OCS Study
MMS 85-0084

PROCEEDINGS

The First Annual Alaska OCS Region Information Transfer Meeting

Bering Sea Region

May 29-31, 1985

Prepared for

Minerals Management Service
U.S. Department of the Interior
Anchorage, AK

Prepared by

Lawrence Johnson & Associates, Inc.
4545 42nd Street, N.W.
Suite 103
Washington, D.C. 20016

October, 1985

Minerals Management Service
Contract Number 14-12-0001-30195

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NOTICE

PREFACE

On May 29-31, 1985, the Alaska Outer Continental Shelf (OCS) Region of the Minerals Management Service (MMS) sponsored its first, annual public Information Transfer Meeting (ITM). The ITM focused on the results of recent studies and related topics and their particular implications for offshore oil and gas exploration and development in the Bering Sea Region.

The meeting was comprised of eight sessions and included presentations on oceanography and meteorology, industrial development, studies on interaction of OCS activities and marine resources, ecological and fisheries studies, resource utilization, lease sale conduct, and government responsibilities. The presentations featured 57 speakers from government, industry, and academia reviewing their investigations and major findings. Each half-day session was followed by questions and discussion from the audience,

This document is a summary of the 2-1/2 day meeting. It is organized to correspond with the conference proceedings, beginning with a summary of the opening plenary session and followed by a chapter on each session. Each chapter begins with an identification of the chairperson and presentation topics, followed by summaries of each presentation. (The appendix includes the list of speakers and attendees.) The last chapter covers the closing session; it includes general questions about the MMS Environmental Studies Program, oil and gas exploration activities, along with their answers.

These proceedings do not provide a verbatim transcript of the meeting but are intended to highlight the main points of each presentation. Further detail on a specific research effort mentioned here can be obtained through MMS *or* the appropriate Principle Investigators.

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Jerry Imm
Chief
Environmental Studies Section
MMS Alaska OCS Region

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OPENING PLENARY

Purpose

The purpose of this first Information Transfer Meeting was to present to all interested parties the results of studies and available information on offshore oil and gas expl oration and devel opment in the Bering Sea Re gion. Study results from the oil and gas industry, the fishing industry, the State of Alaska, and other Federal agencies were shared. The information presented will assist the Alaska OCS Region in meeting the requirements of the Nati onal Environmental Policy Act (NEPA), derivation of policy and procedures, and further developing the Regi on's study agenda.

The Bering Sea was chosen as the first focal area because of its importance to the search for domestic energy supplies. Subsequent ITMs will focus on oil and gas development in the Arctic Ocean, and the Chukchi and Beaufort Seas. Details on next year's meetings will be announced at a 1 ater date.

OPENING REMARKS

by Alan D. Powers
Regional Director
Minerals Management Service
Alaska OCS Region

Welcome, again, to the first Information Transfer Meeting (ITM) for the Alaska OCS Region and to the first ITM held outside of the Gulf of Mexico.

We are focusing on oil and gas exploration in the Bering Sea because of its importance to the search for domestic energy supplies. While the outcome of these explorations in frontier areas is very uncertain, we believe that continuing the search is important in that domestic discoveries will reduce our reliante on imports. This, in turn, has important economic and national security effects in this post-oil embargo era. That is why all four presidential administrations since the early 1970s have shown strong support for domestic energy programs.

This ITM will make clear the scope and detail of information-gathering activities relsting to the Bering Sea. It will give interested parties an opportunity to participate in discussions of important topics dealing with oil and gas leasing, exploration, and development in this area. It will also serve as an opportunity for our regional staff to hear about the information that has been gathered and, therefore, help us to formulate study plans for future years.

In addition to the opening and closing plenaries, there are nine sessions focusing on such topics as oceanography, industrial development, marine mammals, and fisheries. We appreciate your participation in the ITM and hope you find the specific workshops useful.

PAST AND PRESENT OF FEllERAL
OFFSHIRE OIL AND GAS LEASING IN ALASKA

by Robert J. B rock
Regional Supervisor, Leasing and Environment
Minerals Management Service

Past Leasing Activities

Leasing activities during the last 11 years have been conducted in three areas in the Alaska OCS: the Gulf of Alaska Area, the Bering Sea Area, and the Arctic Region. (A map of the Alaska OCS areas is provided in Figure 1.)

A summary of the activities in each area is provided below:

Gulf of Alaska Area - The offshore program began in this area with Sale No. 39 *in* the Gulf of Alaska. The *lease* sale, scheduled for 1975, was final ly held in April 1976. Subsequent sales in the Gulf of Alaska Region were Cl, Sale No. 60 in Cook Inlet, 55 in the Gulf of Alaska, and two re-offerings. MMS has issued 212 leases and, as of April 1985, 21 of them were in an active status. Total bonuses accepted for those six sales were $1,072,635,368. Twenty-five holes have been drill ed, plugged, and abandoned. Sale No. 88, which was scheduled for last summer, has been postponed indefinitely because of lack of industry interest in that area.

Bering Sea Area - The three sales in this area are Sale No. 70 in . George, Sale No. 57 in Norton Basin, and Sale No. 83 in Navarin Basin. MMS has issued 318 leases, all of which are still active. The total of the bonuses accepted in these three lease sales was $1,260,649,533. In additi on, 13 wells have been drill cd-- 3 i n Norton and 10 in St. *George.* All have been plugged and abandoned.

The Arctic Region - In this region, which includes the Bering Strait around to the Canadian border, MMS has had three lease sales-- the first Federal Joint Beaufort Sea Sale, Sale No. 71, and Sale No. 87. MMS has issued 372 leases, all of which are still active. MMS has accepted total bonus bids on these three sales of just over $3,411,183,800, To date, 9 wells have been drilled, and one commercial discovery has been announced on Seal Island.

Today, for the entire Alaska region, a total of $196 million has been spent on the studies program for research, 902 leases have been issued, and $5,744,468 ,701 in total bonuses have been accepted. (The figure does not include the rent payments.) Thirty-eight exploratory wells have been drilled, and one discovery has been made.

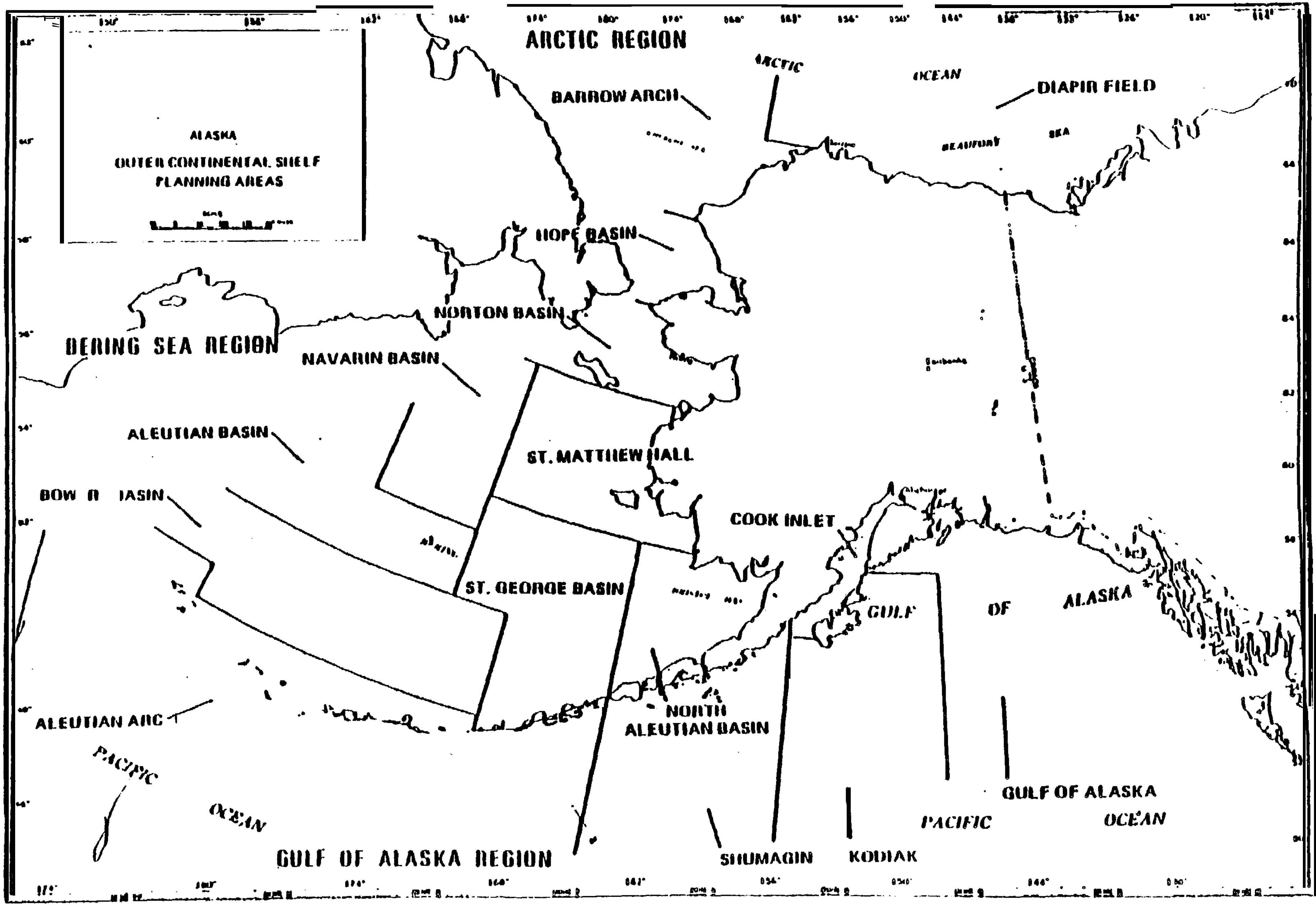
MMS Future Leasing Activities

The f oll owing activities are planned for the next 5-year schedule:

Gulf of Alaska/Cook Inlet

One sale is planned in Shumagin. Study plans have been initiated and the Call for Informati on requests will be issued i n November 1985. Exploration plans in Shelikof Strait and in the lower Cook Inlet have been approved, but no drilling is anticipated.

MAP OF ALASKA OCS



Bering Sea

s that most of the activity for the next couple of years will take place here, as is evident below:

- St. George September 1985 The second St. George sale is scheduled for September 1985, and the proposed notice of sale is out for review.

- The North Aleutian Shelf Basin (Sale No. 92) - The final should be published this summer. The public hearing process for the second Norton Sound sale has just been completed and the final EIS is being prepared. As a result of the original sale, MMS has approved one drilling permit and a second one is pending, so there could possibly be some activity there this summer. For the second Navarin Basin sale, MMS has completed the scoping and is in the process of preparing the draft EIS. As a result of the first sale in the Navarin Basin, MMS has approved four drilling permits so there could be some activity there this summer also.

- Arctic Region (Beaufort and Chukchi Sea)- For the first Chukchi Sea sale and the next Beaufort Sea sale, MMS has completed the scoping and is starting to draft the EIS. In addition, MMS has approved one drilling permit and two applications in the Beafort Sea. Consequently, there could be some activity here this summer.

REGIONAL TECHNICAL WORKING GROUP -
ROLES AND RESPONSIBILITIES

by Nancy Swanton
Regional Technical Working Group
Minerals Management Service.

The Regional Technical Working Group (RTWG) was established in 1979 as one Of three types of committees of the National Outer Continental Shelf (OCS) Advisory Board. The other committees, the Scientific Committee and the National OCS Policy Committee, are national in scope; the RTWGs, as the name implies, are more regional in scope.

There are six RTWGs nationwide: three for the eastern United States, one for the Gulf of Mexico, one for the Pacific (excluding Alaska), and one for Alaska. The function of the RTWGs is to advise the Director of the Minerals Management Service (MMS) about technical concerns and issues regarding Federal offshore minerals leasing in a given region.

The Alaska RTWG has 17 members. The Director of the Alaska OCS Region and a representative of the State of Alaska co-chair the group. Federal agencies represented on the RTWG include the U.S. Fish and Wildlife Service, the National Oceanic and Atmospheric Administration, the U.S. Coast Guard, the Environmental Protection Agency, the Department of Defense, and an agency selected by the Alaska OCS Region. The remaining members are selected from the private sector. They represent local communities, the commercial fishing industry, the petroleum industry, environmental groups, and petrol cum-support industries.

All members are appointed by the Secretary of the Interior for a 2-year term. Each Federal agency member is nominated by the local director of the agency; non-agency members may be nominated by anyone. In selecting individuals, the effort is retie to achieve a balance of representation, and a range of technical expertise and knowledge relevant to OCS-related activities in Alaska.

The Alaska RTWG provides a forum for exchange of information *related* to OCS leasing. It helps to identify and clarify various technical issues pertinent to offshore minerals resource management. It also is a source for comments and suggestions about various MMS program docunents, as well as regional environmental studies recommendations. The Alaska RTWG normally meets three times per year. The meetings usually coincide with Federal offshore leasing activities for which RTWG comments are desired.

GEOLOGIC SETTING AND RESOURCE POTENTIAL OF THE BERING SEA REGION

by David A. Steffy
Geophysicist
Resource Evaluation
Minerals Management Service

The Bering Sea is truly a frontier area. The expanse and the extreme environmental conditions have in some ways inhibited petroleum exploration of this remote region. The earliest petroleum exploration wells in the region were established in the late 1950's on the Alaska Peninsula and eastern Siberia. To date, 10 wells have been drilled on the Alaska Peninsula and 30 in eastern Siberia. Although a number of oil and gas findings have been reported, none have suggested a discovery of commercial size. Six COST wells have been drilled in the Bering Sea since 1976. Geologic information released by MMS about these wells, except for the North Aleutian No. 1 well, represent the first non-proprietary subsurface data available from the shelf basins. Post-sale exploratory drilling on leased acreage has occurred in the Norton Basin (7 wells) and St. George Basin (10 wells). Ultimately, all 17 were plugged and abandoned. As of August 1985, 7 exploratory wells were drilled in the Navarin Basin, of which 2 were reportedly plugged and abandoned.

Geophysical surveys have located eight major tertiary continental shelf basins in U.S. Bering Sea water: Chirikov, Norton, St. Matthew-Hall, North Aleutian, Amak, St. George, Pribilof, and Navarin. These basins occur mostly in the broad, flat, gently-sloping shelf areas which have water depths of less than 600 feet. In addition, there are the Aleutian and Bowers Basins. The latter are two deep-water tertiary basins found in the Aleutian Plain area of the Bering Sea in water depths greater than 14,000 feet. Finally, there is the Umnak Plateau, which rises about 4000 feet above the abyssal Aleutian Plain at the juncture of the Aleutian Ridge and the Bering shelf.

Inner-shelf basins-- Norton, Chirikov, St. Matthew-Hall-- formed as pull-apart basins in response to Late Cretaceous-early Tertiary movement along the Kaltag fault. Over 14,000 feet of layered, Tertiary marine and non-marine elastics have filled Norton Basin, whereas only 5000 feet are found in the other two basins. The source rock potential is discouraging for the inner-shelf basins. However, Norton Basin is mature enough to produce hydrocarbons if some source rock is present. The hydrocarbon potentials of the Chirikov and St. Matthew-Hall Basins are less than Norton Basin because of their thinner cover of Tertiary fill.

The forearc basins were formed in the Late Cretaceous-early Tertiary period in response to the oblique subduction or transform motion between the Kula and North American plates. The North Aleutian, Amak, St. George, and Pribilof Basins are filled with Up to 40,000 feet of marine and non-marine, coarse-grained elastics and volcaniclastics. The Navarin Basin is filled with over 36,000 feet of marine and non-marine fine-grained *elastics,* predominantly mudstones. The forearc basins show a better potential to produce economic accumulations of hydrocarbons than the inner-shelf basins because of the encouraging results from the drilling in the adjacent Russian forearc basins (Anadyr, Khatyrka) and from the COST wells drilled. Thermal maturity, timing, traps, and seals do not appear to pose serious problems at this time.

Reservoir quality is the most important limiting factor in the Navarin Basin, whereas the lack of source rocks is the biggest problem in the St. George and Pribilof Basins. Reservoir quality and possible source rock problems are present in the North Aleutian and Amak Basins.

In the deep-water basins-- Aleutian, Bowers, Umnak Plateau-- there are good hydrocarbon source rock potentials, but the potential for thick prolific reservoirs necessary for economic potential is low.

IDENTIFIED ISSUES OF CONCERN ASSOCIATED WITH OCS LEASING IN THE BERING SEA

by Tom Boyd
Supervisory Environment Specialist
Minerals Management Service

OCS leasing in the Bering Sea region has been ongoing since 1983. Each of the past lease sales has begun with the preparation of an environmental impact statement (EIS). The initial step in the EIS preparation is termed "scoping" which is defined as the identification of significant environmental issues that are to be investigated. At that point, issues not considered significant are eliminated from the area of consideration.

The primary means of identifying the most significant environmental issues is to solicit input from the citizens of local areas about resources and activities that potentially could be affected by leasing. Input is also solicited from State, Federal, and local government agencies; environmental groups; the oil industry; the fishing industry; and the general public. Such information is obtained by conducting public meetings and by soliciting comments through the "Call for Information" which is published several months in advance of EIS preparation. The Office of Leasing and Environment is responsible for compiling the lengthy list of issues identified during the scoping process, distributing that list for staff analysis, and identifying the issues to be analyzed in the EIS. Since MMS is presently preparing the fifth and sixth EIS's for the Bering Sea region, a fairly consistent list of issues for this region has evolved.

For the most part, the issues tend to fall into two major categories: effects on the living marine resources, and effects on resource harvest activities. The primary factors that potentially could produce effects on these resources and activities include oil spills, drilling discharges, noise disturbances, facility siting, and population increases.

The following list of issues has been consistently identified for the Bering Sea region:

Living Marine Resources

- o Effects on important fish resources from:
  - Oil spills
  - Discharges (muds, cuttings, formation waters, and ballast water)
  - Seismic (geophysical) operations
- o Effects on birds from:
  - Oil spills
  - Noise disturbance (particularly chronic disturbance)

- Effects on <u>marine mammals</u> from:
  - Oil spills
  - Discharges (muds, cuttings, formation waters, and ballast water)
  - Noise disturbance
  - Habitat loss (siting of oil industry support facilities)

- Effects on <u>endangered whales</u> from:
  - Oil spills
  - Noise disturbance

<u>Resource Harvest Activities</u>

- Effects on the <u>marine ecosystem/ food web</u> from:
  - Oil spills
  - Discharges (muds, cuttings, formation waters, and ballast water)

- Effects on <u>commercial fishing</u> from:
  - Loss of fishery resources
  - Oil spills
  - Gear conflicts
  - Ocean space use conflicts (platforms, pipelines, and collisions)
  - Competition for harbor space
  - Beneficial services suppliedby the oil industry

- Effects on <u>subsistence resources</u> from:
  - Increased harvest competition
  - Oil spills
  - Discharges
  - Noise disturbance

- Effects on <u>subsistence harvest</u> activities from:
  - Oil spills
  - Noise disturbance
  - Access to resources

- Effects on <u>sociocultural systems</u> from:
  - Changes in subsistence practices
  - Increases in population
  - Changes in cultural values and orientations

<u>Additional Issues</u>

- Effects on air quality
- Effects on water quality
- Effects on cultural resources
- Effects on community infrastructure
- Oil spill containment and cleanup

INDUSTRY PERSPECTIVE: ECONOMIC AND TECHNOLOGY CAL ASS UMPTIONS AND RESTRAINTS INVOLVED IN OIL EXPLORATION AND. DEVELOPMENT IN THE BERING SEA

by Micheal Golas
Amoco
Denver, Colorado

Industry's spending on leasing, drilling, as well as geophysical and engi neering work is a cl ear indicator of its belief that exploration and production in the Bering Sea is technically feasible. What industry must now determi ne is whether or not *it* makes sense *economically. Since* the technology exists to conduct expl orati on and devel opment i n the Bering Sea Region, the focus of this presentation concentrates more on economic assumptions.

There are four major factors, which will determine whether the Bering Sea will become a viable economic opportunity. They are:

1) The cost of expl orati cm, development, production and, <u>very imports ntl y,</u> transportation of oil.

2) The magnitude of the oil reserves found.

3) The time it takes to efficiently find, delineate, develop and produce a field.

4) The worldwide price of the oil when it is finally produced.

costs

The costs that oil companies face to produce oil in the Bering Sea are monumental . Up-f rent capital investment costs will be $4-10 per barrel for every barrel of oil expected to be produced. Day to day operating expenses will be in the same range, and transportation costs will be in the $3-7 Per barrel range depending on West Coast or Gulf Coast delivery. Additionally, there are royal ti es, and property and income taxes to be considered. The sum of the capital costs for a single Bering Sea fi el d coul d wel 1 be in the range of $5 to $15 billion.

Magnitude of the Reserves

The magnitude of the reserves that industry might find is control l ed by mother nature. Nevertheless, some very large reservoirs will not be developed because costs will be too high. The $10 bil lion capital investment wil 1 not be economically feasible. Industry therefore needs to find ways to control costs. Regulations should be sufficiently flexible in order to encourage the efficient exploration for reserves. With government and industry working together, it is possible for the constraints to be reduced without jeopardizing environmental *or* other *interests.*

Time

Delay in any phase of the activity, from exploration through production, reduces the value of industry investments. Certain minimum rates of return for any investment are necessary.

For example, in the Bering Sea where Exxon purchased leases in 1984, the first dollars of revenue are not expected until 1995. Prior to that time, Exxon will incur costs for exploratory drilling, as well as the design, construction and installation of production facilities. While payout for successful Navarin Basin exploration may occur about 2002, we now face an unknown cost for the borrowed capital needed to purchase production facilities. There are also large uncertainties as to the future price of crude.

Obstacles which impede sensible exploration and production, which lengthen the process from months to years and years to more years, and which add uncertainty to the investments are not in the best interest of anyone. The oil industry cares and is sensitive to environmental, social, and cultural concerns, but these factors should not be turned into costly obstructions for the oil industry. Such an approach would be hazardous not only to the industry but to the nation's economic health as well.

Worldwide Price of Oil

Price, of course, is the fourth major economic factor. As the rate of return diminishes, so does the industry's interest in exploration and development. There are many current examples in the oil business where this is being demonstrated. It does not bode well for the future when oil exploration firms believe oil exploration does not bring an adequate rate of return on their investments.

Oil companies need flexibility in exporting opportunities once the oil has been produced. Currently, although there are a few special exceptions, industry is prohibited by Federal law from transporting domestic crude anywhere but to a port in the USA. Industry, for example, would like to have the opportunity to export Bering Sea crude to Japan. The Japanese are also very interested in this approach because Japan could provide cheap crude to the U.S. on the Gulf coast in exchange for crude delivered directly f rum Alaska. The Government Accounting Office estimates that $800 mini on to $1.4 billion a year could be saved if we could transport North Slope crude to Japan. Exports to Japan would make the price of Alaskan oil competitive with other oil prices worldwide for the first *time.*

Federal law also requires that industry use U.S. built tankers to transport the crude. This is economically unsound for the nation and the oil industry and it is another significant cost. The U.S. needs to find ways to reduce costs while maintaining job opportunities for its citizens. Costs could also be better controlled if industry had more flexibility in the potential use of tanker or support facility sites.

In conclusion, industry, government, and educational and research institutes -- working together-- can help reduce costs, as well as time of exploration and development in the Bering Sea areas. This cooperation would enhante industry's interest in the area and allow development of more and larger supplies of domestic oil while mitigating environmental, social and cultural Impacts.

SESSION IA

OCEANOGRAPHY, METEOROLOGY AND RELATED STUDIES

Chaired by

Dale Kenney
Oceanographer
Environmental Studies Unit
Minerals Management Service

Presentations

Bering Sea Meteorology and Oceanography (NOAA/PMEL) - James Overland

Marginal Ice Zone Experiment - MIZEX (NOAA/PMEL) - James Overland

Circulation and Oil Spill Trajectory Modeling (NOAA/OCSEAP) - David Hale

Oil Weathering Predictions (SAIC) - James Payne and Bruce Kirstein

Bering Sea Coastal Environments - Oil Spill Sensitivity (CS&E) - Erich Gundlach

Inner Shelf Transfer and Recycling in the Bering and Chukchi seas - ISHTAR (University of Alaska) - John Goering and Alan Springer

BERING SEA METEOROLOGY AND OCEANOGRAPHY

by James Overland
National Oceanic and Atmospheric Administrate on
Pacific Marine Environmental Laboratory
Seattle, Washington

The Bering Sea is affected by arctic, continental and maritime air masses. In winter, weather elements are continental and arctic in character, replaced by maritime influences from the south in summer. In winter this results in north to easterly winds, a tendency for clear skies, and substantial diurnal temperature range. Sumner is characterized by a progression of storms through the Bering, rather than fixed weather types, which produce increased cloudiness, reduced diurnal temperature range, and winds rotating through the compass with a slight tendency for southwest.

There is a tendency for two storm tracks, one parallel to the Aleutian Island chain (the Aleutian 10W) and one Curving northward into the central Bering Sea. A comparison of composite cyclone charts summed over the winter season and over the five heaviest and five lightest ice years from 1958 to 1980 shows a shift in cyclone centers toward the west in light years. The relation of sea ice extent and the location of cyclone tracks shows that the advance of the ice edge in the Bering Sea is dominated by wind-driven advection and that southerly winds associated with cyclone tracks to the west inhibit this advance. These results indicate that the interannual variability in seasonal sea-ice extent in the Bering Sea is controlled by an externally dertermined variation in storm-track position due to large-scale differences in the general circulation.

