIL SPILL, CLEANUP, AND LITIGATION: A COLLECTION OF SOCIAL-IMPACTS INFORMATION AND ANALYSIS**

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The purpose of this study was to collect, organize, and synthesize all relevant social information associated with the *Exxon Valdez* oil spill, cleanup, and litigation that shows the effects on the environment, and to identify key social factors for analyzing the social information showing the effects to local communities resulting from the oil spill, cleanup, and litigation. Six key social factor categories were identified to classify and interpret findings: 1) context factors (including [a] biophysical environment and natural resource cycles and [b] event characteristics); 2) subsistence; 3) culture; 4) social organization; 5) social health; and 6) economic characteristics. A factor-by-factor analysis was produced to organize and synthesize major findings by key social factor category. The final comprehensive report provided a community by community summary of social impacts as found in the literature, and the differential distribution of social impacts seen is discussed in relationship to social factors. A summary of social impact "lessons learned" is provided on a factor by factor basis. An annotated bibliography and abstracts of the relevant literature was also produced and will be available on a searchable CD-ROM.



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## **AN ECONOMIC ASSESSMENT OF THE MARINE SPORT FISHERIES IN LOWER COOK INLET**

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constructed and are operating. Further work is being performed to refine the models, combine the final models into a spreadsheet that can easily be used by MMS, and write the final report. The project is expected to be finished within 6-9 months.

This study combines data from an Alaska Sea Grant funded study of marine sports fishermen with an input-output (I-O) model of the Kenai Peninsula Borough developed with funding from the University of Alaska Fairbanks and the Mineral Management Service. The Sea Grant study provides two important inputs for the MMS I-O model: expenditure data for sport fishermen fishing in lower Cook Inlet, and a predictive model of the determinants of sport fishing participation rates that will be used to explore the effects of changes in the physical or political systems that could affect changes in the total allowable catch rates for marine salmon and halibut. The I-O model will use the expenditure data to estimate the value of the Kenai sports fishery from primary and secondary effects. Income from the sports fishery is generated from expenditures on fishing, processing sports fish and support-related activities as well as income-generated expenditures. The participation rate model will be used to predict changes in fishing participation from changes in expected harvest. Ultimately, these changes will be combined with the expenditure data and the I-O model to project changes in income to the Kenai Peninsula from changes in expected harvest. Preliminary expenditure data has been tabulated and initial participation rate and input-output models have been

# PANEL DISCUSSION

## COMMENTS ON ALASKA ENVIRONMENTAL STUDIES PROGRAM

### *Processes, Programs, and Priorities*

**PANEL MEMBERS: Tom Albert, V.M.D., Ph.D., Vera Alexander, Ph.D., Patricia Longley Cochran, Cleve Cowles, Ph.D., Joy Geiselman, Ph.D., Glenn Gray, Ray Jakubczak, Ph.D., Susan Saupe, and Paul Stang**

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Before we start I wish to make a few introductory comments. Obviously we are opening a panel discussion on the Alaska Environmental Studies Program. Our objective is to examine the processes and priorities for essentially the next millennium, the next few years anyway. The Environmental Studies Program that Dr. Cowles is in charge of is responsible for the assembly of information basically to be used in the Environmental Impact process. I think most of you here have been involved in that process. As you are aware environmental impact assessments are really predictive documents that rely basically on historical information to evaluate the potential impacts of some proposed project in the future. It is imperative that we have the best data available to make those kind of predictive statements about proposed projects.

To provide that information over the years, the MMS has initiated and funded a lot of different programs covering a broad spectrum of studies over the last few decades. Today we have seen the progress reports from many of those on-going studies. I think it has been an excellent measure of diversity. We have seen everything from socioeconomic studies to physical oceanography to birds. That is kind of an on-going process that the Environmental Studies Program has to address.

This afternoon we would like to provide the opportunity over the next hour to receive input from the panel participants and from the audience on what they see are information needs for the future and items that might have to be discussed as far as key issues or decisions that have to be made, etc.

1. Since industrial activity in the Beaufort Sea is moving into development and production, MMS should take reasonable steps to help reduce the likelihood of severe stress between people of the North Slope, industry, and MMS. The stress level is always there. I think it has the potential to worsen unless we take some steps.

I will be introducing the panel members shortly but they have all been invited because they have participated in the program in the past. They have all been involved in acquiring this knowledge base and have specific knowledge of a variety of areas. We are going to begin this afternoon with a five minute talk from each panel member on what they see as the needs in the future. Then we will open for general discussion.

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### **THOMAS ALBERT, V.M.D., PH.D.**

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I have worked for the North Slope Borough for twenty years and have had a relationship with MMS staff people since even before MMS was "born". Having the opportunity to sit through the meeting, which I enjoyed, I have come up with the following recommendations. In the few minutes available I would like to quickly go over seven points that I would like to recommend to MMS.

By way of background, I think we need to point out for some people that the North Slope Borough and MMS relations over these many years have been less than even. Years ago, they were rocky at best. Now relations are pretty good. Those of you who were here a few days ago heard George Ahmaogak, former mayor of the North Slope Borough, and Maggie Ahmaogak, Executive Director of AEWC, point this out. Times used to be a lot tougher, now they are better.

But as offshore development progresses, I foresee a return perhaps to the old days of not so good relations. That is why I am going to make these seven recommendations which in my opinion may help MMS and the folks in the north maintain good relations so we don't go back to the old days.

2. It is important to continue to note the concerns of hunters regarding industrial noise particularly seismic noise and the impacts to fall migrating bowheads and to the fall subsistence hunt at Kaktovik, Nuiqsut, and Barrow. This is really important and I can't say too much about it. It is a real sore point.

3. It is important to document oil and gas related social and economic impacts on the North Slope particularly regarding social stress and subsistence hunting patterns. This is a follow-up to what the National Research Council recommended in their 1994 report and is noted in Dr. Cowles' Alaska Annual Studies Plan, namely that OCS activity affects the human environment.

4. Continue to use traditional knowledge in EIS preparation and in study planning and implementation. This should have been done years ago as hunters requested at numerous meetings over the years. It should have been done years and years ago. The ignoring of traditional knowledge has infuriated many people and thank God MMS is now paying a little attention to it.

5. Eskimo hunters of the North Slope have specific, traditional knowledge regarding the bowhead whale, sea ice, and other OCS relevant items. I recommend that MMS work with the hunters to select some aspects of traditional knowledge relevant to the OCS and then conduct studies to determine their validity. In other words, is this true or not true? We know that all traditional knowledge is not true but we also know that a lot of it is true. In this regard we have to remember that the Borough's bowhead whale census effort over about 18 years has validated five very specific aspects of traditional knowledge. Plus the recent site-specific monitoring studies around seismic operations in the Beaufort Sea are supporting what Eskimo hunters had said about displacement of whales, namely that distances are greater than what the early studies showed.

6. Since MMS has in recent years established cooperative agreements with the Canadian group and with ADF&G and with UAF/CMI, and since MMS environmental studies and the Borough research effort seem to have several common objectives, I recommend that MMS and the Borough discuss establishing a cooperative agreement regarding research. Obvious areas for cooperation pertain to the bowhead whale, assessing impacts to subsistence hunting, and documenting subsistence harvest patterns. I think this would be a good way to help reduce stress, shall we say, for MMS and the Borough to get a little more enmeshed.

7. Finally, since MMS is committed to the wide-spread dissemination of its research findings and since the people on the North Slope, particularly in Barrow, Nuiqsut, and Kaktovik, are affected by happenings in the Beaufort and Chukchi Seas planning areas, I recommend that MMS hold information transfer-type meetings each year in Barrow. The Barrow Information Transfer Meeting could be modeled after this one

I seem to be filling the role of the sole academic on this panel. So I feel compelled to give a statement in part that will seem to be appropriate from an academic based on people's prejudices about academics. We will try not to do too much of that and I will go on into a couple of comments on relationships between MMS and academic research.

