

ALASKA LEGISLATURE SPECIAL COMMITTEE/SUBJECT FILE 8672
2140 SCOMM 79: HOUSE SPEC. COMM. ON OIL & GAS, 1991-1992

158

EXHIBIT B , 2

distribution and abundance in known and frequently used bowhead habitat, such as that represented by the actual Cabot proposed location.

An allied range of questions to be addressed focuses specifically on source sounds produced under actual drilling conditions. These measurements will be taken after the migration, when drilling actually begins, and will be conducted when a safe surface ice condition is present (approximately mid-November). A major purpose of this component of the Cabot monitoring study is to test the hypothesis first developed from the recordings acquired from the CIDS in the Stinson acoustic work that a very significant proportion of actual drilling sounds (perhaps 90%) falls within the infrasonic (or very low frequency) ranges. Only when high fidelity infrasonic recordings are made can they be used in other study programs to measure bowhead responses, if any, to them.

Finally, the Cabot monitoring program will include an aerial observation component. The purpose of this addition is to detect and observe the reactions of bowhead whales before, during and after they enter an assumed zone of influence produced by the SSDC operating at idle. In other words, the aerial observations are meant to be a scientific check on what has been previously observed at Stinson and Fireweed in which observers on the drilling platform detected no apparent avoidance responses among the whale groups sighted where some approached within as close as 100 meters to the units.

OIL SPILL CONTINGENCY PLANNING AND PREPAREDNESS: Over the past two seasons where ARCO has operated offshore drilling programs in the Beaufort Sea, a number of substantial advances have been made in the area of oil spill planning and preparedness. These advances have depended not only on the acquisition of high quality response equipment in adequate quantities and a thorough and continuing training program of rig personnel who will act as the immediate response team, but critically upon the training and organization of village response teams in Nuiqsut, Kaktovik, and Barrow. The thirty some individuals who have received this training (many of whom have participated in drills and demonstrations at ARCO's offshore exploratory locations) will continue to receive training up-date courses in order to maintain their certificates. In fact, many village team members are currently in the process of becoming integrated to the newly reorganized North Slope spill response organization, Alaska Clean Seas. From ARCO's perspective, one of the highest values it has received from its work with the village response teams is the advice its members have given on environmental conditions, sensitive areas and coastlines, wildlife resources, and cultural and subsistence sites and activities. This advice has truly improved and rendered more realistic spill response preparedness. This will be no less the case with the Cabot project where the Barrow team's advice, in particular, is crucial.

NORTH SLOPE RESIDENT HIRE: ARCO is proud of the record it has acquired in the aggressive recruitment and employment of North Slope residents on its offshore projects at Stinson and Fireweed. On the Stinson project a third of the drilling crew were Alaska North Slope Natives. Although the Fireweed drilling program was of shorter duration, a nearly equal number of Native hires were employed in the drilling phase of that project and others continue to remain employed during the current warm-stack phase of the operation. ARCO and its contractors plan to continue the practice of making jobs available to local people since they have found both a wide range of appropriate skills and high caliber employees in Slope communities.

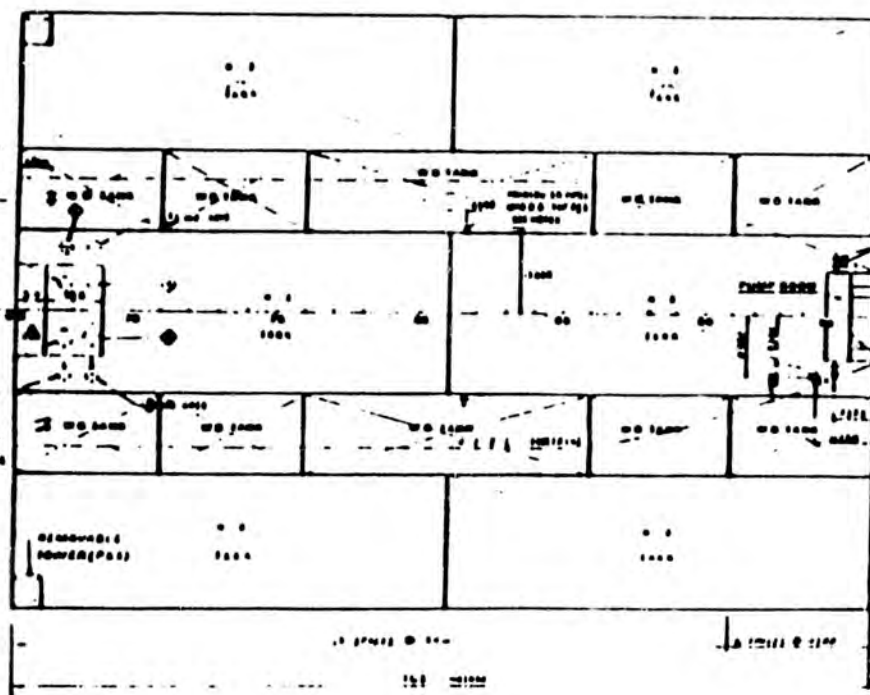
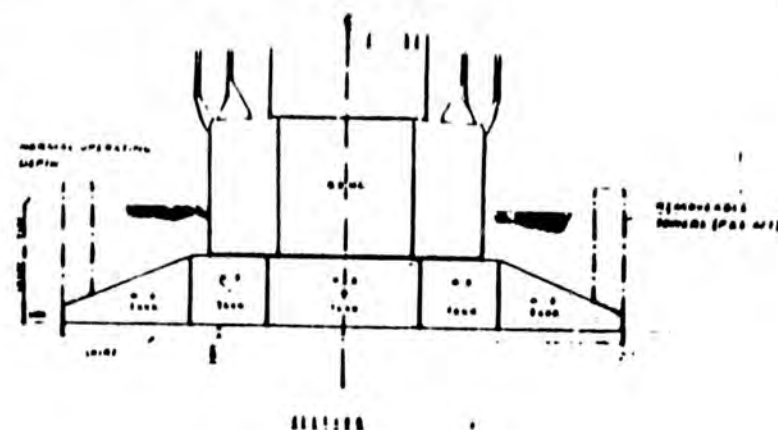
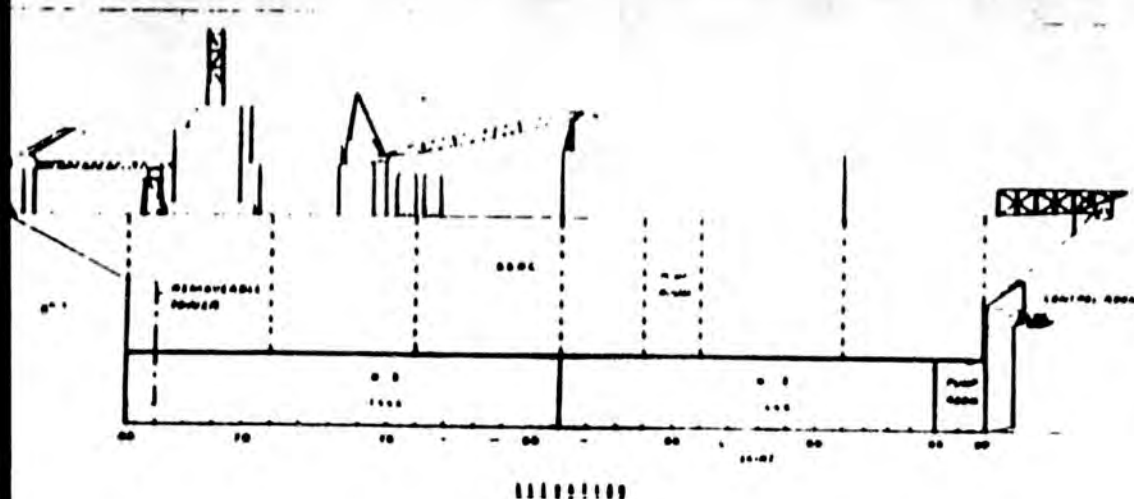
PLANS OF COOPERATION: Even before Plans of Cooperation were required by Federal incidental take regulations, ARCO made it a point to maintain regular communication with North Slope villages so that members of their communities could be informed of ARCO's operating plans and be given the chance to comment and advise on them. These contacts have taken various forms from the Oil/Whalers Cooperative Program and radio communication system to formal informational meetings and informal gatherings such as community-wide suppers. While there is no specific design of a plan of cooperation, ARCO fully intends to continue the pattern of

EXHIBIT B, 3

communication it has established with those villages potentially influenced by its operations on a regular informal basis.

CONTACTS AND SOURCES OF INFORMATION: You may be interested to know that the Alaska Oil and Gas Association (AOGA) has created a new committee called the Alaska Arctic Offshore Operators Committee (AAOOC). The purpose of this committee is to exchange information among industry operators on their plans, projects, and operations and in so doing to provide a single source to which members of the public can turn to find out what various companies are either proposing or are doing in the Beaufort and Chukchi offshore lease areas. The person to whom you should address any inquiries is Mr. Bill Hopkins, Executive Director, Alaska Oil and Gas Association, 121 West Fireweed Lane, Suite 207, Anchorage, AK 99503-2035, Tel. (907) 272-0347.

For specific contacts within ARCO Alaska, Inc. on information about the Cabot project, call
Don McKelvey, New Ventures Drilling Superintendent, (907) 263-4609
Steve Porter, Permits Manager, (907) 265-6269
Bob Griffeth, Environmental Dept., (907) 265-1551



PRINCIPAL CHARACTERISTICS

TABLE 1: SSDC

1. BELT AREA: 120 SQ FT
2. TOTAL HEIGHT: 10' 0" (3050)
3. NOMINAL FREQUENCY (Hertz): 4.2 (25.5 Hz)
4. OPERATIONAL WATER DEPTH WITH NO OTHER PREPARATION OR TREATMENT: 11' 0" (3350)
5. NOMINAL GROSS WEIGHT: 10,000 LBS (4536 KG)
6. THERE IS NO STRUCTURAL CONNECTION BETWEEN GROUND AND SIDE. THE HEAVIEST TRAILER IN THE GROUND IS BY MEANS OF GROUND AND TAILGATE.
7. AFTER INITIAL SETTING IN TO OPERATE WATER THE SIDE - GROUND WILL OPERATE AS A SINGLE UNIT THROUGHOUT ALL SUBSEQUENT MOVES FROM SITE TO SITE.
8. AN EXTENSIVE OPERATING RANGE OF 150 FT CAN BE REALIZED IN SPACING (SEE DRAW)