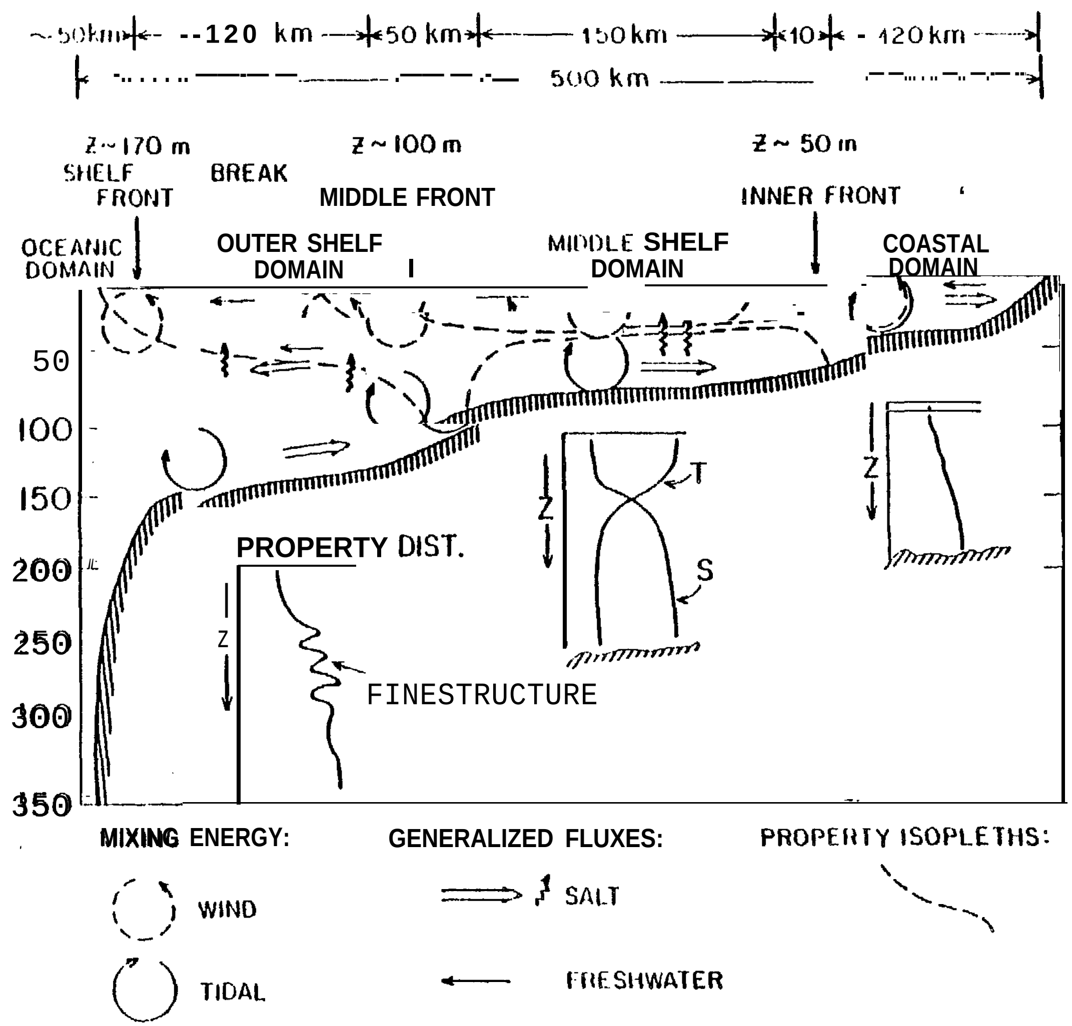
Waters of the southeastern Bering Sea shelf are divided into distinet domains, delineated by the water depths (z) and separted by frents. (See Figure 2.) Within the coastal domain, z is less than 50 meters (m), tidal mixing exceeds buoyancy input, and the water (away from the direct influence of river discharge) is mixed vertically. In the middle shelf domain, z is between 50 m and 100 m, when the seasonal input of buoyancy (either from melting ice or insolation) exceeds tidal mixing, a two-layered structure is obtained. Separating these domains is the inner frent, the zone of transition is in the balante between tidal mixing and buoyant energy input.

Over the southeastern shelf, tides dominate the kinetic energy of the water, often comprising 90 percent of the fluctuating kinetic energy. However, farther north the tides become less energetic and are a much smaller percentage of the total fluctuating kinetic energy.

Circulation in the southern Bering Sea is determined primarily in response to local winds. Circulation over the northern shelf is dominated by a generally northward flow of water bound for the Arctic Ocean. This pattern can be temporarily reversed because of large-seale meteorological forcing, particularly in early winter. Currents east and west of St. Lawrence Island and through Bering Strait mean flow often reach 10 to 15 centimeters per second (cm/s) or more. In Norton Sound, the northward mean flow, appears only in the western portion, and mean currents in the remainder of the Sound *are* weak, although wind-driven currents with instantaneous speeds Up to 100 cm/s have been observed.

Figure 2

Energy Balance, Water Fluxes and Vertical Structural in the Southeastern Bering Sea



MARGINAL ICE ZONE EXPERIMENT (MIZEX-WEST)

by James Overland
National Oceanic and Atmospheric Administration
Pacific Marine Environmental Laboratory
Seattle, Washington

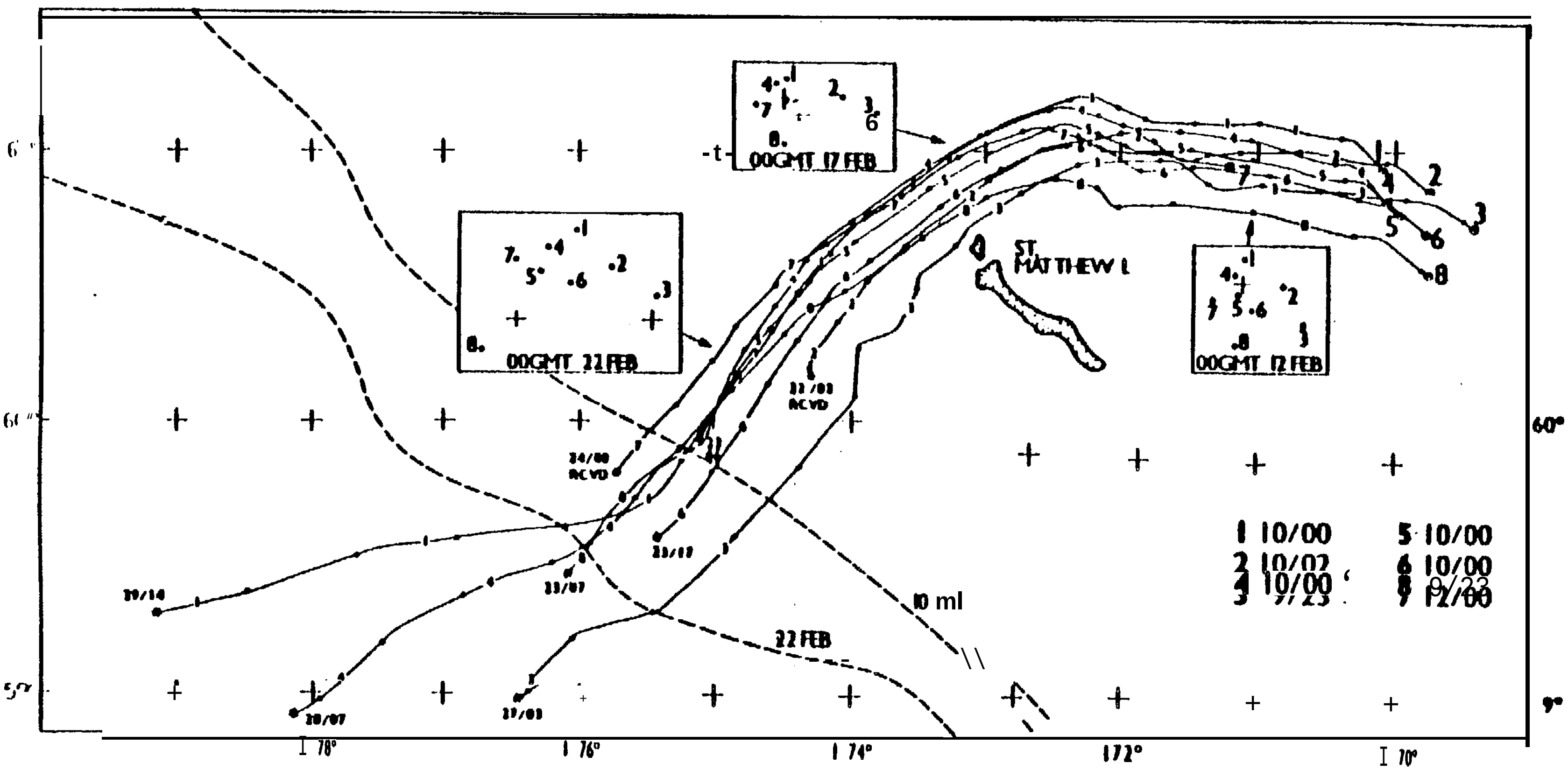
The Marginal Ice Zone Experiment (MIZEX-West) field study took place in the southeast Bering Sea during February 1983. The experiment involved two ships--- the Coast Guard ice-breaker WESTWIND and the NOAA ship DISCOVERER; two aircraft-- the NASA Convair-900 and the NOAA P-3; a set of over-winter moored current meters; and the Scanning Multichannel Microwave Radiometer (SMMR) on board the Nimbus-7 satellite. The purpose of the study was (1) to study the oceanic, atmospheric and sea ice processes which control the ice motion; (2) to determine the physics which control the ice edge position; and (3) to study the microwave radiometry c pro perti es of sea ice with the purpose of improving our use of satellite instruments to determine sea ice concentrate cm.

The WESTWIND steamed about 150 kilometers (km) into the ice and deployed an array of satellite- and ship-tracked position and meteorological buoys. The WESTWIND then drifted with the surrounding ice over a 16-day period as the ice moved from the interior towards the ice edge. As the ship drifted, investigators carried out a variety of oceanographic, meteorological, and remote-sensing surface observati ens. At the same time, the DISCOVERER carried out a similar set of measurements at the ice edge. The two aircraft, which were based in Anchorage, carried out several overflights of the experimental region. The NASA aircraft-- equipped with serai passive microwave radiometers, as well as a version of the radar altimeter planned for the European Space Agency satellite ERS-1-- carried out six high-level mosaic overflights of the experimental region. The NOAA P-3, which was equipped with a gust probe, a SLAR, a laser profilometer, and temperature sensors, carried out five low-level overflights in the course of which they flew several vertical profiles over each ship.

As a part of the study, a 50 km array of 8 ARGOS-tracked floes provided information on the intermediate seal e behavior of the ice pack. Wind and current measuring platforms on two of the floes gave detailed information on the forces on individual floes which were compared with the larger-scale motions. Under relatively steady northeast winds and with weak or negligible regional currents, the floes accelerated considerable y as they crossed the MIZ. The array showed little distortion even though it skirted around St. Matthew Island and changed trajectory direction by over 90° during the 12 day study period (see Figure 3). Similarly, individual floes remained within 200 of their original orientation, although their angular motions were erratic and often rapid. One of the floes was much smoother than the other, and higher winds and currents were noted at the smoother floe. The motion of the floes reflect strong coupling to the currents at tidal and lower frequences, and low-frequency response to the wind (that is, greater than 6 hours). Both floes drifted to the right of the mean wind by approximately 30° at about 4 percent of the wind speed at 3 meters, and relative wind and current directions were within 200 of being colinear; these traits are consistent with free drift hypothesis.

Figure 3

Ice Edge Advance in Bering Sea



Ice edge advance and the ice buoy trackline around St. Matthew's Island: The ice edge's position on 10 February and 22 February are shown as dashed lines. the approximate center or the ice-buoy array at 00 GMT from 10 February at 61 N, 170 W until 28 February at 59 N, 179 W is shown." Meteorological and oceanographic measurements were taken on floes 2 and 7. The WESTWIND operated near flow 7 while the DISCOVERER operated near the ice edge, during 6-17 February to the east of St. Matthew Island, and after that to the west.

The motion of the ice floes and ice edge were compared by examination of satellite photos. Two regions of the ice pack, one thick with rafting and rubble to the west of St. Matthews Island, one thin and broken to the east of the I sl and, showed a ratio of edge velocity to floe velocity of .64 and .43 respectively. Thinner ice melts more rapidly in the wanner sea water ahead of the ice edge than the thicker ice.

CIRCULATION AND OIL SPILL TRAJECTORY MODELING

by David Hale
National Oceanic and Atmospheric Administration
Outer Continental Shelf Environmental Assessment Program
Alaska Office
Anchorage, Alaska

To accurately compute oil spill trajectories, numerous physical processes must be considered. These include but are not limited to currents, tides and winds. This information flows through the various submodels of the oil spill trajectory model that was developed by the Rand Corporation.

The model is primarily composed of three submodels: (1) a 3-dimensional hydrodynamic submodel; (2) a 2-dimensional weather submodel; and (3) the oil trajectory submodel. The hydrodynamic and weather submodels provide the necessary information to drive the trajectory submodel. Each submodel is verified and supplemented by field data and observations. These three submodels are summarized below:

3-Dimensional Hydrodynamic Submodel

This submodel provides hydrodynamic information for the oil trajectory submodel. It is a multi-layer model which solves the 3-dimensional equations of motion as well as other conservation equations to yield the desired information.

Input to the model consists of field data on tides, water mass characteristics (salinity and temperature), bathymetry, and ice coverage. The model computes water levels, currents, temperature, salinity, and ice movements due to winds, tides and pressures. As an option, it can compute the dispersion of spilled oil.

Wind scenarios are put into the model to calculate wind response functions for the oil trajectory model. These functions are used to determine the response of the surface layer to varying wind fields.

2-Dimensional Weather Submodel

This submodel provides the necessary meteorological information needed to drive the computation of an oil spill trajectory. The database is 19 years of synoptic weather data; it is supplemented by observed surface wind statistics.

The model operates by Markov Simulation using a transition matrix of weather type, transition probability, and surface wind statistics for each weather type. It is periodically interrupted to enter the storm track model. The stochastic storm track mode? calculates *a storm's* forward speed and direction, and computes the geostrophic wind field. This wind field is then modified by the Marine Boundary Layer model and computes the mean wind field for use by the trajectory model.

Oil Spill Trajectory Submodel

This third submodel actually takes the data and results from the other two submodels and computes the final spill trajectories. It combines the mean wind field with the response function to compute the upper-layer velocity.

The model computes Stokes drift, the mean drift, and the residual currents. It also calculates surface oil drift as well as the drift of oil spilled under an ice cover. Finally, it plots the trajectory information for each simulation and site. Actual trajectory positions are provided to MMS for the final risk analysis.

A summary of the inputs and outputs of each model is provided in Figure 4. A flow chart of how input flows through the submodels is provided in Figure 5.

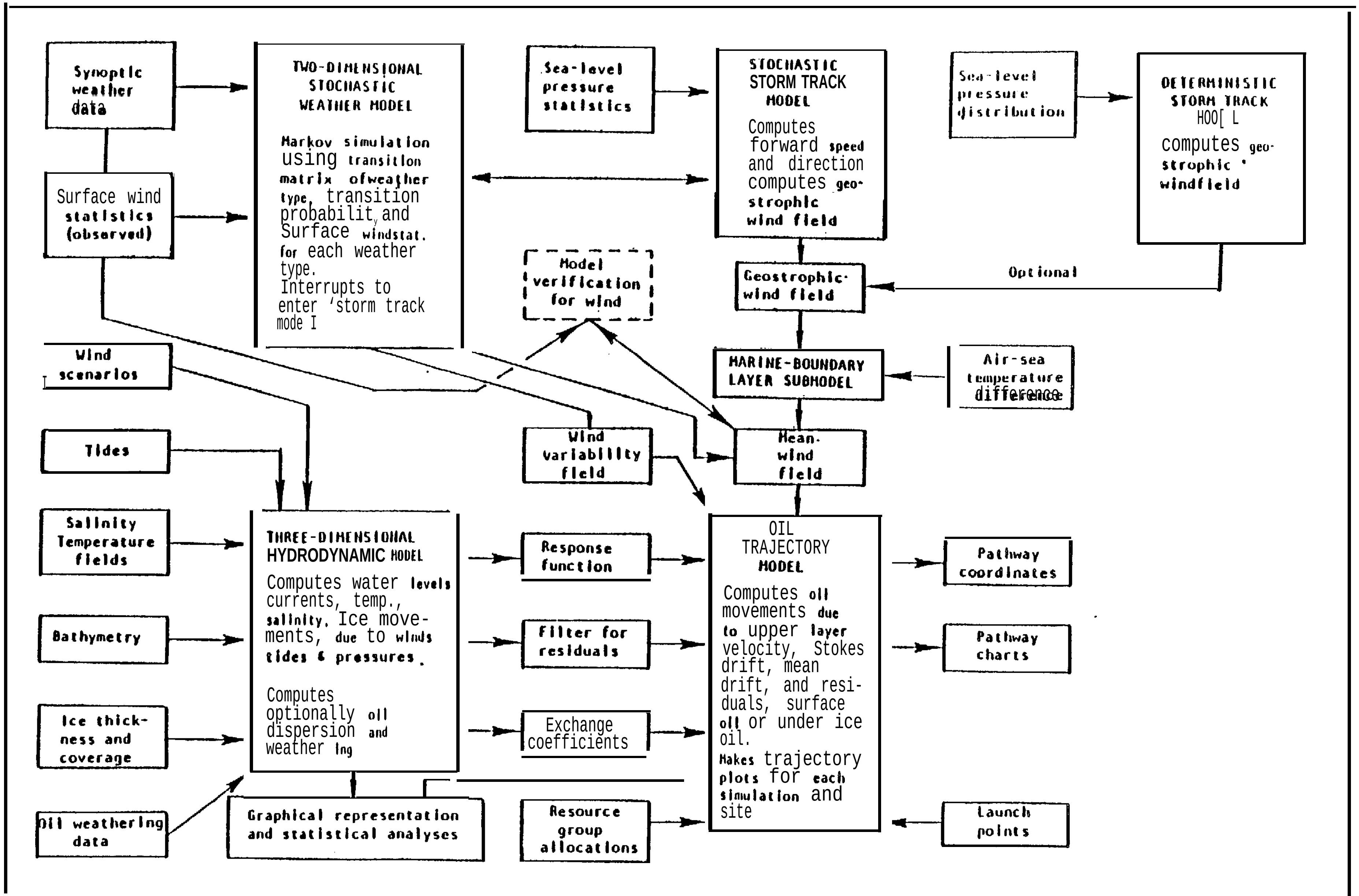
Figure 4

Oil Spill Trajectory Submodels-- Inputs and Outputs

Submodel	Inputs	Outputs
Hydrodynamic	1) tidal information 2) salinity and temperature data 3) bathymetry 4) ice thickness and coverage 5) oil weathering data (optional)	1) water levels 2) currents 3) temperature and salinity fields 4) ice movements and concentrations 5) optionally-oil dispersion and weathering 6) wind response functions 7) mass and energy exchange coefficients
Weather	1) weather types (from 19 years historical data) 2) surface wind statisties	1) mean wind field 2) wind variability field
Oil Spill Trajectory	1) water levels 2) currents 3) temperature and salinity fields 4) ice movements and concentrations 5) oil dispersion and weathering (optional) 6) wind response functions 7) mass and energy exchange coefficients	1) oil movements due to upper layer velocity 2) oil movements due to Stokes drift 3) oil movements due to residual currents 4) total drift of oil on the surface 5) total drift of oil under an ice cover 6) trajectories for each simulation from each launch point

Figure 5

OIL SPILL TRAJECTORY MODEL INFORMATION FLOW CHART



[formation flow chart showing that both the three-dimensional hydrodynamic and the weather model provide important parameters needed by the oil-spill trajectory model. These parameters are difficult and expensive to measure over the entire Alaskan waters. Observed wind roses, if available, can still be used to drive the trajectory model in its simplist mode.

OIL-Weathering PREDICTIONS

by James R. Payne and Bruce E. Kirstein
Science Applications, Inc.
LaJolla, California

While the oil trajectory model described earlier (see David Hale's summary in this session) predicts the location of an oil spill, the oil weathering model predicts mass and composition. The information is then provided to biologists for use in assessing development.

The concepts used in deriving equations which are used to describe oil spills are based on its material balance and physical properties. These equations are programmed on a computer to generate case studies of potential oil spills. The computer programs are accessible from the keyboard and allow the user to specify the type of oil and environmental parameters.

Knowledge of the physical properties of crude oil is required before a weathering prediction can be made. For the important weathering process of evaporation, the partial pressure of the components must be known. However, characterizing the physical properties of crude oil on a component-specific basis is impossible.

The methodology used for crude oil characterization is the pseudo-component technique where a true-boiling-point distillation of a sample provides fractions characterized by boiling point and density. By using this information for each fraction, physical properties are calculated which describe the behavior of the whole uncut crude. Thus, a crude oil is "cut" into light fractions which boil at a low temperature, a gasoline fraction, and on through to the "bottom" of the barrel where the fractions boil at temperatures in excess of 800°F. This concept of pseudo-components, or cuts, is used in industry for making oil-weathering calculations to predict physical properties.

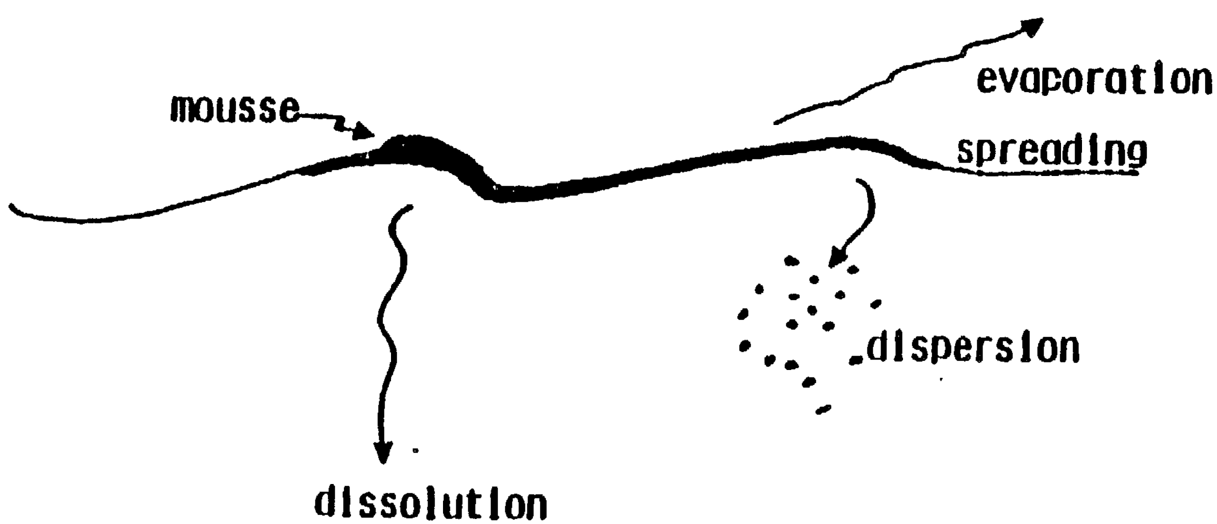
The oil-weathering processes which decrease the mass of an oil spill are evaporation, dissolution, and dispersion. Both evaporation and dissolution (into water) are molecular processes, while dispersion is the formation of discrete oil droplets in the water column as the result of turbulence (see Figure 6). These mass transfer processes depend on slick spreading which determines the air- or water-interfacial areas. The formation of a water-in-oil emulsion (mousse) is also important because of the resulting increase in viscosity.

In the presence of ice, the oil-weathering processes are the same as in open-ocean weathering. However, the rate at which dispersion and mousse formation occur increases due to change in the turbulence. In addition, when oil is encapsulated in ice, weathering ceases until the oil is released to either the air or water phases. Oil also interacts with suspended particulate matter by adsorption of dissolved species from the watercolumn and by the collision and sticking of discrete oil droplets and particles (see Figure 7). The oil evaporates when it is on the ice surface.

While the process of evaporation is well understood and quantified, such processes as emulsification-- how the oil-water surface tension depends on oil composition-- are not. Therefore, the development of computer-driven oil-

Figure 6

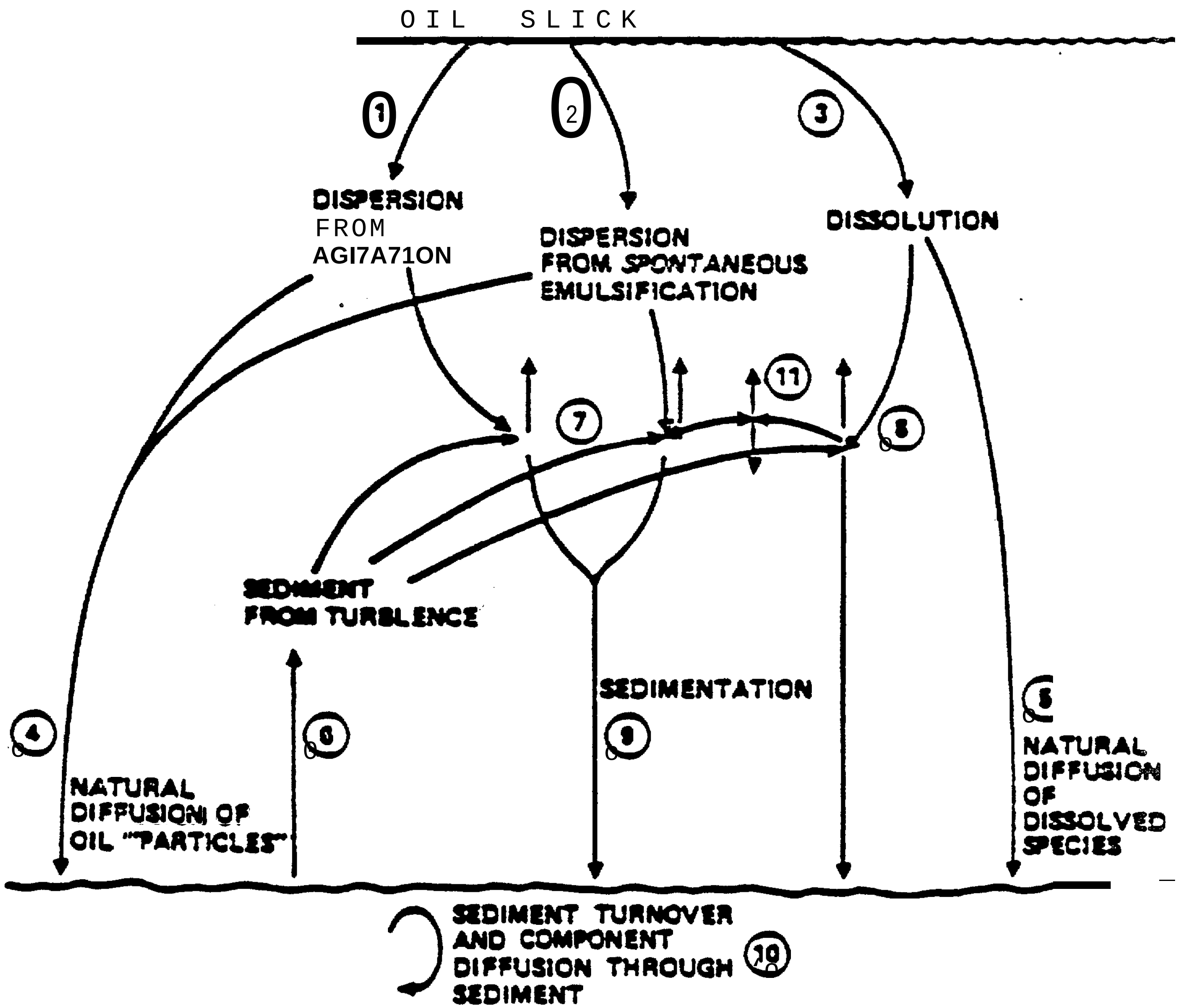
OIL WEATHERING PROCESSES



Model Objective: Predict mass balance, composition and physical properties.

Figure 7

SUSPENDED PARTICULATE MATTER & OIL INTERACTIONS



weathering models requires extensive experimentation in order to quantify and verify the weathering processes. The design and conduction of oil-weathering experiments is an interactive process where knowledge and observation are used to plan the next set of experiments.

The oil-weathering models developed by SAIC for NOAA predict the true-boiling-point distillation of oil as it weathers. As a result, the models predict a field-observable attribute which can be measured by a standard procedure. The models are user-friendly and menu-driven so that minimum experience with "oil" is required to use the codes.