First of all, I think I can speak to the OCS-type of assessment research fairly knowledgeably because I have been involved in it personally for a long time. I was the chief scientist on the first cruise to the southeast Bering Shelf during the OCSEAP program in 1975 on the *Discoverer* which was brought out of mothballs. So it has been a long history. I am also the longest surviving Dean in the University of Alaska system,

now being held in Anchorage. If there is a Barrow Information Transfer Meeting it should focus on studies and issues related to the Beaufort and Chukchi Seas planning areas, obviously. Sessions should use plain language with scientific jargon kept to a minimum. In other words, you need to inform the public. This Barrow meeting should be well advertised and broadcast over the local radio station, KBRW. There should be provision for adequate representation at the meeting for other North Slope communities, particularly Kaktovik and Nuiqsut. Some folks may be shuddering at such a proposal because there would be spirited discussions. But just by holding such a meeting on an annual basis, in plain language, MMS could take a giant step, in my opinion, to help reduce suspicions that a lot of people hold. The less you understand about something the more easy it is to be suspicious and resentful. The more people know about something, such as the Environmental Studies Program, which Dr. Cowles does a good job of running, the better off we are all going to be.

These are just a few things that I contribute to you.

**Cleve Cowles:** Thank you, Tom. Those are some exciting ideas. My first reaction is that the last two recommendations are things that I can act upon within the Environmental Studies section fairly quickly. I think we would definitely want to follow up on the idea of having another Information Transfer Meeting in Barrow. Perhaps holding a meeting in Barrow is something on which both agencies can cooperate. Certainly one of the challenges for us down here in Anchorage would be trying to figure out the logistics for such a meeting, in terms of availability of meeting space, etc. We would certainly want to get your help on that. I appreciate your comments and good ideas. I have thought about these things myself over the years as well.

It would be helpful for you and me to identify those on our respective staffs who could discuss and implement some of these ideas. I know the managers in our office will be supportive as well.

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## **VERA ALEXANDER, PH.D.**

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whatever that means. So I will start out with my more esoteric academic point of view.

There have been many discussions recently about the type of research needed in support of Alaska natural resources utilization and conservation. The debate often results in two end concepts: 1) you have to target important management problems so that you can address the development needs in the short run. In other words, as an extreme, you might say put all of your money in bowhead whales; or today, you might say put it all in sea lions—which is something you were hearing an awful lot about in connection with the Bering Sea right now. The other end of the spectrum says study that which will help you

understand the system so that whatever your problems in the future are, you will be able to address them more effectively.

The habitats are very complex. The biological interrelationships are very complex. Given the dramatic changes that appear to be happening in the marine environment surrounding Alaska, whether they are flip-flop changes of the sort the we heard from Dr. Proshutinsky or whether they are unidirectional, global warming changes, there are changes going on. We don't know whether they are going to flip back completely to a previous condition at this point, because they don't seem to be at first glance.

So I suspect that under those circumstances, the first approach is necessary but not sufficient. Even the second approach could be hard to apply unless you understand the response of the whole system and all of its complexity. So the question I ask was very well put actually in a draft report I just saw a couple of days ago. It was from a workshop held in Seattle led by NOAA dealing with what caused the unusual conditions in the Bering Sea over the past few years. That workshop asked three questions. The first two dealt with the mechanisms and research needed. The third asked given the large changes in the Bering Sea ecosystem, how do we manage marine resources in a fluctuating and highly variable environment.

So we could ask the same question, except reword it. How do we provide the knowledge needed in support of marine minerals development in a highly variable and changing environment? Put in this way, the depth and complexity of knowledge required becomes much greater and approaches what we think of a comprehensive and basic research.

I will end this part of my comments by saying congratulations to MMS because they have made a real attempt, especially the Alaska program, to make sure that good science is done in connection with their programs regardless of whether it is academics or others who are doing the work. I think that is being very well-addressed. All I can say is keep on in that regard.

The final item might seem like a negative. I think Dr. Cowles mentioned in his opening comments on Tuesday morning, that we have to match dollar for dollar the MMS funding. This leverage is often quite a challenge for us. But it has worked out wonderfully because we have become very imaginative in our definition of what constitutes "dollar for dollar." And in this regard we have help from the Barrow community in providing helicopters and manpower at times. We have had help from the Japanese government by paying for ship time. We have help from Alaska Dept. of Fish and Game. Any non-Federal source can be used. This has brought in more partnerships and involvement. So I think the whole program has been very much to our benefit. This kind of agreement and interaction is a good way to go.

**Cleve Cowles:** We tried to make sure that we distribute our Studies Plan to as much of the relevant academic community as possible. There is a limit as to how many documents we can send out and how many people really want to read them. Recently we put the current plan on our internet home page. I was wondering if you had received any feedback from the university scientists as to which of those they use and

The next part of my comments speak a little more to how the university can play a role in this. The university is not a mission agency. People say the university should do this or should do that. Actually, if you really want to be a pure academic, there is no "should" to it. You have really, in the research arena, two obligations. One is to advance your own particular area of knowledge. Move the field one step forward. The second, is to train graduate students to do the same. Those are the two things. So how does this really work when you want to address the real problems of the world?

We are in fact a state-assisted university, not even a state-funded university. We are barely state funded at all, for that matter. But we do have societal obligations. So I am going to bring in the Coastal Marine Institute. This allows us to contribute most effectively in this particular arena.

First of all three-way interaction in management among the university, MMS, and the state. Not only does this insure that the work that is done is of benefit to all, it also insures that people at the state know what we are doing. That we understand what the state's interests and needs are as well as MMS's. I think it has been a very good learning experience for me and for other people involved in this process.

The Coastal Marine Institute has an annual meeting with presentations by all of the principal investigators and their students. It involves the graduate students whether or not they are the speakers. It involves other faculty; even other administrators from around the campus walk in and hear what we are doing. It is a very valuable learning experience and a wonderful opportunity.

The other benefit of this for us is continuity. We can look at these programs and see where they fit into the overall MMS scheme and needs and either terminate, modify, or continue them. It allows for very good input from us and involvement of our principal investigators in the program.

do they have any other ideas for getting this information to them?

**Vera Alexander:** My feeling is that the web page approach is probably going to be more useful. I think that the written version is probably going to end up on peoples' desks until it is time to start thinking about where they might fit in and then they won't be able to find it. Probably they would use the web page a lot more. I think this is important though. This is something that I have not thought of. We need to get word out to them that it is there and remind them to look at it.

## **PATRICIA LONGLEY COCHRAN**

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Before I start my remarks, I want you to know that I really didn't copy any of Tom Albert's remarks. It just goes to show

you that we are thinking along the same lines because we had the same ghost writer and came up with a lot of the same recommendations and solutions.

The Alaska Native Science Commission was formed by the Alaska Native community to assist the Native communities in working with science and research across the State of Alaska. My recommendations are:

1. Establish community partnerships, much like the idea that Dr. Albert presented in cooperative agreements. We really feel that establishing community partnerships is essential, from the very beginning planning stages to the very end stages. Communities need to be involved in knowing what is going on from the very start. It will alleviate so many problems that have happened in the past if communities are active participants to begin with. This means also bringing results, etc. back to the communities.

2. Look at the information bases that are currently available. Things like the database that the Alaska Native Science Commission and the Institute of Social and Economic Research at the University of Alaska Anchorage have been working on for several years. We do have a contaminants in subsistence foods database that is available for public use. We are adding information to that database on a daily basis. We are working currently on our traditional knowledge and radionuclides project. That project is assisting in gathering traditional knowledge and local observations of issues of everything from environmental contaminants to health issues across the State of Alaska. We will be holding five regional meetings each year over the next three years. And gathering information from local communities and then putting that information onto our database. We are looking at setting up website for both of these. That information is the kind of

For those of you who are not aware of it, our Bering Sea Summit will be on March 16-20, 1999 here in Anchorage. It is a meeting of communities across the Bering Sea. In our Native world that encompasses everyone from the Aleutian Chain to Barrow. We look at how things impact everyone who is affected by the Bering Sea. We will have community representatives from all of those areas spending four days talking about conditions, problems, observations, recommendations, priorities within the Bering Sea.

**Chuck Mitchell:** Mr. Joel Blatchford seemed to be very frustrated regarding beluga whales in Cook Inlet. Would your organization be a vehicle for him to express that need?

**Patricia Cochran:** Yes, absolutely.

**Joel Blatchford:** Do all of you realize that oil spills will affect the beluga? I noticed that most results say that nothing will affect them. I wanted to know if the board would change their mind on that? An oil spill will affect the beluga.

**Patricia Cochran:** I heard your questions and understand that. I don't know that if any researchers are looking at that as a research topic.

**Joel Blatchford:** I would like to change your views on that. It affects a lot of people.

information that is really critical to making decisions about the kind of science and research that needs to be looked at in terms of community needs and desires.