1. 1.1.1. MOON POND: 1117 SQ FT
2. 2.1.1. MOON POND: 1117 SQ FT
3. 3.1.1. MOON POND: 1117 SQ FT
4. 4.1.1. MOON POND: 1117 SQ FT
5. 5.1.1. MOON POND: 1117 SQ FT
6. 6.1.1. MOON POND: 1117 SQ FT
7. 7.1.1. MOON POND: 1117 SQ FT
8. 8.1.1. MOON POND: 1117 SQ FT
9. 9.1.1. MOON POND: 1117 SQ FT
10. 10.1.1. MOON POND: 1117 SQ FT
11. 11.1.1. MOON POND: 1117 SQ FT
12. 12.1.1. MOON POND: 1117 SQ FT
13. 13.1.1. MOON POND: 1117 SQ FT
14. 14.1.1. MOON POND: 1117 SQ FT
15. 15.1.1. MOON POND: 1117 SQ FT
16. 16.1.1. MOON POND: 1117 SQ FT
17. 17.1.1. MOON POND: 1117 SQ FT
18. 18.1.1. MOON POND: 1117 SQ FT
19. 19.1.1. MOON POND: 1117 SQ FT
20. 20.1.1. MOON POND: 1117 SQ FT
21. 21.1.1. MOON POND: 1117 SQ FT
22. 22.1.1. MOON POND: 1117 SQ FT
23. 23.1.1. MOON POND: 1117 SQ FT
24. 24.1.1. MOON POND: 1117 SQ FT
25. 25.1.1. MOON POND: 1117 SQ FT
26. 26.1.1. MOON POND: 1117 SQ FT
27. 27.1.1. MOON POND: 1117 SQ FT
28. 28.1.1. MOON POND: 1117 SQ FT
29. 29.1.1. MOON POND: 1117 SQ FT
30. 30.1.1. MOON POND: 1117 SQ FT
31. 31.1.1. MOON POND: 1117 SQ FT
32. 32.1.1. MOON POND: 1117 SQ FT
33. 33.1.1. MOON POND: 1117 SQ FT
34. 34.1.1. MOON POND: 1117 SQ FT
35. 35.1.1. MOON POND: 1117 SQ FT
36. 36.1.1. MOON POND: 1117 SQ FT
37. 37.1.1. MOON POND: 1117 SQ FT
38. 38.1.1. MOON POND: 1117 SQ FT
39. 39.1.1. MOON POND: 1117 SQ FT
40. 40.1.1. MOON POND: 1117 SQ FT
41. 41.1.1. MOON POND: 1117 SQ FT
42. 42.1.1. MOON POND: 1117 SQ FT
43. 43.1.1. MOON POND: 1117 SQ FT
44. 44.1.1. MOON POND: 1117 SQ FT
45. 45.1.1. MOON POND: 1117 SQ FT
46. 46.1.1. MOON POND: 1117 SQ FT
47. 47.1.1. MOON POND: 1117 SQ FT
48. 48.1.1. MOON POND: 1117 SQ FT
49. 49.1.1. MOON POND: 1117 SQ FT
50. 50.1.1. MOON POND: 1117 SQ FT
51. 51.1.1. MOON POND: 1117 SQ FT
52. 52.1.1. MOON POND: 1117 SQ FT
53. 53.1.1. MOON POND: 1117 SQ FT
54. 54.1.1. MOON POND: 1117 SQ FT
55. 55.1.1. MOON POND: 1117 SQ FT
56. 56.1.1. MOON POND: 1117 SQ FT
57. 57.1.1. MOON POND: 1117 SQ FT
58. 58.1.1. MOON POND: 1117 SQ FT
59. 59.1.1. MOON POND: 1117 SQ FT
60. 60.1.1. MOON POND: 1117 SQ FT
61. 61.1.1. MOON POND: 1117 SQ FT
62. 62.1.1. MOON POND: 1117 SQ FT
63. 63.1.1. MOON POND: 1117 SQ FT
64. 64.1.1. MOON POND: 1117 SQ FT
65. 65.1.1. MOON POND: 1117 SQ FT
66. 66.1.1. MOON POND: 1117 SQ FT
67. 67.1.1. MOON POND: 1117 SQ FT
68. 68.1.1. MOON POND: 1117 SQ FT
69. 69.1.1. MOON POND: 1117 SQ FT
70. 70.1.1. MOON POND: 1117 SQ FT
71. 71.1.1. MOON POND: 1117 SQ FT
72. 72.1.1. MOON POND: 1117 SQ FT
73. 73.1.1. MOON POND: 1117 SQ FT
74. 74.1.1. MOON POND: 1117 SQ FT
75. 75.1.1. MOON POND: 1117 SQ FT
76. 76.1.1. MOON POND: 1117 SQ FT
77. 77.1.1. MOON POND: 1117 SQ FT
78. 78.1.1. MOON POND: 1117 SQ FT
79. 79.1.1. MOON POND: 1117 SQ FT
80. 80.1.1. MOON POND: 1117 SQ FT
81. 81.1.1. MOON POND: 1117 SQ FT
82. 82.1.1. MOON POND: 1117 SQ FT
83. 83.1.1. MOON POND: 1117 SQ FT
84. 84.1.1. MOON POND: 1117 SQ FT
85. 85.1.1. MOON POND: 1117 SQ FT
86. 86.1.1. MOON POND: 1117 SQ FT
87. 87.1.1. MOON POND: 1117 SQ FT
88. 88.1.1. MOON POND: 1117 SQ FT
89. 89.1.1. MOON POND: 1117 SQ FT
90. 90.1.1. MOON POND: 1117 SQ FT
91. 91.1.1. MOON POND: 1117 SQ FT
92. 92.1.1. MOON POND: 1117 SQ FT
93. 93.1.1. MOON POND: 1117 SQ FT
94. 94.1.1. MOON POND: 1117 SQ FT
95. 95.1.1. MOON POND: 1117 SQ FT
96. 96.1.1. MOON POND: 1117 SQ FT
97. 97.1.1. MOON POND: 1117 SQ FT
98. 98.1.1. MOON POND: 1117 SQ FT
99. 99.1.1. MOON POND: 1117 SQ FT
100. 100.1.1. MOON POND: 1117 SQ FT

CANADIAN MARINE SERVICES LTD.	
PROJECT: SSDC MAT DESIGN	
DESIGNED BY: ENGINEERING DESIGN	
TITLE: BARGE	
GENERAL ARRANGEMENT	
ISSUED FOR: 01.01.07	ISSUED FOR: 01.01.07
ISSUED FOR: 01.01.07	ISSUED FOR: 01.01.07

FIGURE 2-1 GENERAL SSDC/MAT CONFIGURATION

EXHIBIT B, 4

EXHIBIT C , 1

ARCO Alaska, Inc.
Box 100360
Anchorage, AK 99510

PLAN OF COOPERATION with Beaufort Sea bowhead whaling communities of Barrow, Nuiqsut and Kaktovik in connection with ARCO Alaska's proposed offshore oil and gas exploration program at the Cabot location, 30 miles offshore east from Barrow, Alaska and 15 miles offshore north from Dease Inlet, 1991-1992.

ARCO initiated its Plan of Cooperation with the Inupiat whaling communities on 8 March 1991 when it met with the Barrow Whaling Captains' Association to discuss its proposed Cabot exploratory program (see Attachment 1, program description). Various ideas and suggestions were put forward by the Barrow whaling captains designed to improve the quality of the required marine mammal monitoring program. Among these suggestions was one that requested ARCO to begin the monitoring program during the last open-water days of the annual fall bowhead migration in order that the monitoring study results might incorporate a behavior/noise disturbance component under actual drilling conditions. While this suggestion is being seriously considered by ARCO, a cautious approach is required since it appears that a consensus is lacking among the whaling captains as to the advisability of conducting actual drilling operations when whales are expected to be within the exploratory project vicinity. The other recommendation from this meeting was that ARCO conduct a public meeting in Barrow where all members of the community would be invited to attend and express their views and concerns on the project.

The Barrow community meeting was held on the evening of Wednesday, 20 March, at the elementary school multi-purpose room. It was widely advertised on KBRW and the local cable television channel. The proceedings were broadcast in full by KBRW. The meeting began at 7:30pm and continued past midnight thus allowing all who wished to do so to comment in both Inupiaq and in English. More than 20 whaling captains, city and Borough officials, and local residents made oral comments. ARCO was represented by its vice president for exploration, J. Dees, and members of its drilling, permitting, and environmental departments. ARCO's main contractors for the proposed Cabot project--CANMAR Drilling, Arctic Catering, and Piquiq Corp.-also sent representatives.

ARCO's brief opening presentation closely followed the project description contained in Attachment 1. The timing, duration, and specific activities associated with the Cabot project were highlighted. The elements of the proposed marine mammal monitoring program were described including the fact that the monitoring program will be fully developed through consultation with the North Slope Borough's Department of Wildlife Management. A description of the North Slope village (including Barrow) Oil Spill Response Teams was given. And, ARCO's commitment to continuing its program of North Slope resident hiring of project personnel was reemphasized.

The balance of the meeting was then devoted to comments by the Barrow community. While many of these comments covered areas that were not necessarily directly linked to the proposed Cabot exploratory project, most were. Broadly, these comments touched on the following areas:

- (1) The nature of the marine mammals monitoring program to be conducted under a Letter of Authorization required by the new incidental take rules.
 - (2) ARCO's oil spill and blowout prevention preparedness and response capabilities.
 - (3) Mitigation measures planned to address potential environmental and socio-economic impacts.
- The only formal written statement was provided by Burton Rexford, Chairman of the Alaska Eskimo Whaling Commission (Attachment 3). The AEWC's statement covered the majority of concerns raised by other speakers. However, a detailed response to specific questions and concerns raised by all speakers is included as Attachment 2. This response is being sent to appropriate community agencies and residents.

Cabot Project, 1991-1992
Plan of Cooperation

- 2 -

Meetings are being scheduled for mid-April with the community and whaling captains' associations in Nuiqsut and Kaktovik. The proposed Cabot project will be presented and community comments invited.

Should an Oil/Whalers Agreement be developed for the 1991 season between oil industry offshore operators and the whaling captains' associations of Nuiqsut and Kaktovik (as administered through the AEWC), ARCO will become a participant.

ARCO and representatives of its contractors will also to continue to make available information about opportunities for employment on the Cabot project. Piquiq Corp. will serve as the principal point of contact for completing the screening and hiring procedures. However, in-village visits will be made by ARCO and contractor representatives to insure the maintenance of their on-going resident hire programs.

As it has in its 1989 and 1990 offshore exploratory programs, ARCO will continue with its training program of the Village Oil Spill Response Teams in Barrow, Nuiqsut, and Kaktovik. Refresher and up-grade courses will be given in conjunction with the Alaska Clean Seas program for North Slope Village Response Teams. Representative OSRT members from the villages will also be invited to participate in spill response exercises and demonstrations at the Cabot location. In this manner the village communities can receive up-to-date information on the exploratory project as it progresses from those residents who serve on the OSRT's.

1 April 1991

TO: Alaska Eskimo Whaling Commission - Barrow, AK
Barrow Whaling Captains' Association - Barrow, AK
North Slope Borough - Barrow, AK
Office of the Mayor
Department of Wildlife Management
Planning Department
Office of the Mayor - Barrow, AK
Ukpeagvik Inupiat Corp. - Barrow, AK
All Interested Barrow Community Residents

FROM: ARCO Alaska, Inc.
Box 100360
Anchorage, AK 99510
Contact Tel. (907) 265-1551 [Bob Griffeth]

SUBJECT: ARCO's Responses to Questions, Comments, and Concerns Raised by Residents and Officials of the Barrow, Alaska Community Regarding the Proposed Cabot Offshore Oil and Gas Exploratory Program (1991/1992) as Stated at the Community Meeting Held on 20 March 1991 in Barrow.

ARCO wishes to thank the various members of the Barrow community who took the time and effort to comment on its proposed Cabot exploratory project at the meeting held at the Multi-Purpose Room of the Elementary School on the evening of 20 March. ARCO recognizes that the Cabot project is proposed for a location of special interest and concern to Barrow whalers in that exploratory activities will be conducted in an area where the fall bowhead migration normally occurs. For this reason ARCO wishes to make a determined effort to conduct an environmentally safe program, in cooperation with Barrow, that will directly address community concerns and incorporate recommendations made by community residents.

We believe we do have the experience and technical capability to schedule and carry out an exploratory drilling program that will not cause adverse impacts on the bowhead migration and subsistence whaling activities. We also believe that the marine mammal monitoring program proposed for Cabot has the prospect of further enriching scientific knowledge of both bowhead ecology and offshore industrial activities that could conceivably influence it. Beyond that, ARCO believes that the preparedness measures it has taken to handle events such as an oil spill are sound ones that go to the heart of many of the concerns expressed at the community meeting.

Nearly all members of the AEWK, Barrow Whaling Captains' Association, NSB and Barrow city governments, and local Native corporations and organizations (including ICAS) who gave comments covered three broad areas: (1) Potential impact of the Cabot program on the bowhead migration (fall and spring) and the NMFS supervised marine mammal monitoring program specifically designed to address that matter; (2) The technical capacity of the offshore operator to contain and clean up spilled oil in Arctic conditions of sea ice cover at the drilling location; (3) Socio-economic and cultural impacts on the Barrow community. These three main topics were elaborated on by various other commentators who were not necessarily officially associated with the whaling organizations, local government representatives, or Native organizations.

In what follows ARCO wishes to respond to the points raised by each of the 21 speakers who made comments, but will do so here by treating the three broad topics in detail. The names of individual commentators who best summarized a specific question, comment, or concern will be mentioned as appropriate.