BERING SEA COASTAL ENVIRONMENTS - OIL SPILL SENSITIVITY

by Erich Gundlach[1]
RPI Coastal Science, Inc.
Columbia, SC

An oil spill Environmental Sensitivity Index (ESI) was applied to Bering Sea coastal environments during 1981 - 82. The information presented on 170 maps of 1:63,360 scale included shoreline sensitivity, location and distribution of ecological resources, location of socioeconomic resources, and proposed areas for placing spill-response equipment. This method of sensitivity mapping has received widespread support in Alaska and the lower forty-eight, as well as in other countries. The maps are used in planning for possible oil development, and for aiding and directing response during an oil spill incident. A brief description of the major components of the ESI follows:

Shoreline Sensitivity

The shoreline of the Bering Sea was classified and ranked in order of increasing sensitivity to spilled oil. The shoreline types of the Bering Sea are presented below. Environments 8, 9, and 10 are the most sensitive.

1. Exposed rocky shores
2. Exposed wave-cut platforms
3. Fine-grained sand beaches
4. Coarse-grained sand beaches
5. Mixed sand and gravel beaches
6. Gravel beaches
7. Exposed tidal flats

8A. Sheltered rocky shores
8B. Eroding peat banks
9. Sheltered tidal flats
10. Marshes

Biological Resources

The habitats of important ecological, recreational, and commercial species were positioned on the maps to indicate specific areas requiring spill protection or response measures. There are also symbols to represent information on seasonality, type and species of the organism, nesting season, and threatened or endangered species.

Socioeconomic Features

Sites of socioeconomic importance, including archeological sites, commercial fishing areas, mining claims, parks, and wildlife areas. They were indicated on the maps by a black-and-white symbol.

Spill-Response Features

To assist the rapid deployment of spill-response equipment, primary locations for boom and skimmer placement were indicated according to wave heights, currents, and equipment performance. Areas for equipment staging and airstrips were also indicated.

Complete sets of maps are available in the Oil Spill Sensitivity Index--Norton Sound, 1981 and the Oil Spill Sensitivity Index-- Bristol Bay, 1982. Interested parties should contact Mr. Lyman Thorsteinson at NOAA/OCSEAP.

[1] Present affiliation - Coastal Science & Engineering, Inc.

, INNER SHELF TRANSFER AND RECYCLING (ISHTAR) IN THE BERING AND CHUKCHI SEAS

by John Goering and Alan Springer
University of Alaska
Fairbanks, Alaska

ISHTAR is a project which is centered on the North Bering Shelf. It involves the study of the transfer and recycling of organic matter in the highly productive Bering Strait area. ISHTAR is a team effort invol vi ng physical, chemical, and bi ol ogical oceanographers, and other people i ntereste d i n meteorol ogy. Most of the extensive field wo rk wil 1 begin this summer. The project may continue for several years. We have al ready begun establishing percepti ons about how the system works and will be testing these percepti ons in the months ahead.

Some informati on is al ready known about the circulation on the Bering Shelf. On the southeast Bering Shelf inside the coastal f rent,' the mean flow is sl ow-- probably 1- 3 centimeters (ems) to the northwest. Inside the middle shelf between the 50- 100 meter isobath, the mean flow is almost n on-exi stant, and it looks like a lake. However, al ong the outer shelf the flow is much faster. There is a current which flows al ong the shelf at between 10- 25 cms per second (cm/sec). This current branches at Cape Navarin, with part of the flow becoming a barotrophic current that flows al ong the 67 meter isobath around the Gulf of Anadyr. The major part flows through the Anadyr Strait at the rate of about 15 cm/sec.

Another current flows intothe Arctic Ocea n from the northern Pacific Ocean thro ugh the Bering Sea. Its mean flow is .8 of a Sv (106 cubic meters per second); and it is much higher in the summer than in the winter. Using the mean f 10W from the southern Bering Sea region and the existing kn owl edge about the nutrient supply in the water, the loading of the nutrient supplY onto the north Bering Sea can be calculated. Currently, the loading has been calculated as 2.5 x 10 million atoms of nitrates per second. This supply is very simil ar to the supply on the Peru upwel l i ng system and expl ai ns why the shelf is so productive.

Most nutrients of the northern Bering Shelf are supplied f rom the deep Bering Sea waters. Two important conditions influence nutrient producti on-- light and ice. Because of the extended dark periods, sufficient light for extensive primary producti on of phytoplanton exists only f rom March through September. In additim, ice coverage continues through Apri 1 and May. Therefore, despite sufficient light conditi ens, high producti on takes pl ace i n the water column only f rom J une through September.

The following nutrient fields were identi tied in the Bering Shelf regi on:

South Bering Sea - Production occurs about 5 weeks in May and June; most nutrients produced are depl eted during that time. Since water is stable, no new nutrients flow in. Nutrient supply is low during summer and fal l, and until winter mixing.

St. Lawrence - While there are more nutrients close to the island, nutrients in the middle and outer shelf follow a pattern similar to that in the South Bering Sea. Nutrients are produced and depleted in the spring; supply is low during the summer, fall, and winter.

Anadyr Strait - Area is high in nutrients throughout the year because of the continuous flow of water from the Bering Sea through the Strait.

Yukon River System - Area also has 4- 5 week production cycle in May and June. As with the south Bering Sea and the St. Lawrence, production is low during the summer and fall.

Gulf of Anadyr - Production continues throughout the year; area is always high in nutrients.

It appears from these preliminary findings that the Anadyr Strait and the Gulf of Anadyr are most protective. Oil and gas developers and MMS should consider the importance of these areas as leasing and development decisions are made.

SESSION IB

BERING SEA INDUSTRIAL TECHNOLOGY AND DEVELOPMENT - I

Chaired by

Rod Smith
Regional Supervisor
Field Operations
Minerals Management Service

Presentations

Marine Seismic Acquisition - Today and Tomorrow (GSI) - W. Rodney Cotton

Overview of the Seismotectonic Characteristics of the Bering Sea Area (State of Alaska) - John Davies

Evaluation of Bering Sea Crude Oil Transportation Systems (Han-Padron) - Dennis Padron

Drilling Technology: (ARCO) - Gary Hammon

Offshore Terminal Operations (Exxon) - Allen Ziarnik

Onshore Pipeline Route Selection and Construction Film (Exxon)

MARINE SEISMIC ACQUISITION - TODAY AND TOMORROW

by W. Rodney Cotton
GSI
Dallas, Texas

Modern seismic acquisition equipment, systems, and methods are in a continuous state of change and improvement. However, this process does not increase linearly with time but is affected by market conditions, industry requirements, and the introduction of new technologies. It is therefore both entertaining and instructive to review recent progress and speculate on future developments in marine acoustic sources, the extension of digital methods into the recording streamer, and advances in the quality control of streamer location systems.

The conventional air gun is essentially a 20-year old design. Recently, a radically new approach to this device was released to the industry. The new device, which is termed a "Sleeve Gun", has improved characteristics in terms of reliability, bandwidth, and acoustic efficiency. The new gun is already in use in conventional marine seismic surveys where it is demonstrating improved resolution with no loss of penetration. It is currently being tested in shallow water environments where it is expected to be particularly robust in the presence of mud and gravel. In addition, there is interest with reference to the source requirements in marine vertical seismic profiling.

Seismic streamers have been produced in greater and greater lengths over the years while the individual group length has decreased, resulting in an expansion in the number of data channels that can be accommodated. The limit to this expansion was essentially reached at 120 channels over a total length of 3000 meters. The introduction of micro-circuits and fiber optic transmission technology have now permitted many more channels to be accommodated in thinner, more manageable streamers of even greater length. To achieve this, the data is digitised with the streamer and the information is multiplexed and transmitted *in serial* form to the recording instruments on the vessel. Two hundred ad forty channel streamers totaling over 3600 meters in length have been introduced, and plans to double these numbers are being executed.

Finally, the introduction of microelectronics has lead to the use of many sensors in the field systems to monitor the location, depth, and performance of the source and receiver mechanisms. It is of paramount importance to the geophysicists responsible for the quality of the data that the information from these sensors be processed and displayed on board the seismic vessel in order that errors and faults can be detected and corrected immediately.

OVERVIEW OF THE SEISMOTECTONIC CHARACTERISTICS OF THE BERING SEA AREA

by John N. Davies
Division of Geological and Geophysical Surveys
Department of Natural Resources
State of Alaska

It is well known that some of the largest earthquakes in this century have occurred in southern Alaska. In fact, five of the ten largest earthquakes *in* the world were located along the Kurile-Kamchatka and Aleutian-Alaska subduction zones.

Less well known are the locations and sense of motion of the plate boundary which connects these subducti *on zones* to the spreading center of the Arctic Ocean. Misfits in global plate models in the Siberia-Bering Sea-Alaska area and significant differences in the locations of the poles of relative motion for the Eurasian and North American plates all suggest that one or more small plates, or intraplate deformation, may be required to fit all of the available data.

Focal mechanisms of earthquakes on the Denali and Tintina fault systems, in the Tanana Valley in Alaska, and in the Richardson Mountains in Canada suggest that all of Alaska and the Yukon from the Gulf of Alaska to the Beaufort Sea may be slowly reforming in a giant, right-lateral megashear. Similar 1 arge-seal e intraplate deformation may also be occurring (perhaps with a different sense of motion) in the Bering Strait and the St. George Basin regions of the Bering Sea. In both areas, historical, teleseismic, and local seismicity data all document the occurrence of earthquakes with magnitudes as large as six to seven points. Rough calculations for the St. George Basin area show that for a randomly-selected site and a *Ml-year* exposure time, the expected peak horizontal acceleration is about 20 percent-- with a 10 percent probability of excedence. Relocations of the earthquakes, calculation of their magnitude on a uniform scale, and determination of the attenuation properties of the crust are all urgent problems if the seismic exposure in the Bering Sea area is to be adequately gauged so that safe structures can be designed.

EVALUATION OF BERING SEA CRUDE OIL TRANSPORTATION SYSTEMS

by Dennis Padron
Han-Padron Associates
New York, New York

The objective of this study is to evaluate and compare the technology and costs associated with crude oil transportation alternatives from the Bering Sea. In order to achieve this objective, three representative scenarios were developed. All relevant parameters were defined and the potential range of critical parameter values was established for a sensitivity analysis. The environmental parameters were based on information in the public domain, while the forces exerted on the various types of offshore structures were based on state-of-the-art procedures. Details were developed for each major element of the transportation system, including offshore loading and storage, nearshore loading, onshore storage facilities, transshipment terminal, marine pipeline, land pipeline, ice-strengthened tankers, conventional tankers, and icebreakers. These elements were combined to make up all reasonable transportation alternatives and total life cycle costs were developed. The alternatives were also compared on the basis of construction logistics, reliability, environmental considerations, and other factors.

For the basic case parameters of all three scenarios, the optimum crude oil transportation alternative consists of an offshore loading terminal for loading two ice-strengthened tankers traveling directly between the terminal and the mainland's West Coast. For the northern Bering Sea, the offshore terminal consists of a concrete crude oil storage structure with a capacity of 1.5 MMB, a separate concrete mooring structure, and interconnecting pipelines. The tankers are 169,000 DWT and are strengthened and powered for Class 4. Two Class 5 icebreaker support vessels are required. The offshore terminal for the central Bering Sea consists of a combined storage/loading facility and a pipeline connecting it with the production platform. The storage/loading facility consists of a floating storage vessel with a capacity of 1.7 MMB, permanently moored to a catenary chain-stabilized articulated column. The 160,000 DWT tankers are strengthened and powered for Class 2; they moor in tandem to the storage vessel. Two Class 3 icebreaker support vessels are required. For the southern Bering Sea, the offshore terminal is similar to that for the central Bering Sea except that the storage vessel has a capacity of 1.3 MMB and the articulated column does not require catenary chains. The tankers are 137,000 DWT and are strengthened and powered for Class 1. In this instance, Class 2 icebreaker support vessels are required.

The sensitivity analysis indicates that the average crude oil transportation cost (ATC) is quite sensitive to the quantity of total recoverable reserves for reserves less than approximately one billion barrels. All other sensitivity factors, except crude oil properties, do not have a significant effect on the ATC, although they may effect the cost of a particular transportation system element. The basic case crude oil is quite suitable for either tanker or pipeline transportation but it would be impractical to transport small quantities of crude (i.e., less than one billion barrels) through a long marine pipeline.

DRILLING TECHNOLOGY

by Gary Hammon
ARCO
Anchorage, Alaska

ARCO utilizes harsh environment semi-submersible rigs at its offshore wells. The greatest mass of the rig is below water level; thus, giving this type rig its superior stability characteristics. The rig is anchored to the sea floor with eight large anchors (i.e., usually 30-45 thousand pounds). The rig is ballasted to various water depths by flooding and evacuating numerous compartments located in the two pontoons. These pontoons provide the larger part of the buoyancy for the rig. This type rig has relatively little surface area impacted by sea conditions. Generally, rigs of this type are designed to withstand 100 kt winds with BO' plus seas and 3 kts of current, all simultaneously.

The greatest problem with logistical support of operations in the Bering *Sea is* the fact that there is relatively little established support infrastructure; what does exist is a long trip between rig and shorebases. For instance, 150 miles offshore in the Gulf of Mexico is considered to be "far out" whereas operations in the Bering Sea (i.e., Navarin Basin) can require l-way trips in excess of 500 miles between rig and shorebase.

In addition, annual ice is a major problem. Ice forms in portions of the Bering Sea during winter and completely disappears during spring, summer and fall. At present, exploration drilling is limited to the "ice free windows" of the year. ARCO, in partnership with the Japanese firm of Mitsui, has designed a semi-submersible rig that has been model tested successfully in simulated Bering Sea winter ice conditiens. Although an actual rig of this design has yet to be built, such a rig-- capable of working in the Bering Sea year round-- could be built and probably will be when the economics of such construction can be justified.

At present, ARCO monitors ice formation by use of Side Looking Acoustic Radar (SLAR). This equipment is utilized in conjunction with a fixed wing aircraft. The ice edge can be tracked on a daily basis utilizing the SLAR. The ice edge, figured as the distance from the drilling operation, can always be known since the SLAR is also capable of "seeing" through cloud cover. If the ice edge begins to approach too near the rig, plans can be made to move the rig off location to ice-free water.

OFFSHORE TERMINAL OPERATIONS

by Allen P. Ziarnik
Exxon Production Research
Houston, Texas

An offshore terminal is a mooring and loading system located directly in the oil field. It is used to load tankers which carry the refined crude oil to market. A terminal typically has some storage capacity, as with a permanently moored storage vessel, or in an adjacent production platform. The offshore terminal and shuttle tankers make Up a total transportation system which can be used in place of a pipeline to shore.

Offshore terminals are most commonly used in remote areas where suitable shore facilities or pipelines do not *exist.* By loading crude oil directly into tankers in the oilfield, the investment associated with constructing a long pipeline and grassroots shore terminal can be eliminated, resulting in reduced overall costs. In addition, earlier production start up can often be achieved in places where several seasons of pipelaying would be required.

At present, there are approximately 40 offshore terminals in use worldwide. One of the first was at Norway's Ekofisk field in the North Sea in 1971. At Ekofisk, Catenary Anchor Leg Moorings (CALMS) were USed in a severe open ocean environment for the first time. The decision to use the CALMS was based on many years of nearshore terminal experience. Since Ekofisk, ten other North Sea fields have utilized offshore terminals. A Single Anchor Leg Mooring (SALM) with permanent 210 KDWT storage vessels was installed in the Fulmar field in 1981. In addition, several Articulated Loading Platforms (ALPs) have been installed in the Statfjord field since 1978. The technological advances associated with these systems, and their successful operating experience, will form the foundation for use of offshore terminals in the Bering Sea.

Offshore terminals may offer significant advantages for Bering Sea OCS field developments. In particular, they may prove to be more economical than a pipeline or shore terminal. Moderate extensions of technology and, perhaps, the development of new concepts will likely be required prior to using offshore terminals in the Bering Sea. The periodic occurrence of sea ice combined with the North Sea-type storm conditions offers a new design challenge. In the southern regions--*including* the St. George Basin, North Sea technology such as the SALM storage vessel or ALP should be used. In the Navarin area, the addition of guylines to the SALM or ALP concept should provide adequate support for resisting the higher loads in ice. In the Norton Sound area, the shallow water depths and frequent sea ice will require a new concept such as a conical single point mooring structure. Research and development activities are underway to ensure that technology is available for these applications.

In addition to direct use in ice prone Bering Sea oilfields, offshore terminal technology may also be applicable to an Aleutian terminal. A floating storage system located in a protected inlet in the Alaska Peninsula or Aleutian Islands may prove less costly than a conventional shore terminal.

" WAYLEAVE"

by BP Alaska Exploration, Inc.
Anchorage, Alaska

"Wayleave" is a color filmstrip, approximately 24 minutes long. The term refers to the strip of land in which a pipeline is buried.

The technical problems of building any pipeline can be daunting, but when a pipeline's route must pass through a developed, inhabited area the problem focuses on the rights and wishes of people.

This film tells, in human terms, the story of the planning, discussions and negotiations that were necessary to obtain the waylcave for the 130-mile pipeline to carry crude oil from the landfall at Cruden Bay to Grangemouth Refinery at BP's Forties Field. It also shows the consideration given to environmental problems and describes how the pipeline was constructed.

SESSION IC

BERING SEA INDUSTRIAL TECHNOLOGY AND DEVELOPMENT - II

Chaired by

Rishi Tyagi
Section Supervisor
Operations Review and Approval
Minerals Management Service

Presentations

Design and Construction of OCS Structures and Facilities in Areas of High Seismic and Climatological Risk (Exxon) - John Wardell "

Superstructure Icing Observations on the Semisubmersible "Ocean Bounty' in Alaska's Lower Cook Inlet (MMS) - Jon Nauman

Technological Assessment and Research (TA&R) Program for Offshore Minerals Operations (MMS) - John Gregory

Risk Assessment: Review of Countermeasures for Major Oil Spills from Vessels (Ross Environmental Research) - Sy Ross

Ice Management Procedures (MMS) - Yil Kuranel

Status ofSt. Matthew Island Land Exchange Agreements, Litigation, Possible Development (USFWS) - Keith Goltz

DESIGN AND CONSTRUCTION OF OCS STRUCTURES AND FACILITIES IN AREAS OF HIGH SEISMIC AND CLIMATOLOGICAL RISK

by John Wardell
Exxon Production Research Co.
Houston, Texas

Severe seismic and climatological conditions make the Bering Sea one of the more difficult areas in the world for the offshore petroleum industry to operate. Development of hydrocarbon reserves in this area requires offshore platform structures that are capable of resisting storms that produce larger waves than those produced by hurricanes in the Gulf of Mexico. Platform structures must also be capable of resisting the effects of earthquakes as severe as those that occur in Japan or California. Finally, these structures will have to be designed to assure adequate resistance to forces caused by ice.

Our industry is prepared to meet the challenge. This is evidented by the numbers of offshore platforms around the world, many of which are subject to conditions equally as severe as those anticipated for the Bering Sea. In the North Sea, for example, several platforms can resist storms having upwards of 100-foot waves acting simultaneously with over 100 mile-per-hour winds--conditions even more severe than those expected in the Bering Sea. Similarly, a significant number of platforms are operating in seismically-active areas. A number of these are designed to resist earthquakes that are similar in magnitude to design level earthquakes of the Bering Sea.

An excellent example of an existing platform that is Capable of meeting seismic and Climatological conditions resembling those of the Bering Sea is the Iwaki platform in Japan. This platform was installed in 1983 in just over 500 feet of water for developing the Iwaki gas field. It is located off the Pacific coast of Japan in an area known for extremely severe earthquakes. The platform is also fully exposed to typhoons approaching from the south and the east.

The Iwaki platform weighs 15,000 tons. It is secured to the sea floor with eight main piles and sixteen diameter skirt piles. The deck consists of a modular support frame, nine major modular units, a cantilever vent boom and special drilling rig. The rig, designed to withstand an earthquake of 8.5 in magnitude, is expected to produce an estimated 75 million cubic feet of gas per day. The Iwaki platform also has a sophisticated seismic instrumentation system. Certainly, this project makes clear industry's ability to meet the seismic and climatological challenges in the Bering Sea.

SUPERSTRUCTURE ICING OBSERVATIONS ON THE SEMISUBMERSIBLE 'OCEAN BOUNTY' IN ALASKA'S LOWER COOK INLET

by Jon W. Nauman
Meteorologist
Minerals Management Service

Spray icing was observed during the winter of 1979-80 on the semi-submersible exploratory drilling rig, Ocean Bounty, during six storms in Lower Cook Inlet, Alaska. The combination of high winds, complex sea state, shallow water, and low air temperatures resulted in sea spray ice accumulations of 5 to 25 centimeters per day, which curtailed drilling operations. This confirms the importance of designing structures to accommodate superstructure icing, or of developing preventive or inhibitive response actions to deal with superstructure icing.

Safe structural design of vessels and drilling platforms requires a thorough diagnostic knowledge of the hazards caused by the arctic environment. Superstructure icing is one of the potential hazards on marine structures, and it is the responsibility of the Minerals Management Service to evaluate this hazard, given its charge to ensure safe production operations.

Even light icing creates problems on vessels 'and platforms. Slippery decks, 1 adders, and handrails are a risk to human safety. In addition, icing on helicopters, platforms, deck cargo, winches and other exposed equipment delays operations, thereby increasing operating costs. Furthermore, ice on antennas can eliminate communications, distort radar sensing, and impair navigation facilities. Ice-coated windows can result in reduced visibility, and ice-sheathed rescue equipment and lifeboats become useless when hatches, munches and cranes are frozen. Clearly, many of these factors contribute to a reduction in crew safety.

The Ocean Bounty drilling operation began in the fall of 1979 i n 541 feet of water, approximately 12 miles from shore. Operations ceased less than a year later due to extreme weather conditions which included gale force winds of 40 miles per hour (mph) every other day, winds at storm force every fourth day (55 mph), and at hurricane force every seventeen days (75 mph). The high winds, combined with low air temperatures and high seas, resulted 1n Tremendous ice accumulation on the rig. During the most severe icing event, the Ocean Bounty accumulated an ice 1 oad of approximately 500 tons, which threatened the stability of the vessel and added potential hazards to the crew.

When location, size, wind speed, positioning, and vessel design are known, it is possible to predict fairly accurately how various construction designs, such as oil production platforms, may be affected by icing at sea. However, because there is presently no practical adaptable method to prevent icing or remove ice from a vessel, reliable weather forecasting is very important. The MMS Alaska OCS Orders governing oil and gas lease operations require lessees to coil ect such oceanographic, meteorological and performance data in an effort to ensure safe operations. The forecasts, together with accurate ice warnings, at least allow crews to change or curtail their operati ens.

TECHNOLOGY ASSESSMENT AND RESEARCH PROGRAM
FOR OFFSHORE MINERALS OPERATIONS

by John Gregory
Technology Assessment and Research Branch
Minerals Management Service
Reston, Virginia

The Technology Assessment and Research (TA&R) Program provides an evolving technology base *for* MMS Offshore Operations to support the BAST requirement as OCS activities move into the deep oceans and ice-infested Arctic. These BAST requirements are specified in Section 21(b) of the OCS Lands Act Amendments of 1978 as follows:

> ". . . The Secretary (of the Interior) and the Secretary of the Department in which the Coast Guard is operating shall require, on all new drilling and production operations, and whenever practicable on existing operations, the use of the best available and safest technologies which the Secretary determines to be economically feasible, whenever production, health, *or* the environment are threatened, except where the Secretary determines that the incremental benefits are clearly insufficient to justify the incremental costs of utilizing such technologies."

Background and Purpose

As a result of recommendations from several OCS advisory studies performed since 1971, most notably by the National Academy of Engineering, a program to assess technologies and perform necessary research " was formed within the Marine Operations Branch of the Conservation Division, U.S. Geological Survey-- now part of MMS. That program, established in 1975 and now known as the Technology Assessment and Research (TA&R) Program, is an integral part of the inspection and enforcement mission of MMS Offshore Operations. TA&R provides the following services to MMS Operations personnel:

- Independent assessment of the technologies applicable to OCS operations;
- Research on the solutions to operational problems where technology gaps are determined to exist; and
- A continuing dialogue on *engineering* and related topics among industry, the research community, and MMS Operations personnel.

The Program focuses on the inspection of "regulatory technologies"-- those technologies which are needed to assure the public that operations are safe and pollution-free. It does not address the economics of specific operations, which is the purview of industry, rather TA&R specifically addresses the operational functions of MMS personnel working with the offshore industry. These functi ons are:

- Approval of Permit and Plan
- Safety *and* Polluti on Inspections
- Enforcement Acti ons
- Accident Investi gati *ons*
- Wel 1 Control Training Requi rements

By dil i gently performing these responsibilities, MMS Offshore Operati ons is able to ensure that industry complies with the regul ati ons governing oi l and gas 1 ease operati ens.

Technol ogy Assessment

Assessments are used to determine the feasibil ity of conducting particular operati ens. For instance, one TA&R proj ect-- Structural Concepts for Lease Sal e 87-- anal yzes the feasibil ity of devel opi ng expl orati on and production systems for the Beaufort Sea, where sea ice, unconsolidated sediments, shallow gas concentrations, and other envi ronmental facto rs wil 1 complicate off sho re operati ens. Another example is the Subsea Collection of Blowing Oil in which oil is collected via a device suspended from a l arge tanker. The project will contribute to an eval uati on of this new concept and its feasibility for use i n conti'nge ncy pl anni ng.

Applied Res earth

Such studies consti tute about two-thirds of the programmatic content and address gaps in OCS operati ons technology. In some cases, fundamental scientifi c questions need to be answered. For example, i n one TA&R project-- Recapture of Oil from Blowing Well s-- the dynamic behavior of the two-phase flow of oil and gas blowi ng f rom a subsea we? l head had to be understood in order to determi ne the conditi ons under which oil coul d be coll ected. Previous experience gained by pl acing a collector over the blowing wel 1, as was the case in IXTOC-I in Compeche Bay, Mexico in 1979, reveal ed an unsatisfactory grasp of the sci ence. As a resul t of this project, a modi ficati on to the IXTOC-I coll ector configurate" on has been successfully developed. Having this coil ector technology in hand, the Subsea Collection of Blowing Oil, which provides for an engi neering analysis of a shipmounted system, can now be properly addressed.

Perhaps the most important aspect of OCS operati ons is the preventi on of blowouts. The TA&R Blowout prevention P rocedures study is an experimental i nvesti gati on into i ndustry's wel l -con tro l procedures in deepwater operati ens. One set of new procedures uses on-ii ne, downhole pressure measurements, known as "measurements whi 1 e dril 1 i ng", and computer-assi steal operati ons for controlling deep-ocean drilling. The blowout preventers are located on the sea bed, perhaps a mile or so beneath the drilling floor. At these depths, "kicks" (potential blowouts) are more difficult to anticipate or control because of the very 1 ong 1 engths of the riser systems and associated flow li nes. Another TA&R project, the Seafloor Seismic Data Study, seeks engineering data to determine the nature and magnitude of seismic signatures in active areas along the West Coast and the Aleutians where drilling and production activities occur or are likely to occur.

The TA&R applied research program is conducted at universities, government laboratories, and private companies-- wherever there are good science and engineering programs. Presently, there are about 30 active projects funded independently or in cooperation with other Federal agencies and the offshore industry. The average research project requires about 3 years to complete and each year there are several new starts.

Technology Transfer

At MMS Offshore Operations, both in the regions and at headquarters, there are working groups which review operational problems and technologies, and make recommendations to management on remedial actions and needed technologies. The groups, called Operations Technology Assessment Committees (OTACs), provide a forum for the exchange of information about technical problems and solutions within MMS. The network provides a person-to-person interface between Operations personnel, the TA&R staff and research contractors-- the latter serving, in effect, as adjunct members of MMS. This communications network comprises the major outputs of the TA&R Program. In addition, there are TA&R quarterly progress reports, a biennial TA&R program summary report, various seminars, and individual project reports.