3. Use community experts. I really recommend that MMS, as in the past, look to community experts and to expand their vision. We very often look to our elders and hunters, but often forget the gatherers: the women, the people who are working with the skins, the people who are living off of the lands. Rarely is that kind of information collected or taken into account in regards to research and science. When women tell us that their skins won't hold a crimp any more that tells us that something is happening in that skin. There are problems that are happening that only the women that are working with those kinds of issues will be able to relate to you. Remember to focus on the issues of those people as well.

4. Most importantly, look at community-initiated research. So many of the problems that we have within our communities are simply not seen outside of our world. Problems like Joel Blatchford mentioned with the beluga. If people had asked the communities what their problems were, what they saw as research concerns, it would be a much different story from what research and science sees. We must remember to look to the communities for community-initiated research topics.

5. I also want to reiterate the Alaska Native Science Commission's support and continued desire to work with MMS and provide whatever assistance we can in working with communities. If researchers and scientists are looking for projects, if they are looking for people to contact within communities, we are here to assist both our communities and researchers as well.

**Patricia Cochran:** In our reviews with communities, I can guarantee you that we will be taking all of the comments from local communities. We will be holding meetings out in your area as well. We will try to make sure that we gather all of the information, all of the concerns of the communities and present them to the appropriate people.

**Cleve Cowles:** There are a lot of parallels between what Ms. Cochran has suggested and what Dr. Albert mentioned earlier. We do try to look to the community for research topics. Sometimes I am sure they feel like they keep suggesting the same things to us and we go back and look at it again. Our staff are always available at these meetings. You can call our office when you have ideas, particularly when our Studies Plan comes out. That is a really good time to put forth idea for our staff to look at and potential use as a proposed study topic. We are aware that there are potential affects on beluga whales. Our staff are very familiar with the literature on what some of the effects were on cetaceans in Prince William Sound as a result of the *Exxon Valdez* oil spill. It is not that gigantic of a leap to think that there could be similar effects on belugas if there were spills in Cook Inlet. The refinements and distinctions between those species are anyone's guess. But those are some ideas that could be developed or looked at from a literature review perspective or proposed research. That is where it all begins. We get a study idea. We write it up. It gets reviewed by many people. We try to defend it to our headquarters who review these proposals and, on a study-by-study basis, decide whether or not there will be

funds available for this research. So it all begins with those kinds of ideas. Thank you for that suggestion.

## JOY GEISELMAN, PH.D.

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I think the U.S. Geological Survey would also like to acknowledge the significant contributions that MMS has made to science in Alaska by funding studies by our scientists as well as scientists with the university, state, and other Federal agencies. Over the past 25 years, there truly have been significant improvements in scientific understanding due to the MMS. We look forward to continuing to work with MMS on these studies.

As most of you may know, the mission of our Alaska Biological Science Center is to do research and provide biological information to the Department of the Interior, client agencies, and also the public. Like Dr. Alexander, I will say that

For the future, one of the studies that our staff is talking with yours on right now is to start some eider research and studies on the Beaufort Sea coastline. One thing that might be helpful for the audience and MMS to know is that right now it is possible to get on to the Internet and use what is called our "Science Information System." That is a system on the Internet to see what projects we are doing, who is doing it, how long the project is going on, what are the objectives. You can easily access that through our home page which "usgs.gov."

As for recommendations, it seemed like especially early on in the program much of the planning often tended to be top down with MMS and our agency through Headquarters. I think one of our recommendations would be to continue to work locally and right here in Alaska, specifically your staff and ours talking about what are the big-term causes of change and what are the big-term things going on with the ecosystem and then what are your short-term needs for information for specific decisions coming up. So the processes that tend to happen more down here at our level are the bureau information needs meeting that USGS has, even though, traditionally USGS and MMS have developed the program nationally. I think we, here in Alaska, want to step up and increase the coordination here in Anchorage. Of course our phones and doors are open and we are ready to discuss any of our studies with you. So I encourage you to keep the contact going here locally, especially.

**Cleve Cowles:** In the lobby there is a poster showing the steps of our interaction processes. We issue our Studies Plan. We then sit down at different times and talk with you. However, our interactions with your agency have been driven by the planning process as far as the schedule is concerned. I am wondering if there could be a better timing. For example, maybe the scientists at BRD may be in the field and maybe we are sending the plan over to you at the wrong time because our process is sequenced in time due to other variables. That would be another item to discuss besides getting the staff to interact

most of the scientists on our staff work in large scale programs trying to understand overall changes in our environment, trying to understand the ecosystems, and doing basic research. But under those large programs we do short-term tactical research projects for which agencies need specific information, perhaps on a shorter time frame. We have two levels of studies: we are doing large-scale studies to understand the large changes, but we also do tactical research to supply information that is more specific for agency concerns such as MMS, National Park Service, or the Bureau of Land Management.

We have about 70 scientists on our staff. We have core technical capabilities in fish, marine and terrestrial mammals, birds, and anadromous and marine fish. You have heard reports from a number of our scientists over the past three days: the studies by John Piatt, Bob Gill, Steve Amstrup, and Geoff York. We have other scientists on our staff that are doing work that probably MMS would be more interested in talking about with us that haven't been funded by MMS but again could be applicable. Some of the ones that come to mind are sea otter studies by Jim Bodkin, the coastal monitoring protocol developments by Gail Irvine, and the *Exxon Valdez* studies that other staff in our Center have been working on.

more, to relook at that "protocol," and see if we need to shift the phasing.

One thing that we have done in our office over the years is to meet periodically with the staff of other Interior Bureaus on a fairly regular basis. That group has been meeting on the topic of Traditional Knowledge over the past few years and we haven't gotten back to other topics. I think perhaps that is another item that I would talk about internally at MMS, scheduling additional meetings on a quarterly basis. That would be another way to initiate discussions with BRD and MMS a little bit better.

## GLENN GRAY

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It is nice to see so many people here at the end of a long conference. I am a member of the Technical Steering Committee with another state representative, Dr. Gordon Kruse, and with Dr. Alexander, Dr. Cowles and others on the Coastal Marine Institute. We review proposals for some of the MMS funding. When I am not reviewing proposals, my full time job is working with the Division of Governmental Coordination, specifically in the Oil and Gas Section. There we work with other state agencies, especially the resource agencies, the Dept. of Natural Resources, Environmental Conservation and Dept. of Fish and Game, to formulate state comments on projects or OCS lease sales.

I want to echo some comments that I have heard already. Dr. Albert said that he has seen sort of a new MMS with new outreach and some really genuine interest in hearing from folks.

I have worked in this position for about six and half years now, and I have really seen a tremendous change. I certainly appreciate that. In the beginning I had the feeling that "the state was there and we will tolerate you" to a real outreach and looking at us as equals, as well as other stakeholders.

I would like to also echo Dr. Gieselman's contributions. Looking through the records, long time before I got involved in oil and gas, you can see the tremendous contribution to science from MMS through its studies. In fact, just recently I got a call from someone in Canada looking for a study MMS had sponsored in 1984.

In this era of belt-tightening, I think it is going to be important for the state and Federal governments and others to work together to make sure that we are not duplicating efforts in our research and certainly in deciding what might be a priority.

I will pick a few studies or areas that I have seen that I certainly appreciate the research efforts from MMS. One might be the effects on whales and other marine mammals from development or potential oil spills. There are two studies that perhaps might get funded this year through the Coastal Marine Institute. One is how long it might take for oil to weather in the Arctic if there was a spill. We had a comment recently on the Northstar project that said we need to have more knowledge about that. Similarly, we heard from some folks in the North Slope Borough that they were concerned with under-ice currents. Just how those currents might distribute an oil spill. MMS is indeed working with the CMI and Dept. of Environmental Conservation to fund one of those studies. I appreciate that.

On the topic of traditional knowledge, I see a great effort by MMS over the last three years to try and incorporate traditional knowledge. That is easier said than done because as soon as you start looking at traditional knowledge, you might have someone from a science background saying how can you prove that someone is just telling you that they observed that. Or maybe they haven't told you the parameter that we need, the specific place, date, time or how that is different from the past.

I will just add my appreciation to Patricia Cochran. I know she is working a great deal on those concepts and trying to work out some of those issues. I think we have a long way to go on that but I am really glad that there is emphasis from MMS and others to at least ask those questions. Quite honestly, I think that sometimes the scientists forget that there are people out there that might have some information that at least might help frame the study or to find out whether or not the results are in line with what you might expect.