EXHIBIT C, Attachment 2, 1

ARCO Alaska, Inc.
Box 100360
Anchorage, AK 99510

**ARCO's RESPONSES TO QUESTIONS, COMMENTS, AND CONCERNS RAISED BY
BARROW RESIDENTS REGARDING THE PROPOSED CABOT #1 EXPLORATORY
WELL PROJECT, BEAUFORT SEA WESTERN LEASE AREA (1991/1992)**

**TOPIC I: Potential Impact of the Cabot Program on the Bowhead Migration (Fall and Spring)
and the NMFS Supervised Marine Mammal Monitoring Program Specifically
Designed to Address That Matter.**

Nine commentators [B. Rexford, E. Brower, E. Itta, D. Rexford, R. Brower, J. Adams, Arnold Brower, Jr., Tom Lohman, and Tom Albert] directed their comments and concerns to this important topic. In general they requested that ARCO follow faithfully the newly stated NMFS guidelines for site specific monitoring and that the Barrow community be given the opportunity to comment on the program ARCO will propose for monitoring.

ARCO response: ARCO has drafted its site specific marine mammal monitoring program at the Cabot location in accordance with the NMFS issued guidelines that resulted from a joint agency/industry workshop held last February in Seattle. Beyond that, ARCO has already begun consultations with the NSB Wildlife Management Dept. in drafting the monitoring proposal and intends to work closely with that department, AEWC, and the Barrow Whaling Captains Association as well as with the two principal Federal oversight agencies (NMFS and MMS) as it develops the detailed monitoring methodology and accompanying science program. Since the monitoring program is also submitted as an essential component of ARCO's application for a Letter of Authorization (LOA) from NMFS under the Incidental Take of Marine Mammals Regulations, there will be further opportunities for members of the Barrow community to comment. In effect, ARCO is anxious to have the continued input from the Barrow community in order to make its monitoring effort a good one.

Various speakers [T. Albert, T. Lohman, E. Itta, A. Brower and others] took note of the fact that the monitoring program, while heavily focused on bowhead whales, must also include monitoring for five other species: grey and beluga whales, bearded, ringed, and spotted seals. This feature is definitely included in ARCO's draft monitoring proposal. Monitoring activity will be conducted in three ways (by aerial, visual--from the drill platform--and acoustic methods) all of which are appropriate to sightings and behavioral observations of five of these species (bowhead and beluga whales and the three seal species). The sixth species, grey whales, will be monitored aerially and visually; but, unlike the other whales and seals, this class of cetaceans does not engage in the vigorous calling activity characteristic of the other five species so that acoustic monitoring is likely to produce meagre, if any, results.

Some speakers [see particularly B. Rexford's written comments on behalf of the AEWC] expressed the concern that the Cabot location lies so clearly within the usual bowhead migratory pathway that operations there might have an adverse impact on the fall subsistence hunt. ARCO has scheduled its summer/early fall 1991 operations to minimize that possibility. We believe that knowledge and experience gained from the Stinson and Fireweed programs of 1989 and 1990 with the drilling units operating only in warm standby mode (no drilling) and minimum surface vessel and aircraft traffic to the units during the migration produced no identifiable blockage of the migration or displacement of whales seaward, away from the rigs. In fact, during both previous programs some whales appeared to actually alter their westward swim orientation to approach within very close proximity of the rigs. These interactions are reported in detail in the monitoring program studies produced by Dr. John Hall, the principal scientific investigator, and are available in the offices of AEWC, NSB Wildlife, and NSB Planning. In any case, ARCO's proposed

operations at the Cabot location will conform to the request, again expressed in the AEWC statement, that no drilling or surface vessel traffic will be conducted during either the fall 1991 or the spring 1992 bowhead whale hunt by Barrow whalers; and, only the operationally necessary minimum helicopter flights will be flown during those same periods of the hunt.

Speakers J. Adams and E. Brower brought up a matter which had previously been discussed at the 8 March meeting between ARCO and the Barrow Captains: that is, when and if Barrow acquires its bowhead quota and declares the hunt over before the end of the migration, then the monitoring program should begin under real-time drilling conditions. Both speakers hold the view (which was also generally agreed to by the majority of whalers at the 8 March meeting) that only when a realistic study under actual operating (drilling) conditions occurs will we be able to determine what, if any, responses bowheads demonstrate to that offshore industrial marine noise source. In this regard E. Brower stated that "we don't want any more bogus studies that don't give us any believable answers." ARCO is receptive to this request for a real-time monitoring study component but would ask that all interested parties (AEWC, NSB agencies, etc. in addition to the Barrow Captains Assoc.) in the Barrow community reach formal agreement on the matter and express that agreement in writing to ARCO. This agreement would be a necessary attachment to ARCO's application for the Incidental Take LOA being sought from NMFS as well as waiver of stipulated requirements imposed by the MMS regarding the specific time at which a drilling program can commence. There are other operational considerations which also influence ARCO's ability to respond to this request to commence actual drilling at the tail end of the bowhead migration that are, generally, associated with NSB, State and Federal seasonal drilling restrictions. However, ARCO is willing to explore these matters in order to respond positively to the Barrow Whaling Captains' Association request.

To summarize the response to questions, comments and concerns which Barrow residents have raised on this topic, ARCO as operator of the proposed Cabot project exploratory drilling program will follow the NMFS guidelines in carrying out the marine mammals monitoring program; will continue consultations with appropriate Barrow and NSB organizations to produce sound methods and scientific procedures for that program; will schedule its operations in a fashion that is expected to produce little or no adverse impact on the fall and spring bowhead whale hunts; and will make efforts to consult with all appropriate parties on the request by Barrow whalers to conduct a portion of the monitoring program under real-time drilling conditions at the conclusion of the fall 1991 hunt but before the migration has ended.

TOPIC II: ARCO's Technical Capacity to Contain and Clean Up Spilled Oil in Arctic Conditions of Sea Ice Cover at the Cabot Drilling Location, Relief Well Plan, and Other Environmental Protection Measures.

In the course of acquiring permission to operate, ARCO is required to prepare, among other things, (1) An approved Oil Spill Contingency Plan covering response techniques to be employed under all potential environmental conditions (open water, broken ice, and solid ice); (2) A Relief Well Plan in the event an uncontrolled blowout of oil occurs; and (3) Permits to discharge non-harmful materials such as muds, cuttings, and treated water into the marine environment. Many individuals who gave statements at the 20 March community meeting touched in varying degrees on all three of these subjects. However, principal concern focused on the plan and techniques to be employed in cleaning up spilled oil should it be released under the ice. This is a particularly apt concern since the Cabot drilling program is scheduled as a winter activity during solid ice cover at the location.

ARCO's responses: (1) The issue of the ability to contain and clean up oil spilled under the ice was first and most thoroughly stated by E. Hopson. Mr. Hopson commented that under ice water currents move at roughly the same speed as a person walking and would therefore likely transport oil spilled under the ice at the same rate. He went on to inquire whether adequately trained

personnel and equipment could effectively deal with such a situation. Many other speakers addressed the same issue. These included B. Rexford (see written statement), NSB Mayor J. Kaleak, A. Akpik (representing Barrow City Mayor D. Long), D. Rexford, B. Adams, W. Ahmakak, and D. Nungasak. Other speakers also alluded to this topic including oil spill clean up capabilities for open water and broken ice conditions.

ARCO believes that prevention preparedness is the best way to address this issue. It has gained considerable offshore experience in the projects it conducted in 1989 at Stinson and 1990 at Fireweed locations. This experience prominently includes training and equipment acquisition, on site, to contain and clean up spills including those which might be entrained under ice. A substantial number of rig crew personnel have received both the basic and specialized courses that focus on prevention and response. In addition, drills and exercises are regularly conducted to insure each response team member understands his or her responsibilities and that the clean up equipment is in good working order for Arctic conditions. Beyond that, the Nuiqsut, Kaktovik and Barrow oil spill response teams (10 members each) have received the basic OSRT course and will continue to receive refresher and up-date training with special attention to spills on or under sea ice. The Nuiqsut and Kaktovik teams have been represented on drills and exercises at Stinson and Fireweed, and two Barrow team members participated in an early winter exercise at Fireweed (see specific response to comments by D. Nungasak, Barrow OSRT member, below). These preparedness measures are dealt with in considerable detail in the Cabot Oil Spill Contingency Plan, copies of which will be made available to appropriate agencies in the community and which may be consulted by any interested resident.

Barrow whaling captain and OSRT trainee D. Nungasak reported that he felt his training, in Barrow along with other members of the fire department, was incomplete. He is correct. The 40 hour training course given in August 1990 covered the basic materials in a classroom setting (which included a 24 hour hazardous materials component). Bad weather prevented carrying out the field/hands-on component of OSRT training at that time. Such training is scheduled for the Barrow OSRT trainees and may be conducted in conjunction with Alaska Clean Seas courses which also focus on response training appropriate for villages, the existing oil fields and, to some extent, offshore operations. Nungasak also participated as an observer at the Fireweed project spill training exercise but expressed his disappointment that no on-ice training occurred there. Very dynamic ice conditions provided the scenario for that exercise and approval was given by the inspecting regulatory agencies that ARCO had adequately demonstrated its response capacity. Even so, no response personnel or equipment were deployed onto the sea ice on that occasion, a matter which is unlikely to be repeated at the Cabot prospect where much earlier stable shorefast ice formation is likely to occur and which will enable OSRT training and demonstration exercises to be held safely on the sea ice.

However, ARCO believes that interested community members in Barrow deserve a much more detailed technical explanation of how it, as operator, would respond to a spill on or under sea ice. For that reason ARCO proposes to hold a seminar/workshop on Arctic offshore containment and clean up measures, in Barrow, at a time and place deemed suitable (perhaps mid-April) by the NSB Planning Department. Residents, NSB and City, and Native organization representatives will be invited to attend the seminar/workshop.

(2) Every offshore drilling exploration project requires an approved plan for drilling a relief well in the event of a blowout with uncontrolled release of oil. Under Arctic winter conditions this naturally requires logistic preparations to transport a relief drill rig to an appropriate location. In the case of the SSDC/MAT drilling unit which is proposed for use on the Cabot project, a second drill site aboard the unit can be equipped to drill the relief with a rig transportable by helicopter. One advantage of the Cabot location is that adequate near-site logistic back-up infrastructure is available in Barrow. Details of the relief well plan can be consulted in documents filed with the MMS and the NSB.

(3) Two speakers (see AEW statement by B. Rexford, for example) asked questions and raised concerns about discharges from the drilling unit made into the marine environment. In particular, the question was asked whether harmful materials might be introduced that would impact the marine food chain. The straight-forward answer to this question is that no waste materials (solid or liquid) containing substances potentially harmful to marine organisms or humans may be discharged into the ocean. Such liquid or solid materials as are normally discharged into the sea (muds and cuttings from the drilling operation and treated waste water from the SSDC's life support systems) are very carefully monitored and regulated by the EPA and other agencies which must certify that such material will cause no adverse environmental consequences. The regulations allow for no exceptions to this high standard. The Cabot project would be in violation of the law if its operations were to result in any unpermitted or potentially harmful discharge.

TOPIC III: Socio-Economic and Cultural Impacts of the Cabot Project on the Barrow Community. Numerous speakers centered their comments around the subject of oil development's impacts on Inupiat culture, society, and economy. In each instance the central role of subsistence was stressed. Among the speakers who directed their remarks to these subjects were B. Hugo, D. Rexford, K. Toovak, Sr., N. Itta, A. Brower, Jr., and J. Brower. Other comments were received from NSB Mayor J. Kaleak and Barrow Mayor D. Long (in a statement given by A. Akpik) regarding local hire of NSB residents. R. Brower speaking as president of UIC emphasized the need of working closely with the community, its organizations and Native corporations. N. Olemaun reviewed the role of the ICAS and its primary concern with insuring the cultural integrity of the Native community in the process of development.

ARCO's responses: ARCO wishes to reinforce to the members of the Barrow community its rock-solid policy of working cooperatively with them to achieve what we hope are mutually beneficial ends. ARCO places a very high priority on North Slope Inupiat subsistence culture and, as in the case of matters discussed above on the proposed Cabot offshore exploration project, not only listens to community concerns but designs its operations by taking them seriously into account. The most important example of this with respect to ARCO's current proposal deals with timing its plan of work to avoid interference with the subsistence bowhead hunt and conducting operations in the environmentally safest manner.