Conclusion

To address MMS operational requirements in a timely manner, the TA&R Program needs to recognize and quantify relevant technologies in advance of offshore activities. Programmatic emphasis is placed on the 5-year lease sale plan and the expected industry response. Presently, a good deal of attention is being focused on the Arctic Ocean and, particularly, deep-ocean areas. There is particular interest in the engineering properties of sea ice, prevention of ice accretion techniques, and blowout prevention procedures.

NOTE: At the end of his presentation, Dr. John Gregory distributed copies of Technology Assessment and Research Program for Offshore Minerals Operations: 1984 Report, which authored along with Charles E. Smith. Persons interested in obtaining a copy of this report should contact either Dr. Gregory or Dr. Smith at the following address:

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REVIEW OF COUNTERMEASURES FOR MAJOR OFFSHORE OIL SPILLS

by Sy Ross
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A range of oil spill possibilities exists for the Bering Sea if oil is discovered and developed in the area. All possibilities can be classified according to various combinations of spill type (tanker spill or blowout); ice conditions (no ice, complete ice cover, and partial ice cover); sea state (low to high); and water depth (shallow to deep). The oil spill cleanup capability associated with each possible spill situation depends greatly on the above factors.

In general, tanker spills are extremely difficult to control at the source. Although technologies exist for dealing with offshore spills, it is very difficult to implement a quick response to a large marine oil spill before extensive oil spreading and weathering occur. For existing dispersants to be effective against a 10,000 ton tanker spill discharged over a one-day period, they *must* be applied to the oil release. Large aircraft and dispersant stockpiles of upwards of 3000 barrels would have to be set up at strategic regional locations and in constant readiness to accomplish this. The costs of such an enterprise are considered prohibitive.

Thus, any factor that allows greater response time for tanker accidents, or decreases the oil discharge rate is beneficial to the cleanup process. However, such factors are generally beyond the control of the oil spill fighter. For example, if a tanker spill occurs in a complete ice cover' environment, the spreading and aging of the oil is drastically *reduced,* and the response need not be instantaneous to be effective. Similarly, if an accident occurs *in* open water where a large oil discharge occurs some time after the accident, an effective response is possible. However, in general these kinds of accidents are rare.

In contrast, almost all oil well blowouts that could take place in Alaskan offshore waters have the potential to be effectively controlled. If the subsea blowout takes place in fairly deep water, it is likely that the oil slick on the water surface will be thin and fresh and easily dispersale by natural forces or by the application of chemical dispersants. Although shallow-water blowouts are likely to form water-in-oil emulsions which are not dispersable, they can be controlled by mechanical containment and in-situ burning, or skimming. Shallow subsea blowouts which occur under a stationary or moving ice cover are *relatively* easy to control because the oil is contained and preserved in the ice until springtime. At that time, the oil can be burned away as it emerges from the ice surface. The only blowouts, then, which will involve serious cleanup problems are those involving broken *or* moving ice, or high seas (combined with the formation of water-in-oil emulsions).

In general, the technological capability to clean up a major spill in Alaskan offshore waters is not radically different than that in more southerly areas. On the one hand, the presence of ice cover for much of the year is an asset in dealing with a spill. Still, a northern oil spill cleanup operation has obvious logistical and environmental difficulties-- a relative lack of local manpower, land based transportation is weak or non-existent, and the Arctic climate can be much more severe than in the south. The technological ability to respond to a northern spill may be equivalent to a southern operation but these additional problems necessitate a. much more complex support organization and planning structure.

I CE MANAGEMENT
AND
THE CANADIAN ExPERIENCE

by Yil Kuranel
Structural Engi neer
Mi nerals Ma nagement Service

Sea ice management involves the handling of sea ice to prevent drilling operati on stoppages due to ice formati ens. It is divided into four categories:

- o Lon g-Range Reconnaissance
- o Direct Observation and Tracking
- o Ice Breaking
- o Ice Pushing

Long-range reconnaissance is a means of identi fyi ng the type(s) of ice and its general movement-- parti cu1 arly, in rel ati onship to the locati on of the drilling pl atform. The SLAR, SAR, and STAR systems are more frequently used in this area. For more direct observati ens, the masthead radar and helicopter reconnaissance are used. In addition, often *crew* members are assigned an ice observer watch on the vessel's pl atform.

Ice breaking equipment is increasingly sophisticated and expensi ve. Two examples are the "Arctic Mari ne Locomoti ve" (Canadians Arctic Class-IO) and new Soviet Arctic Class-8. The main idea here is to break the ice into manageable sizes in an effort to facilitate ice pushing. Without proper ice management, a drilling pl atform may be forced off its location. In this case, an anchor recovery operati on and pl atform evacuati on may be necessary.

STATUS OF ST. MATTHEW ISLAND LAND EXCHANGE
AGREEMENTS, LITIGATION, POSSIBLE DEVELOPMENT

by Keith Goltz
U.S. Fish and Wildlife Service
Anchorage, Alaska

In December of 1980, Congress enacted the Alaska National Interest Lands Conservations Act (ANILCA). The Act placed St. Matthew Island under the stewardship of the Alaska Maritime National Wildlife Refuge and, thereby, made it unavailable as a base for development *in* the Bering Sea.

On 10 August 1983, the Department of Interior executed an exchange agreement which conveyed interest in twelve thousand acres of land to the United States. In return, the Department made available four thousand acres of land on St. Matthew Island for use as an oil support facility. On the same day the exchange agreement was executed, a group of eight *(8)* environmental plaintiffs sued to halt the exchange.

Plaintiffs charged that St. Matthew is a wilderness isl and by virtue of ANILCA. They argued further that wilderness lands cannot be conveyed out of Federal ownership. The United States countered that the exchange was in the public interest, and supported this position with facts present in the administrative record. The Department ultimately prepared an environmental impact statement which found the potential environmental benefits to far outweigh any potential environmental danage.

On 30 November 1984, in <u>National Audubon Society v. Clark</u> (Civ. No. A83-425), the District Court held that the record does not support the Secretary's conclusion that the exchange was in the public interest. The Court found that the prospect for environmental destruction was immediate and certain and that the Secretary had ignored such evidence in his ruling.

SESSION IIA

STUDIES OF RELATIONSHIPS OF LIVING MARINE RESOURCES AND OCS ACTIVITIES

Chaired by

Cleve Cowles
Supervisory Environmental Specialist
Environmental Studies Unit
Minerals Management Service

Responses of Endangered Bowhead Whales to Offshore Industrial Activities (MMS) -Jerume Montague

Responses of Endangered Gray and Humpback Whales to Offshore Industrial Activities (MMS) - Steve Treaty

Monitoring Change and Factors Affecting the Population Status of Colonial Seabirds (LGL) - Alan Springer

Seasonal Distribution and Monitoring of Endangered Whales in the Navarin Basin (Envirosphere) - John Brueggeman

Modeling Studies of Marine Mammals -- Oil Spill Interactions (ASA) - Mark Reed

Vulnerability of Alaskan King Crab to Oil Spills (NOAA/OCSEAP) "- Carol - Ann Manen

Application of Effects Information in Environmental Assessment and Migration (MMS) - Debby Johnston

RESPONSES OF ENDANGERED BOWHEAD WHALES TO OFFSHORE INDUSTRIAL ACTIVITIES

by Jerome Montague
Wildlife Biologist
Minerals Management Service

Early MMS-sponsored bowhead whale studies were largely directed at describing bowhead general biology and behaviors. More recent studies have focused on responses of bowheads as a seasonal resident of Bering Sea waters, to stimuli associated with offshore oil industry activities. Many findings of studies conducted in Arctic regions have direct and indirect applications for bowheads, in resolving questions and issues in subarctic areas.

Studies of the General Biology and Behavior of the Bowhead

Spring aerial surveys have documented the behaviors, distribution, migration routes, and migration timing of bowheads in the Bering Sea. Spring bowhead distribution in the northern Bering generally corresponds to open water areas that develop annually during ice breakup-- southeast and north of St. Lawrence Island and south of Cape Prince of Wales. Large numbers of bowheads in the northern Bering in early April indicate that the open water may be an important staging area from which the bowheads begin their northern migration. Behavior data is generally collected via aerial survey where dive cycles, playing and feeding activities, and underwater blows are observed and logged. During early spring, bowhead behaviors in this area consist primarily of resting and social interaction, with only 5 percent actively migrating.

The timing of the northward migration out of the Bering Sea also appears to be regulated by the seasonal breakup of sea ice. Aspects of the general pattern of bowhead migration and distribution that are not well documented include fall migration routes along the Soviet coast, fall routes through the Bering Strait, and winter distribution. Since 1979, MMS has funded the development of satellite whale tags suitable for use on bowheads. Continued development of a satellite-linked whale tag is necessary to collect information on bowhead distribution, behavior, and migration routes in remote areas, as well as to provide an alternative to aerial surveys. Data collected will also serve to validate behavioral measurements made from aircraft. Development of a successful prototype is continuing.

Another topic of study funded by our program was an analysis of overall tissue structure. Tissue samples were collected from bowheads, and cross sections were made to describe gross internal and external anatomy. Researchers found regions of skin depressions and indentations marring the otherwise smooth integument of the bowhead. In addition, skeletal samples were collected and bone cells were isolated. This work led to the completion of the most in-depth report on anatomy and histology ever completed on a large cetacean.

Responses Associated with Offshore Oil Industry Activities

Baleen was taken to a laboratory for oil fouling experiments in an effort to quantify the effects of potential contact with oil spills on filtering efficiency. It was found that the food-gathering efficiency of the baleen would be reduced by 6.8 percent if the bowhead is exposed to an oil slick l-roil 1imeter thick. This loss in filtering improves immediately after flushing with clean water and is completely restored after 30 days. The response to oil spills is far less dramatic in species with coarser baleen filaments.

In order to evaluate behavioral responses of bowhead whales to activities associated with offshore oil exploration and development, it was necessary to describe their 'normal' behavior in the absence of potentially disturbing stimuli. Most of this data was collected by expert behaviorists on aircraft specially equipped with radar, tape recorders, video cameras and the like. Aspects of undisturbed surface behavior were categorized into (1) general behavior, which includes travel, feeding, and social interaction; (2) surface and dive cycles; (3) aerial displays; (4) call rates and types; and (5) a variety of other less specific behaviors such as playing, cow/calf interactions, and pre-dive actions. These normal behaviors were used as a basis for comparison with behaviors of whales exposed to potentially disturbing stimuli.

Bowheads observed in the vicinity of industrial activities provided an excellent opportunity for gathering opportunistic data while exerting direct control of the acoustic stimuli provided for the gathering of experimental data. The findings are summarized below:

- Behavioral responses of bowheads to boats is the most consistent and the second-most pronounced of all disturbance factors tested. Whales oriented away from vessels up to 4-kilometers (km) away and actively avoided vessels at a distance of up to 2 km. They also appeared on the surface for shorter periods of time. In cases where boats approached bowheads directly, animals initially tried to outrun the vessel. As the boat closed in on the whales, bowheads would swim in a 90° angle from the boat's track.

- Responses to circling, fixed-wing aircraft were less consistent, and included such instantaneous responses as unusual changes in orientation, rapid dives", changes in aerial displays such as breaches and tail slaps. The frequency of such responses varied according to changes in altitude-- very frequent at 305, less frequent at 457, and rare at 610 meters. There was no conclusive evidence of disturbance by single passes by helicopters, which is a more likely industry scenario than circling. But since several of the bowheads were underwater at the time of the overflight further observations would be useful to verify these results.

- Short-term behavioral responses were not apparent in observations of whales near active drillships. But, experiments involving playbacks of recorded drillship sounds on bowheads demonstrated tendencies to change orientation and to reduce calling rates and dive durations. The reasons for the more pronounced response to playbacks than to actual drillships is not known but is likely to be a startle reaction.

o No overt response was seen in bowheads observed 2.8 km away from active dredges. Short-term behavioral response of bowhead whales to playbacks of recorded dredge noise included movement away from the site at ranges of 1 to 2.25 km and sometimes vacating the area within 2 km of the playback site. As with drill ships, reactions to recordings of dredge sounds were more pronounced than the actual industry activity.

o In five controlled experiments conducted by the Naval Ocean Systems Center and LGL Ecological Research Associates in 1984, short-term behavioral responses of bowhead whales to marine geophysical exploration were observed. In these experiments, whales were observed prior to ensonification, during the passing of an active seismic vessel, and after the vessel had passed and the firing of its airguns had ceased. When a vessel approached to within 6.7 to 3 km, the whales ceased their undisturbed activity for approximately one hour after the vessel had passed and had shut down its airguns. After which, they resumed their original 'normal' behaviors. Bowheads swam from 2 to 5.3 km away from their initial position when active *seismic* vessels approached to ranges between 1.5 and 6.7 km. However, cows with calves continued to stop and nurse during this movement away. In no case was the fleeing that becomes evident when non-seismic boats approach closely seen in response to seismic boats. It should be further noted that vessels firing at greater than 7.5 km from the whales appeared to be unnoticed until the distance was reduced to approximately 3.5 km as opposed to a 6.7 km response when the vessel became active at that range. This would indicate that bowheads are twice as likely to react to close start ups than to approaches by ongoing seismic operations.

RESPONSES OF ENDANGERED GRAY AND HUMPBACK WHALES TO OFFSHORE INDUSTRIAL ACTIVITIES

by Stephen D. Treaty
Wildlife Biologist
Minerals Management Service

In addition to studies on bowhead whales, the Alaska Region has funded several studies on other marine mammals and their relationship to oil and gas industry noise. There have been specific studies on ringed seals, beluga whales, humpback whales, sea otters, gray males, as well as more generic efforts. These studies have addressed short- and long-term displacement, communications masking, hearing, and various behavioral responses.

This presentation focuses on recent studies conducted for the Minerals Management Service (MMS) by Bolt, Beranek, and Newman (BB&N) on the acoustic responses of migratory gray whales to seismic exploration noise and other sounds associated with oil and gas development. Since the entire population of gray whales are considered migrants/seasonal residents of Bering Sea waters, an update on this species is particularly applicable to the regional focus of this meeting.

The studies were conducted along the Big Sur Coast in California, perhaps the best shore location for observing migrating gray whales given that 95 percent of the population passes within two miles of the shore. Theodolites (instruments used to measure the exact position of sightings) were used to track whales from shorn. Full-scale seismic vessels, voluntarily made available by industry sources, were used in field experiments. Also, an air compressor, together with a single air gun (100 cubic inch), was used in smaller-scale tests. A sonobuoy was used to record background noise and was particularly helpful in determining the level of noise received by the whales. Tape-recorded sources from a production platform, overhead helicopter, and semi-submersible drilling rig were played back underwater using an underwater speaker system.

The study results indicate that the gray whales tended to avoid the noisiest area, which had a sound level of 180 decibels (re 1 micro Pa at 1 m). They avoided this area by making what appeared to be minor course corrections and then regrouping after they had passed the seismic noise. The higher the decibel (dB) level, the greater was the chance that whales would avoid the area where the sound was made. There was a 0.8 probability of avoidance by whales to seismic noise at 180 dB and to the recorded sounds at 130 dB. When a. moving 40-gun array of airguns (4000 cubic inch) was turned on suddenly within 1000 meters of cow/calf pairs, avoidance was very dramatic due possibly to a “startled response” on the part of the whales.

There was a 0.5 probability that migrating gray whales would avoid various sounds at certain specified distances. For most playback sounds, this distance was less than 100 meters; for the single airgun, it was 400 meters; and for drill ship sounds, the same probability of avoidance Occurred at 1100 meters. For the full array of airguns, the whales demonstrated a 0.5 probability of avoidance when sounds were retie at a distance of 2500 meters.

Avoidance behavior to the full seismic array began to occur (0.1 probability) at 5000 meters.

A review of historical data from oil companies and geophysical companies of their *own* seismic surveying did not reveal any demonstrable long-term effects on gray whale migration routes or population growth. Between 1967 and 1979, when seismic activity was increasing exponentially, gray whale population growth increased at a rate of 2.5 percent each year. Overall, these studies showed that although minor localized course alterations or avoidance reactions can occur, major long-term effects on migration routes or population levels are extremely unlikely for the sound sources tested.

In a subsequent MMS study by BB&N using related methodology, the avoidance responses of humpback whales were tested. Initial results show little or *no short-term* avoidance to industrial sounds at the sound levels tested (up to 172 dB). This may indicate a general insensitivity to oil industry noise by humpbacks or it may be an indication that feeding whales, including gray whales, will tolerate more acoustic disturbance than migrating ones.

MONITORING CHANGE AND FACTORS AFFECTING THE
POPULATION STATUS OF COLONIAL SEABIRDS

by Alan Springer
University of Alaska
Fairbanks, Alaska

Seabird colony studies in the Bering Sea have focused primarily on indices of population numbers, reproductive success, and food habits. The colonies studied are located in marine areas with different physical environments and food webs, thus providing views of seabird ecology from several perspectives.

Studies of murres and kittiwakes have been particularly important because these taxa are abundant, accessible, and sensitive to changes in supporting food webs. Long-term studies at Bluff, the principal colony in Norton Sound, and at Capes Thompson and Lisburne in the eastern Chukchi Sea, have documented large inter-annual variability in the numbers, productivity, and food habits of murres and kittiwakes. The fluctuations are related to physical changes in the marine environment, particularly temperature, and apparently to the subsequent effect of the environment on coastal zone food web organisms, particularly certain species of zooplankton and fishes.

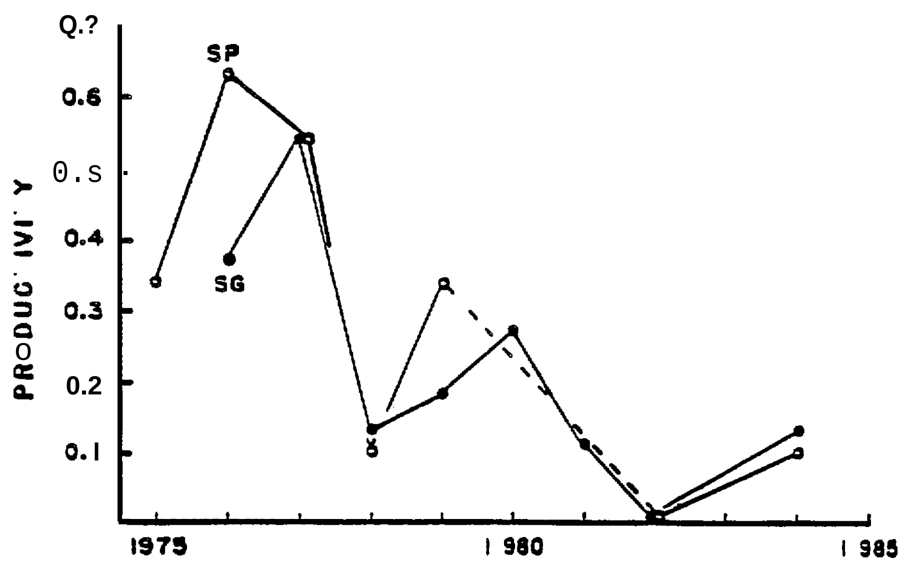
Murres and kittiwakes at colonies on the Pribilof Islands and St. Matthew Island in the southeastern Bering Sea, also experience large inter-annual variability in their breeding biology. For example, in 1981-84 on the Pribilofs and in 1982-83 on St. Matthew Island, kittiwakes had very poor reproductive success, while during the mid-late 1970's, kittiwake reproductive success was much higher. Also, censuses taken on the Pribilofs in 1982 and 1984 indicate that numbers of *murres* and kittiwakes, as well as cormorants, may have been as much as 30-70 percent *lower* than in 1976.

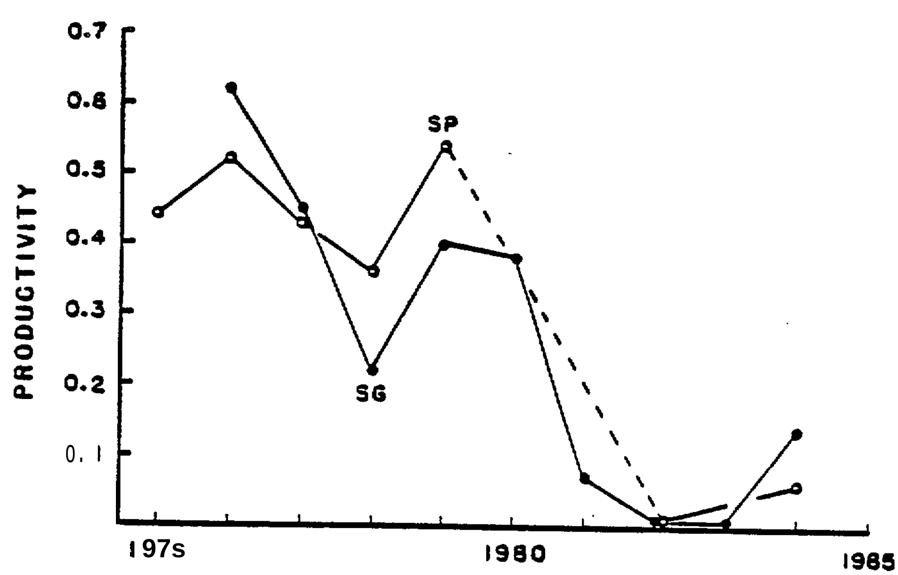
The walleye pollock is an important food of the piscivorous seabirds in the southeastern Bering Sea, including "murres, kittiwakes, and cormorants. The reproductive success of kittiwakes on the Pribilofs and St. Matthew Island is related to the abundance of pollock, with lower reproductive success in years of low recruitment. Recruitment has been generally poor during the 1980's, which probably accounts for the persistent breeding failures of kittiwakes, and might also explain the declines in the number of seabirds. (See figure 8 for productivity of the kittiwakes on the Pribilofs.)

Seabird studies on St. Matthew Island, sponsored by MMS, will again be undertaken *in* 1985-86. In addition, this year the Fish and Wildlife Service initiated a monitoring program for the Pribilofs. In view of the recent downward turn in seabird status at these islands, the continuation of annual work there should receive high priority.

Figure 8

PRODUCTIVITY OF KITTIWAKES





Productivity of kittiwakes on St. Paul 1. (SP) and St. George I. (SG). Productivity measured as the number of young per nest, Data sources are: 1975-79, Hunt et al. 1981; 1982, Craighead and Oppenheim 1982; 1983, A. Merculieff pers. comm.; 1984, LGL Alaska Research Associates, Inc. unpublished data.

SEASONAL DISTRIBUTION AND MONITORING OF ENDANGERED WHALES IN THE NAVARIN BASIN

by John J. Brueggeman
Envirosphere
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Recently, MMS provided funding support for studies of endangered whales in the central Bering Sea. The work was contracted through the NOAA Outer Continental Shelf Environmental Assessment Program (OCSEAP). Aerial and vessel surveys were conducted in the Navarin Basin to determine endangered whale abundance, distribution, and habitat use patterns. Surveys were conducted during the spring, summer, and fall from 11 May to 12 November 1982, and from 19 February to 18 March 1983. The spring-through-fall surveys occurred on parts of the outer continental shelf, slope, and rise and were made from a single helicopter and vessel. The late winter-early spring survey was done in the marginal ice front from two helicopters and a vessel.

A total of 5,648 nautical miles (rim) were surveyed during the spring through fall *period.* Ninety-one whales were observed, including 45 fin, 44 gray, and 2 right whales. Fin whales were observed during each of the three surveys, whereas gray whales were observed only during the fall, and right whales only during the summer. All three species were observed exclusively on the outer continental shelf. Gray whale densities were lower than those reported in or near the Bering Sea, while there was no appreciable difference for the fin whale. No regional data was available to compare right whale densities.

During the late winter-early spring period, 2,410 nm were surveyed in the marginal ice f rent. Approximately 21-32 bowhead whales were recorded. All of the wha? es were recorded in the vicinity of St. Matthew Island. Bowheads were associated with a range of ice conditions but primarily recorded in the higher ice concentrate ons (80-100 percent cover) of relatively thin ice. Similar studies conducted in 1979 showed that bowheads were widespread in the marginal ice front but were most abundant in the St. Matthew Isl and vicinity. Bowh cads were also associated with a range of ice conditions but were most prevalant in areas of moderate ice concentrate ons (25-75 percent cover).

The results of the four seasonal surveys, although based on small sample sizes, indicated that endangered whales utilize the Navarin Basin year round. During the spring through fall period, they dwell primarily on the outer continental shelf. During the late winter-early spring period, bowheads are present throughout the marginal ice f rent. However, the St. Matthew Island vicinity appears to be an important bowhead wintering location each year, possibly because of the presence of a recurring polynya.

MODELING STUDIES OF MARINE MAMMALS - OIL SPILL INTERACTIONS

by Mark Reed
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Wakefield, Rhode Island

Numerical modeling studies funded by MMS are in progress to estimate the probability of bowhead and gray whale encounters with oil spills, and the potential effects of oil spills on the Pribilof Island fur seals. Migration models have been developed for both species of whales and are now in the testing stage. A coupled population dynamics-migratory model for the fur seal has been formally designed and is now being programmed. linkage of each model to an oil spill model will allow interaction probability estimates for a variety of oil spill scenarios.

Assessment of interaction probabilities by simulation of potential oil spills in specific offshore lease areas proceeds as follows: First, the oil spill model is used to create a "population" of oil spill scenarios for various potential oil spill sites, seasons, and ice conditions. Based on oil spill occurrence rate statistics and the expected yield of the lease area, a set of spill scenarios will be drawn at random from the population. By running each spill scenario and each migration model simultaneously on the computer, an interaction estimate can be made for each set of scenarios. By repeating this process many times, a probability distribution of oil spill-marine mammal encounter probabilities can be established for each species.

VULNERAB ILITY OF ALASKAN KING CRAB TO SPILLED OIL

by Carol-Ann Manen
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Outer Conti ne ntal Shelf Envi ronmental Assessment Program
Alaska Office
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Oil spil led in the marine environment will have a maximum impact, in terms of levels of hydrocarbon contami nati on attai *ned* and persistence of these 1 eve?s in estuari ne and nearshore areas.

The Alaskan red king crab fishery, until recently the richest fishery i n the United States, is particularly sensitive to the presence of oil in estuari ne and nearshore areas given that these are the primary 1 ocati ons for reproducti on and rearing. The major portion of the red king crab popul ati on in the Bering Sea is recruited from juvenile crabs spawned and reared in the nears here areas on the north side of the Al aska Peni nsula. However, even though the di stributi on of pelagic 1 arvae is relatively even throughout this area, the distribution of juveniles is extremely patchy. It is believed that these crabs have strict h abi tat requirements for survival . For example, they are *more* prevalent where there is a high percentage of gravel and shell hash i n the sediment. Because the mortal i ty rates of juvenile and sub-legal crab are estimated to be 1 ow (about 0.10 a year), the future magnitude of a cohort is largely determined by the reproductive success and survival of 1 arvae and juvenile crab in such areas. C ontami nati on of juvenile refuge areas by spil led oil cou1 d have signi fi cant impact on the red king crab popul ation and on the fishery.