There are also some recent social and economic studies that are quite important. It is nice to see that those are on-going.

Regarding what improvements might be made, I might have a couple of suggestions. I am not really addressing this to Dr. Cowles because I don't know how you would do these.

First, engage the managers and the people on the line that are reviewing projects and making decisions, in the process of identifying what studies are needed. Perhaps they could help prioritize them. I am not sure quite how to do that because with

My next comment responds to something that Dr. Alexander said regarding the two types of people that look for research: those that are looking from more of a systems approach and those that are looking for management issues. I think she might have been speaking about me regarding people who want research to focus on management issues. I am always harping at the Coastal Marine Institute that we need to have studies that answer some of the management questions. But I must admit that I have great respect for Dr. Alexander and also understand and respect the need for studies that will help you understand the systems a little bit more.

My bias is for those studies that deal with management issues, those issues that come up during reviews of lease sales or of individual projects. And perhaps that is because I am either on the other end of a lawsuit or an appeal or someone on the phone screaming at me why don't we know more about this subject.

these days of low budgets a lot of these people are out there working full time plus just to get their job done.

A quick aside, before this meeting I sent out to 25 people the question of how is MMS doing on their studies. I don't know if they think MMS is doing a great job or if my turn around time was too slow or too quick, but I didn't hear back from one person. So I will interpret that as that you are doing a great job.

My second suggestion is that once you get the information is how to transfer that to managers. I think it is out there. I think the Web site is great. I am going to put that in our next oil and gas update that we put on our web page to take a look at MMS' web page.

I think in general we need to do a better job of making this information easily accessible to people. Some people just don't have enough time to read and long study and to try and figure out really what it said. Again, I don't know how to do that but it is just a suggestion of something to think about.

All in all, I appreciate MMS' efforts to include people and spend the money in Alaska to do these studies.

**Cleve Cowles:** When you were referring to getting the planning process more into the hands of managers, you weren't just meaning in terms of MMS, you meant agencies within the State of Alaska. I think one of the things that we can do is keep advising people that this plan is on the web page to look at.

Our process for prioritizing is pretty much handled within our own agency, within the managers in the region where we get together and work with the staff on up to the Regional Director trying to sort these studies out and decide which ones are the most important.

One of the things about that is that is augmented by the CMI process. We can go through that list of studies and ranked them from one to whatever. Then we may get some portion of the funds through that stack, but in the meantime, the university researchers can match their expertise to just about any where in the plan. We can achieve more of our priorities that way. The prioritization process is a difficult question. We have a pretty good way of working that within our office. I am not sure what

the answer would be to try and expand that but I encourage people to call or write to me or the Regional Director and tell us that you think a particular study is really important. Let us take that into consideration as we mull it over. We do that every springtime. That is how it fits in with the funding cycle for the Federal government. We are coming up with our priorities usually March or April. So the list out in the lobby will be reviewed in the next couple of months, and then we will come up with our rankings. So if anyone has any thoughts, please let us know and we will try and fit it in with all of the other information.

I thought I would take a minute to explain how we see the current situation. I was just looking at a production and price graph that goes back to 1981, in 1986 when we had the terrible price crash that precipitated all of the job losses and loss of people from the state, at the bottom, after the crash we were producing 1.8 million barrels of oil per day at a price of \$14.00 per barrel. Today, we are producing just over 1 million barrels per day, and the current spot price is \$10.15 per barrel. So we are bringing into the state, everyday, less than half as much revenue as we did at the bottom of the last crash.

How are we responding to that? You can see with the BP-AMOCO merger and the Exxon-Mobil merger, they are responding by trying to cut costs out of their operation units. In an extreme and almost a desperate way, in 1999 we expect to cut our overall capital spending by 30% at least. In 1998, we spent \$2 billion and in 1999 we think that is going to be down 30%. Not all but some substantial portion of that is going come from staff cuts which are going to be rolled out next week. Hopefully, I won't be participating in those, but you never know.

Enough on the gloom and doom, but that is the framework within which we are operating.

But what that says to me is that we have to become a lot more efficient in how we go about our environmental research. I see a couple of ways we can do that. I think probably the most important thing we can do is to make sure that all of us who work in this field are working together. We need to increase our collaboration on specific projects and to build partnerships to carry out our research programs.

A few examples of collaboration on specific projects: this last year BP and the North Slope Borough worked together to do a caribou calving survey on the Teshekpuk herd because people were concerned about potential leasing in the National Petroleum Reserve-Alaska. Currently, we are doing seal surveys for an ice road that is being built to the Northstar site. We have a monitoring requirement for that. We have several biologists from LGL out there. They called in and said this is great but are we sure we would be seeing seals if they were here? So I called my friend Craig George of the North Slope Borough and he sent out a seal hunter to show us how to find the seals. So sometimes the collaboration is on big projects and written agreements, but sometimes it is just getting someone out to show you how to do the research.

We also have some very valuable partnerships. One that I think was mentioned is the work that Dr. Amstrup of the BRD is doing on polar bears. We provided in-kind support to his efforts

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I think the central fact of life for us in the oil industry at the moment is the incredibly difficult price environment that we are facing. That is bound to affect our environmental research programs and, I think perhaps a bit later, everyone else's.

to develop new techniques to find polar bears in their dens so we can minimize potential interactions.

We are doing a similar program with Alaska Dept. of Fish and Game on grizzly bears. The North Slope Borough also plays a role in that in managing the handling of trash on the North Slope which is a major factor in bear distributions and potential bear interactions.

The MMS, of course, is going to be critical as we go ahead with the Northstar Project and hopefully Liberty after that, in doing the bowhead distribution work. We have a requirement from the North Slope Borough and the State of Alaska to do acoustical work so that we understand the noise that our operation is putting into the marine environment and to document the distribution of bowhead whales as they pass this facility on their fall migration. And to do that for as long as necessary to insure that we are not having a negative effect. We do a lot of that type of work on the seismic surveys. MMS does it much more broadly. It is important that we work very closely together if we are doing to do these kind of project efficiently.

One thing that I wanted to point out is that there is a role for regulators in allowing these collaborative relationships to build; that is to create the necessary flexibility in the language that they put into the regulations to allow scientists from various organizations to work together in the experimental design. In the case of the Northstar stipulation, the language actually says—and Glenn Gray called me on this just to make sure that we were comfortable with it—you have to measure the sound at “something like” 2, 4, 6, 8, 10 miles away. The “something like” is actually written into the regulations. Glenn called me up and said, “You know that doesn't sound like regulatory language and here at the state we thought we would take that out.” I said I think that is there for a reason. They were sending us a message that we need to work together to carefully design the study. Maybe it shouldn't be two miles, maybe it should be three. But the way we are going to respond to that is to work with the Borough and with the state and design the study so that it best meets their needs. But the language in the regulations has to be right in order to allow you to do that. If it is highly prescriptive, I think you can reduce the quality of the science.

So one piece is collaboration and cooperation. The other thing we need to do is focus our research on the right questions. I happen to think that they should be closely related to management decisions. The MMS, I think, should be focused on applied research and should focus on programs that lead to the right management decisions.



We should also focus our efforts on studies that are applicable to future developments rather than just to a single development in a single location. For example, we have done a lot of telemetry work on spectacled and Steller's eiders over the years. Recently we have decided to take a break from the field work on that in order to conduct a power analysis and see if the techniques that we are using can actually answer the questions that we are trying to answer. And then if we believe that they can, we will resume the field work. But it is often tempting, and I feel like we hear it in these kinds of meetings, that we need to collect data, that we need to continue long-term programs. I think those things are right, but I also think we need to ask ourselves if they are focused on the correct questions and if we are doing the studies in such a manner that we can actually answer those questions.

For example, the Boulder Patch mapping exercises were discussed yesterday. I would really like to see all of the Boulder Patch habitat in the Beaufort Sea mapped. But I think that before we decide that is where we should put our limited resources, I think we should make sure that we are asking the right question. Perhaps the question is whether Boulder Patch communities are rare or are they common?

**Joel Blatchford:** In 1992, I invited all of the oil companies to attend a meeting in the Federal Building to talk to us Natives about belugas. And no one showed up except Unocal because they had an oil spill that year down here in the inlet. How can we get better communication from the oil companies, at least from BP?