Various speakers made reference to the fact that they and the country need and will benefit from new discoveries of oil and gas. But they hoped equally that such exploration and production activities as might conceivably follow from a major discovery would not be at the expense of the vitality of Inupiat culture. ARCO shares both these views and would like to respond here by stating some of the areas in which past cooperative activity and future plans appear aimed toward a common set of goals.

Environmental Protection. The basic idea behind organizing and training village oil spill response teams was that it should be a cooperative effort between ARCO, North Slope Communities, village corporations and the NSB. Both ARCO and the villages must constantly confront the issue of protecting against, preparing for and responding to fuel spills. Thus the ARCO-funded spill team training programs in Barrow, Nuiqsut and Kaktovik were not designed exclusively to provide ARCO with additional skilled responders to possible spills during its offshore operations, but were aimed toward assisting local communities which face the same problems. At the same time those who have been and will be trained have added employable skills to their personal resumes. This program could not have succeeded without the cooperative efforts of all four parties involved.

ARCO has also joined with various North Slope groups in conducting environmental programs of mutual interest. Most recently (spring 1990) the Atlantic Richfield Foundation funded a grant to AEWG and the Nuiqsut Whaling Captains Association which resulted in the clean-up of spent drums and barrels from the Cross Island whaling camp. Through its wildlife monitoring programs, ARCO has also participated with the NSB and Slope villages in various studies of specific and general interest to both parties.

Employment and Business Activities. ARCO is proud of its record of North Slope resident hire with respect to the offshore exploratory activities it has conducted since 1989. In the two operations conducted to date (Stinson, 1989 and Fireweed, 1990) more than 30% of the drilling rig crews were recruited and employed from Slope communities. Piquiq Corp. has facilitated this hiring policy. ARCO intends to continue its aggressive resident hire program for the Cabot project.

There is an extensive record of direct business dealings and ventures between ARCO and the North Slope Native Corporations and their subsidiaries. In the case of the Cabot project it is clear that many services can be supplied through UIC and ASRC units. This would naturally present significant opportunities for NSB resident employment and training. Specific business negotiations are presently underway to that end.

Cultural and Subsistence Concerns. ARCO has encouraged and supported many activities of its North Slope neighbors that touch these areas. In 1990 a grant was made to the AEWG for the purpose of assisting it in defraying the management costs associated with the Cooperative Program for the Beaufort Sea (otherwise referred to as the Oil/Whalers Agreement). This communication program is expressly designed to eliminate potential conflicts between active whaling crews and oil industry offshore exploratory operations and has worked successfully in the mid and eastern Beaufort communities since 1986. ARCO has supported various projects of the NSB Commission on History and Culture including archeological work in Barrow. Undoubtedly there will be other projects in future where ARCO will have the opportunity to participate in the support of community programs whose purpose is to reinforce and strengthen the cultural bonds that link the Inupiat of the North Slope.

To summarize: ARCO believes that its past record of cooperation with the North Slope Inupiat communities on vital matters of environmental protection, job and business opportunities, concerns for the maintenance of subsistence culture--particularly bowhead whaling--and participation in other cultural projects is a pretty good one. Many speakers were kind enough to recognize this record which we appreciate. While the brief summary given here could not hope to address all the matters which may be of some concern to the Barrow community in weighing and evaluating ARCO's proposed Cabot exploratory program, we hope that you accept the spirit of willingness to cooperate with you that is at least outlined in all the above responses.

Thanks for attending the 20 March meeting and speaking up. We were listening and we have attempted to respond to you directly.

STATEMENT
OF
THE ALASKA ESKIMO WHALING COMMISSION

Regarding ARCO'S
Exploratory Drilling Project
in the Beaufort Sea for 1991 and 1992

Barrow, Alaska
March 20, 1991

My name is Burton Rexford, I am an Inupiaq Whaling Captain and also the Chairman of the Alaska Eskimo Whaling Commission.

The location being proposed tonight by ARCO for exploratory drilling is an important bowhead whale hunting area for Barrow whalers. As you know, the bowhead whale is an extremely important resource for us, not only for subsistence purposes, but for our culture as well. Since the oil industry began exploring in our waters, the whaling crews in Barrow have been reporting fewer bowhead whales or no bowhead whales in areas where we have always hunted. Our whalers, in spite of great danger to human life, have begun to hunt farther from shore. But even when we can locate and take whales at these distances, we often lose the whale meat because of the time required for towing and this counts against our IWC quota.

In 1989, Barrow lost the meat from four whales because of this problem. And now with ARCO's plans, we are very concerned that these problems will only worsen.

Therefore, we do not want any drilling or boat and helicopter traffic during the fall bowhead whale hunt by ARCO until after Barrow gets their bowhead whale quota or stops its hunts. Also, we do not want any industrial activity during the spring hunt.

Another concern that we have has to do with the possibility of an oil spill from an oil blowout off the offshore exploratory well.

We've been told many times that the risks of a blowout is low, but the statistics that this argument are taken from are almost entirely from offshore exploration outside of Arctic waters. Based upon my years as a subsistence hunter, I know the hazards of Arctic weather and sea ice. These hazards present increased risks to offshore oil exploration that have yet to be fully factored into risk assessments conducted by the oil industry.

In addition, I believe it will be virtually impossible to respond to an oil spill in Arctic waters, especially in the presence of sea ice. The proof here can be drawn easily from the experience gained during the so-called "gray whale rescue" offshore from Barrow a few years ago and the more recent disastrous clean-up attempts at Prince William Sound.

This is why AEWC asks that any activity in the Arctic OCS should be conducted only in the immediate presence of containment and cleanup equipment which has been proven capable prior to exploration.

AEWC also believes that any dumping of drilling muds into Arctic waters be avoided, as well as any other discharge from oil and gas exploration in the Arctic OCS. The food chain in the Arctic is very short. The North Slope Borough scientists who autopsy our bowhead whales each year are telling us that toxic levels of pollutants are being found in the organs of the bowhead whales. While the source of this pollution has not been identified, any potential pollution from OCS oil and gas operations cannot be tolerated since it directly affects the food upon which our people depend.

In regards to bowhead whale monitoring activities, the AEWC wants ARCO to follow the Site Specific Monitoring Guidelines recently outlined by the National Marine Fisheries Service.

I strongly urge you to give serious consideration to these concerns and comments. Furthermore, we will be monitoring the Letter of Authorization process to make sure that our concerns are adequately addressed before ARCO is given their LOA. Thank you for

EXHIBIT D

DRAFT PROPOSAL FOR

A MARINE MAMMAL MONITORING PROGRAM AT
ARCO ALASKA, INC.'S CABOT EXPLORATORY WELL
SITE, WESTERN BEAUFORT SEA, ALASKA, 1991/92
WITH SPECIAL EMPHASIS ON THE BOWHEAD WHALE

SPONSOR

ARCO Alaska, Inc.
Box 100360
Anchorage, AK 99510
ATTN: Bob Griffeth
Tel. (907) 265-1551
FAX (907) 265-6216

SCIENTIFIC CONTRACTOR

Coastal and Offshore Pacific Corp. (COPAC)
Dr. John Hall, Principal Investigator
P. O. Box 31554
Walnut Creek, CA 94598
Tel. (415) 937-1556
FAX (415) 937-9251

April 1, 1991

TABLE OF CONTENTS

INTRODUCTION	3
CABOT EXPLORATORY PROGRAM AND TIMING	5
MONITORING STUDY OBJECTIVES	6
THE STUDY AREA	7
METHODS	7
A. Aerial Surveys	7
B. Passive Acoustic Bowhead Call Localization	10
C. Visual Monitoring from the SSDC/MAT	10
D. Study of the Marine Acoustic Environment	11
1. Received and Source Levels	11
2. Ambient Noise Levels	11
3. Transmission Loss Estimates	12
E. Other Questions to be Addressed	12
1. Comparisons of Fall/Spring Bowhead Call Recordings	12
2. Identifying Bowhead Migration Pulses	13
SUMMARY	13
CITATIONS	14

INTRODUCTION

ARCO proposes to conduct a site specific marine mammal monitoring program at the exploratory oil and gas lease site named Cabot. The prime focus of the monitoring effort will be placed on observing and describing the behavioral reactions of bowhead whales before, during and after their arrival at and passage beyond the SSDC/MAT, a bottom-founded drilling unit which will be operating in a warm-standby mode (not drilling) during the September-October 1991 bowhead whale migration and subsistence hunt. Acoustic, aerial, and visual monitoring from the SSDC platform will also be conducted for five other species of marine mammals: gray and beluga whales, ringed, bearded and spotted seals.

The Cabot study will be the third Beaufort Sea monitoring program which ARCO has sponsored since 1989. In that year Dr. John Hall and his team of scientists carried out a passive acoustical monitoring study at the Stinson exploratory well location in west Camden Bay. The results of that study were reported in John D. Hall and Jon Francine, "Report on Sound Monitoring and Bowhead Whale Calls Localization Efforts Associated with the Concrete Island Drilling Structure (CIDS) off Camden Bay, Alaska," Hubbs Marine Research Center-HMRC Technical Report 89-219 (San Diego, February 15, 1990), and in John D. Hall and Jon Francine, "Measurements of underwater sounds from a Concrete Island Drilling Structure located in the Alaska sector of the Beaufort Sea," Journal of the Acoustical Society of America, v. 88, no. 4 (April, 1991, forthcoming).

In 1990 the site specific passive acoustic monitoring program was continued by Dr. Hall and his team for a second year at ARCO's Fireweed exploratory well site in the western Beaufort Sea twelve miles offshore from Pitt Point. The results of that program are reported in John D. Hall, Marianne L. Gallagher, Kenneth D. Brewer, and Donald K. Ljungblad, "Passive Acoustic Monitoring Program at the ARCO Alaska, Inc. 'Fireweed' Prospect, September-October, 1990," COPAC Report for ARCO Alaska, Inc. (March, 1991).

Passive acoustic monitoring at the Cabot location in the far western lease sale area of the Beaufort Sea is proposed for the third year of the monitoring and study program carried out by Hall and his team. As in the previous efforts reported above, passive acoustic monitoring for the presence, absence, distribution and abundance, behavioral responses, and calling activity of bowhead whales during their annual fall westward migration will be a main feature of the program. In addition, this study proposes to incorporate an aerial observation component covering the peak pulse of the migration expected to arrive between 25 September and 7 October in the study area. Bowhead behavior will be identified before the arrival of whales, during their presence in the vicinity of the SSDC/MAT, and after they have passed beyond the area of activity. Linked to this basic objective are other tasks designed to address a variety of intriguing questions which involve analysis and comparison between bowhead calling activity during both the spring north and eastward migration and the fall return passage.

A final main component of the monitoring program is to record sounds produced by the SSDC at known distances and water depths. From these data SSDC sound source levels and accompanying transmission losses can be calculated. In the Stinson and Fireweed studies, acoustic measurements of the sound energy levels produced by the two bottom-founded drilling units on warm standby were made during open water conditions. Comparable measurements under actual drilling conditions were made at Stinson only after the whale migration was over and the sea ice surface stabilized sufficiently to permit the work. The drilling program concluded at Fireweed before similar work could be accomplished. For the Cabot monitoring program, this objective will be met in the same fashion as at Stinson: SSDC sound production during actual drilling activity will be recorded when ice conditions permit working safely on the sea ice surface. An essential feature of this program component is that it is designed to record underwater sounds that fall in the very low (or infrasonic) ranges where, the Stinson study revealed (Hall and Francine, 1991), >95% of actual drilling sounds in the marine environment occur.

Recipients of this draft monitoring program description are warmly invited to comment on its design, objectives and methods. The intent here is to insure not only that the regulatory agencies which mandate monitoring programs for offshore oil and gas exploratory operations are satisfied that their regulatory requirements are adequately met, but that the best possible scientific program design is achieved and that its results make a positive contribution to scientific understanding of bowhead whale biology and arctic marine acoustics.