Laboratory Studies of the effects of oi 1 contaminated sediments on red king crabs between one and two years old indicate no change in mortality, molt rate, weight or length, feeding rate, or "scope for growth" for crabs hel d for three months over sediments contami nated with a maximum of 20 parts per thousand (ppt) Cook Inlet crude oil as compared to those held over clean sediment. However, concl usi ons about the 1 ong-term resistance of young crab to oil may be premature as the crabs did take up signi fi cant amounts of hydrocarbon f rom the sediment.

APPLICATION OF EFFECTS INFORMATION IN ENVIRONMENTAL ASSESSMENT AND MIGRATION

by Debby Johnston
Wildlife Biologist
Minerals Management Service

Through the data collection process, an author becomes aware of information needs that are pertinent to the analysis of the potential effects from the MMS offshore continental shelf oil and gas leasing program. The scientific literature is the starting point in the data collection process. The studies program also provides information to the environmental assessment authors for use in analyses pertinent to an environmental impact statement. The focus of this talk is how the information from these studies is used in the preparation of mitigating measures.

The purpose of mitigating measures is to reduce or eliminate potential adverse effects associated with the proposed activity. Mitigating measures are developed and refined during several in-house meetings before publication in the EIS, at which point public input is sought. These suggested changes are sent to the Secretary of the Interior where they are *reviewed* again. The wording of a mitigating measure is not in a final version until publication of the Notice of Sale, which immediately preceeds the lease sale. Two elements associated with OCS oil and gas activities that are of great concern are the potential for harm to wildlife populations from oil spills, and exposure to intense sound pulses f ran geophysical seismic exploration.

The studies program had a direct influence on the evolution of a seasonal drilling *restriction* applicable to all Federal drilling activities in the Beaufort Sea. Originally, drilling in the Beaufort Sea was limited to the winter months-- November through March. Data collected resulted in changes such that drilling activity is now restricted for approximately one month and varying in dates according to current observations. As new studies data are collected and analyzed, particular mitigating measures will be refined to reflect this information. The studies program evolves to follow the changing needs of EIS authors and the general public and, in particular, to respond to their questions about the impacts of OCS oil and gas leasing activities on the effected environment and ecological systems.

SESSION II-B

BERING SEA ECOLOGICAL AND FISHERIES STUDIES

Chaired by

Jawed Hameedi
National Oceanic and Atmospheric Administration
Outer Continental Shelf Environmental Assessment Program
Alaska Office
Anchorage, Alaska

The Integration of Biological and Physical Princesses in Ecosystem Studies (NOAA/OCSEAP) - Jawed Hameedi

The Role of the Bering Strait in Carbon/Nitrogen Fluxes of Polar Marine Ecosystems (University of Alaska) - John Goering

Environmental Characterization and Biological Utilization of the North Aleutian Shelf Nearshore Zone (LGL) - Denis Thomson

Life History of the Bering Sea Salmon Stocks (NOAA/NMFS/NWAFC) - Richard Straty

King Crab Research *in* the Southeast Bering Sea (University of Washington) - David Armstrong

Bering Sea Fish-Oil Spill Interaction Model (NOAA/NMFS/NWAFC) - Nancy Pola

THE INTEGRATION OF BIOLOGICAL AND PHYSICAL PROCESSES IN ECOSYSTEM STUDIES

by Jawed Hameedi
National Oceanic and Atmospheric Administration
Outer Continental Shelf Environmental Assessment Program
Alaska Office
Anchorage, Alaska

The central purpose of policy-relevant evaluative research is to provide information that is directly applicable to making decisions concerning actions or undertakings related to the legislative or institutional authority of an agency. The importance of biological, physical, sociological and other considerations in resource management decisions is highlighted in various legislation. The use of ecosystem research is explicitly *or* implicitly provided for in a number of acts.

<u>OCS Land Act, as amended (1978)</u>

> The timing and location of exploration, development and production of oil and gas . . . . shall be based on a consideration of the relative environmental sensitivity and marine productivity of different areas of the outer continental shelf. (Section 18(a)(2)(G)i)

<u>Clean Water Act (1977)</u>

> Pollution control should not only be based *on* effects on individual organisms but also on the effects of pollutants on the diversity, productivity, and stability of the biological community. (Section 304 (a)(l))

<u>Marine Protection, Research, and Sanctuaries Act (1972)</u>

> To conduct a comprehensive and continuing program of research with respect to the possible long-range effects of pollution and other man-induced changes in ecosystems. (Title II, Section 202)

Clearly, terms such as "productivity," "stability," and "diversity," signify properties of ecosystems and not of individual species. Thus, the concept and importance of ecosystem studies in policy-relevant evaluative research is well founded.

Because of the numerous interacting components, and problems concerning the varying spatial and temporal scales of various processes, ecosystem research poses conceptual as well as methodological difficulties. The complexity of "ecosystem" studies is manifest in the definition *of* the term:

> An organized, coherent entity which is composed of diverse, interdependent and integrating components and which exhibits regulative, homeostatic properties.

Yet, in areas where concerted and substantive efforts have been undertaken, the ecosystem approach has proved to be more effective than studies on individual populations or processes in providing useful environmental data and information for resource management decisions.

Key findings and conclusions based on ecosystem studies of coastal lagoons in the U.S. Beaufort Sea are presented as examples. In the case of Jones Island-Simpson Lagoon ecological studies, it can be surmised that the ecosystem possesses the general qualities that should lend it extremely resilient to environmental perturbations. It is subject to climatic extremes, and food resources {and perhaps habitat) for the seasonally abundant fish and bird populations which are very abundant. However, the system is not immune to man's activities, including industrial development in the nearshore and outer continental shelf areas. It is also possible to formulate hypotheses and extrapolate data from this study to other coastal lagoons along the Beaufort Sea coast.

THE ROLE OF THE BERING STRAIT IN CARBON/NITROGEN FLUXES OF POLAR MARI NE ECOSYSTEMS

by John Goering
University of Alaska
Fairbanks, Alaska

Seasonal and inter-annual variation of the transport of Pacific water north through the Bering Strait returns about 25 - 50 percent of dissolved carbon dioxide to the surface Arctic Ocean. The carbon is removed by polar down-welling of Norwegian Sea water, south of the Denmark Strait and the Faeroe Bank Channel . The associated nutrient flux *onto* the Bering Sea shelf is the same as that of the productive Peru up-welling system.

About half of this Arctic nutrient input is stripped by the primary producers of the southeastern Bering Shelf. Despite injections of nutrients from the Yukon River to waters east of St. Lawrence I sl and, most of the nutrient supply for the Arctic food web north of St. Lawrence is thus derived f rom the Bering Shelf water tothewest of the I sl and. Productivi ty estimates of the waters between St. Lawrence Island and the Bering Strait and 250 kil ometers to the north suggest that the nutrients are consumed hem, thereby forming the organic input to the carbon deposits of the Chukchi shelf sediments.

During years of weak transport of water through the Bering Strait as a result of very low temperatures, reproductive failure occurs among colonies of fish-eating birds foraging in the Chukchi Sea. This is similar to the recruitment failure of Alaska pollock during cold years in the southeastern Bering Sea. These inter-annual atmospheric changes may cause a two- to four-fold difference i n the flux of nutrients from the shelf-break of the northwestern Bering Sea; the primary production north of St. Lawrence I sl and; or the burial of carbon within Chukchi sediments. In additi on, there may be a change in the amount of energy passed up the Bering-Chukchi food web and, eventually, i n the chemical properties of the Arctic *Ocean water* transported across the Greenl and-Scotl and ridge system.

ENVIRONMENTAL CHARACTERIZATION AND BIOLOGICAL UTILIZATION OF THE NORTH ALEUTIAN SHELF NEARSHORE ZONE

by Denis Thomson
LGL Ecological Research Associates
Toronto, Canada

The study area extends from Cape Moridvinof on Unimak Island to Cape Seniavin on the Alaskan Peninsula. Gray whales, sea lions, harbor seals, sea otters, shearwaters and other seabirds, and a large biomass of both commercially important fish and forage fish utilize the area. In particular, the Izembek lagoon contains the largest, single-standing stock of eelgrass in the world..

The goal of this study is to describe the dominant biotic components of the North Aleutian Shelf and to clarify the important ecological processes on which they depend. Specific objectives are to (1) *assess* the relative importance of lagoon, marine, and terrestrial primary productivity to the food webs of the dominant components; (2) assess the roles that zooplankton, benthos, and detritivores play in cycling these materials; (3) assess the important pathways by which vertebrates utilize available food web materials; and (4) describe vulnerabilities of important biotic components to OCS oil and gas-related activities.

Marine primary productivity is measured directly. From the information collected, *a* physical model is being developed which traces the transport' of organic matter from the lagoons. Naturally-occurring isotopes are used to assess the importance of eel grass as a food source for important vertebrates and their prey species. Biomass of zooplankton and benthos, and the distribution, abundance, and feeding habits of fish, as well as seabirds are being determined based on data from six cruises. The distribution and abundance of seabirds and marine mammals are being determined in 14 aerial surveys. However, the primary source of info rmati on on the feeding habits of marine mammals and feeding rates of all vertebrate species is existing literature.

The marine system is not a homogeneous body of water. There are east-west differences in abundance and distribution of birds, fish, marine mammals, and their prey. There are also temporal differences in distribution. In spring, euphausiids *are* the dominant zooplankters. They are most abundant in the western end of the study area where they are a major prey for fish and birds. In the fall, euphausiids are absent and small fish then feed on copopods while large fish and seabirds feed principally on fish. Jellyfish may be an important competitor for plankton resources in the fall. Preliminary results of isotopic work indicate that lagoon-derived material is overwhelmed by high marine primary productivity and is relatively unimportant as a food source. Physical oceanographic data and distribution patterns of zooplankton and eel grass suggest that water movements carry lagoon-derived material offshore rather than 1 ongshore.

Valued ecosystem components, including key 1 inks in the food web within the study area, will be identified during the course of the study and their sensitivity to OCS-related activities will be determined from the relevant literature. It is expected that the level of vu1 nerability will vary in some way according to sea sona 1 and temporal changes.

LIFE HISTORY OF BERING SEA SALMON STOCKS

by Richard R. Straty
National Oceanic and Atmospheric Administration
National Marine Fisheries Service
Northwest and Alaska Fisheries Center
Auke Bay, Alaska

Five species of Pacific salmon (Oncorhynchus spp.) are produced in the river systems tributary of the Bering Sea. The sockeye salmon (O. neka) is the most abundant species followed in order by chum salmon (O. keta), pink salmon (O. gorbuscha), chinook salmon (O. tshawytscha), and coho salmon (O. kisutch).

Salmon are anadromous; that is, they mature in the ocean and spawn in fresh water. All salmon spend a portion of their juvenile and adult lives as residents of the Bering Sea. Although this residency is transitory, salmon compose a significant and highly variable portion of the total pelagic fish biomass of the Bering Sea during spring through early fall. Knowledge of the seasonal movements, migration routes, and magnitude of annual variations in the biomass are vital to our attempts to assess the impact of OCS oil and gas-related activities on salmon resources.

Both maturing and juvenile salmon are present in the Bering Sea from May through September, but their migration routes do not overlap appreciably. Juvenile salmon migrate seaward across the Bering Sea shelf along the coast, eventually moving to offshore waters as their sizes increase. Maturing salmon remain in the offshore waters until they are near their home river systems. The Bering Sea shelf distribution of maturing salmon appears similar for all species, with all migrating to rivers located in the same geographic areas. Chinook salmon are the first to enter the shelf during both spawning and seaward migration, followed in order by sockeye, chum, pink, and coho salmon.

Immature salmon are also present in the Bering sea and have been taken incidentally by trawlers operating near the shelf edge. These immature salmon appear to be most abundant during the fall and winter; they are composed primarily of chinook salmon.

Annual and seasonal variations in sea temperature appear to influence the distribution, growth and, indirectly, survival of salmon while they are residents of the Bering Sea.

Significant gaps exist in our knowledge of the distribution and movements of Pacific salmon in the Bering Sea. The greatest contribution to this knowledge can accrue from exploratory surveys conducted in coastal waters of less than 10 fathoms depth from May through October, and in offshore waters between 168°W and the shelf edge from 56°N to 66°N during June through October.

KING CRAB RESEARCH IN THE SOUTHEAST BERING SEA

by David A. Armstrong
School of Fisheries
University of Washington
Seattle, Washington

Both the red king crab (*Paralithodes camschatica*) and the blue king crab (*P. platypus*) have supported substantial crustacean fisheries in the southeast Bering Sea for over a decade. The collapse of the former fishery in the early 1980's drew attention to the need for ecological and early life history information to manage the fishery but also to plan and mitigate possible impacts of oil development in that region. Although the National Marine Fisheries Service has conducted a historic fish survey since the early 1970's that is primarily concerned with distribution and abundance, substantial gaps in life history, habitat needs and ecological information still remain.

Blue king crab were studied in a series of cruises supported by OCSEAP in 1983 and 1984 during which side-scan sonar was used to help characterize and map substrate types around St. Paul and St. George Islands in the Pribilofs. Instar juveniles of the species were newly recruited to the benthos in about August at a mean carapace length of 2.8 millimeters (mm). By April of the first year, the 1983 year class had grown to about 5-6 mm, which may reflect cold bottom water temperatures of 0 to $-1^{\circ}C$ through winter and spring. Juveniles under two years of age were most abundant nearshore within the 60-meter isobath of St. Paul, primarily on the east/northeast side. A much more restricted juvenile population was distributed just east of St. George Island. Juveniles were most abundant in shell hash, covered with epiphytic growth, and in cobble; they were virtually absent on open sand/mud bottom between the two islands.

Densities ranged from several hundred to 28,000 crab per hectare or several hundred to over 9 million per square nautical mile (nm; standard areal unit used by NMFS). Up to several hundred million juveniles were estimated to occur primarily within 10 nm of St. Paul Island. No juveniles were caught between 30 and 75 nm carapace length during any of the three cruises despite several hundred trawls made in the area. This suggests that several sub-adult age classes are extremely weak or missing. The nearshore distribution of juveniles was very aggregated and the high degree of association with and dependence on shell hash suggest a high vulnerability to potential nearshore oil mishaps. Moreover, it suggests that extreme care should be taken in planning location and timing of operations.

Similar early life history information for red king crab is not nearly as detailed as that for blue. Despite OCSEAP-supported cruises along the North Aleutian Shelf (NAS) in 1983, the scale of the study area precluded formulation of a definitive early life history scenario. Larvae are apparently hatched nearshore and, perhaps, transported several hundred kilometers away before metamorphosis. Populations of larvae are found in the midshelf area at a depth of at least 50 meters. Small juveniles under 3 years of age are rarely found in the offshore area and appear to be most abundant inside the 50-meter isobath from Amak Island through Port Moller, with large populations occurring as far east as Kvichak Bay. This species too seems to be associated with epibenthic materials such as tube worms, sponges and cobble that apparently provide some degree of refuge from predators. The nature and extent of such material is poorly documented, and much more work on ecological requirements and principal recruitment areas al ong the NAS must be done i n the future in order to properly manage oi 1 development and mitigate against potential impacts.

BERING SEA FISH - OIL SP ILL INTERACTION MODEL

by Nancy B. Pola
National Oceanic and Atmospheric Administration
Northwest and Alaska Fisheries Center
Seattle, Washington

Techniques used in ecosystem simul ation models such *as* DYNUMES and PROB UB, developed by Dr. Taivo Laevastu and presently used on a regularbasis at the Northwest and Alaska Fisheries Center (NWAFC) to study Bering Sea ecosystem dynamics, were adapted to the Biological Impact of an Oil Spill (BIOS) (Biological Impact of an Oil Spil l) ecosystem simulation model . Many of the princesses simulated by DYNUMES and PROBUB were modified in BIOS due to the short time step (daily) and duration of the BIOS model run (less than 50 days). Two hypothetical oil spi? l scenarios, a well blowout and tanker diesel spill, were simulated at each of *three* locations in Bristol Bay-- offshore of Port Moller, Port Heiden, and Cape Newenham. Subsurface oil concentrations were gridded daily for each scenario and location by SAI and the Rand Corporation. A 32x34 grid was used for the oil spill scenario and a 50x50 grid was used for the blowout scenario. In each case, 2-kilometer grid spacings were used. Sedimented oi 1 was simulated by TARS, a model also developed by Dr. Laevastu.

Model calculations were performed at each grid point. Fish contamination was simulated by a singl e-compartment uptake-depura ti on mod el . The species-specific uptake and depuration rates were determined from field and empirical studies, and were kept constant for each species group throughout each simul ation. Contamination was computed in parts per million (ppm). Contamination of 5 ppm was taken as the threshold level for "tainting" of fish, which occurs when there is a detectable aroma or taste of petrol cum. The fraction of pel agic or demersal food in each species' diet was estimated and the 1 evel of contaminate on was assumed to be directly proportional to the *concentrate on* of the aromatic fracti*on* of the subsurface oil *concentrate* ons for pelagic food; or the sedimented oils for demersal food.

The oil concentrate ons for the blowout scenario were less than 1 ppm. The simul ated effect on the ecosystem was minimal and of short duration. For the accident scenario, tainted fish were found in up to 32 percent of the model grid area. However, estimated fish biomasses at each 1 ocation were 1 ess than 2 percent of the total eastern Bering Sea biomass for each species. As a resul t of migrati on, the area covered by tainted fish in al 1 cases was increased, but levels of contami nation were decreased.

SESSION II-C

BERING SEA RESOURCE UTILIZATION STUDIES

Chaired by

Fred King
Supervisory Socioeconomics Specialist
Social and Economics Study Unit
Minerals Management Service

Presentations

Ringed Seal Monitoring - John Burns

Local Dependence on Commerical Fisheries and Subsistence of Bering Sea Communities (University of Alaska) - Steve Langdon

Aluetian Harvest Effects Disruption Study (Stephen R. Braund and Associates) - Steve Braund

Bering Sea Fisheries Methods and Gear (University of Alaska) - John Doyle

Oil/Fisheries Group of Alaska: Methods of Resolving Potential Conflicts (SOHIO) - Peter Hanley

State of Alaska Studies' of Subsistence Resource Utilization (ADF&G) - Robert Wolfe

RINGED SEAL MONITORING

by John J. Burns
Alaska Deparment of Fish and Game
Fairbanks, Alaska

The three most important objectives of the monitoring effort on ringed seals are to (1) further develop a series of base line data that indicate differences in regional abundance and habitat dependencies; (2) provide information on the natural, spatial and temporal variations in seal abundance and habitat quality; and (3) measure impacts of human activities.

Data Collection

The ringed seal monitoring effort was initiated in nearshore Chukchi and Beaufort Seas in 1970, prior to extensive, on-ice, seismic exploratory activity. Aerial surveys were taken in 1970, 1975-77 and 1981-82. The most intensive surveys began in the spring of 1985. These surveys provide information on the relative abundance of molting seals in different regions of the fast ice zone of northern Alaska, as well as in some parts of the drift ice.

A series of studies to determine density and composition of subnivean structures maintained by ringed seals has also been undertaken using line transects and grids. Trained dogs were used to locate structures that were subsequently examined to determine physical charactersties, type, and ice conditions at the time of formation.

Study Findings

Aerial surveys indicated a density of molting ringed seals on the fast ice of the Chukchi Sea that ranged from .93 to 7.08 per square mile. The range in the Beaufort Sea was .53 to 3.73 per square mile.

Searches for subnivean structures along line transects in the regions of fast ice from southern Norton Sound to Peard Bay in the Chukchi Sea showed a range of 0.6 to 4.4 structures per linear mile of transect. There were marked differences in predominant types of structures in different geographic regions. The average number of subnivean structures found along transects on drift ice in the central Chukchi Sea was 2.7 structures per linear mile, close to the average of 2.4 found on the fast ice.

Intensive searches of grids showed that the mean density of subnivean structures in southern Kotzebue Sound was 21.4 per square mile in search areas totaling 11 square miles. In the Chukchi Sea between Cape Lisburne and the Pitmegea River, average density of structures was 23.2 in areas totaling 10.6 square miles.

These data provide indications of the density and relative abundance of seals and seal-made structures in regions suitable for on-ice developmental activity by man.

LOCAL DEPENDENCE ON COMMERICAL FISHERIES AND SUBSISTENCE OF BERING SEA COMMUNITIES

by Steve J. Langdon
University of Alaska
Anchorage, Alaska

The Bering Sea supports one of the most productive ecosystems in the world. Groundfish harvests alone have amounted to in excess of 1 million metric tons of commercial catch in recent years. The Bering Sea ecosystem also supports approximately 90 communities on the Alaskan mainland coast, the Pribilof Islands, Nunivak Island, and St. Lawrence Island. The foundation of the overwhelming majority of these communities is a mixed economy composed of commercial fisheries and subsistence, both components of which are based, in large measure, on the Bering Sea ecosystem.

Coastal residents of Bering Sea communities are major participants in the salmon and herring commercial fisheries, but are only minor participants in the crab and groundfish commercial fisheries. The value of the salmon and herring fisheries has grown tremendously since 1975 due to extension of the 200-mile limit and mild environmental conditions that have promoted biological growth of stocks. In the last two *years,* 1983 and 1984, the combined ex-vessel value of the Bering Sea Alaskan salmon and herring fisheries has exceeded $200 million. The majority of that value for both salmon and herring comes from the Bristol Bay area.

Research in four predominantly Yupik Eskimo communities in the western part of Bristol Bay and the southern part of Kuskokwim Bay, during 1982 and 1983 revealed that commercial fisheries were the largest source of cash to village residents ranging from a high of 75.3 percent in Togiak {western Bristol Bay) to a low of 43 percent in Quinhagak (southern Kuskokwim Bay). The second most important source of cash was wages from government jobs; third, in three of the four communities, was transfer payments. In only one community did other private sources of income exceed 10 percent.

A 1983 survey of Bristol Bay villages, primarily in the Nushagak River and Lake Iliamna area, revealed a similar pattern of sources of cash. Commercial fishing contributed 45.4 percent of total income, wages 27.2 percent, permanent fund dividends 6.3 percent, and transfer payments 5.2 percent.

Net earnings from commercial fisheries and other cash are used by village residents to purchase capital goods (i.e., guns, snow machines, skiffs, outboards) for subsistence production. Household expenditure patterns in the 1983 Bristol Bay survey revealed that food and transportation were the two most expensive items. Subsistence production has been shown to be *cost* effective, producing high quality protein at a lower cost than it can be purchased from stores. Subsistence produces the majority of protein consumed in most coastal Bering Sea communities.

ALEUTIANS HARVEST EFFECTS DISRUPTION STUDY

by Stephen Braund
Braund and Associates
Anchorage, Alaska

The purpose of this study is to identify and analyze the potential effects on the local economy, social structure, and culture in King Cove should there be a disruption in renewable resource utilization associated with OCS lease sales. Based on a review of the relevant secondary sources and extended fieldwork in King Cove, the study team is preparing an ethnographic baseline of the community. At the time of this presentation, the harvest disruption had not been prepared.

King Cove, established as a cannery town in 1911 and with a current population of 500, is a small fishing community located on the south side of the Alaska Peninsula near Cold Bay. The community grew as Aleut families from other settlements, as well as a number of Northern European fishermen with Aleut wives, were attracted by the cannery. The commercial fishing industry dominates the economy of King Cove and provides the cultural focus for the community. Presently, the summer salmon fishery is most important, with tanner crab as the species of secondary importance. Peter Pan Seafoods, the largest cannery in Alaska, is located in King Cove and physically dominates the community.

Limited entry had a significant impact on King Cove. Many fishermen received more than one salmon permit (e.g., seine and drift gill net) and were thus able to take advantage of increasing salmon returns beginning in the late 1970's (e.g., sell a permit to make "money; sell a permit in order to buy a better fishing boat; transfer a permit to one's son). Since 1980, fishermen have specialized and capitalized; in addition, they tend to fish with one gear type throughout the season. The increased salmon returns and permit transfers have resulted in increased fishing effort and competition in the Alaska Peninsula salmon fishery. For example, by 1984 the amount of gear fished in the South Unimak June fishery had increased 216 percent since 1976. The increased catch has resulted in fewer fishing days; an ever increasing advantage for efficient, well-equipped fishermen; and a trend towards even greater capitalization of the fishing fleet.

Despite King Cove's prosperity in commercial fisheries, residents continue to harvest renewable resources for home use. Caribou, waterfowl and salmon are the preferred foods and comprise the majority of pounds of locally harvested foods for community consumption. This subsistence harvest of renewable resources in King Cove differs from strategies found further north (e.g., Arctic/Yukon/Kuskokwim) in three ways:

- o The perennially ice-free nature of the marine environment allows year-round access to most resources.
- o The reliance on a single mode of access (boats) during all seasons enables King Cove residents to concentrate capital on one piece of harvest equipment rather than two or three.
- o The overlap of commercial and subsistence activities.

BERING SEA FISHERIES METHODS AND GEAR

by John Doyle
Marine Advisory Program
University of Alaska
Anchorage, Alaska

The eastern Bering Sea supports one of the world's richest food fisheries. The total 1984 harvest of all species of fish and shell fish in the eastern Bering Sea, including the Aleutian Islands, was approximately 1,699,700 metric tons.

Commercial fishing in territorial waters is entirely domestic while the fishery outside territorial waters is both domestic and foreign.

The largest single 1984 species fishery was for pollock (Theragra chalcogramma), which amounted to slightly more than 1 million metric tons. Other harvests include yellowfin sole (Limanda aspera), 160,000 metric ton; and Pacific cod (Gadus macrocephalus), at 111,000 metric tons. In the inshore fisheries, salmon (Oncorhynchus spp.) was the most important fishery with a total harvest of 66,000 metric tons. All five species of eastern Pacific salmon are harvested in the eastern Bering Sea with sockeye (Oncorhynchus nerka) being the most abundant. Herring (Clupea harengus pallasii) constitute the other important inshore fishery with a total 1984 harvest of 22,700 metric tons.

Offshore halibut and crab resources have been the exclusive domain of the U.S. fishing industry since the Fisheries Conservation and Management Act of 1976. The offshore white fish fisheries (i. e., cod, pollock, flounder, etc.) have historically been dominated by foreign fleets-- predominantly Japan, the Soviet Union and, more recently, Korea and Taiwan. The U.S. fleet effort on ocean white fish, however, has increased significantly in recent years. For example, in 1980, the total U.S. harvest was only 41,000 metric tons. However, by 1984 the domestic harvest was 417,000 metric tons, a ten-fold increase in five years.

The U.S. fishing industry has two components: joint ventures and strictly domestic. The joint ventures involve domestic harvesters delivering their catches to foreign processing ships at sea, while the totally domestic fishery involves harvesters delivering to shore-based plants or harvesting and processing at sea by catcher-processors. In 1984 the joint venture harvest was 358,000 out of a total of 417,000 metric tons.

Fishing gear can be divided into two broad classifications-- mobile or fixed. Fixed gear, as the name implies, is either anchored in place or held in place by its own weight. Mobile gear moves either with the current or under the power of the vessel in control of the gear. Examples of fixed gear are herring and salmon set nets; halibut and sablefish longlines; and crab, fish, shrimp and snail pots. Mobile gear includes salmon and herring drift gill nets, salmon and herring purse seines, and bottom and midwater trawls.