**Ray Jakubczak:** We make a big effort to distribute the results of our research as widely as possible. But we don't operate in Cook Inlet and as far as I know we don't have any plans to.

**Joel Blatchford:** But your main building is here and you are taking money from Alaskans to get our oil. It is pretty important to a lot of people, maybe not to you. A lot of money is invested. The state itself invests a lot of money in tourism. Most of the work should be where the work is needed. There is a lot of work needed in this inlet. The big oil companies make a lot of money from us.

**Glenn Gray:** There is a very high possibility that they will be taking a regional look at the Boulder Patch in the Beaufort Sea. What we are going to need is help from industry to compile some of the older data that has either been misplaced, lost, buried, or given to some contractor that doesn't know where it is. So you will probably be hearing from us in the next six to eight months. Any kind of results that we get, we will be sending them to you.

**Ray Jakubczak:** That is great. We appreciate it. But I don't think our contractors lose the data, do they?

**Glenn Gray:** You get so many contractors that you forget who did the work, where they are actually located, and what they are called right now.

**Cleve Cowles:** A lot of people are interested in Northstar and Liberty. I was wondering if you had any feel for what type

**Ray Jakubczak:** None of our environmental studies are proprietary in design or in results. That is a very important

of monitoring BP is going to sponsor or anticipated doing as part of its expected programs related to either of those projects.

**Ray Jakubczak:** For both Northstar and Liberty, whale and seal efforts are at the top. So we will be doing acoustical work and also fall migration bowhead distribution studies for Northstar. For the last couple of years and continuing through construction and into production for some time, we will do aerial surveys for ringed seals in the spring. We are looking for a change in distribution during or after construction.

Liberty is very close to the Boulder Patch. We have done side scan sonar surveys which was how we selected the potential pipeline routes. Then Larry Martin and colleagues from LGL actually went out and surveyed the route with an ROV so that we had visual confirmation to make sure that our route was not going to go through Boulder Patch habitat.

We will likely be doing some spectacled eider work in connection with Northstar. We will be developing a collaborative program with the Fish and Wildlife Service on that. We would like to know what happens to the spectacled eiders when they through nesting. How many of them go into leads near Northstar and how much time they spend? Then we will be doing some sediment sampling in connection with both projects as well. And probably some other things I haven't thought of.

Another thing I might mention are caribou surveys. Instead of looking at caribou distributions within a specific oil field, we have tried to broaden our caribou work across the Slope. We have found that they don't respect Unit boundaries very well. We get better information if we do a broader scale survey. So both Northstar and Liberty will be asked to pick up a piece of the cost of these slope-wide caribou surveys.

Maybe I should say a word on where we stand on these projects. We are currently constructing an ice road out to Northstar. That is done in the hope that the EIS will be completed on the current schedule of March 23, 1999 so that permits can be issued and the island constructed. We hope we are not building a road to nowhere. Then we will do very little work the following year because we have deferred for a year on construction of the modules. As you know we have been building modules at the Port of Anchorage and we are going to stop that work for a year. So that is going to create a three-year construction effort instead of a two-year construction effort for Northstar.

We have also deferred the Liberty Project. We have put off the plan to go to London and request funding from the Board for the Liberty Project. So that will slide at least one year in the schedule.

**Steve Treacy:** Does BP have something like the MMS Annual Studies Plan and is there some way to exchange these documents so we can be aware of what your plans are? I don't know how much would be proprietary and how much isn't. I guess the more we have in writing, the better able we would be able to coordinate.

policy that our company adheres to. We are happy to share with you our plans for studies for this year. Having said that, they are

somewhat in flux because of the price situation. So the plan that I give you today, may or may not be the plan that is carried out depending upon how specific oil field projects are moved ahead or behind in the schedule.

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I guess I am the only representative of a citizen's group on the panel. And as such since everyone else has covered the importance of involving local citizens, I am not even going to make that recommendation. I am going to move right on to what I have perceived as data gaps. I also think that I am the sole representative here that is going to put a plug in for Cook Inlet. I know it is relatively low on the priorities list. However, there are some issues that have been listed as high priority in the strategic plan.

I am addressing this not as a researcher, but as someone who was asked to make recommendations to a citizens group that is made up of city, borough, municipality representatives, and specific interest groups around Cook Inlet. I am asked to make recommendations to them on any scientific and technical issues relating to oil industry development and transportation in Cook Inlet which is quite broad range. Some of the concerns that are raised, I think, are blown out of proportion or there are misinterpretations by the public because there is a lack of data. So it is hard for me to make recommendations or to allay fears or concerns when I don't have any data.

I will point out what I think are major data gaps. First of all, I would like to say that one of our mandates is to conduct environmental monitoring to assess environmental impacts of oil industry operations in Cook Inlet. Over the years we have conducted our own environmental monitoring. Over time, based on our results, based on the results that MMS is reporting with their sediment quality study, the results of the EPA study, the results that Greenpeace and the Public Awareness Committee for the Environment (Pace) came out with years ago, and results from oil industry in their mixing zone application, I feel comfortable that our concerns in Cook Inlet are not related to chronic discharges from the NPDES permit discharges. So that will allow us to now maybe focus our efforts on the chance of

I think there are still some questions on fates and effects of oil. Glenn Gray mentioned needing to have better information on oil weathering. Also, I think especially for Cook Inlet and other areas, there is a lack of data on oil/mineral fine interactions. And then you can take that one step further to oil/mineral fine/dispersant interactions. What is the fate? How do you affect microbial degradation rates? Transport, do you make neutrally or negatively buoyant particles? Where would this get deposited? What is the dilution? If you were to disperse oil, how fast would it disperse out? Because I believe there are a lot of situations where dispersant use is preferable to letting even a teaspoon of oil hit the shoreline at some of these sensitive areas.

an acute impact, specifically related to an oil spill. That brings up issues of prevention and response.

Cook Inlet has some extreme environmental factors. The first of which is really incredible tides. Second, a high sediment load is coming in from the Knik, Susitna, and Matanuska Rivers and, right now especially, dynamic, broken ice. Imagine trying to respond in this kind of environment in the winter when you have dynamic, broken ice that is moving in these incredible currents that are caused by these incredible tides. You don't have a lot of response options. In the past, because of the lack of data, we felt that our hands were tied on some of the response options. For example, *in situ* burn guidelines we felt were too strict in terms of air quality. They had built in so many safety issues and safety distances, that made it an almost unuseable tool in the inlet. We felt, in the winter conditions, it should be the primary response option. Partially, as a result of funding from MMS-nationwide and the U. S Coast Guard, actual data was collected, they were able to refine the models, and *in situ* burn guidelines are less strict and more useable for an area like Cook Inlet.

Similarly, this year dispersant guidelines will come up for review. There is a lot of controversy surrounding dispersant toxicity, efficacy, interaction with mineral fines, and there are some huge data gaps out there that others are trying to assess. But I think response options relating to oil spill research is definitely a valid direction for MMS' Environmental Studies Program.

Probably the biggest data gap that I have encountered is the lack of physical oceanography data for Cook Inlet. MMS is conducting a study where they are mapping the locations of the rip currents with the purpose of being able to remove those from lease sale areas. I think that knowing where those rips are is a small part of the story. In terms of knowing the fate of spilled oil, either subsurface or using trajectory models, you need to know what is happening in the rips. What is the magnitude of shear forces? How can you model subsurface plumes, how can you model oil spill trajectories? How can you plan response options if you don't know where the oil is going to go? Currently there are three oil spill trajectory models. NOAA has one. We heard a presentation on the MMS COZOIL Model. Then the Cook Inlet RCAC has helped develop a model. Each one of them has their strengths and weaknesses. I think it is important that some agency take the lead in getting these modelers together to discuss the pros and cons of each of these models and the potential for integrating these models in different areas and making them useable for response organizations.

I would like to talk a little bit about the processes on which we were asked to comment. MMS has been very good to Cook Inlet RCAC. They provided Dr. Richard Prentki, as an ex officio member of our Board of Directors. He has been extremely helpful to us. They have provided logistical support when they were doing field work and we need less expensive vessels. I would like to see MMS continue supporting public participation. And by putting the Strategic Plan out for review several years ahead, has really helped other organizations do their own long-term planning and increases opportunities for leveraging funds.

**Joel Blatchford:** Since they haven't set up that model for the Inlet—Unocal said they can't even clean it up when I invited them to the meeting—even if the state couldn't clean it up, why did they open the Inlet up for leasing? If they can't prove that they can clean it up, why did they open it up?