CABOT EXPLORATORY PROGRAM AND TIMING

The Cabot exploratory well project is proposed for a site located 30 miles east from Barrow and approximately 15 miles north from Dease Inlet in 45-50 foot water depths (see Map 1). The drilling unit to be employed is CANMAR's SSDC/MAT, a mobile bottom-founded structure (see Fig. 1).

The exploration program would begin in summer (early to mid August). A brief site clearance program involving water depth measurements, soil core samples, and shallow hazards seismic testing will be conducted prior to towing the SSDC from its present warm standby location offshore from Pitt Point to the Cabot exploratory site. The bulk of supplies required for the drilling program--including fuel and water--would be loaded on the SSDC before it is moved. Therefore, very little surface vessel traffic to the rig is anticipated. This timing is quite similar to that which was scheduled for the Fireweed exploration program and is done in large measure to insure the least possible potential disturbance to either the bowhead fall migration or the subsistence hunt.

The start-up of actual drilling operations would not commence until such time as the bowhead westward fall migration has been determined by NMFS to have passed the Cabot location and the subsistence hunt is declared over by the AEWG.

One feature of the Cabot location is abundantly clear: it rests within an area occasionally used by bowhead whales as a feeding/aggregation habitat (most recently in 1984 and 1989; Moore, 1990). In other years (1983, for example; Ljungblad, 1986) the migration corridor appears to have been located well north of the Cabot location, most likely a function of early season nearshore ice formation. However, the probabilities are that either small or substantial numbers of migrating bowheads will be present at some point during the proposed monitoring activity. These waters are also within the normal range of Barrow subsistence hunters.

Since the SSDC will be operating only on warm standby during the period when whales might be expected to pass through or remain in the area, the structure should provide an ideally located study site from which to conduct both the passive acoustical location program and observations of bowhead behavioral responses within visual range of the platform itself.

Noise introduced into the marine environment from the SSDC operating in the idle mode should not--if the Stinson and Fireweed studies can be taken as a guide--elicit avoidance response from whales present in the area.

However, one of the objectives of the monitoring program is to test this hypothesis at a location that is very similar to, but fairly distant from, the Stinson and Fireweed sites. In this case, a ground-truthing component will be added in the form of aerial observations.

MONITORING STUDY OBJECTIVES

OBJECTIVE I. To locate and record the behavior of westward migrating bowhead whales prior to their arrival in the vicinity of the SSDC/MAT drilling unit operating in a warm standby mode; to observe and record the whales' behavior while they remain in that vicinity; and to monitor their behavior once they have passed westward beyond the vicinity of the activity.

OBJECTIVE II. To determine the actual locations of whales by range and bearing in relation to the SSDC using both passive acoustical and aerial observational methods.

OBJECTIVE III. To conduct bowhead distribution and abundance analyses within the general vicinity of the study site.

OBJECTIVE IV. To record and analyze bowhead vocalizations.

OBJECTIVE V. To measure and record sound pressure levels produced by the SSDC when operating under actual drilling conditions and to calculate sound transmission losses at varying distances and water depths.

OBJECTIVE VI. To employ data acquired in the Cabot monitoring program to address other biological topics associated with their calling activity, fall migration group size and composition, and apparent movement in migratory pulses.

THE STUDY AREA

Based on the sound propagation characteristics measured and calculated for the SSDC/MATS operating in warm standby mode at the Fireweed location, received sound levels from the drilling unit above Beaufort 0 Sea State Ambient Noise Level should not extend further than 10,000 m (10 km) from the source (Hall, et al., 1991; for further comparison to another bottom-founded drilling unit, the CIDS, see Hall and Francine, 1990 and 1991a). This distance represents the maximum possible study area radius and is described as the immediate vicinity of the activity within which bowhead behavioral responses can be observed and correlated with drilling unit sound production during warm standby mode.

However, an expanded study area covering 5000 km sq around the Cabot exploratory site is defined in order to conduct all aspects of the aerial component of the monitoring program. While aerial observations of bowhead behavioral responses in the immediate vicinity of the unit is a prime focus, the items set forth in Objectives II, III and VI, above, will be covered over the wider area of aerial surveying.

METHODS

Described below are the methods proposed to acquire and analyze the data which relate to the six stated Monitoring Study Objectives. Objectives I, II, and VI will require data acquisition by both passive acoustic and aerial observational methods. Objective III will be met primarily through analysis of the data acquired from aerial surveying. Objectives IV and V will be met through collection and analysis of data acquired through the passive acoustic program components.

A. Aerial Surveys.

The aerial survey component of the Cabot monitoring program will be designed to accomplish all the features specified for aerial observation activity in the NMFS site specific monitoring guidelines for 1991.

Prior to the commencement of activities at the proposed drillsite location, both the normal bowhead migratory pathway along the 20 metre bathymetry contour line leading from east to west and the immediate vicinity of the drillsite location will be surveyed from the ARCO Twin Otter aircraft flying a crew of biologist observers. Regular (twice to three times

weekly) periodic surveys of the same areas will be conducted by the Twin Otter observer crews from late August through September 24 and from October 8 until the conclusion of the 1991 bowhead migration. No transect survey flights are planned for this aerial monitoring component; however, sighting data which is acquired will assist in determining the potential approach of bowheads and their presence within the site specific monitoring area. Such sighting data will also provide for an appropriate definition of the control area to be incorporated in the concentrated aerial survey scheduled for 25 September through 7 October (see below). For these periodic samplings the Twin Otter will be equipped with navigational and GPS location systems including an on-board computer dedicated to marine mammal sighting data collection and processing.

Because the greatest number of bowhead whales migrate through the Alaskan sector of the Beaufort Sea, including the proposed Cabot drillsite area, during the last week of September and the first week of October (Hall, 1991; Moore and Clarke, 1990; Ljungblad, et al., 1988), aerial transect surveys will be conducted daily during the hours of daylight, weather permitting, from 25 September through 7 October.

This concentrated survey period (25 September through 7 October) will be conducted from a twin engine, high wing Rockwell 680 FL Commander. This aircraft has been specially modified for Arctic aerial surveys and includes the following modifications: (1) Full de-icing system including heated windshield, hot props, heated cowls, wing, vertical and horizontal stabilizer de-ice boots; (2) 1240 nautical mile range (2269 km) at 120 knots survey speed and 238 knots (274 mph) transit speed at 70% power settings; (3) Arctic survival equipment including HF/SSB radio, 2 VHF com/nav radios, Marine VHF radio, FAR Part 135 survival raft, survival suits for all on board, Aviation and 406 MHz ELT/EPIRB, and Trimble GPS/Loran navigation system; (4) Elongated "bubble" windows for centerline viewing at observer stations 3 and 4; (5) On board aerial survey computer including custom software for near real-time determination of marine mammal densities using either the line transect (Fourier) or strip transect estimators. The aerial survey computer determines the three dimensional location of the aircraft using an independent Trimble GPS navigation system dedicated to the survey computer.

In order to cover the 5000 km sq study area, aerial surveys will be designed to use systematic transect lines oriented north-south and placed 7.3 km (4 nm) apart. One aerial survey of the Cabot monitoring area will include slightly less than 610 km (330 nm) of trackline. Surveys will be flown starting at the western-most trackline and proceed through the most

easterly trackline. This procedure of flying "against the grain" of the fall migration will reduce the potential of double sighting the same whale on two different tracklines.

The aerial surveys will be flown at 457 m (1500 ft.) and a speed of 120 knots. The aircraft survey crew will include the pilot, primary observer (no. 2, rt. front seat), secondary observer (No. 3 left rear seat) and recorder/observer (No. 4, rt. rear seat). All observers will be experienced marine mammal biologists or field technicians with appropriate training and qualifications for this task (such as North Slope local personnel with backgrounds in the various NSB/AEWC bowhead census programs). The observers to be employed on the survey will have from two to fifteen years of experience conducting marine mammal surveys, including Arctic waters.

Aerial survey data will be collected using an unbounded survey design (Burnham et al., 1980). Vertical sighting angles will be measured for all sightings in order to determine the distance from trackline to sighted marine mammal. Upon completion of the aerial survey a determination will be made whether or not sufficient sightings have been made to utilize a line transect (Fourier) estimator (unbounded condition), or a strip transect estimate using 0.93 km (0.5 nm)/side strip widths. The on board computer and custom software provide capability to determine density estimates using either estimator.

Aerially observed bowhead whale behaviors will be recorded both on transect and off in order to include behaviors within the study area. The following sets of behavioral parameters will be recorded:

Primary behaviors: (1) Number of whales sighted; (2) Number of groups of whales sighted; (3) Number of whales in each group; (4) Group composition including estimates of adults, sub-adults or juveniles, and calves; (5) Number of assumed cow/calf pairs; (6) Swimming direction of individuals and groups.

Secondary behaviors: (1) Respiratory rates of individuals; (2) Dive times of individuals and synchronous diving within groups; (3) Overt surface behaviors such as lobtailing, breaching, flipper-slapping, copulation, or feeding; (4) Estimates of swimming speeds of individuals, including changes of swimming speed and/or direction.

During aerial surveys 8mm tele-video footage of bowhead behaviors will be recorded for post-survey analysis and possible identification of individuals.

Aerial observations of any of the other five species--grey and beluga whales, ringed, spotted and bearded seals--sighted within the study area will be recorded and behavioral data, if any, incorporated within the study parameters of the monitoring program.

B. Passive Acoustic Bowhead Call Localization.

The passive acoustic monitoring component of the program will utilize longlife sonobuoys moored in arrays located 11 km to the east-southeast and 8 km to the west-northwest of the Cabot location. The arrays have a minimum of 3 sonobuoys in each array monitored 24h/day from 5 September until ice formation. These arrays, based on 1989 and 1990 drillsite monitoring experience in Camden Bay and off Pitt Point, will be able to detect and localize calling whales from 5 km to 70 km away from the arrays (see Hall, et al., 1991 for a review of whale call localization methods using digital recording and signal processing). The localization distance estimates are based on various combinations of ambient noise levels, masking by industrial sounds and transmission loss estimates for the area near the drillsite. By mooring two arrays of sonobuoys in locations southeast and northwest of the drillsite, we will be able to monitor the acoustic movements and progress of calling bowheads as they approach, pass and depart from the drillsite area. In this manner we will be better able to detect changes in calling rates and swimming speed and direction. Analysis of this data will enhance understanding of potential changes in whale behavior which may be associated with an offshore exploratory operation.

All other marine mammal vocalizations will also be recorded and incorporated within the study parameters.

C. Visual Monitoring From the SSDC.

An Inupiat Communicator/Monitor and an experienced marine mammal observer will be aboard the drilling unit throughout the duration of the monitoring program. They will monitor for the presence and behaviors of marine mammals within visual sighting distance of the SSDC drilling unit (potentially up to 10 km under ideal visibility conditions from observational posts located 135 ft. above the sea surface). All marine mammal sightings will be recorded on sighting logs using appropriate

formats for marine mammal sightings and behavioral observations.

D. Study of the Marine Acoustic Environment.

Key aspects of the acoustical monitoring component of this program will involve data acquisition and analysis of sound source levels produced by the SSDC in the drilling mode and their attenuation in the marine environment which constitutes the study area. To accomplish this objective three features will be recorded and precise acoustic properties calculated:

(1) Received and Source Levels. Recordings lasting several minutes will be made using a TEAC RD-101T Digital Audio Tape Recorder (rated response is flat from 0.2 Hz to 20 kHz), Bruel & Kjaer 8103 hydrophone (rated response is flat ± 1.5 dB from 0.1 Hz-50kHz) and Bruel & Kjaer 2635 Charge Amplifier at several different distances and water depths from the drilling unit. In addition, salinity and temperature data for all recording depths at all stations will be made in order to provide accurate speed of sound estimates using the Leroy equation (Bruel & Kjaer, 1986).

The use of digital recording equipment enables one to record infrasonic frequencies as low as 0.2 Hz. Hall and Francine (1990,1991a) have noted infrasonic frequency components in the recordings made of the bottom-founded CIDS drilling unit while it was drilling in ice covered areas. LGL Ltd. (1990) in a proposal to the Minerals Management Service noted that "oil platforms in temperate waters, icebreakers and other large ships are known to emit strong infrasounds." The infrasonic frequencies reported for the CIDS represented more than 95% of all the sound energy transmitted to the water by the drilling unit. It seems appropriate to continue using digital recording technology when recording sources which may contain infrasonic frequencies, i.e. drilling operations, ship traffic, balaenid and balaenopterid whales.