The gear and setting patterns used in a particular situation will depend on a number of factors, including species type and location of catch. To avoid perturbations and maximize *gear* effectiveness, it is also important that operators at least be aware of other activity which could impair functioning. For example, king crab pots are used along the edge of the continental shelf and weigh up to BOO pounds (see Figure 9). They are particularly susceptible to other mobile fishing gear, tug and barge operations, and towed seismic operatiens. often, buoy lines become fouled in the tow lines and are separated, dropped in deep water, or dragged away from the location and, thus, are lost to the fishermen. Moreover, the heavy buoy lines can foul propellors of vessels underway. Bottom trawls operating in the same area are particularly susceptible.

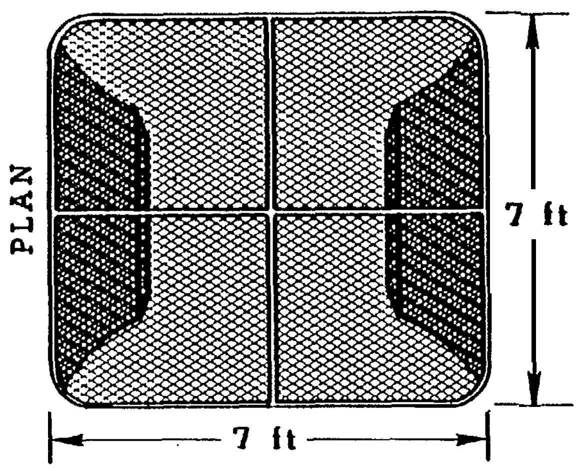
On the other hand, mobile gear presents a different set of problems for other uses of the same water space. In this case, fixed obstructions constitute a major hazard. For example, the salmon drift gill nets consist of a small boat with nets set perpendicular to the current in the path of migrating salmon. *Clearly,* the current controls the movement of the net and boat. Even with full power applied, the boat will have only a minimal effect on controlling the net and, thus, any unknown fixed object presents an extreme hazard. A hard snag will destroy at least a part of the shackle. A surface view of a salmon drift net and boat are shown in Figure 10.

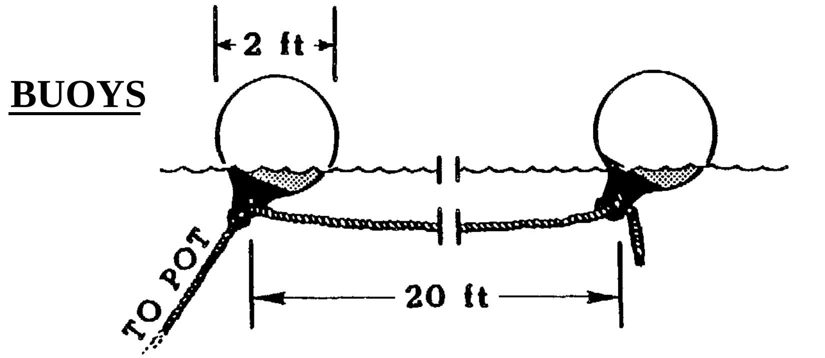
By far the largest percentage of fish taken in the Bering Sea are harvested by trawlers-- both foreign and domestic. A fish trawl is a funnel-shaped bag made by complex, tapered panels of web. They are used to capture fish that tend to congregate in schools either at or near the ocean bottom, or in the midwater areas. Trawls vary in size and complexity. Pollock, flounder, and numerous other species are the exclusive targets of the trawlers. These are high volume, low unit value fisheries.

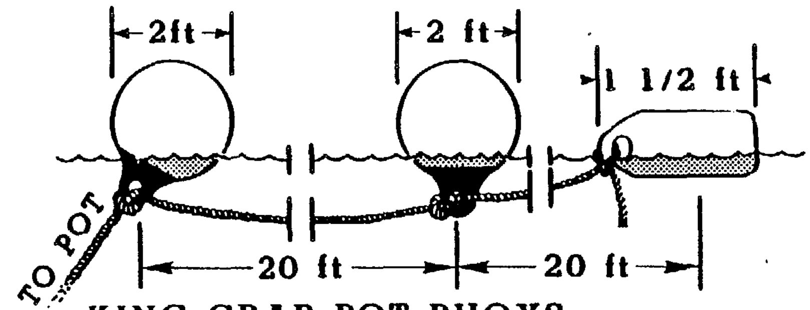
The *otter* trawl , a bottom fishing operation, has been used for centuries. Here, the vessel tows a net along the bottom at two to three knots, with otter doors and bridles herding the fish toward the center of the net's path. The speed of the net soon outpaces the swimming fish; and once the foot rope has passed under the fish, they float passively back to the cod end.

A detailed paper with graphics for this presentation can be obtained from the Marine Advisory Board.

Figure 9 **Fixed Gear - King Crab Pot**

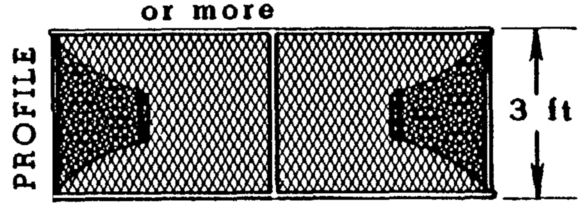






KING CRAB POTS

- are made of heavy steel frames
- are set on the bottom to 50fm or more



- are spaced 100 - 300 fm apart
- may drift up to 1/4 mile horizontally during setting
- cost approx. $1000 per pot, fully rigged
- may be stored in groups in less than 25fm water
- are side-loading, so crabs enter from side

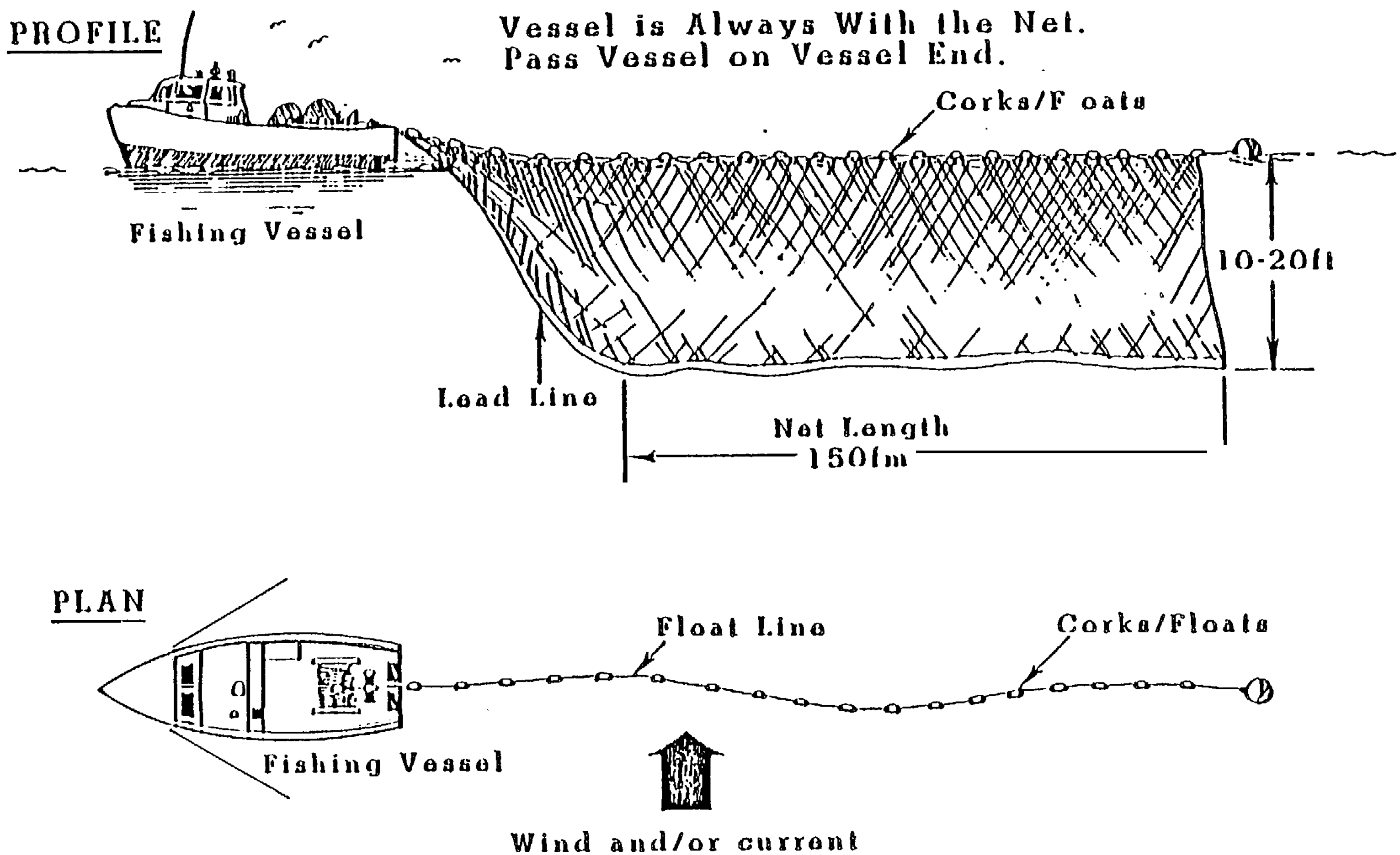
KING CRAB POT BUOYS

- are rigged 2 -4 per pot (usually 2)
- one buoy has fisherman's ADFG number
- are brightly colored orange, yellow, red
- buoys of lost pots will bear large growth of moss
- carry no radar reflectors
  each fisherman has own color pattern
- the first or deepest buoy is the heaviest and toughest "Sea Lion Buoy"
- the last or top buoy is the lightest, for retrieval "Trailer Buoy*

Figure 10 SALMON DRIFT GILLNET AND BOAT

SALMON & HERRING - At S rface

- always inside 3 mile imit



Note: Dimensions of net vary by region in Alaska.
These dimensions are the most typical.

OIL/FISHERIES GROUP OF ALASKA: METHODS OF RESOLVING POTENTIAL CONFLICTS

by Peter Hanley
Sohio
Anchorage, Alaska

Commerical fishing has successfully coexisted with oil and gas activities in many areas of the world, including the North Sea and, closer to home, the Gulf of Mexico, Offshore California and Cook Inlet. Successful coexistence does not mean that there are no problems or conflicts between the two industries nor does it mean that hard negotiations and compromises do not occur. However, the record shews that compatible multiple-use can occur through communication, education and good faith efforts at problem resolution. In areas where there is multiple-use of the ocean space it is also important that the oil and fishing industries coordinate their respective activities as much as possible in order to avoid conflict.

In the North Sea, a forum consisting of the oil and fishing industries, and representatives of the government of the United Kingdom was established in 1974. The main objective of the Fishing and Offshore Oil Consultative Group (FOOCG) is to foster closer relations between the two industries in order to minimize interference to their operations. FOOCG aids in settling claims for lost or damaged fishing gear under a fund established by the United Kingdom Offshore Operations Association (UKOOA). In addition, the group has addressed such issues as ocean debris and platform location.

In central California, a liason office was established in 1983 to act as an information clearinghouse for oil and fishing industry activities. Funded by Central California Oil Operators, the liaison office is monitored by a committee of oil and fishing industry representatives. The office's watchword is to resolve potential conflicts before they happen. Advance information on each industry's activities is a key factor in accomplishing this goal. It is provided to the appropriate party via the liaison office.

In Alaska, we can learn from these experiences while developing an inter- industry organization tailored to our special circumstances. Our own Oil/Fisheries Group was launched on 29 March 1983 when representatives from four major oil companies and the major fishing and fish processing organizations met in Anchorage. Credit for the initial idea and for most of the preparatory work in forming the inter-industry organization goes to Mark Hutton, a fisheries scientist and Bristol Bay Fisherman. Another prime mover was Rick Lauber of the Pacific Seafood Processors' Association.

At the second meeting of the group in September 1983, the participants agreed to a statement of purpose as follows:

> The purpose of the Oil/Fisheries Group of Alaska is to provide a forum for inter-industry communication and education and to seek to resolve potential problems relsting to operations in Alaska. Its goal is the successful coexistance of commercial fishing, processing, and oil industry activity in Alaska offshore areas. An important objective is the formation of an open, easily

accessible communication channel between individuals who are participants in the group. Projects, education programs, and field trips will be undertaken to the benefit of both industries.

During the first eighteen months of its existence, the group was administered relatively informally by a steering committee. However, in August 1984, a more formal organizational structure was adopted when the group became incorporated as a non-profit organization. There are two membership categories-- fishing and oil. The position of president and vice-president alternate annually between the oil and fishing industries. Currently, there are eight oil companies, six geophysical companies, one geophysical industry unbrella organization, ten fishing organizations, a seafood processors' organization, and four fish processing companies active with the Group.

Given concern about the potential for interference and gear damage from geophysical operations, the Oil/Fisheries Group prepared an operations manual for geophysical companies and industry. The manual includes basic information on the fishing industry in the Bering Sea, Kodiak Island area and Lower Cook Inlet; a voluntary systematic approach for geophysical program planning and marine operations that involves communications with the fishing industry prior to and during seismic operations; and basic information to the fishing industry on the characteristics of seismic operations (i.e., equipment, techniques, etc.). It was first published in September 1983 and copies of the second edition, published in May 1984, are available upon request.

In conclusion, the Oil/Fisheries Group is a model for cooperation between various industries that presently have a commercial interest in the Alaska OCS Region. It facilitated the discussions last fall between Chevron and fishermen in the Dutch Harbor/Unalaska area concerning the erection of a rig on Shelikof Strait. Should commercial discoveries of oil and gas be made in the region, it is very important that there is an organization in place committed to ensuring the compatible and successful coexistence of oil development and production with Alaska's commercial fishing industry.

STATE OF ALASKA STUDIES OF SUBSISTENCE RESOURCE UTILIZATION

by Robert Wolfe
Alaska Department of Fish and Game
Juneau, Alaska

One of the major research challenges to the Division of Subsistence of the Alaska Department of Fish and Game is to describe and understand Alaska's subsistence-based socioeconomic system. Communities with subsistence-based systems are economically and socially dependent on fishing and hunting for local use. Without access to the natural resource base of fish, game and plants the communities could not exist as they do today.

Characteristics of such a system include high participation rates in fishing and hunting activities in a given season; substantial outputs of fish and game products for local use; extensive, non-commercial production, distribution and exchange networks; traditional systems of land use and occupancy; and a mixed economy combining subsistence and commercial sectors. The Division of Subsistence has conducted work in several such communities. The locations of some of these communities are depicted in Figure 11.

The economic activities of a community follow a yearly cycle, based on the seasonal appearance of fish and game resources. The seasonal round of production activities is complex and differs in detail between communities. The seasonal round is a regular pattern, although fluctuations appear in it from year to year depending upon the availability of resources, weather conditions and other factors. Participation rates in selected subsistence activities also vary among communities, but are generally at least 50 percent for such catch as sockeye salmon, white fish, and caribou.

Outputs of fish and game are substantial in subsistence-based systems. Figure 12 shows food outputs for three communities near the *Yukon* River Delta and for Nondalton in pounds dressed weight per household per year, in 1980. The sample of 88 Yukon Delta area households interviewed produced on average 4600 pounds of fish and game, or about 780 pounds per household member. These are substantial outputs, reflecting the high dependencies of these communities on fish and game. This contrasts with the economic basis of other Alaska communities which are more dependent on activities such as trade, government services, finance, defense, and manufacturing.

As of yet, there is little information documenting trends in subsistence outputs. What little information exists for Yukon Delta communities suggests there has been no radical changes in output in recent years. For example, there is fairly uniform information on salmon caught along the lower Yukon River over the last 20 *years.* King harvests fluctuate from year to year primarily due to run strength and catch conditions; five-year averages seem to be increasing slightly. The five-year averages for chum harvests seem to show a decline over time, attributable e *in* part to the decrease *in* the use of dog teams *in* the area.

Figure 11

ALASKA'S SUBSISTENCE-BASED COMMUNITIES

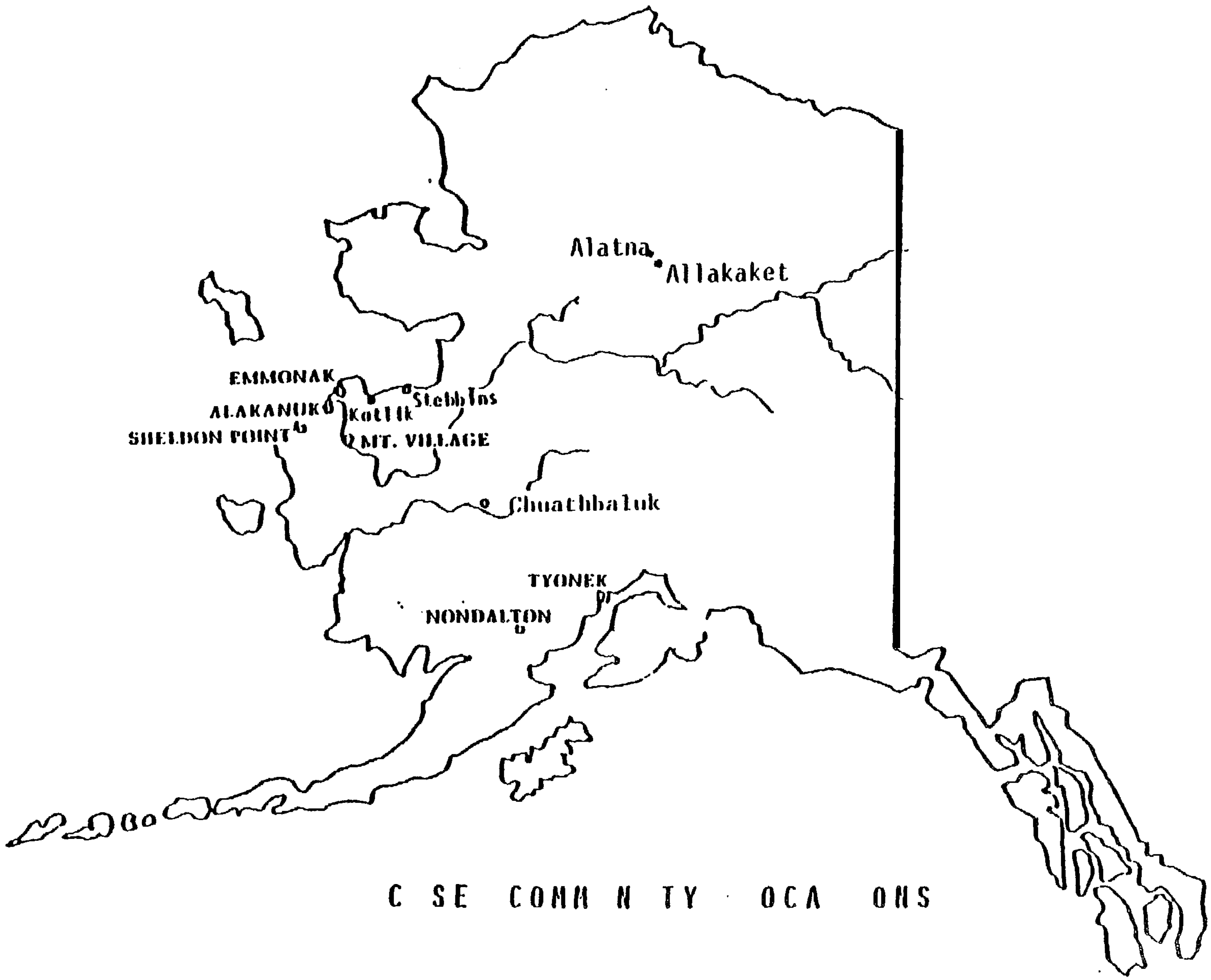
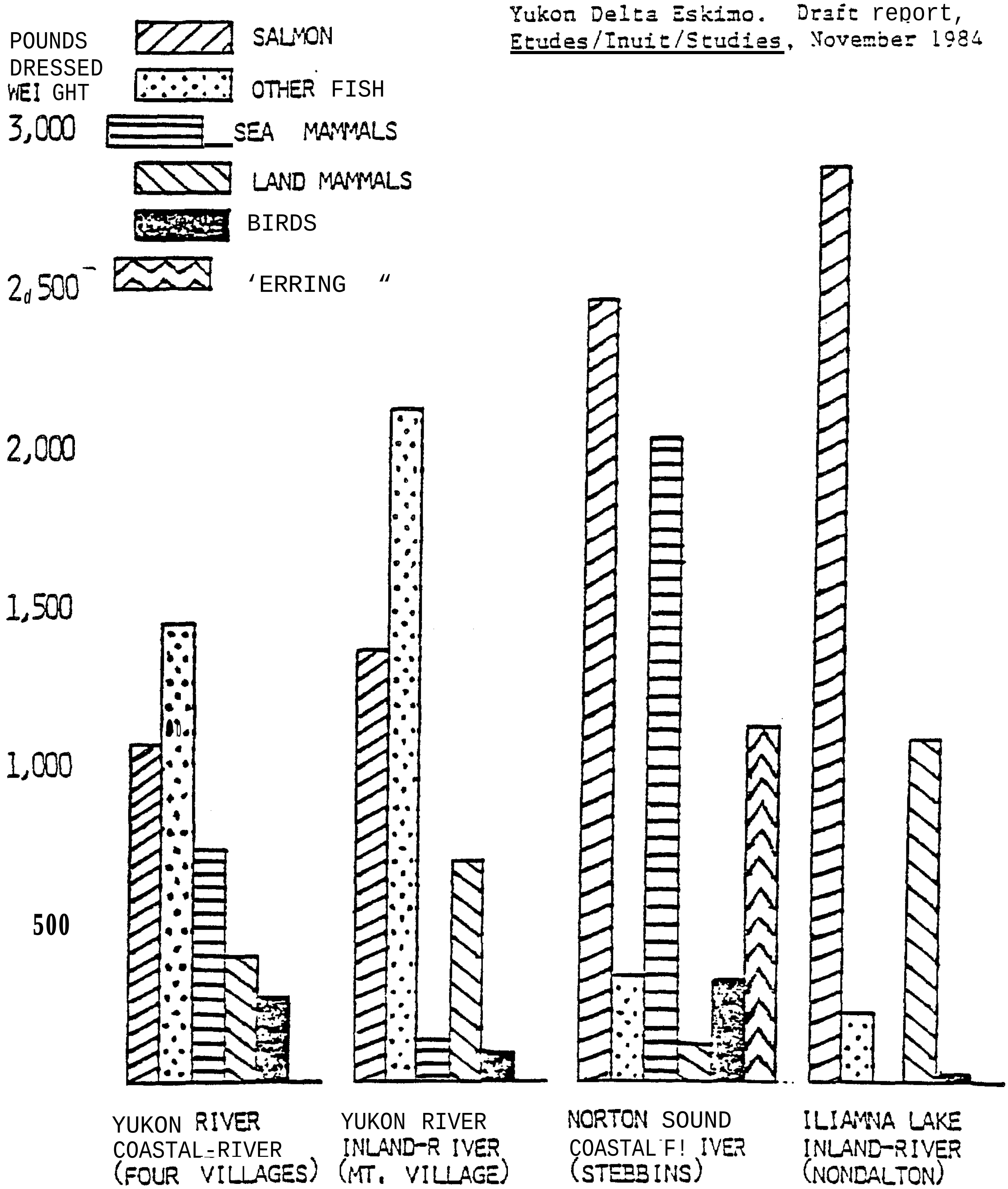


Figure 12
FOOD OUTPUTS IN POUNDS

From Robert J. Wolfe (1983) Resource Diversification and Coastal-Riverine Habitats: The Economy of the Yukon Delta Eskimo. Draft report, Etudes/Inuit/Studies, November 1984



MEAN HOUSEHOLD HARVESTS IN POUNDS DRESSED WEIGHT DURING 1980, BY COMMUNITY

Fishing and hunting activities primarily occur within kinship units composed of one or more households. In the more complex production groups, the households involved may represent different villages. In subsistence-based economies, production levels are determined by the needs of the family group, which are typically at levels below capacity. This contrasts markedly with the social organization in capital economies where production primarily occurs in firms separate from the family, and it is directed toward market sale and accumulated profit.

Fish and game are shared, distributed, and exchanged in large quantities among family groups in subsistence communities. Consequently, even though a household may not participate directly in the harvesting and processing of a resource, the household may use the resources taken by someone else. In these communities, the locations of fishing and hunting activities by residents of a community are governed by traditional systems of land use and occupancy. Trap lines, fish camps, net setting sites, and big game areas are recognized as the use areas of particular kinship groups and communities.

Still, even in the Yukon Delta area there is some commercial activity as fish and furs, and cottage crafts are exchanged for money. But because commercial harvests are finite-- and wage-paying jobs are few, low-paying, highly seasonal, and part-time-- incomes are relatively low. Typically, communities with subsistence-based economies cannot function solely on monetary earnings. Consequently, money is invested in equipment for fishing and hunting for subsistence uses, the most reliable sector of the economy. Thus, the commercial and subsistence sectors are mutually supportive. Understanding the form and functioning of Alaska's subsistence-based socioeconomic system is one of the major directives of the Division of Subsistence.

SESSION III-A

ENVIRONMENTAL ANALYSES AND RELATED PROCEDURES IN THE LEASING PROCESS

Chaired by

Paul Dubsky
Supervisory Biologist
Technical Support Unit
Minerals Management Service

Presentations

Pre-Sale Milestones and Procedures (MMS) - James Seidl

The Environmental Impact Statement - James Seidl

Public Involvement in the Oil and Gas Leasing Process - Nancy Hendrix

Techniques and Responsibilities of the EIS Analyst (MMS) - Joel Hubbard

International and Federal/State Boundary Problems (MMS) - Stan Ashmore

PRE-SALE MILESTOES AND PROCEDURES {AN OVERVIEW)

by James Seidl
Envrionmental Special ist
Minerals Management Service

The twelve formal pre-sale milestones, their place and timing in the pre-sale schedule, and their use are described below:

1. Leasing Schedule - A 5-year program of proposed lease sales updated yearly with a new schedule developed every 5 *years.* The current schedule is from 1982- 87.

2. Request for Resource Reports - Requests Federal and state comments about a wide range of subjects on a specific proposed lease area. It is issued 2-1/2 years prior to the sale decision.

3. Call for Information - Notice in the Federal Register requesting comments from industry, special interest groups, governmental agencies, and interested publics on proposed lease sale area. The request is issued about 25 months prior to the sale decision.

4. Area Identification - Based on comments received in Step 3 and Minerals Management Service information, an area is selected from the Area of Call for further study in the EIS process. This *occurs* about 20 months prior to the sale decision.

5. Scoping - A public process to determine concerns regarding the proposed sale area. The information is most often obtained through meetings or written comment. The scoping process begins about 20 months before the sale decision.

6. Endangered Species Consultation - The MMS consults with the Fish and Wildlife Service and National Marine Fisheries Service regarding endangered species in the area. Consultations *occur* between 20 and 12 months before the sale decision.

7. Draft Environmental Impact Statement - About 12 months before sale decision, MMS prepares an analysis of probable effects of the proposed sale on the environment.

8. Public Hearings - Formal meetings and requests for comments on the draft EIS.

9. Final Environmental Impact Statement - The final EIS is written based on comments on the draft EIS and any new information. It is submitted to the Environmental Protection Agency and the Secretary of the Interior about 5 months before the sale decision.

10. Secretarial Issue Document - Prepared by MMS, the document contains additional comments, technological information and a summary of the final EIS environmental information to aid in the Secretary's decision.