**Susan Saupe:** The organization that I work does not decide whether there will be a lease sale or not. We do comment on them. We are involved in trying to evaluate response options for Cook Inlet. And I would have to agree with you, as far as Cook Inlet is concerned, it is a very difficult area to respond to.

**Joel Blatchford:** Even if a person goes out there to clean it up, the sediment in the water is really bad. You can wear a life jacket or whatever, and it is going to sink you down in two hours. If someone falls into the water, the poor visibility makes it extremely difficult to find him. I had to rescue one person and all we could find was a yellow strap from his vest. That was the only way we found him.

**Susan Saupe:** You are talking about the rips?

**Joel Blatchford:** Yes, you can have an oil spill over on one side, and then it can be right here in a couple of hours. That is how fast the tide moves. Is the state responsible for opening it up?

**Susan Saupe:** Cook Inlet RCAC has no say, so I guess that I would have no say.

**Glenn Gray:** After the meeting, I suggest you meet with Brian Havelock who works with the Division of Oil and Gas. There is a whole lease sale process and as far as I can tell, you may not like the answers in it, but it is quite inclusive of the comments.

**Joel Blatchford:** People keep saying that it isn't going to affect us. But it will affect us! You should shut down that lease sale because you are going to put a lot of hunters out of a life style that we live for. I don't want to see the inlet become like the St. Lawrence River, where they can't even eat their belugas. That is where I see this heading, a political ball game. It is going to hurt the Natives in this town. I have relatives in Seward, in Barrow. It is going to affect everyone. No one has done the research. ignore him.

**Walt Parker:** Has the CIRCAC taken an official position on dispersants?

**Susan Saupe:** No we have not at this point we do not have an official stance.

**Walt Parker:** The last oil and ice workshop we had was sponsored by CISPRES?, CIRCAC, the state, and Clean Seas in 1993. I am not aware that we have made any progress since that workshop as far as any major decisions that would affect response. So maybe we can pull together another one and at least reestablish the state of the art.

**Chuck Mitchell:** I would like to make a quick comment. While MBC hasn't made any responses to a spill up here, we do frequently in the southern California area. One of the things that always seems to be a source of frustration is that when there is a spill there never seems to be a well thought out response and

biological assessment plan already on the shelf. There is frequently a document that you can pull off the shelf that tells you who has to call whom and where the booms comes from, etc. It would make it so much easier if there was a document that stated how and what communities were going to be looked at, what is the methodology, all predetermined in quiet, calm discussions before the fact.

**Susan Saupe:** Actually that process is going on right now. In November there was what was called Planning Processes for GRP (Geographical Response Plans) and they are going to develop 30 GRPs for middle Cook Inlet. A GRP identifies specific response plans for specific areas and forces the state and Federal agencies, and the public to agree up front on a prioritization of where response efforts will be in the event of a spill. Which areas are most sensitive, how you would respond to it exactly.

I want to respond to what Dr. Parker mentioned. There was a dispersant workshop last spring. With a lot of the new tests that SINTEF and other groups have been doing in the North Sea trials, I think they are getting a better handle on these dispersant issues. But some of the questions still remain on area-specific questions, how they would respond to species.

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My main reason for being here was to listen. I think I have heard a lot that has been of value. I maybe can put all of the pieces together.

To start first with a comment that Ms. Saube made, that is that if people have a problem with oil and gas, part of it might be an educational issue. That depends on understanding the science so that you can explain to people how things work. If you don't do that, how can you convince them? That is a clear logic pattern, I can't disagree with it whatsoever. Unfortunately, things work a little differently in the Congress. There have been a number of areas removed from oil and gas leasing in the Outer Continental Shelf. Part of the rationale for that is that we don't know enough now and so hold off and when you know more. Then you could lease, in theory. In practice, what happens when an areas gets taken off the table or is cut back dramatically, the funds for the science studies get cut back in turn. So there is a little of a "Catch-22" there.

So that leads us to the point that you are going to be fighting harder for dollars in a area that is not the main focus. It won't be that you can't do it, it is just a harder fight.

Secondly, our program is changing and has changed dramatically over the years. The Alaska program is basically is operating in few areas right now. It used to operate in a lot of areas. Also it is changing in another way. After 20 years of leasing we are now working in developmental areas with Northstar and Liberty and others to come. So we need to internally adjust our ways of thinking and operating to accommodate use of all of our resources including the science program on those development projects.

That brings up some points that a number of panelists here have made—the need to have local involvement, in particular in the North Slope. Dr. Albert mentioned Native involvement in various processes. A number of others mentioned the need to work collectively. Of course you need to do that too. We need to work with industry. We need to understand what their efforts are and what ours are too. We need to understand what each of the groups here is doing and involved in and work together with the state and the NSB, and with the various commissions, etc. You get more "bang for your buck" that way.

Dr. Alexander mentioned keeping in mind the broader picture. Somehow we have to try to do that as well as the specific issues. Dr. Alexander also mentioned environmental

changes. In a sense that really complicates matters. If all of the research that we have been doing—and as I mentioned on Tuesday, Alaska has about half of the research money that MMS has spent over the years—if we are having such changes that is going to be difficult. What do you do? What do they mean? So it is a challenge to know what changes are real and what effects they have.

Dr. Jakubczak mentioned the oil prices. This is also relates to where you lease and where you develop. If the oil price goes down to a point to where we have less leasing or less development, then in turn, and I think Dr. Jakubczak made the point, that works into the system. That works into the congressional appropriations, etc. Therefore you end up focused on where you are operating rather than where you could or might be or where you might have been operating. That means a more focused Studies Program. A focus probably on the Beaufort. Uncertainty about the future for a variety of things, the price of oil, the uncertainty about environmental changes, etc.

Let me give you an example of where the focus might be a little different. Dr. Jakubczak talked about the monitoring program that BP is doing. We are having a meeting at MMS tomorrow on monitoring for the Liberty and Northstar projects. What can we do? What focus can we put? If you look at the array of priorities out there, monitoring efforts would be at the top of the list for the new starts in the Studies Program. To focus on those development projects that are coming.

What that means is a big challenge, I think, for all of us to make as an effective use of our dollars and our efforts, and energies as possible, and work collaboratively in order to continue maximizing the benefits we have in this program.

We have an advantage in the Environmental Studies Program. This is a program that over the years has gotten tremendous support through the Congress and the various administrations. This program was very strongly supported by James Watt and very strongly supported by Bruce Babbitt. So if you have a program that is supported on either end of the political spectrum, you really have an advantage. You might worry a little bit if they are both in favor of this program, but let's not worry too much. Let's say we have a real advantage and we think there are grounds for this program continuing and surviving in various budget climates and we can hope that will continue in the future.

I want to thank everyone who has participated in this conference for the contributions that they have made. I especially was pleased with the panel on Tuesday with the North Slope Borough residents told us straight what they thought, what they liked and what they didn't like. And what the people have contributed here today has been very helpful to me, personally. And I want to thank you.

**Joel Blatchford:** I was watching the television and they showed all the senators up there getting money for Alaska. One thing that got to me was that Alaska got \$750,000 to study grasshoppers. These guys can get \$750,000 for these schools to study grasshoppers, when I can barely get \$6,000 per year for a crew of ten! Something is wrong there. I agree that if both sides are picking money, MMS is going to get it. Here you have a "red flag" beluga whale out here that isn't receiving anything.

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## GENERAL DISCUSSION

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Everyone seems to think that that is okay. What are you guys going to do? Everybody heard it. \$750,000 for grasshoppers, that is a lot of money. We don't need research for grasshoppers up here in our schools. It is not an extinct insect. It is just like the ant, it comes and goes every summer.

**Chuck Mitchell:** It too bad you couldn't have been here yesterday. There were several talks on beluga whales.

**Steve Treacy:** One study was on the distribution of beluga whales in winter in Cook Inlet. So there is certainly interest in the species here. There are two studies dealing with tissue collection. One is the study that the Biological Resources Division is doing for MMS in the offshore. They have a number of excellent beluga tissue samples that they have collected in cooperation with the local hunters. Those have been stored and archived. Analyses have been run on those and there is a lot of good data as far as the contaminants that exist right now in the beluga tissues. So if something were to happen in the future, we would have some idea of what the backgrounds levels of contaminants. Another one is the tissue study through the CMI. They collect tissues from all types of animals, terrestrial and offshore. I am sure they have tissues there as well. We have been concerned about the species in the Cook Inlet and will continue to be.