(2). Ambient Noise Levels. In addition to the sounds produced by the drilling unit, recordings will be made, using the technology described above, of the broad band and 1/3 octave ambient noise levels in the vicinity of the study site. Recordings of ambient noise levels may be compromised by the presence of vessels not associated with the Cabot project and by seismic operations operating within 100 km of the prospect.

(3) Transmission Loss Estimates. During our efforts to record received sound levels from the drilling unit, we will also calculate, based

on the received levels at several distances and directions from the SSDC, the acoustic transmission loss for the study area. Previous efforts similar to this in other areas of the Beaufort Sea have produced transmission loss estimates ranging from 8.7 Log R to 12.6 Log R (Hall and Francine, 1990, 1991a; Miles et al., 1987; C. Malme, BBN pers. comm. to Davis, 1987 for the Hammerhead site). Transmission loss in these relatively shallow waters likely follows spherical spreading loss (20 Log R) from the source to a distance equal to the water depth and then assumes loss characteristics approaching cylindrical spreading (10 Log R) out to beyond the limits of the study area. Our transmission loss measurements will determine if these assumptions are correct and provide a transmission loss estimate for the monitoring area.

E. Other Questions to be Addressed in the Monitoring Effort.

Two questions have arisen from a close examination of the results of the Stinson and Fireweed acoustic monitoring efforts that will be addressed in the Cabot program. These involve:

(1) Acquiring recordings of the calling frequencies and rates produced by migrating bowhead whales in the fall in order to compare them with the frequencies and calling activity characteristic of the spring migration. From the recorded data collected to date, it would appear that calling activity during the fall migration occurs primarily at night (> 77% of calls were received between 1800h and 0600h in the Fireweed monitoring study, Hall et al., 1991), a phenomenon also noted in other acoustic recording studies of the fall migration (see, for example, Ljungblad, et al., 1987).

Calling activity during the spring migration through leads at Barrow is often intense during daylight hours as the whales navigate north and eastward in often heavy ice (Clark, 1991). The question addressed here is whether bowheads may engage in calling activity for at least two different purposes: (a) To use calls for purposes of navigation while swimming through ice infested waters; and (b) to communicate with other whales especially during periods of reduced visibility under open water conditions. A related question involves whether bowheads employ different frequencies and call types for these differing purposes. While no experimental design is envisaged to address this question during the proposed Cabot monitoring effort, data will be acquired that may prove useful should an experimental program comparing bowhead fall and spring calling rates and frequencies be carried out in the future.

(2) Analysis of both the acoustically acquired sighting data and that

obtained from the aerial survey component of the monitoring program in an effort to verify the premise that the fall bowhead migration through the Beaufort Sea occurs in three pulses which can reasonably be thought to take place in the periods 10 to 18 September, 27 September to 7 October, and 10 to 20 October with the middle of these pulses containing the largest number of migrating whales. The 1991 sighting data to be collected as part of the Cabot monitoring program will be analyzed with reference to both the aerially and acoustically acquired data of survey work done annually since 1979 to test this premise.

SUMMARY

While ARCO and its scientific contractor recognize that the primary purpose of the marine mammal monitoring program at the Cabot location is to detect whether the proposed exploratory operation produces identifiable responses from bowhead whales or other marine mammals that migrate past or remain within the vicinity of that operation, we also believe that major and very costly efforts such as the program proposed here (including as it must both passive acoustic and aerial observation components) should also be aimed at enriching our scientific knowledge of the mammals being studied and the acoustic properties of the Arctic marine environment which they utilize. For this reason we propose the six objective monitoring program and associated methodology outlined in the above proposal.

CITATIONS

- Bruel & Kjaer. September, 1986. Pocket Handbook - Noise, Vibration, Light & Thermal Comfort. 36 pp.
- Burnham, K. P., Anderson, D. R. and Laake, J. L. 1980. "Estimations of wildlife density from line transect sampling of biological populations." Wildlife Monographs, v. 72: 1-207.
- Clark, C. 1991. "Moving with the Herd." Natural History (March, 1991), 38-42.
- Cummings, W. C. and Thompson, P. O. 1971. "Underwater sounds from the blue whale, *Balaenoptera musculus*." J. of the Acoustical Soc. of Amer., 50, 1193-1198.
- Cummings, W. C., Fish, J. F. and Thompson, P. O. 1972. "Sound production and other behavior of southern right whales, *Eubalaena glacialis*." Trans. San Diego Soc. of Nat. Hist., 17, 1-13.
- Hall, J. D. and Francine, J. 1990. "Report on Sound Monitoring and Bowhead Whale Calls Localization Efforts Associated with the Concrete Island Drilling Structure (CIDS) off Camden Bay, Alaska." Hubbs Marine Research Center--HMRC Technical Report 89-219 (San Diego).
- Hall, J. D. and Francine, J. 1991a. "Measurements of underwater sounds from a Concrete Island Drilling Structure located in the Alaska sector of the Beaufort Sea." J. of the Acoustic Soc. of Amer., v. 88, 4.
- Hall, J. D., Gallagher, M., Brewer, K. D. and Ljungblad, D. K. 1991b. "Passive Acoustic Monitoring Program at the ARCO Alaska, Inc. 'Fireweed' Prospect, September-October, 1990." Coastal and Offshore Pacific Corp. Report for ARCO Alaska, Inc. (Walnut Creek, CA, March 1991).

LGL, Ltd. and Greeneridge Sciences, Inc. 1990. Draft Proposal for "Effects of Production Activities on Arctic Whales, 1991 Phase: Technical and Management Proposals." To MMS-Alaska OCS Region (Anchorage, 26 October 1990).

Ljungblad, D. K., Moore, S. E., Clarke, J. T. and Bennett, J. C. 1986. "Aerial surveys of endangered whales in the northern Bering, eastern Chukchi, and Alaskan Beaufort Seas, 1985: with a seven year review, 1979-85." MMS-Alaska OCS Region Technical Report 1111 (San Diego).
Malme, C. 1987. Pers. comm. to R. Davis re: Hammerhead site study.

Lungblad, D. K., Moore, S. E., Clarke, J. T. and Bennett, J. C. 1987. "Distribution, Abundance, Behavior and Bioacoustics of Endangered Whales in the Alaskan Beaufort and Eastern Chukchi Seas, 1979-86." MMS-Alaska OCS Region Study No. 87-0039/NOSC Technical Report No. 1177 (San Diego, CA).

Miles, P. R., Malme, C. I., Shepard, G. W., Richardson, W. J. and Bird, J. E. 1987. "Prediction of drilling site-specific interaction of industrial acoustic stimuli and endangered whales: Beaufort Sea (1985)." MMS-Alaska OCS Region Study no. 86-0046/BBN Laboratories Report no. 6185 (Cambridge, MA).

Moore, S. E. and Clarke, J. T. 1990. "Distribution, abundance and behavior of endangered whales in the Alaskan Chukchi and Western Beaufort Sea, 1989." Final Report for MMS-Alaska OCS Region study no. 90-0051 (San Diego).

EXHIBIT E

ARCO Alaska Inc CABOT #1 EXPLORATORY WELL PROJECT
Western BEAUFORT SEA, Alaska (1991 - 1992)

POLAR BEAR/PERSONNEL ENCOUNTER PLAN

The Marine Mammals Management Section - US Fish and Wildlife Service, Anchorage, AK has on file the Polar Bear/Personnel Encounter Plan approved for use on the SSDC/MAT Drilling Unit as appropriate for work conducted there on the Fireweed #1 Exploratory Well Project, Beaufort Sea (1990 - 1991).

This plan was approved by USFWS and the Alaska Department of Fish and Game. It requires minor site specific modifications for application to the CABOT project which is located approximately 45 miles northwest from the Fireweed site.

A polar bear monitoring and reporting component is included in both the Fireweed and Cabot plans.

When a completed CABOT POLAR BEAR/PERSONNEL ENCOUNTER PLAN is available (expected by 5.15.91) it will be filed with NMFS and MMS to complete this EXHIBIT E to the application for a Letter of Authorization.

S. LYNN SUTCLIFFE
ATTORNEY AT LAW
SIXTH FLOOR
1050 THOMAS JEFFERSON STREET, N.W.
WASHINGTON, D.C. 20007

(202) 298-1939

October 24, 1990

Mark N. Savit, Esq.
Jackson & Kelly
1701 Pennsylvania Avenue, N.W.
Washington, DC 20006

Dear Mark:

On behalf of your clients, Amoco Production Company; ARCO Alaska, Inc.; BP Exploration (Alaska), Inc.; Chevron U.S.A. Inc.; Conoco Inc.; Exxon Corporation; Shell Western E&P Inc.; Union Oil Company of California; and Western Geophysical Company (collectively "the MMPA Group"), you have requested a letter of assurance with respect to the Alaska Eskimo Whaling Commission's ("AEWC") intentions in light of the MMPA Group-AEWC joint proposal to amend the National Marine Fisheries Service's ("NMFS") incidental take regulations, 50 C.F.R. Part 228, Subpart D. This joint proposal is set forth in the Joint Petition to Amend Regulations Governing the Taking of Marine Mammals Incidental to Oil and Gas Exploration Activity in Alaska (the "Petition"), to be filed with NMFS by the above named parties.

It is our understanding that the MMPA Group conditionally agrees to abide by the terms of the proposed amendments effective immediately, and will continue voluntarily to abide by the amendments until they become binding pursuant to final promulgation by NMFS. You have notified us that the condition precedent to this agreement by the MMPA Group is receipt of written assurance from the AEWC that those two organizations will take no action, nor in the future directly or indirectly support any action taken by others, challenging the lawfulness of 50 C.F.R. Part 228, Subpart D; and that they have no intention of supporting, directly or indirectly, any action seeking a legislative prohibition on offshore drilling activities in the Chukchi or Beaufort Seas while the Petition is pending and, if the requested amendments are adopted in a timely fashion, during the period such regulations remain effective under present circumstances. You also requested assurance that if circumstances change, other than through action taken pursuant to the agreed upon amendments, such that the AEWC or the BSFA conclude that legislative action is necessary, those parties will consult with the MMPA Group before pursuing such legislative action.

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NATIONAL MARINE FISHERIES SERVICE

RECEIVED NMFS
90 NOV 26 PM 4:20

JOINT PETITION TO AMEND REGULATIONS GOVERNING THE TAKING
OF MARINE MAMMALS INCIDENTAL TO OIL AND GAS EXPLORATION
ACTIVITIES IN ALASKA, 55 FED. REG. 29214 (1990)
(to be codified at 50 C.F.R. Part 228, Subpart D)

Submitted on behalf of:

Amoco Production Company
ARCO Alaska, Inc.
BP Exploration (Alaska), Inc.
Chevron U.S.A. Inc.
Conoco Inc.
Exxon Corporation
Shell Western E&P Inc.
Union Oil Company of California
Western Geophysical Company

Alaska Eskimo Whaling Commission

November 26, 1990

CORRECTION

**THIS DOCUMENT
HAS BEEN REPHOTOGRAPHED
TO ASSURE LEGIBILITY**

S. LYNN SUTCLIFFE
ATTORNEY AT LAW
SIXTH FLOOR
1050 THOMAS JEFFERSON STREET, N.W.
WASHINGTON, D.C. 20007

(202) 298-1939

October 24, 1990

Mark N. Savit, Esq.
Jackson & Kelly
1701 Pennsylvania Avenue, N.W.
Washington, DC 20006

Dear Mark:

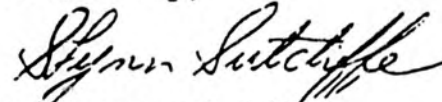
On behalf of your clients, Amoco Production Company; ARCO Alaska, Inc.; BP Exploration (Alaska), Inc.; Chevron U.S.A. Inc.; Conoco Inc.; Exxon Corporation; Shell Western E&P Inc.; Union Oil Company of California; and Western Geophysical Company (collectively "the MMPA Group"), you have requested a letter of assurance with respect to the Alaska Eskimo Whaling Commission's ("AEWC") intentions in light of the MMPA Group-AEWC joint proposal to amend the National Marine Fisheries Service's ("NMFS") incidental take regulations, 50 C.F.R. Part 228, Subpart D. This joint proposal is set forth in the Joint Petition to Amend Regulations Governing the Taking of Marine Mammals Incidental to Oil and Gas Exploration Activity in Alaska (the "Petition"), to be filed with NMFS by the above named parties.