11. Proposed Notice of Sale - Formal announcement of proposed sale which is submitted to the Government for comment ninety days before the sale.

12. Decision and Final Notice of Sale - The final Notice of Sale, which contains the Secretary's decision, is published 30 days prior to the lease sale.

THE ENVIRONMENTAL IMPACT STATEMENT: ITS DEVELOPMENT AND ROLE IN THE DECISION PROCESS

by James Seidl
Environmental Specialist
Minerals Management Service

The National Environmental Policy Act (NEPA) states that:

> "The primary purpose of an Environmental Impact Statement is to serve as an action-forcing device to insure that the policies and goals defined in the Act are infused into the ongoing programs and actions of the Federal government. It shall provide full and fair discussion of significant environmental impacts and shall inform decisionmakers and the public of the reasonable alternatives which would avoid or minimize adverse impacts or enhance the quality of the hunan environment. Agencies shall fecus on significant environmental issues and alternatives, and shall reduce paperwork and the accumulation of extraneous background data. Statements shall be concise, Clear, and to the point; and shall be supported by evidence that the agency has made the necessary environmental analyses. An Environmental Impact Statement is more than a disclosure document. It shall be used by Federal officials *in* <u>conjunction with other relevant material</u> to plan actions and make decisions."

Guidelines

NEPA also states that:

1. Environmental Impact Statements shall be analytic rather than encyclopedic.
2. Impacts shall be discussed in proportion to their significance.
3. Environmental Impact Statements shall be kept concise and shall be no longer than absolutely necessary to comply with NEPA and other agency (i.e., Council on Environmental Quality] regulations. Length will vary according to potential environmental problems and project size.
4. The range of alternatives discussed in the Environmental Impact Statements shall encompass those to be considered by the ultimate agency decisionmaker.
5. Environmental Impact Statements shall serve as the means of assessing the environmental impact of proposed agency actions, rather than justifying decisions already made.

In addition to the Environmental Impact Statement (E IS), the Secretary of Interior uses the Secretarial Issue Document, comments provided by affected states, and concern for national security, economics and environmental protection to decide whether or not to lease an area for oil and gas development. It takes a multi-disciplined team about 12 months to develop a final EIS. The draft stage is reviewed by Federal, state and local governments; special interest groups; industry; and other interested publics. The final EIS is based on that review and comment. Draft and final EIS's are available to the public upon request.

PUBLIC INVOLVEMENT IN THE OIL AND GAS LEASING PROCESS (MMS)

by Nancy Hendrix
Environmental Specialist
Minerals Management Service

There are three steps in the leasing process where the public is invited to participate in the formal pre-sale milestones on any specific leasing project:

- o The Call for Information and Notice of Intent to prepare an Environmental Impact Statement (EIS)
- o Scoping
- o Review and Comment period on the draft Environmental Impact Statement (including public hearings)

The Call for Information and Notice of Intent to prepare an EIS are published in the Federal Register. They serve as an invitation to the oil and gas industry, government agencies, environmental groups, and the general public to comment on areas of interest or special concern in the proposed lease area. Comments on the Call are to be received within 45 days after the announcement is published. Comments on the Notice of Intent are to be received within 30 days of the Area Identification. The Notice of Intent also announces the start of the scoping process.

The Council on Environmental Quality defines scoping as "an early and open process for determining the scope of issues to be addressed *in* an Environmental Impact Statement (EIS) and for identifying the significant issues related to a proposed action" (40 CFR 1501.7). It is a means for the early identification and ranking of those issues deserving study in an EIS. Comments are invited from affected Federal, state, and local government agencies, other affected groups, the proponent of the action, and any interested persons. Information obtained from the Request for Resource Reports and the Call for Information is considered part of the scoping process.

Based on information gained through the scoping process, major issues, alternatives to the proposed action, and measures that could mitigate the effects of the proposed action are identified and analyzed in the EIS. After publication of the draft EIS, oral and written comments are requested on its contents. In addition, public hearings may be held in the communities most likely to be affected by the project.

TECHNIQUES AND RESPONSIBILITIES OF THE EIS ANALYST

by Joel Hubbard
Wildlife Biologist
Minerals Management Service

In the Office of Leasing and Environment, the Environmental Assessment Section primarily is responsible for analysis of the environmental consequences of offshore oil and gas development. The responsibility basically derives from the National Environmental Policy Act which requires the preparation of an environmental impact statement for significant federal actions in order to inform decisionmakers and the public of the consequences of all reasonable alternatives. Primary responsibilities of the staff analyst include (1) description of important attributes of the physical, biological and human environment; (2) assessment of the potential risks and effects associated with development; (3) identification of additional data requirements for impact analysis; and (4) initiation of mitigating measures which will minimize adverse impacts.

The analyst, in assessing potential impacts of OCS petroleum development, especially with regard to biological resources, may utilize at least three different approaches or techniques. Each of these approaches presents certain strengths as well as weaknesses. First, the MMS oil spill risk analysis model, which predicts oilspill trajectories and probability of spillage, can be used in conjunction with estimates of the areal extent of a spill, and for example, bird densities to predict the immediate impacts of individual spills. But without other information it may be difficult to translate these predictions into specific effects on a regional bird population or to project long-term effects. Secondly, mathematical modeling of population dynamics before and after removal of some proportion of a population may be used to predict population effects, but the results of such an exercise often may be confounded by the large numbers of variables requiring data, and their complex and relatively unquantified interaction. Thirdly, monitoring animal populations through a program of regular censusing can reveal changes in population abundance, distribution and reproductive success. If techniques are sufficiently refined, population fluctuations can be measured with enough precision to detect the additional change resulting from perturbation. However, this effort is easily confused by natural variation in patterns of distribution and abundance of individuals on a daily, seasonal or annual basis. To a variable degree, the approaches outlined here present a dilemma in that verification of their sensitivity as accurate predictors of potential effects to a great extent requires that an oil spill or other adverse factor actually impact a population, an event which we steadfastly attempt to avoid.

Ideally, we would like to document the natural variation in distribution, abundance and reproductive success of a population over several generations, with sufficient accuracy and ecological sophistication to detect significant change between these variables and suspected perturbing activities or events. However, while a more substantial database which will enhance our capability to assess potential effects is acquired, considerable reliance will continue to be placed upon estimates derived from predictive models.

INTERNATIONAL AND NATIONAL BOUNDARY PROBLEMS

by Stan Ashmore
Cartographer
Minerals Management Service

All maritime boundaries in the Bering Sea are based on observations from tide gauges that have been in place less than one year. The fact that there are no long-term tidal data makes setting the boundary in the Bering Sea *very* difficult. Other complicating factors are dated and/or inadequate hydrographic surveys; limited number of tide-coordinated shoreline surveys; and poorly sealed nautical charts. In addition, severe weather and sea conditions in the Bering Sea often disrupt survey activity.

The three-roil e boundary is not constant but, rather, it moves with changes in the shoreline. It is computed by collecting a series of salient points along the low water line. Intersecting areas are drawn from these points. As a result, the three-mile offshore boundary as well as the OCS leasing line are a series of intersecting arcs. The Federal government draws the offshore and territorial three-roil e boundary by this means.

On the other *hand,* the State determines its boundaries by drawing a series of straight baselines. There are international precedents which allow Alaska to do this deriving from its sale to the United States by the Soviet Union. Predictably, this divergence contributes to conflict between our Federal government and Alaska on off show management and lease activity. In an effort to resolve the conflict, the two governments have formed a Boundary Working Group which investigates and supervises surveys and the establishment of tide stations. In 1984, during shoreline reconnaissance surveys along most of the Bering Sea coastline, tide stations were established at Port Moller, Elim, Kivalina, and Kotzebue. Geodetic surveys will be conducted near Kotzebue in 1985 and in Bristol Bay at some future date if lease sales are held in that area.

Similarly, there is a significant dispute between the United States and the Soviet Union over their common offshore boundary in the Bering sea. The two agree that the 1867 Convention Line is the reference point; however, they differ on the method of drawing the line. The Soviet Union favors the use of rhumb lines, or lines of constant bearing, the United States favors the geodesic or great circle lines. Approximately 15,000 square nautical miles of submerged lands are at stake.

SESSION III-B

LEASE SALE CONDUCT AND POST-SALE MANAGEMENT REQUIREMENTS

Chaired by

Thomas Warren
Supervisory Mineral Leasing Specialist
Leasing Activities Section
Minerals Management Service

Presentations

Area Identification Process-- EIS Area of Study (MMS) - Gordon Euler

Lease Sale Decision Process (MMS) - Dean Yoesting

Lease Sale Design (MMS) - Dean Yoesting

Litigation Affecting the Alaska OCS Leasing Program (MMS) - Phyllis Casey

post-Sale Environmental Assessments and Exploration Plan Reviews (MMS) - Allen Adams and Jeff Walker

AREA IDENTIFICATION PROCESS-- EIS AREA OF STUDY

by Gordon M. Euler
Supervisory Minerals Leasing Specialist
Minerals Management Service

The area identification (area ID) process is the first step in the pre-sale leasing process (see Session III-A, Pre-Sale Milestones and Procedures by James Seidl). The purpose of the area ID is to describe the area that will be the focus of study in an Environmental Impact Statement (EIS) required under NEPA. The tract selection princess (the predecessor to area ID)-- used when the OCS program was in the Bureau of Land Management-- is also discussed.

The tract selection and area ID processes are alike *in* that the purpose was and is to identify an area for analysis of the effects of offshore leasing. In order to identify the area, information on its resources and some measure of the interest of the oil and gas industry are needed. This information is obtained through resource report requests which are sent to Federal and state agencies having jurisdiction over hunan, coastal and marine resources in or adjacent to the proposed sale area. The information collected contributes greatly to the tract selection decision. For the area ID, information is gathered as part of the scoping process and used mainly in preparing the EIS.

Comments from the public and delineation of areas of interest to industry are solicited in the Federal Register. In the tract selection process, this notice was entitled the "Call For Nomination and Comments". For area ID, the notice is entitled "Call for Information and Nominations and Notice of Intent to Prepare an Environmental Impact Statement."

Resource information and nominations that are received in response to the notice are processed by the Sales Activities Unit in the Leasing Activities Section of the Alaska OCS Region. In the tract selection process, consideration was given to environmental information (i.e., other resources potentially at risk from OCS development) as well as the nominations by industry, and the oil and gas potential of the area. The resulting selection was usually a few hundred blocks at most. For the area ID, nominations and nomination priorities are mapped, and unless there are overriding environmental concerns, the area ID is generally based on industry interest and the oil and gas potential of the area. The result has been EIS study areas that cover several thousand blocks. A comparison of the tract selection and area identification process is provided in Figure 13.

After a series of management briefings, a regional area ID recommendation is developed and forwarded to headquarters. The decision on the area to be studied in the EIS is retie by the Secretary of the Interior, *Secretary* Hodel recently stated that lease sales would be held on men? focused areas, thus getting away from the area-wide offering concept. It is possible that in the future, a modified version of the tract selection process will be used to focus proposed sale areas.

Figure 13

Comparison of Tract Selection and Area Identification Processes

TRACT SELECTION (Bureau of Land Mangement)	AREA IDENTIFICATION (*Mineral* Management Service)
Resource report request made three months prior to Call for Nomination; comments and other information received are used in tract selection.	Resource report request made at same time as Call for Information and Nominations and Notice of Intent to Prepare an Environmental Impact Statement. Information received used *during* scoping process after area is announced,
Comments from public and industry solicited in the Federal Register through Call for Nominations and Comments.	Comments from public and industry solicited in the Federal Register through Call for Information *and* Nominations and Intent to Prepare Environmental Impact Statement.
Tract selection based on environmental information and nomination by industry; resulting tract selected is usually a few hundred blocks.	Area selection based primarily on industry interest, and oil and gas potential in area. Area may cover several thousand blocks.

LEASE SALE DECISION PROCESS

by Dean Yoesting
Supervisory Mineral Leasing Specialist
Minerals Management Service

There are a number of major decision steps in the leasing princess. Scme of these steps are required by law and some are the result of Department of the Interior regulations. These steps include the Secretarial Issue Document (SID), proposed and final Notice of Sale (NOS), and the section 19 process.

The SID is used to analyze all issues involved in the proposed sale. It provides support for the proposed Notice of Sale, it 'develops the mitigating measures for the notice, it is the basis for the section 19 consultation, and it integrates all analyses -- environmental, legal, economic, and hydrocarbon resources. Above all, it is the first decision document that goes to the Secretary's office after he announces the area identification.

Next, the proposed Notice of Sale is published. It specifies the size of the sale area, the expected time and location of the sale, and the various terms and conditions. As required by section 19 of the OCS Lands Act, the proposed notice is sent to the Governor for comment. The Governor has 60 days to respond to the Secretary and these comments are used to develop recommendations regarding the final Notice. A balancing letter is sent to the Governor by the Secretary indicating which recommendations have been accepted for the final notice, and which ones have not been accepted -- and why they were not accepted. The final Notice is published at least 30 days prior to the sale. It indicates the blocks to be offered; the date, time and location of the sale; and various terms and conditions to be considered.

LEASE SALE DESI GN

by Dean Yoesting
Supervisory Mi neral L easing Specialist
Minerals Management Service

A number of factors are involved in the sale design, including bidding systems, 1 ength of l ease, minimum bid, and bid adequacy. The typical bidding system is a cash bonus with either a one-eighth or a one-sixth percent ro yal ty. The royal ty rates may vary dependi ng on the water depth of the blocks within the planning area. Other systems are available but are not currently being used. The 1 ength of the 1 ease will vary from not less than 5 years to not more than 10 years. This range is established by law. The minimum bi d ranges from $1.00 to $150.00 per acre, with an average rent of $3.00 per acre per year.

The Secretary of the Interior is required to assure a fair market value for all l eases accepted. He is also required to meet the nation's energy and econ omic needs, promote timely and efficient hydrocarbon exploration and development, and maintain competi ti on. The current system is designed to take advantage of market competi ti on to determine the true market value of a block at the time of the sale. If the criteria are met, then the bid is accepted.

Each high bid is subjected to a Me-phase eval uati on to determine whether the bid meets the fair market value system developed by MMS. MMS evaluates only those blocks where there is insufficient competition, or where a company has an informati on advantage (i.e., concerning drai nage and development blocks) In Phase 1, al 1 legal high bids for blocks judged by MMS not to be located" on a viable prospect will be accepted. After screening for anomal ously l ow bi ds, the high bid wins for all wildcat and proven b? ocks where three or more bids are received. If less than three bids are received on a block, but the high bid is in the upper 50th percentile of wildcat and proven blocks bid upon, then the high bid is accepted in Phase 1. This process is to be completed within 3 days of the sale.

All other bids are considered i n Phase 2. These include all drainage and devel opment bl ticks, and those blocks receiving 1 ess than three bids and i f the bid is in the lower 50th percentile of wil dcat and proven blocks receiving bids. This process is not to exceed 21 days fol 1 owi ng the sale, when the Regional Di rector recommends acceptance or rejection of the bid.

LITIGATION AFFECTING THE ALASKA OCS LEASING PROGRAM

by Phyllis J. Casey
Supervisory Minerals Leasing Specialist
Minerals Management Service

'The Department of the Interior is required by law to manage the exploration and development of oil and gas resources on the OCS and to conserve its natural resources. To help meet the energy needs of the nation, these resources must be developed as expeditiously, and yet as carefully, as possible. While overseeing this development, the Secretary of the Interior is charged with, among other things, balancing orderly resource development with protection of the human, marine and coastal environments; ensuring that the public receives a fair return for these resources; and preserving and maintaining free enterprise competition.

Most OCS lease sales in Alaska have involved litigation to either stop the sales or to limit the areas of offering. Lawsuits have been filed by, for example, the State of Alaska; local governments such as the North Slope Borough; the People of the Villages of Gambell, False Pass, and Nunam Kitlutsisti; the Association of Village Council Presidents; as well as environmental groups such as the National Audubon Society and Natural Resources Defense Council.

This discussion highlights cases which have had a direct or indirect affect on the Alaska OCS leasing program. It will focus on the major issues in dispute (i. e., effects of seismic activities on endangered species; compliance with the Coastal Zone Management Act -- brought against Sale 70; applicability of Section 810 of the Alaska National Interest Lands Conservation Act -- -brought against Sales 57 and 83 *in* the Bering Sea; determination of Federal /State jurisdiction over certain portions of submerged lands in the Beaufort Sea -- -brought against Sale BF; the validity of the St. Matthew Island Land *Exchange for* use *as a* support base for development activities -- -brought against Sale 83 in the Navarin Basin; and sharing of revenues from the OCS -- brought against the Department of the Interior by affected coastal states). I will also address the status of disputed cases, any rulings by the courts, and effects of the litigation on OCS lease sales. Because the case law is an evolving process and affects all subsequent lease sales, the discussion is not limited to only those suits brought against Alaska OCS sales in the Bering Sea. A listing of the major cases, including a summary on the decision and status for each, is provided in Figure 14.

Figure 14

Summary of Alaska OCS litigation

Case	Control Issue	Applicable Rule of Law	Decision/Status
1. U.S. v. State of Alaska, ... Supreme Court, No. 84, Original (1979)	'Whether' the U.S. or Alaska owns submerged land in the Beaufort Sea (Sale BF).		Issues under review of Special Master. Supreme Court decision expected in the fall of 1987.
2. State of Louisiana v. Secretary of the Interior, ____, Eastern Dist. of Louisiana filed July 27, 1979)	Whether the State of Louisiana is entitled to compensation under Section 8(g) of the OCSLA from Federal land leases.	Section 8(g) of the OCLSA	Lower court ruled partial summary judgement for plaintiff [Louisiana]. It held that 1) bonus enhancement is compensable; 2) onshore impacts are not; 3) taxes are distributable under Section 8(g); and 4) pre-section 8(g) revenues not distributable. Appeal scheduled for 10/7/85. Federal government has requested interlocutory appeal on taxation issue.
3. State of Texas v. Secretary of the Interior, 580 F. Supp. 1197 (USDC, Eastern Texas 1984)	Whether statutory language requires a review of the "total circumstances" of leases or single factor (i. e., drainage) in determining fair and equitable compensation.	Section 8(g)(4) of the OSCLA	Lower court ruled that compensation not limited to compensation for drainage. In addition, 1) Federal government and Texas to receive 50% of all lease bonus windfalls or enhancements, with interest. 2) Federal government to receive 50% of existing and future royalties, with interest. The rest will go into a separate treasury account. 3) All unspecified lease revenue to be paid to Federal government. Federal government appealed on 7/20/84. Decision is still pending.
4. The People of the Village of Gambell, et al., v. Donald P. Hodel, Civ. No. A83-003 (USDC, Nome, Alaska, April 4, 1983); appeal docket No. 83-3735, -3781 (9th Cir. April 8, 1983); remanded, in part, 745 F. 2nd 572 (9th Cir. 1984)	1) Whether lands involved in OCS Sale No. 57 are in Alaska and, thereby, require DOI to follow the procedures of Title VIII, Section 810 of the ANILCA before offering public lands for lease? 2) Whether the Alaska Native Claims Settlement Act [ANCSA) extinguished plaintiffs aboriginal title to OCS lands? (Sale No. 57).	Section .910 of ANILCA Section 4(b) of ANCSA	Lower court denied plaintiffs' petition for injunction. It ultimately ruled that plaintiffs do not have property rights to the OCS under ANILCA and that any aboriginal rights to OCS were extinguished by ANCSA. Decision upheld by appellate court on 11/2/84. Case remanded to lower court for decision on appropriate remedies and whether EIS in compliance with Section 810 of ANILCA. Subsequent petition for injunction also denied.
5. Association of Village Council presidents v. Donald P. Hodel, Civ. No. A83-150 (USDC, Alaska filed March 14, 1983)	Whether OCS Sale No. 57 threatens villagers way of life (subsistence).		Plaintiffs' petition for injunction originally dismissed for lack of proper documentation. Plaintiffs ultimately filed amended complaint in January, 1984 following issuance of lease. Defendant oil companies have requested dismissal. Decision pending.
6. Village of False Pass v. William Clark, 565 F. Supp. 1123 (USDC, Alaska 1983), aff'd., 733 F. 2d 605 (9th Cir. 1984)	1) Does the National Environmental Policy Act (NEPA) require a pre-OCS sale analysis of the impact of the sale? .?) Old Sale No. 70, St. George Basin, violate the Endangered Species Act (ESA) by issuing the notice of sale before the National Marine Fisheries Service issued its biological opinion and by not investigating the sales impact on the endangered gray and white whales? 3) Should the Secretary have taken measures at the sale to protect gray and white whales from oil spills and seismic testing?	Coastal Zone Management Act of 1972 (CZMA); National Environmental Policy Act of 1969 [NEPA); Endangered Species Act of 1973 (ESA)	Lower court held that DOI violated NEPA and ESA by failing to take action to protect the gray and white whales. DOI responded with such plan. However, appellate court affirmed earlier court's decision. No further appeal was made.
7. National Audubon Society, et al., v. Donald P. Hodel, et al., Civ. No. A83-425 (USDC, Alaska November 30, 1984); appeal docket Nos. 85-3673, -3683 and -3686 (9th Cir. March 7 & 11, 1985)	Whether the St. Matthew Island exchange was lawful.	Section 1302 (h) of ANILCA	Lower court ruled that the St. Matthew Island land exchange was invalid. DOI and other defendants filed notice of appeal 3/1/85. Pending.
8. The People of the Village of Gambell and Nunam Kitlutsisti v. Donald P. Hodel, Civ. No. A85-201 (USDC, Alaska filed April 25, 1985)	Whether the Secretary violated Section 810 of the ANILCA in Sale 83, Navarin Basin, thereby justifying an injunction to prevent any activity relative to the sale until its validity is determined.	Section 810 of the ANILCA	Plaintiffs' motion seeks injunction and invalidation of sale. Motion for injunction denied. No ruling has been made on the issue of compliance with Section 810 compliance.

POST-SALE ENVIRONMENTAL ASSESSMENTS AND EXPLORATION PLAN REVIEWS

by Allen Adams
Physical Scientist

and

Jeff Walker
Petroleum Engineer

Minerals Management Service

To assure full compliance with the spirit and objectives of the National Environmental Policy Act (NEPA) of 1969, other Federal environmental legislation, and supporting Executive Orders and regulations, NEPA created the Council of Environmental Quality (CEQ) to oversee implementation of the Act. The Council has responsibility for (1) analyzing trends and conditions in the quality of the environment; (2) concocting certain environmental investigations; (3) appraising the effect of Federal activities and programs on environmental quality; (4) advising the President on national environmental policies; and (5) preparing an annual environmental quality report for the President's review.

On the other hand, a primary mission of MMS is to supervise oil and gas exploration, development, and production activities authorized under leases and permits. Our responsibility in this area calls for the impartial enforcement of environmental laws and regulations governing oil and gas operations on Federal OCS lands. The key to our success, as in all work, is organization, good planning, and good supervision.

In accordance with this general division of responsibility, our environmental assessments (EA's) are prepared at the area level by the Regional Supervisor for Leasing and Environment. Review of plans and the supervision of operations is carried out by the Regional Supervisor for Field Operations. The Environmental Operations staff assures proper execution of environmental directives, and assists in plan reviews and in the resolution of environmentally sensitive and controversial issues. At headquarters, the environmental office assists the Division Chief in establishing environmental policies, guidelines, and procedures; resolves any environmental issues. or problems forwarded by regional directors; and coordinates and reviews environmental documents including EAs. The central office also develops environmental legislation and regulations.

The key to good planning is the proper use of the EA process and the development of quality EA's. An effective EA is the result of proper coordination and consultation with other agencies and interested parties. It specifies measures to minimize the adverse environmental effects of a proposed action and, moreover, it provides a good rationale for determining whether an environmental impact statement (EIS) is necessary.

The EA must include, at a minimum, brief discussions of the need for the proposal; of alternatives, as required by section 102(3)(E) of NEPA; and of the environmental effects of the proposed action and alternatives. The depth and detail of analysis in an EA should be limited to that needed to determine whether any project effects would be significant and how to avoid or minimize adverse effects. The EA's public commenting provisions are very important.

Although the EA is not a decision document, it is an important resource to Federal decisionmakers. And unlike the pre-lease document, the post-lease EA is a much more precise instrument in that it includes information on environmental effects and mitigation measures that are more site-specific. In other words, problems that were not completely recognized and evaluated at the earlier stage can be considered in depth in the post-lease EA or EIS. As environmental reviews are tiered from a broad-based study to a site-specific action, we should also tier the discussion of "alternatives". Thus, the post-lease EA should include discussion of alternatives to full approval of a particular lease sales proposal.

When there is a finding of "no significant impact" the Regional Supervisor for Field Operations will generally approve the plan of operation. Once the project is implemented, the Field Operations staff must monitor the drilling and related activities in order to insure that a lessee operates in accordance with an approved plan and does not violate environmental standards, regulations, or safety requirements.

Continuous population growth and the desire to achieve a high "quality of life" naturally impose increasing demands on our limited natural resources. The challenge today and in the future is to find a better way to manage our resources while reconciling conflicts generated by these various demands. Not only do we have to balance current demands, but also we must consider the needs of future generations.

SESSION II I-C

ROLES AND RESPONSIBILITIES OF FEDERAL AND STATE AGENCIES IN THE OCS OIL AND GAS LEASING AND DEVELOPMENT PROCESS

Chaired by

Judy Gottlieb
Deputy Regional Supervisor
Leasing and Environment
Minerals Management Service

Presentations

National Oceanic and Atmospheric Administration (NOAA) -
LCMDR Robert Pawlowski

Outer Continental Shelf Environmental Assessment Program (OCSEAP) -
Robert Bunney

U.S. Army Corps of Engineers (USACOE) - William Fowler

Roles and Responsibilities of the U.S. Fish and Wildlife Service (USFWS) -
Gerald Reid

U.S. Coast Guard (USCG) - Capt. T. Wood

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

by Lt. Cmdr. Robert J. Pawlowski
Director, National Ocean Service Center
National Oceanic and Atmospheric Administration
Anchorage, Alaska

The National Oceanic and Atmospheric Administration (NOAA) consists of five line offices: (1) the National Weather Service (NWS), (2) the National Ocean Service (NOS), (3) the National Marine Fisheries Service (NMFS), (4) the Ocean and Atmospheric Research, and (5) the National Environmental Satellite Data and Information Service (NESDIS). NOAA contributes significantly to numerous phases of the OCS oil and gas leasing and development process. Its roles and responsibilities include operational support, resource and environmental assessments, and protection of the oceans and coastal zone and the resources within. Names and telephone numbers of staff members assigned in the various line offices is provided in Figure 15.

Throughout the OCS leasing process, from planning for initial studies to actual production, NOAA provides operational information on marine weather, tides and currents, and nautical charting. It also supports the engineering design with an archived environmental database. Resource information is provided to support resources at risk and identify potential conflicts between the oil and gas industries, and other users of the living marine resources. Numerous environmental investigations continue to address shortfalls in existing information in an effort to resolve questions in areas of perceived conflict.

During the EIS period, NOAA plays a major role in reviewing the statement for its accuracy on environmental information and its consideration of aspects mandated to NOAA. Strategic assessments play a key role in evaluating the potential conflicts in the area proposed and the selection of alternatives. Coastal zone issues are thoroughly analyzed for potential changes to the existing environment and culture and for consistency with existing Coastal Zone Management (CZM) plans. Special attention is placed on the protection of marine mammals and endangered species, as identified in Biological Opinions. Close coordination between NMFS and NOAA results in a final position paper on the EIS.