**Chuck Mitchell:** It seems like over the years, we hear from the public at large, that come to the podium and say that this or that hasn't been done or that something hasn't been addressed adequately. Frequently it has been, but they are just not aware of where that information is. Certainly EISs or EIRs are voluminous documents. Is there any way we can make them more readable or an executive summary written more simply and more widely distributed?

**Paul Stang:** You touched my heart strings there. I agree that EISs can be difficult to read. Actually, some are very well written. We, at MMS, are trying to do something about that. The first effort on that will be the Liberty EIS, which MMS is doing. We are trying to write it in plainer English. We are trying to write it in a way that is more understandable. We are trying to write it more concisely. There is always a balance between writing something clearly and understandably, and writing something that is technically and scientifically complete and accurate. That is a challenge and always will be. My view is that the need for technical accuracy and completeness doesn't obviate the need for plain English. So we are working towards

**John Goll:** One important part of the equation that I have heard discussed is the integration of the engineering side of the house with the biological or science side. Because it is the engineering side of the house that will help to prevent oil spills, that will help to mitigate things. It is good to know everything with regard to biology, but if you put all of your money there rather than on the prevention side, you are not going to prevent accidents.

Dr. Albert mentioned learning from the Inupiat with regard to sea ice. There are a lot of engineering issues connected with that. But are there ways of getting good cooperation between the engineers and the biologists to get them to understand each other?

**Ray Jakubczak:** As a biologist who works in a company of engineers I am somewhat familiar with this. I am sorry to

that end. It will be interesting when we have another ITM in the future and people will have seen the EIS and can say whether they agree or not. I guess George Ahmaogak made that point quite clearly when he made his presentation on Tuesday afternoon. So we are definitely addressing it. Furthermore, after we started our process, the President said "You, bureaucrats, will write in plain English." We can say that we are already on that boat and moving forward.

**Cleve Cowles:** I wanted to mention another source of more readable documents. We have the Environmental Studies Program Information System (ESPIS) which has an abstract for many studies available. That can be accessed through the World Wide Web. I realize that even that is formidable because I have tried ESPIS at times, and it doesn't always answer my questions. I know there is an answer to questions about the Alaska Environmental Studies Program. We can get it for you by calling me or someone on my staff. So if you run into "technology frustration" and you can't find a report or can't find the abstract, our office can help you get the information.

When you have had a program that has spent as much money, we need to caution a little bit on that because about half of that money went into logistics. The other half went to science. We spent a lot of money, have a lot of studies, we have a good institutional memory. We like to have a few challenges to dig up information. So if there is anyone who is a little bit intimidated by that volume of information, I understand, our staff understands, and we will try to help you find it. We have most of the reports and if we don't have a master copy in our office, we can find it somewhere else. My phone number is (907) 271-6617.

The costs are a concern for us. We try to get help from as many sources as we can. For example, our studies that we consider cooperative, if we have someone to help us out with logistics, we look at that real hard and try to figure out how to get logistics shared. That is one of the biggest budget items of a study in the State of Alaska, getting the scientists out into the field. It is unique here compared to other states. We are up against that and we are trying to work around those kind of problems as best we can. The Cook Inlet Tide Rip study is a good example of how we are sharing our problems with others who can help us out in getting information in the field.

report that I do not have a definitive answer. I think we are getting better over time. One thing that is really tough for us is how to sequence things. It takes a long time to design a project and it takes a long time to permit a project. So the question is, how far do you push the engineering before you talk to the permitting agencies? Of course you want to do it early, but the downside to that is that you have to deal with a lot of design changes which are frustrating to the permitting agencies and staff. I think you have to talk together from the very beginning and all of the way through. We certainly haven't got it all figured out. But I think I do see, with each successive project, a real improvement. At BP we haven't done many new projects for a long time until the last couple of years. The recent ones have been Badami which is now operating, Northstar which is next on the horizon for us, and then some others that are further out. When I look at the project groups that are formed to do the engineering work on each of these, I do see an improvement.

Badami did a really good job but I see real improvement with Northstar and then the people that are starting to design and think about Liberty, improvement there as well.

**Tom Newbury:** I want to say something about the purpose or function of meetings like this. The purpose is the transfer of information, the exchange of information. Mr. Stang made the comment that the MMS program is likely to become more focused because of the progress from exploration into development. I see a need to continue to update information in areas where there are developments. We recently helped to write the Environmental Assessment for Northstar. Just because the assessment has been written doesn't mean that the flow of information stops. MMS and BP have on-going studies. There is going to be more information. I would like to see that information synthesized with the previous information. I would like to see meetings like this focused on those areas, updating that information. I don't think the meeting should exclude people outside of Anchorage. The meetings could be held in the North Slope also. It could be done at the time of the Alaska Federation of Natives convention when there are lots of other groups in Anchorage. I see a need there and I wouldn't like to see it left out.

**Steve Treacy:** Regarding John Goll's question about engineering and biological split, I think that within MMS itself there is at least one mechanism for doing engineering-type studies, which is our Technical Assessment and Research Program out of Headquarters. As we get into a more production phase, maybe we will find ourselves fielding ideas from our clientele of an engineering-type nature. While we may not be set up to do this, this other program is already in place and set up to do these types of studies. So maybe there is room for increased communication there where we can get assistance from that program to help out with some of our engineering problems in Alaska.

**Steve Amstrup:** I just wanted to reemphasize one of the points that some of the panel members made—that is regarding partnering in order to make the most of our cumulative resources. From my standpoint, I view myself and my project, and therefore the resource that I have been involved in for the last 20 years, as being a very significant beneficiary of significant partnering. In the early 1980s we got much unofficial support. It wasn't really formal support at that time.

**Chuck Mitchell:** I would like to add my support to that. We have found over the years in our group, that without partnering, it just cripples everyone. From the standpoint of the client, whether it be an oil company or another Federal agency, they don't get the information they need. Funds are wasted and we look like fools if you haven't integrated the program and cooperated together to use those resources that are at hand. It can be to everyone's advantage all the way around to cooperate on studies from the very start of the program in terms of study design, etc. through to the data analysis.

**Paul Stang:** I agree completely. At MMS we are smaller now and that makes it easier. But John Goll's priority is that we don't have two sides of the house, the Operations side and the Leasing side. We are all one, working together. It is easy to revert to the old, "I can handle it, I know best" sort of thing. But I think we are doing rather well. Hopefully, internally we are doing well and then we have to carry that through with our

from MMS, but substantial, unofficial support in the way of logistics. Dr. Cowles mentioned that half of what MMS does is logistics. You can't do the science without the logistics. In the first six years of my program, my budget was so small that I would have had very limited ability to collect any data on polar bears in the Beaufort Sea if it hadn't been for significant partnering albeit unofficial with MMS. And also partnering with Dome Petroleum, of Canada at the time. We did about a quarter of a million dollars a year worth of research for a Fish and Wildlife Service budget of \$100,000 because of the partnering with MMS. More recently, we are on the cusp of some real major breakthroughs of important applied research findings that have very significant management ramifications only because of significant partnering with BP in developing maps and getting significant logistical support to be able to stay out in the field longer, and with support from ARCO to be able to use their Twin Otter aircraft that has the infrared device that was shown in a video yesterday. Although we have small samples sizes, we have some significant results. We wouldn't have many of those things if it hadn't been for the partnering that my program has benefitted from. And I think in this day of declining budgets, certainly our budgets and our agency are smaller, at least my program budget is smaller than it has been for a number of years, if we don't more effectively share resources and continue to look for better ways of sharing resources, we are doomed. I want to emphasize that we just need to continue to do partnering and look for better and more effective ways of sharing resources so that we can get the science done.

cooperation with the state, industry, other agencies, the private sector, and Native groups.

**Chuck Mitchell:** How could we facilitate the exchange of traditional knowledge? I grew up in a fishing community. I can remember as a child the fishermen telling me that they could smell fish, etc. Thirty years later when I became a fisheries biologist, I suddenly found out that maybe you could smell fish and it wasn't all a story. How can we integrate that knowledge a little more effectively?

**Paul Stang:** I think that Dr. Albert touched on that. He said that we need to be together. MMS needs to go to the North Slope and work with the Natives. Others have mentioned talking with the women of the North Slope who have a perspective that often gets ignored.