It is our understanding that the MMPA Group conditionally agrees to abide by the terms of the proposed amendments effective immediately, and will continue voluntarily to abide by the amendments until they become binding pursuant to final promulgation by NMFS. You have notified us that the condition precedent to this agreement by the MMPA Group is receipt of written assurance from the AEWC that those two organizations will take no action, nor in the future directly or indirectly support any action taken by others, challenging the lawfulness of 50 C.F.R. Part 228, Subpart D; and that they have no intention of supporting, directly or indirectly, any action seeking a legislative prohibition on offshore drilling activities in the Chukchi or Beaufort Seas while the Petition is pending and, if the requested amendments are adopted in a timely fashion, during the period such regulations remain effective under present circumstances. You also requested assurance that if circumstances change, other than through action taken pursuant to the agreed upon amendments, such that the AEWC or the BSFA conclude that legislative action is necessary, those parties will consult with the MMPA Group before pursuing such legislative action.

Mark N. Savit, Esq.
October 24, 1990
Page 2.

We have notified both the AEWG of your request and have been authorized to inform you of their agreement to abide by the above stated conditions.

Sincerely,

A handwritten signature in cursive script, appearing to read "S. Lynn Sutcliffe".

S. Lynn Sutcliffe

SLS/sks

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NATIONAL MARINE FISHERIES SERVICE

RECEIVED NMFS
90 NOV 26 PM 4:20

JOINT PETITION TO AMEND REGULATIONS GOVERNING THE TAKING
OF MARINE MAMMALS INCIDENTAL TO OIL AND GAS EXPLORATION
ACTIVITIES IN ALASKA, 55 FED. REG. 29214 (1990)
(to be codified at 50 C.F.R. Part 228, Subpart D)

Submitted on behalf of:

Amoco Production Company
ARCO Alaska, Inc.
BP Exploration (Alaska), Inc.
Chevron U.S.A. Inc.
Conoco Inc.
Exxon Corporation
Shell Western E&P Inc.
Union Oil Company of California
Western Geophysical Company

Alaska Eskimo Whaling Commission

November 26, 1990

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NATIONAL MARINE FISHERIES SERVICE

JOINT PETITION TO AMEND REGULATIONS GOVERNING THE TAKING
OF MARINE MAMMALS INCIDENTAL TO OIL AND GAS EXPLORATION
ACTIVITIES IN ALASKA, 55 FED. REG. 29214 (1990)
(to be codified at 50 C.F.R. Part 228, Subpart D)

Amoco Production Company; ARCO Alaska, Inc.; BP Exploration (Alaska), Inc.; Chevron U.S.A. Inc.; Conoco Inc.; Exxon Corporation; Shell Western E&P Inc.; Union Oil Company of California; and Western Geophysical Company (collectively, the "Petitioners"); and the Alaska Eskimo Whaling Commission ("AEWC"), pursuant to Section 553(e) of the Administrative Procedure Act, 5 U.S.C. §553(e), jointly petition for the amendment of regulations governing the taking of marine mammals incidental to oil and gas exploration activities in Alaska, 55 Fed. Reg. 29214 (1990) (to be codified at 50 C.F.R. Part 228, Subpart D) (the "incidental take regulations"), in the following respects: (1) in section 228.33, by adding subsections (c) and (d) relating to seismic operations and support and supply vessel operations; (2) in section 228.34, by making certain punctuation changes; (3) in section 228.35, by adding subsection (a) relating to activity levels for exploratory drilling and seismic operations and by redesignating the existing provisions of this section as subsection (b); (4) in section 228.36, by adding certain qualifying language; (5) in section 228.37, by deleting certain language in subsection (a), by adding

a new subsection (e) relating to observers, and by revising and redesignating existing subsections (e) and (f) as subsections (f) and (g), respectively; and (6) in section 228.38, by adding certain qualifying language to subsection (a)(2); all as more particularly shown on the mark-up of the incidental take regulations attached to and made part of this petition as Exhibit A.¹ In support of this request, Petitioners and the AEWC state as follows:

I. INTRODUCTION

1. On February 16, 1988, the Petitioners, pursuant to Section 101(a)(5) of the Marine Mammal Protection Act ("MMPA") and Sections 7(b)(4) and 7(o) of the Endangered Species Act ("ESA"), petitioned the National Marine Fisheries Service ("NMFS") to promulgate regulations that would allow the taking of bowhead and gray whales incidental to oil and gas exploratory activities in the Beaufort and Chukchi Seas (the "Petition"). Four additional species (beluga whales; and spotted, bearded and ringed seals) were subsequently included in the rulemaking process.

2. On April 13, 1988, NMFS published a Notice of Receipt of Request for Rulemaking and Request for Information which announced the availability of the Petition for review and solicited public comments thereon. 53 Fed. Reg. 12170 (April 13, 1988).

3. Numerous comments were received by NMFS in response

¹ Language proposed to be added to the incidental take regulations is underscored; language proposed to be deleted is designated by strike-throughs.

to its notice. Following its review of the comments submitted concerning the Petition, NMFS completed and, on May 4, 1989, issued an Environmental Assessment ("EA") in which it made a finding of no significant impact regarding the proposal of rules requested in the Petition. Specifically, a finding was made that the impact on populations of marine mammals would be negligible, and there would be no unmitigable adverse impacts on the availability of the species for subsistence by Alaska natives.

4. On October 3, 1989, NMFS published a Notice of Proposed Rulemaking in which it set forth its proposed incidental take regulations and solicited comments thereon. 54 Fed. Reg. 40703 (October 3, 1989).

5. The proposed incidental take regulations were based, in part, on the following activity levels over the 5-year period to be covered by the regulations: (1) up to 77 exploratory wells, and (2) up to approximately 17,500 trackline miles of seismic surveys.

6. On July 18, 1990, following its review of the comments received and two public hearings, NMFS published final incidental take regulations which are to be codified at 50 C.F.R. Part 228, Subpart D. 55 Fed Reg. 29214 (July 18, 1990).

II. REASONS FOR AND THE NATURE OF THE REQUEST

7. Throughout the rulemaking process, various groups - most notably, the AEWC - voiced strong opposition to the incidental take regulations.

8. The grounds raised by the AEWG in opposition to the incidental take regulations centered on its concern that exploratory operations not adversely impact the subject marine mammals, their habitat and their availability for subsistence uses, and NMFS' findings in this regard.

9. Absent a resolution of the issues between the parties, concurred in by NMFS, the AEWG has represented that it would be obliged to file a legal action challenging the lawfulness of the incidental take regulations.

10. Ongoing discussions have been conducted over the last several months among the Petitioners and the AEWG in an effort to address the concerns of the AEWG.

11. As a result of those discussions, the Petitioners and the AEWG have reached an agreement with respect to the manner in which the incidental take regulations could be amended to adequately address the concerns raised by the AEWG. This agreement is reflected in the language of the proposed amendments to the incidental take regulations requested in this Petition, as set forth in Exhibit A.

12. If the amendments requested herein are adopted by NMFS, the AEWG represents that its concerns will have been satisfactorily resolved and, further, that it will not institute any action, legal or otherwise, challenging the lawfulness of the incidental take regulations.

WHEREFORE, following notice of an opportunity for public

comment on the proposed amendments, Petitioners and the AEWC respectfully request that the incidental take regulations be amended in the manner set forth above, as more particularly shown on Exhibit A.


Mark N. Savit
Thad S. Huffman
Jackson & Kelly
1701 Pennsylvania Avenue, N.W.
Suite 650
Washington, D.C. 20006
(202) 956-7680

Counsel for:
Amoco Production Company Inc.
ARCO Alaska, Inc.
BP Exploration (Alaska), Inc.
Chevron U.S.A. Inc.
Conoco Inc.
Exxon Corporation
Shell Western E&P Inc.
Union Oil Company of California
Western Geophysical Company


S. Lynn Sutcliffe
1050 Thomas Jefferson St., N.W.
Sixth Floor
Washington, D.C. 20007

Counsel for Alaska Eskimo
Whaling Commission


Jessica S. Lefevre
Van Ness, Feldman & Curtis
1050 Thomas Jefferson St., N.W.
Seventh Floor
Washington, D.C. 20007

Counsel for Alaska Eskimo
Whaling Commission

EXHIBIT A

1 PART 228 - REGULATIONS GOVERNING SMALL TAKES OF MARINE
2 MAMMALS INCIDENTAL TO SPECIFIED ACTIVITIES
3

4 1. The authority citation for Part 228 continues to read
5 as follows: 16 U.S.C. 1371(a)(5).

6 2. Subpart D is added to read as follows:
7

8 Subpart D - Taking of Marine Mammals Incidental to Oil and Gas
9 Exploration Activities in Alaska

10 §228.31 Specified activity and specified geographical region.

11 §228.32 Effective dates.

12 §228.33 Permissible methods of taking.

13 §228.34 Prohibitions.

14 §228.35 Level of Activity.

15 §228.36 Measures to ensure availability of species for
16 subsistence.

17 §228.37 Requirements for monitoring and reporting.

18 §228.38 Letters of Authorization.
19

20 §228.31 Specified activity and specified geographical region.
21

22 Regulations in this subpart authorize only the non-lethal
23 incidental taking of bowhead, gray, and beluga whales and bearded,
24 ringed, and spotted seals by U.S. citizens engaged in oil and gas
25 exploration in the Chukchi Sea or Beaufort Sea off the coast of
26 Alaska. The geographical region includes Alaska state waters and
27 outer continental shelf waters that have been leased for
28 exploration or that are being considered for leasing. The
29 activities include geophysical surveys and exploratory drilling and
30 support operations (e.g., ice-breakers, supply vessels and

31 aircraft).

32

33 **§228.32 Effective dates.**

34

35 Regulations in this subpart are effective for a 5-year
36 period, and Letters of Authorization must be renewed annually. A
37 take of marine mammals is not authorized each spring until the
38 bowhead whale has completed its migration through the spring lead
39 system in the Chukchi Sea and Beaufort Sea. This period is about
40 from mid-April through early June. Each year, the National Marine
41 Fisheries Service will determine when the bowhead whale has
42 completed its migration through the spring lead system, and will
43 notify the exploration companies and the native communities when it
44 has made this determination.

45

46 **§228.33 Permissible methods of taking.**

47

48 (a) The incidental, but not intentional, non-lethal taking of
49 marine mammals is permissible by U.S. citizens under a Letter of
50 Authorization issued pursuant to § 228.38 for the following
51 activities other than when bowhead whales are using the spring lead
52 system:

53

54 (1) Geophysical surveys including shallow hazard and
55 acoustic surveys and

56 (2) Exploratory drilling including ice-breakers, support
57 vessels and aircraft.

8 (b) The activities identified in §228.33(a) must be conducted
59 in a manner that minimizes to the greatest extent possible any
60 adverse impacts on marine mammals, their habitat, and on the
61 availability of marine mammals for subsistence uses.

62
63 (c) (1) Seismic exploration operations in the Beaufort Sea
64 east of a line 50 miles west of Point Barrow shall, to the maximum
65 extent practicable, be concluded prior to September 1 in waters
66 east of Prudhoe Bay, and by September 15 in waters west of Prudhoe
67 Bay.