NOAA's responsibility continues into the exploration, development, and production phases with the monitoring of environmental and resource data. It maintains a baseline of information to detect environmental changes associated with development. This data, combined with data from previous studies and assessments, is especially useful in the event of a spill. It provides the scientific information upon which spill response decisions are based, and it produces information useful for the litigation of damages.

NOAA receives its mandate from several sources including, for marine fisheries, the Fish and Wildlife Coordination Act, the Fisheries Conservation Management Act, and the National Environmental Policy Act (NEPA). Its coastal zone management responsibilities are authorized by the Coastal Zone Management

Figure 15

BERING SEA OCS - NOAA EXPERTISE

Area of Expertise	Name	Office	Telephone Number
B., B., & C. Strategic Assessment Atlas	Dan Basta	NOS	301/443-8843
Charting & Surveying	Don D'Onofrio	NOS	907/786-2407
Fisheries	Ron Morris	NMFS	907 /271-30 20
General Counsel (Alaska Reg.)	Patrick Travers	NOAA	907/586-7414
Hazardous Materials Response Team	John Robinson	NOS	206/526-6273
Marine Chemistry	Carol-Ann Manen	NOS	907/271-3585
Marine Mammals and Endangered Species	Byron Morris	N MFS	907/271-3329
Marine Weather (Real Time Analyses)	Reuben Eaton	NWS	907/271-3471
NOAA Fleet Operations	Lt. Ron Kimball	NOS	907/271-3665
NOAA RRT Member (Alaska Reg.)	R. E. Bunney	NOS	907/217-3)33
Oceanography, Research & Modelling	Jim Schumacher	PMEL	206/526-4197
- Trajectory Studies	David Hale	NOS	907 /271-30 33
- Data Centers & OPDIN	Michael Crane	NESDIS	907 /271 -4063
Scientific Support Coordinator	David Kennedy		206 /378 -5322
Sea Ice- Real Time Analyses	Ron Scheidt	NWS	907/271-5107
	Ray Godin	NOAA/NAVY JIC	301/763-8133
- Strategic Assessment (OCSEAP)	R. E. Bunney	NOS	907/271-3133
- Dynamics & Modelling	Carol Pease	PMEL	206 /526-6809
Other NOAA Activities	Robert Pawloski	NOS	907/271-3448

Act (CZMA), while its involvement in marine mammal protection is covered by the Endangered Species and the Marine Mammal Protection Acts. Finally, NOAA'S *role* in pollution monitoring is authorized by the Ocean Pollution Planning Act, the Marine Protection Research and Monitoring Act, and Superfund.

NOAA OUTER CONTINENTAL SHELF ENV IRON MENTAL ASSE SSMENT PROGRAM (OCSEAP)

by Robert Bun ney
National Oceanic and Atmospheric Admini strati on
Director, Outer Con tine ntal Shelf Environmental Assessment Program
Alaska Office
Anchorage, Alaska

The Outer Con tine ntal Shelf Environmental Assessment Pm gram (OCSEAP), formed in 1974, provides the Minerals Management Service with marine envi ronmental inf ormati on needed to make sound mana gement deci sions regarding the devel opment of oil and gas resources i n the Alaska OCS. OCSEAP is involved In the following activities:

- P redevel opment contaminant distributi ons
- E nvi ronmental hazards
- Poll utant transport, weathering, and fate
- Living marine resources at possible risk
- Effects of poll utants and other human alterations

Before the establishment of OCSEAP, this information collection effort was supported with funds from the U.S. Geological Survey, the Advanced Research Project Agency, the Cold Region's Research and Engineering Laboratory, the National Science Foundati on, and the U.S. Navy. In 1974, the OPEC situation and push for oil resources in the United States resul ted in an Interagency Agreement (IA) between the Bureau of Land Management-- which had the charter for of fshore oil and gas l easi rig-- and NOAA-- which had mari ne science capability-- to establish OCSEAP. The agreement continues now between MMS and NOAA.

Since the incepti on of OCSEAP, the total expenditure has been $163 mil lion. NOAA has also provided a total of 4374 days of ship time. For fi seal year 1985, NOAA's budget is $7.1 mill ion, of which 75 percent goes into the direct support of science. The remaining 25 percent is allocated to salaries, administration, and equipment. The spending is apportioned almost evenly between the physical and bi 01 ogical sciences.

Expenditures for the Physical Sciences include:

- Geology and marine hazards
- Circul ation and ocea nogra hi c processes
- Numerical predictive modeling
- Sediment/Oil/Ice interactions
- Oil weathering
- Arctic meteorol ogy

Expenditures for the Bi 01 ogical Sciences include:

- Marine ecosystems and habitats
- Abundance and feeding studies
- End angered species studies
- Industrial noise effects

- Mammal distribution
- Simulation studies
- Effects of oil on the food chain

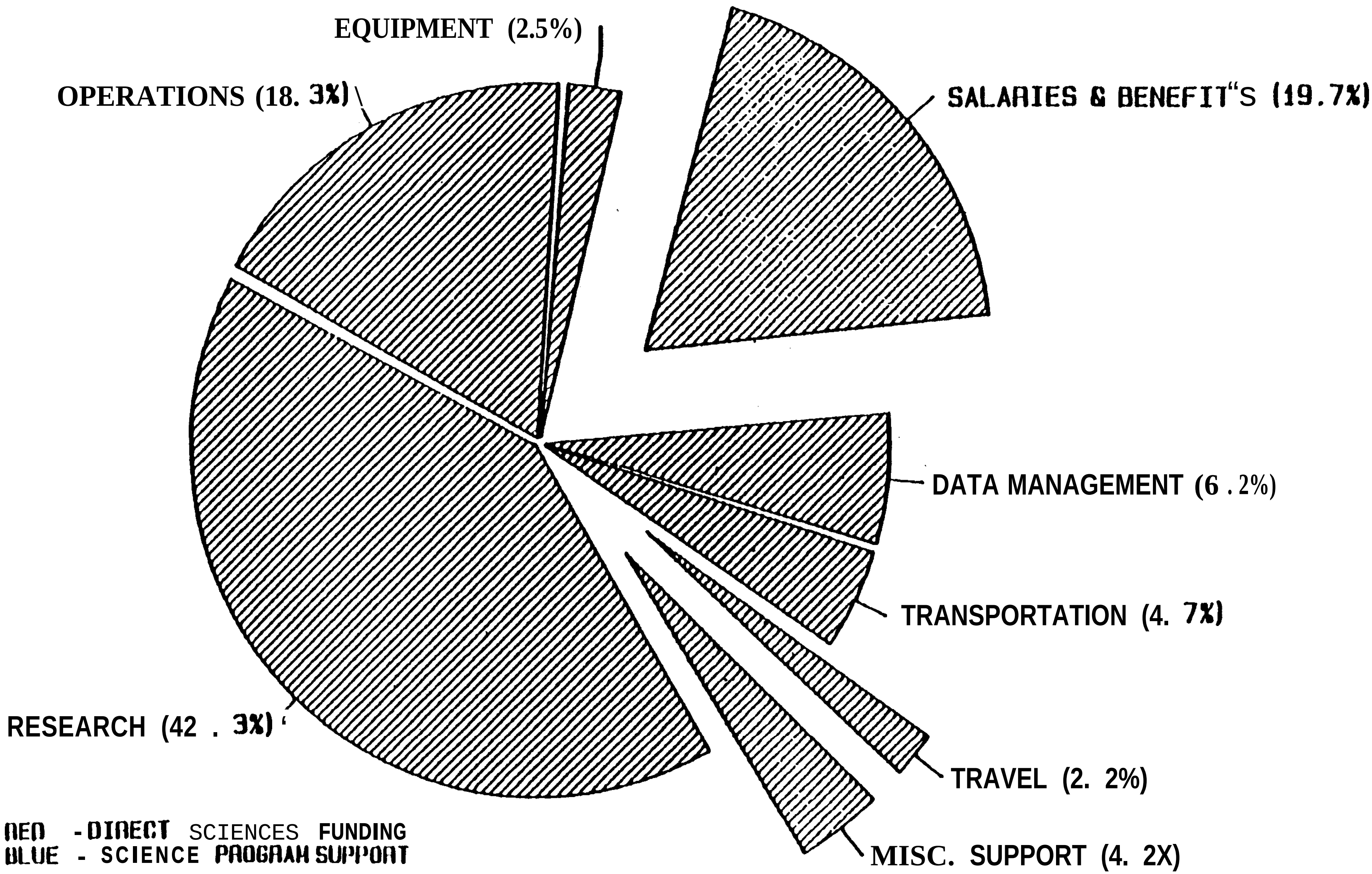
OCSEAP also provides auxiliary support for the MMS/OCS Program such as:

- Conducting synthesis and information update meetings
- Publishing synthesis reports
- Providing EIS reviews and comments
- Participating in development of RSP's
- Publishing annual reports of principal investigators
- Preparing Annual Technical Development Plan
- Publishing Annual Program Report
- Maintaining data bases

Figure 16 shows OCSEAP's budget allocation for the present fiscal year.

Figure 16

NOAA OCSEAP PROGRAM



FY-85 BUDGET ALLOCATION

U.S. ARMY CORPS OF ENGINEERS

by William Fowler
Corps of Engineers
Anchorage, Alaska

The U.S. Corps of Engineers has both direct and indirect regulatory authority with respect to the OCS. This authority dates back to the River and HarborAct of 1899 which essentially gave the Corps responsibility to regulate any work in U.S. navigatable waters. The Outer Continental Shelf Lands Act extended that authority to the OCS but limited it to assessing impacts on navigation and national security,

When industry goes into the OCS, two permits are required for the Corps. The first one concerns all structures placed in, navigable waters. A typical example is a COST well, which is often drilled prior to a lease. Once the lease has been issued, normally within 60 days, activities in the OCS itself are covered under a nationwide permit which the Corps issues. That permit is virtually a blanket authority to the lessee and it goes into effect once MMS has decided to allow development in a given area. For the most part, this step is automatic.

The Alaska district has proposed "regional conditioning" of the permit, or prior notice of structure location and types. Although not yet official , many of the oil companies are adhering to the conditions. The information is sent to NOAA to update navigation charts, but is also useful to the Coast Guard and Department of Defense.

In addition, if there are any causeways or solid fill islands within State waters, those activities require an individual permit from the Corps. The nationwide permit does not apply in this case. For example, the nearshore gravel islands and associated causeways used in the Beaufort Sea to transport oil and gas resources require such a permit. The result is substantial monitoring by the Corps and cooperating agencies to assess environmental impacts. Thus, there can be substantial hurdles for industry when extensive development onshore and nearshore are expected as a result of the additional reviews and requirements.

ROLES AND RESPONSIBILITIES OF U.S. FISH AND WILDLIFE SERVICE IN THE OUTER CONTINENTAL SHELF OIL AND GAS LEASING AND DEVELOPMENT PROCESS

by Gerald M. Reid
OCS Coordinator
Fishery Biologist
U.S. Fish and Wildlife Service
Anchorage, Alaska

In Alaska, the U.S. Fish and Wildlife *Service* (FWS) interfaces with the Minerals Management Service (MMS) Outer Continental Shelf (OCS) leasing and development program at five important points:

1, The OCS Coordinator for FWS has responsibility under Departmental' Manual Section 655 **to provide input on the** MMS pre-lease process in the form of resource reports, comments on the Call for Information, recommendations for mitigating measures, EIS review, studies program review, and advice to the FWS Washington office on input to the Secretarial Information Documents (SID). The Coordinator also serves on biological task forces and represents the Regional Director on the Regional Technical Working Group.

2. Alaskan refuges, some 37 minion acres which are in or adjscent to the Bering Sea, may be directly involved in the program, especially when those lands are considered for operational bases, facility sites, or transportation corridors.

3. Wildlife Resources personnel, particularly those working with marine mammals under FWS responsibility (i.e., walrus, polar bears, sea otters), can provide current information on the status of those resources in an effort to assist MMS in developing mitigating measures for their protection.

4. The Endangered Species office provides MMS with biological opinions on the potential effect or lack thereof of MMS leasing on species of concern. For the Bering Sea, these species are. the Aleutian Canada goose, Arctic peregrine falcm, short-tailed albatross, and the Eskimo curlew.

5. The Ecological Services field offices are involved with OCS operational activities in the Berin Sea. North Alaska Ecological Services (NAES), headquartere% in Fairbanks, handles activities North of the Yukon Delta and Western Alaska Ecological *Services* (WAES), located at Anchorage and south of the delta. Specific responsibilities under the Fish and Wildlife Coordination Act include review and comment on Exploration Plans, Corps of Engineer (COE) Section 10 and 404 permits, and Environmental Protection Agency (EPA] National Pollution Discharge Elimination System (NPDES) permits.

U.S. COAST GUARD (USCG)

by Capt. T. Wood
Chief, Marine Safety Division
Coast Guard
Juneau, Alaska

The Coast Guard has broad authority to regulate vessel safety, maintain navigational safety, protect the marine environment, and enforce U.S. law and treaties. The OCSLA (1978) extended the Coast Guard's authority to regulate vessels and structures used in OCS operations. The Guard operates and maintains navigational aids to serve the needs of the U.S. maritime commerce. Vessel traffic services, fairways, and traffic separation schemes are established under the Ports and Tanker Safety Act to provide safe access routes for the movement of vessel traffic. Safety of life and property on offshore islands, structures and adjacent waters, is carried out under the OCSLA. This also includes the establishment of safety zones around such structures.

The USCG is responsible for enforcement of Sections 311 and 312 of the FWPCA and the administration of the Offshore Oil Spill Pollution Fund. It may direct the cleanup of oil spills and impose penalties for violations. The Guard is authorized to enforce all Federal laws on the high seas and waters subject to its jurisdiction. Under the Intervention on the High Seas Act, it may take measures to prevent, mitigate, or eliminate any grave or imminent danger of oil pollution to the coast of the United States.

To assure commercial vessel safety, USCG begins with planned reviews and inspections at construction yards, followed by periodic reinspections--usually annually -- during the entire life of the vessel. In addition, USCG investigates casualties, both material and human; develops personnel standards and qualifications; and takes steps to ensure that safe working conditions exist. To move efficiently perform these functions and eliminate duplication of effort, USCG has executed MOU's with the Departments of Interior and Labor.

In an effort to protect the marine environment, USCG inspects vessels and equipment to check for compliance with the regulations. It also reviews each EIS and pollution contingency plan, and provides input to MMS. In the event of a spill, USCG provides the Federal On-Scene Coordinator, who is responsible for all phases of response activities. In the Bering Sea area, the Captain of the Port in Anchorage serves in this role. Of course, the Captain is assisted by many Federal and State agency representatives, as well as members of the local response team.

The USCG administers three programs which provide funds for response and damages from pollution. The <u>Pollution Fund</u>, as it is commonly called, is used to pay for clean-up costs when the Federal government must take over cleanup actions. The <u>Offshore Oil Pollution Compensation Fund</u> may be used for cleanup and damages claims. It is sustained by a 3-cent per barrel fee on all oil produced on the OCS and kept at a level of from $100 to $200 million. The <u>Financial Responsibility Program</u> requires each vessel and facility to demonstrate financial responsibility of up to a maximum of $35 million for a facility in order to be compensated for damages resulting from oil pollution.

With regard to the possible conflict between the various users of the waters contained within a proposed lease sale, the USCG prefers to place as few restrictions as possible on industry during the initial exploration phase, while retaining the right to establish fairways should a major find occur and increased vessel traffic density become a problem. Most often, rather than identify specific fairways which might prove unsuitable at a later date, the Coast Guard requests that MMS insert a provision in all lease sale notices and agreements that the United States reserves the right to designate necessary fairways, precautionary zones, or traffic separation schemes through lease tracts. Rigs are encouraged to provide their own rescue equipment given the distance, for some, from USCG facilities. Most have standby gear and a contract helicopter on one of the rigs.

CLOSING PLENARY SESSION

Chaired by

Jerry Imm
Chief
Environmental Studies Section
Minerals Management Service

The Chairman expressed his gratitude for the large turnout for the ITM and the high quality of the presentations and discussions. He stated that the details of the next ITM covering the Beaufort and Chukchi Sea areas are not yet finalized but that he hopes it will be earlier in the year in an effort to avoid the fishing and tourist seasons. He noted also that the proceedings of this ITM should be available within 3 -4 months.

The Chairman then opened the meeting for questions and comments from the audience.

<u>Question and Answer Session with Panel of Session Chairpersons</u>

Q. 1 I am curious about the status of the synthesis workshops. There are three frontier areas coming up and I am wondering if you have plans to have a Synthesis Meeting for these areas?

A. 1 First, these ITM's do not replace the Synthesis Meetings, although next year we may design the ITM to be more of a synthesis meeting than this one was. The purpose of the ITM, again, was to transfer studies' information and other things that are going on. There has not been a Synthesis Meeting yet this year but probably we will have one in October. We have also gone to another format called the Information Update Meetings. For example, if EIS people need some additional information, we will bring in specific investigators who may have collected information since the last synthesis meeting. We also have another form for meetings called Small Meetings and Workshops where very specific topics can be addressed.

Q. 2 Actually, this does not apply to the Bering Sea particularly but rather to the entire social and economics studies program. In the ten years or so since it started the Alaskan Socioeconomics Studies Program has made a very significant contribute on to the State. It has helped to expand both our factual knowledge and our understanding. We have h card a good deal about the shortcomings of the AESP, but I think the positive contributions must not be overlooked-- especially in its function of gathering data in small dispersed communities.

I commend you, therefore, for this partial ar vehicle of the ITM which *spreads i nformati on around.* I would urge that additional vehicl *es* be found to make the informati on avail abl e because the overall contribute ons invol veal, the" methodology, and the facts of the AESP are signi fi cant enough to warrant some kind of a widespread dissemi nati on of the work i n both the technical and socioeconomic fi el ds.

A. 2 We have trial to integrate the social and econ om ic studies program porti on into the Synthesis Meeting. We feel it is important for programs to be integrated *as* much as possible *and so* I woul d suggest that there probably will be additional forums within which the socioecon omic program can be portrayed and explained.

Q. 3 Is there any way the one-page summaries can be made available wi thout any i nterpretati on sooner than the 3- 4 month peri od?

A. 3 Like al 1 Federal agencies, we are reluctant to send out drafts. We gave ourselves extra time because this is the first meeting. I am sure we can probably get them out sooner than we stated, but we were al 1 owi ng maximum time. We do have summari es and outlines and I think we can probably do what you ask.

Q. 4 I just want to make a comment and throw out a questi on. First, the comment is sort of *a* compl iment f rom a 1 ong-time observer i n the OCS synthesis process. Over the years, I have been fairly critical of this process because we ask investigators to write papers to predict impacts based upon their indivi dual areas of knowledge. I had al ways thought that this was a rather dangerous thing to do because al though they are experts i n their areas, they do not know much about the effects on oil. Last summer at the Synthesis Meeting at Denal i, I was very pl eased to see the beginning of the i ntegrati on of not only the Rand model but a lot of oil weathering wo rk that SA I had done. I thought this was a very positive step and I was pl eased to see at this meeting that we went a step further. The mode? i ng process is very important because it forces you to "bring together al 1 the disci pli nes and al 1 the i nformati on i n tryi ng to integrate everything to show what the potential impacts mi ght be. We are really starting to get to a point now where we are turning i n al 1 the knowl edge f rom the di fferent pieces of your studies program and I fully endorse this type of approach.

Secondly, I woul d 1 ike sane feedback as to whether or not some of the panelists feel the informati on we are collecting from the studies program over the next 2, 5 or 10 years is really going to be signi ficant enough to make a decisi on as to whether or not we should have drilling or not. Is there significant enough informati on available that would *warrant a* 10-year delay from the operati ons standpoint?

A. 4 Let me respond to your first remarks on the modeling approach and its application. Since we have gone into it in a lot of different respects, either in terms of fisheries or interaction of whales or oil spills or whatever, we feel also that the approach has merit. Besides just integrating different pieces of information and getting them to bear on just one problem, another very valuable product of modeling is the better identification of where we need to go. For example, we can learn where the information is sketchy and then we have something more concrete to evaluate and can, therefore, make a decision on whether we feel it is appropriate to apply our resources to that question.

One issue that canes up in the Beaufort and Bering Sea is whether or not to drill during seasons when whales are migrating, A lot of this goes back to the days when uncertainty was great. The studies program has reduced that degree of uncertainty. In the Beaufort Sea, we have a very concrete database on the timing of the bowhead migration and the modeling study that will help to quantify better the probability of whales and oil spills meeting will reduce that uncertainty even further. I am not about to predict how long it will take for that to make a difference in the regulatory process, but I think we can see that in the last few years we have gone from a standard data approach of seasonal drilling in the Beaufort to one that's flexible.

As to gaining information, I doubt that the real arguments will change much by further study. A lot of these questions are political as opposed to technical and I just doubt that a 5-year delay would make a lot of difference in the North Aleutian shelf. As an optimist, I like to think that the studies we are doing are providing the information that is necessary and I firmly believe we have sufficient information to make those decisions relevant to particular lease sales.

Q. 5 I believe our seismic tectonic database is very poor and I would like to take this opportunity to remind you that the data which we have for the Bering Sea is very rudimentary. Indeed, if we are to advance beyond the present stage, a very long-term program is required. I would like to suggest that a couple of things be done in the short term, and that if we are going to look to the linger term (50 years), then there are some other things we ought to be doing.

In the short term, I think that it would be very beneficial to relocate all of the earthquakes that have occurred in the Bering Sea. By relocating them I mean take the original data and use modem techniques to relocate the events. There are not that many and it would not be an overwhelming project, but it could be significant. The most important thing would be to use modern techniques to assign magnitudes to all the earthquakes that have occurred. In reviewing my notes, I was reminded that perhaps more than 50 percent of the earthquakes do not have magnitudes assigned to them. These magnitudes are extremely important when you are trying to assess what the probability is for a larger one to occur. Thus, we need to have this database.

In the long term, from the State of Alaska's point of view and also from the Department of Interior's point of view, it is not very likely in the present circumstances that we can improve our seismic monitoring capability in northern and western Alaska, and in the Bering Sea region. I think the agency which is best situated to review this situation is MMS given its interest in improving the database. I would suggest that there should be a concerted effort with the State and Alaska, the Department of the Interior, and perhaps even a cooperative program with the USSR. A long-term program would not be very costly and would significantly improve our position 25 years down the road.

A. 5 It is not normal for the MMS studies program to engage in those sorts of activities, so we essentially wound down our Hazards Program. I think the Secretary at that time more properly felt that it was the oil industry who should maintain this data. I have not seen anything yet to change the original decision, which was made three years ago. Until now, we have provided some support but, I can say as a non-policymaker, that until there is a change in policy or it is recognized that a proper studies program is needed, I do not see much hope for MMS engaging in that sort of activity.

I don't see that industry is going to address those long term problems but, in fact, given my contacts with other consultants, I do know that industry is looking at some of the short-term things (e.g., the relocation of earthquakes). For the longer term, however, industry assumes that is the role of government. These time scales are much longer than any particular decision to drill in a lease area and the companies are simply not going to put money into these programs when they might not in the future even decide to drill there. But it is in the public's interest to have this data over the long term and I think it is appropriate to have this done. I think we should re-examine this issue and MMS should realize its regulatory function hew.

Q. 6 At this point, our regulatory process requires industry to furnish Sufficient information to verify that the design of a platform will withstand the type of forces in the area. I was really interested in your paper yesterday and I may have misinterpreted something, but it appeared to indicate that there is a possibility of higher seismic activity in the southwestern part of the St. George Basin than we had previously thought, and that relocation data might shed more light on it. I hope that you do have a paper or that we get the information so that it can be published as part of the information to be used in future studies.

A. 6 When we have a problem of this sort-- for example, when someone proposes to use an offshore structure-- we are forced into a very conservative approach and, sometimes, overdesign. You can see that there can be a lot of expenditures with strong motion devices on the seafloor as we anticipate the various types of activity that might take place. Finally, when I first came here I was very concerned about the earthquake design of offshore platforms. I got into it in detail in Upper Cook Inlet, another area of high seismic activity. The design criteria for the Upper Cook Inlet platforms are really based on the ice and the currents as opposed to the earthquakes which are really much greater. In sane other areas of Alaska' we have the same situation.

Q. 7 I have a comment on the format of the meeting. It is a problem that we all face at meetings and conferences we attend when there are concurrent sessions. I would like to think that maybe in the next meeting things could be scheduled so that chemical distributions and concentrated information could be directly disseminated to the biological groups. I realize there is not time for all the presentations to be given sequentially but I would like to suggest that in the future greater effort be made to try to integrate the biological and chemical sides of the program. After all, it is the chemistry that ultimately drives the biological impact and that fact needs to be underscored.

A. 7 Sane of that was pretty self-evident but the purpose of the ITM was not to do a synthesis or a complete environmental portrayal of the Bering Sea, because that's a big task in itself. I think. next year we will probably look at integrating those sessions more appropriately, but again, we want to discuss the wide spectrum of studies that we have done over the years and some of the other processes that are taking place in other agencies. However, I tend to agree with you and maybe next time we will try to make it something like a quasi-synthesis meeting if that seems to be the general concensus of the people who attend.

Q. 8 As you know, the amount of biological information we have available on the Navarin Basin is scarce, yet the industry's interest in the areas's potential for petroleum development is quite high. If industry is successful in their exploration attempts, will there be more interest generated by MMS in developing additional information on the biology in that area?

A. 8 I think I can probably safely say yes. We have not neglected the Navarin, but have not studied it in the same detail as we have some of the nearshore areas. Certainly for the nearshore, the coastal ecosystems are a fairly significant component of the program, but the oceanic areas don't get the same kind of treatment. The logistics of working in Navarin would be difficult for doing studies, as industry is now finding out. However, successful exploration activities would trigger a number of studies as our monitoring efforts expand. The increased interest in monitoring is evident by the increased funding for such studies from 3% in FY 1984 to 8% this year. In addition, industry is helpful in providing some important information in this area.

The whole process of permitting is set up to determine whether or not studies need to be done on specific 'projects. We also have a Bering Sea biological task force that is used to advise the MMS on studies or surveys that might be required in connection with specific types of operations. We should really tie the studies with the type of operations that are proposed. In a place like the Navarin Basin, the development is going to be very slow. Thus, we will probably have time to do studies as we go along.

Q. 9 You triggered a special topic of mine-- monitoring. I just want to make a couple of comments on it. As a lot of you know, for the last couple of years NOAA has spearheaded a project called the "Long-Term Effects Program". Its purpose is to get together over a dozen of the top experts in marine science to review all the existing information concerning the potential impacts of OCS development. They will also evaluate existing knowledge and technologies so that we can take a look at the long-term impacts, determine what to study, and how to do it with the present technology. Hopefully, the project report will be coming out in the near future.

A. 9 I was involved in that process and have seen the draft report. When you talk about monitoring in the Navarin Basin, I can just summarize by saying that if you think baseline studies are a bottomless pit for money, then you haven't seen anything. Unless you are very careful and selective, you can study the environment forever and not get any answers-- all under the guide of monitoring. I feel strongly that when we talk about monitoring, we must *not* be too casual -- or our baseline studies will look cheap.

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