**Patricia Longley Cochran:** One of the real frustrations in the Alaska Native Community is that we are sick to death of

being called “anecdotal information.” I cannot tell you how furious it makes us. We are trying to get to the point where people can see and understand that it is much more than that. Part of what we are trying to do is to document the knowledge that we know our communities possess. We are doing that in our project, using a process foreign to Native ways of passing on and sharing information. But we are trying to appease scientists as well. So we put the information that we gather into a database that will build up and create a viable source of information that validates, that tells the number of people who said the same comment, where this comment has come from, it dates it, it time lines it, it maps it. We are trying to get all of this data into one place so it is more than anecdotal information.

**Tom Albert:** Thank you for making that comment. I didn’t know what traditional knowledge was when I was back at the University of Maryland. I was always in the academic world where if you wanted to learn something about a new bird or a new area where you were going to go work, etc. you would talk to some professor or a colleague or you would go to the library, etc. I didn’t know what traditional knowledge was. Then in coming to the North Slope and spending a long time working there, I found out what traditional knowledge is.

Something that has bothered me a lot is that in meetings like this and in other forums, it is very common for much service to be given to traditional knowledge. Then you go out in the hallways and if you make the mistake of standing near the “wrong” group you hear snickers, etc., “who do they think they are?” The bottom line, “I am a great scientist and they don’t know what they are talking about. It is anecdotal.” I have heard a lot of those comments out in the hallways at various meetings over the years.

By the same token I have heard a lot of the people that I work with up on the North Slope who feel that all traditional

There is a scientific library, contributed to by many people here in this room about the Beaufort area now that didn’t exist 20 years ago. There is this other aspect of knowledge, anecdotal or whatever, but the fact is I think a lot of it is very true. I think that we could save a lot of money regarding something we really want to understand (the ice or bowhead whale, or whatever) by: 1) going to the library, and 2) sitting down with people who in their community are acknowledged to possess the highest degree of local knowledge about this subject and finding out what they have to say. Then one could design an experiment to try to figure out what is really going on. That is exactly what we did with the bowhead whale. Faced with an empty library and no great professors to turn to, 18 years ago, we turned to traditional knowledge. We just didn’t ask someone walking down the street. We went to the people in the community who were acknowledged by almost everyone as being the possessors of the highest degree of knowledge about this animal. We asked them very patiently over a couple of years, to tell us about this animal. They kept saying the same few things over and over. There were a lot of little extraneous things, but the same several things kept coming through about how the animals behave in ice. Experiments were designed, based upon the traditional knowledge, and have since proven correct the several basic points about bowheads that were so often repeated by the hunters.

I am sorry to give you “both barrels” on this. Don’t put down traditional knowledge unless you have some proof that

knowledge is chiseled in stone. The truth is someplace in the middle. There are a lot of things that some local people hold as “we think this is right” that are probably not right. But a whole lot of it, at least the parts that we have looked at and spent an absolute minimum of ten million dollars on over the years, has turned out to be correct. Now maybe the next thing we look at, from a traditional knowledge point of view, might crumble. That is why I suggested that MMS pick out some topic and do something about it. Frankly, I get tired sometimes of snide comments that some scientific people in private or out in the hallways make about the value of traditional knowledge.

One thing that struck me as very interesting, “how does traditional knowledge come about,” because I had to give a talk on it one time and I had to try to figure out what do I really think about this. Scientists, of which there are many in this room, are people who look at nature in a highly organized way and try to figure out what the universe is doing (whether it is in a drop of water or in a galaxy). The hunter people that I and Ms. Cochran and Craig George work with are people that spend a lot of time out hunting and in my view some are the holders of really profound traditional knowledge. This is because they spend their whole life looking at nature in a less intense way, with a much smaller magnifying glass than the average scientist has. If hunters don’t get it right over a period of centuries, they starve to death. So there is a lot to traditional knowledge. Before scientific data are fully documented, they are regarded as preliminary and when using such finding one often says, “don’t quote me on this, this is just preliminary, this is a draft.” I think that there is some traditional knowledge that, just like some scientific information, is preliminary or draft. What we need to do in frontier areas like the Beaufort Sea, where it costs millions of dollars to do things and there are animals at risk, is to take advantage of what traditional knowledge is relevant to the area.

what the person is saying is no good. I think traditional knowledge from highly respected people deserves a good look and not a derisive comment.

**Vera Alexander:** I would like to comment. After all, if we just look at the derivation of the word “science” it means knowledge. As long as it is good, it doesn’t really have to be any one or other kind. It is just that we have become a little prejudiced. So I agree with Dr. Albert.

**Cleve Cowles:** Those are certainly some excellent points. I think back, Tom, to the success of your early investigations and how you worked with the whale hunters in Barrow. One of our very first studies benefitted 100% from that input, that participation and really sharing of the work. I think that is one real good way that we can keep traditional knowledge having a real valuable payoff in the Studies Program is encouraging all of our scientists doing these studies to check with “home base” and be involved in the local communities and the whale hunters or the subsistence hunters, whatever species they are after to have their participation early on.

We encourage that through our contracts. At CMI they have encouraged all of their investigators to make that contact. We are continually trying to do that. It has been definitely an important part of our program. There are varying degrees of success. Some studies never leave a library. And those are the ones that are more challenging to make that connection. I think

the kind of work that Ms. Cochran is doing will help make those points of contact for those kind of studies too. We look forward to all of your comments on the proposed studies and think about going in the field or visit a community, maybe there is some way at some point to make that connection earlier.

**Enoc Schiedt:** My name is Enoc and I am an Eskimo. In 1954 my grandfather told me that you are going to talk in front of people that you don't know who they are and where they come from. Let me give you some background knowledge of natives.

On noise: our animals are very scared of noise. When they hear noise, they go down to the ocean or they run away if they are land animals. I will give you an example. There was a study being done in our area and we were hunting seals, the big seals, the oogruks (bearded seal). A plane went overhead 300 feet above us. I was crawling out to the seals. There was about 1,000 feet of flat ice. I wanted to get into shooting range. When the plane went over, the seals went straight down. I was just loading my rifle. Just think how I felt. This is a conflict for Natives. They don't want to go against the people, but there is a conflict now building up because we can't live with the noise any more. Because our hunting is so short, we hunt all year-round, but certain animals we hunt for only three weeks. Hold your progress for three weeks and you won't have any trouble from the Natives. Someone could do that. You are talking about millions of dollars, but we are trying to put food on our table.

My grandfather taught me when I was eight years old about different foods from animals from mammals to land. His

**Cleve Cowles:** I would like to thank the panelists. I really appreciate their comments. They have offered a lot. The ESP staff and others from our office are here. They have been taking notes. We have time to think about it. We will follow up as we can. I would also like to thank everyone for hanging in here and appreciate your contribution to this Information Transfer Meeting either as a speaker or a participant. I know many of you have come from a long distance. You have been very professional in your presentations and they have been very good. We are all very appreciative of it. Thanks again.

concern is when the blubber starts getting skinny means what the smaller fish eat, not what our animals were eating. Some Natives are natural biologists without going to school. We don't have anything written down and some scientists will not honor it because it is not written. But our knowledge is passed on in a verbal traditions. That is why Eskimos like to share what they have and we are not being heard by people. You guys will hear us but you are not hearing what we are saying. We are not being heard. My grandfather told me oil is very good up to a point. It is going to hurt the animals from both ways, from the sea and dropping from the air. Maybe his was talking about the jets flying over. Because if they go over, it is going to hurt the ice and we will have nothing but black ice in the future. We are seeing that this summer, when we were hunting seals there was nothing but black ice, about 80%. It is changing out there. We are even seeing iceberg ice up north. We could tell it is iceberg ice because it is all blue ice. We don't have all blue ice. Even the people from Shismaref called me up and asked if I had ever noticed the iceberg. This summer it was the worst of all time. You people have to start studying different things and talk to the Natives and the Elders. You have to hurry up and talk to the Elders. Every time we lose an Elder, we lose knowledge. So if you want to come to the Kotzebue area and talk to the old people and get knowledge, I will gladly take you out there and translate for you. What he was talking about the seals, the walrus, the polar bears, the whales and the beluga, you watch them. If the blubber is going down you have to worry. From 4 inches of beluga blubber is down to less than 3 inches now. The main problem is going to be noise and oil.