68
69 (2) In the event such seismic operations cannot be
70 concluded prior to those dates, the following conditions must be
71 fulfilled before any further operations may continue:

72
73 (i) The operator must consult with NMFS and with
74 affected subsistence whaling communities regarding
75 the presence of whales in or near the area of
76 operations and those areas in which whaling
77 activity may take place; and

78
79 (ii) Such operations must be planned and conducted so as
80 to:

81
82 (A) mitigate any adverse impact on the
83 availability of the species or stock for
84 subsistence uses;

5 (B) not exceed a negligible impact on the species
86 or stock;

87
88 (C) provide that seismic vessels within a 15 mile
89 (24 km) radius of a pursuing whaling crew's
90 estimate of the position of a bowhead whale
91 being pursued shall move out of that radius,
92 or cease seismic operations while within that
93 radius;

94
95 (D) occur, to the maximum extent practicable, in
96 areas and during periods when there is no
97 active whaling;

98
99 (E) assure that operations are completed in the
100 minimum time necessary, without compromising
101 the safety of the vessels affected; and

102
103 (F) assure that there are mechanisms available to
104 facilitate direct communications among whalers
105 and seismic vessels in order to allow seismic
106 vessels to avoid areas of active whaling.

107
108 (iii) Notwithstanding the above, the conditions set forth
109 in subparts (2)(i) and (ii) of this section shall
110 not apply if:
111

12 (A) The affected subsistence whaling community has
113 reached its bowhead quota; or

114
115 (B) The operator and the subsistence whaling
116 community otherwise agree.

117
118 (d) Support and supply vessels within a 10 km (6.25 mile)
119 radius of a pursuing whaling crew's estimate of the position of a
120 bowhead whale being pursued shall move out of the radius, or cease
121 operating while within that radius, or if neither of the above is
122 practicable, shall undertake to the fullest extent practicable, all
123 available measures to avoid any potential interference with the
124 pursuit.

125
126 §228.34 Prohibitions.

127
128 Notwithstanding takings authorized by §228.33 or by a Letter
129 of Authorization issued under §228.38, the following activities are
130 unlawful:

131
132 (a) The take of any marine mammal in the spring lead system
133 used by bowhead whales in the Chukchi Sea and Beaufort Sea (See
134 §228.32);

135
136 (b) The incidental take of a marine mammal other than by
137 unintentional, non-lethal harassment; ~~or~~

138 (c) The violation or the failure to comply with the terms,

9 conditions and requirements of these regulations or a Letter of
140 Authorization; or

141 (d) The incidental taking of any marine mammal not specified
142 in these regulations or by a Letter of Authorization.

143

144 §228.35 Level of activity.

145

146 (a) Subject to the restrictions set forth in these
147 regulations the taking of marine mammals incidental to the
148 following activities is authorized:

149

150 Exploratory drilling operations conducted from
151 natural islands or artificial islands constructed
152 from gravel or ice;

153

154 (ii) Exploratory drilling operations conducted from no
155 more than six Mobile Offshore Drilling Units
156 ("MODU") as defined at 46 C.F.R. §107.112 at any
157 one time in the U.S. Beaufort and Chukchi Seas;

158

159 (iii) Exploratory drilling operations conducted from an
160 average of five (5) exploratory wells from MODU's
161 per year, not to exceed twelve (12) exploratory
162 wells from MODU's in any one year; and

163

164 (iv) Seismic exploration of an average of 7,000 vessel
165 miles of data acquisition per year not to exceed

15,000 vessel miles of data acquisition in any
single year.

For the purposes of this section, an exploratory well from a MODU shall include all operations conducted (i) from a multiple slot MODU at the same surface location, or (ii) from a MODU within a 2,500 foot radius from the surface location at which initial drilling is commenced, provided that the move from the initial surface location is due to avoidance of geological hazards. In computing the number of such wells, a well shall be counted only in the year in which operations are first commenced at that surface location.

(b) When Letters of Authorization are requested each year, the National Marine Fisheries Service will determine whether the level of activity identified in the requests exceeds that considered by the National Marine Fisheries Service in making a finding of negligible impact on the species and a finding of no unmitigable adverse impact on the availability of the species for subsistence. If the level of activity is higher, the National Marine Fisheries Service will reevaluate its findings to determine if those findings continue to be appropriate based on the higher level of activity. Depending on the results of the evaluation, the National Marine Fisheries Service may, after notice and opportunity for public comment, deny the request for a Letter of Authorization, or add conditions or mitigating measures that would make the impact negligible.

1 §228.36 Measures to ensure availability of species for
194 subsistence.
195

196 When applying for a Letter of Authorization, the applicant
197 must submit a plan of cooperation that identifies what measures
198 have been taken and will be taken to minimize any adverse effects
199 on the availability of marine mammals for subsistence uses if the
200 activity takes place in or near a traditional subsistence hunting
201 area. A plan must include the following:
202

203 (a) A statement that the applicant has notified the affected
204 subsistence communities and met at an agreed upon location with
205 residents of each such affected subsistence communitiesy and its
206 authorized representatives, if any, to discuss proposed exploratory
207 activities and to attempt to resolve potential conflicts regarding
208 siting, timing, and methods of operation;
209

210 (b) A description of what measures the applicant has taken
211 and will take to ensure that exploratory activities will not
212 interfere with subsistence whaling, including reasonable efforts to
213 implement a formal communications agreement; and
214

215 (c) What plans the applicant has, up to and during the
216 exploratory operations, to continue to meet at an agreed upon
217 location with residents of each such affected subsistence
218 communitiesy and its authorized representatives, if any, up to and
219 during the exploratory operations to attempt to resolve conflicts

and to notify the communities of any changes in the operation.

As used in these regulations, the term "authorized representative" shall mean a person or entity designated as such by the affected subsistence communities through written notice to NMFS.

§228.37 Requirements for monitoring and reporting.

(a) Holders of Letters of Authorization and their employees, agents, and designees must cooperate with the National Marine Fisheries Service and other designated Federal, State, or local agencies to monitor the impacts of oil and gas exploration on marine mammals. The Holder must notify the National Marine Fisheries Service, Alaska Region, of any activities specified in §228.33 ~~or any other activity~~ that may involve a potential take at least 30 days prior to the activity in order to satisfy §228.37(d).

(b) Holders of Letters of Authorization must designate a qualified biologist or another appropriately experienced individual to observe and record the effects of exploration activities on marine mammals. The observer must be approved by the National Marine Fisheries Service.

(c) When applying for a Letter of Authorization, the applicant must include a site-specific plan to monitor the effects on populations of marine mammals that are present during

7 exploratory activities. This plan, which must be approved by the
248 National Marine Fisheries Service, should identify what survey
249 techniques will be used to determine the movement and activity of
250 marine mammals near the exploratory sites including migration and
251 other habitat uses, such as feeding. A qualified biologist or
252 another appropriately experienced individual must observe the
253 behavior of the marine mammals present to determine if they are
254 being affected. The monitoring program should document the
255 acoustical effects on marine mammals and document or estimate the
256 actual level of take. The requirements for monitoring plans may
257 vary depending on the activity, the location, and the time.
258

259 (d) At its discretion, the National Marine Fisheries Service
30 may place an observer on board drillships, aircraft, etc. to
261 monitor the impact of exploration activities on marine mammals.
262

263 (e) Authorized representatives of affected communities may
264 request the National Marine Fisheries Service to place an observer
265 representing those communities and designated jointly by them on
266 board drillships and seismic vessels to monitor the impact of
267 exploration activities on marine mammals and the National Marine
268 Fisheries Service shall accommodate all such reasonable requests,
269 taking into account vessel space constraints. However, no
270 observers shall be placed on any vessel pursuant to this subsection
271 if the parties have already provided for the placement of an
272 observer or communicator on board the vessel pursuant to a
273 cooperative or communications agreement then in effect.

4 (f) The holder of a Letter of Authorization must submit
275 a report to the Assistant Administrator for Fisheries within 90
276 days of the completion of any exploratory activities. This report
277 must include the following information:

278
279 (1) Dates and types of activity;

280
281 (2) Dates and locations of any activities related to
282 monitoring the effects of exploration on marine mammals; and

283
284 (3) Results of the monitoring activities including an
285 estimate of the actual level and type of take, species name and
286 numbers of each species observed, direction of movement of species,
287 and any observed changes or modifications in behavior.

288
289 A copy of the report shall be sent to affected local
290 subsistence communities and authorized representatives of those
291 communities, if any, at the time it is submitted to NMFS.

292
293 (g) Results of behavioral, feeding, or population
294 studies must be made available to the National Marine Fisheries
295 Service before applying for a Letter of Authorization for the
296 following year. Copies of these results shall be sent to affected
297 local communities and authorized representatives of those
298 communities, if any, at the time the results are forwarded to NMFS.

299
300

301 §228.38 Letters of Authorization.

302
303 (a) (1) To obtain authorization for an incidental take of
304 marine mammals pursuant to these regulations, each company
305 conducting an exploratory activity in the geographical area
306 described in §228.31 must apply for a Letter of Authorization for
307 each geophysical survey or seismic activity and each drilling
308 operation.

309
310 (2) The application must be submitted to the National
311 Marine Fisheries Service at least 90 days before the activity is
312 scheduled to begin except in 1990. The National Marine Fisheries
313 Service will publish notices of each request for a Letter of
314 Authorization in the FEDERAL REGISTER and effective November 1,
315 1990, there shall be an opportunity for public comment for those
316 requests for Letters of Authorization submitted after that date.

317
318 (b) An application for a Letter of Authorization must include
319 the following:

320
321 (1) A plan to monitor the behavior and the effects of
322 the activity on marine mammals;

323
324 (2) A plan of cooperation which describes the measures
325 that have been and will be taken to minimize any potential
326 conflicts between the proposed activity and subsistence hunting;
327 and

329 (3) A description of the activity including the method
330 to be used, the dates and duration of the activity, the specific
331 location of the activity and the estimated area that will actually
332 be affected by the exploratory activity.

333

334 (c) The National Marine Fisheries Service will evaluate each
335 request for a Letter of Authorization based on the specific
336 activity and the specific geographical location. Each Letter of
337 Authorization will identify allowable conditions or methods that
338 are specific to that activity and location.

339

340 (d) Any substantive modifications of the Letters of
341 Authorization will be made only after notice and opportunity for
342 public comment.

343

344 (e) Substantive modifications of the Letters of Authorization
345 can be made without opportunity for public comment as provided in
346 §228.38(c) if the National Marine Fisheries Service determines that
347 an emergency exists which poses a significant risk to the well-
348 being of the species or stocks of marine mammals concerned.

349

350 (f) The Letter of Authorization must be in the possession of
351 the person or persons conducting activities that may involve
352 incidental takings of marine mammals.

Observations on the Ice-Breaking and Ice Navigation Behavior of Migrating Bowhead Whales (*Balaena mysticetus*) near Point Barrow, Alaska, Spring 1985

JOHN C. GEORGE,¹ CHRISTOPHER CLARK,² GEOFF M. CARROLL¹ and WILLIAM T. ELLISON¹

(Received 28 January 1988; accepted in revised form 21 October 1988)

ABSTRACT. During a four-day period from 28 April to 1 May 1985, we observed bowhead whales breaking up through sea ice in order to breathe. Our observations were made from grounded sea ice approximately 10 km northeast of Point Barrow, Alaska, during the spring bowhead migration (14 April to 10 June). From acoustic and visual data, it was estimated that 665 whales passed the observation perches during this four-day period. However, only 117 (17%) whales were seen. The remaining whales either passed underneath the ice or were beyond the range of the visual observers. Whales used their heads, in the area of the blowholes, to push up against the ice (18 cm maximum thickness) and fracture it, creating a hummock of ice in which they were able to respire. Often during such breathing episodes, even at distances of only several hundred meters, the animal was not seen but its blows were clearly audible to the visual observers. Acoustic tracking of whales showed they avoided a large multi-year ice floe seaward of the observation perch. We hypothesize that bowheads use their calls to assess the thickness of ice in their migratory path. In assessing their calls, we suggest the whales can avoid areas where the ice is too thick to break through (to breathe) and/or too thick to provide clearance for them to swim beneath.

Key words: *Balaena mysticetus*, Point Barrow, bowhead whale, ice breaking, behavior, sea ice, singer, acoustic, anatomy, census

RÉSUMÉ. Au cours d'une période de quatre jours, du 28 avril au 1^{er} mai 1985, on a observé des baleines franches qui remontaient à la surface en cassant la glace de mer pour respirer. Les observations ont été faites depuis la glace échouée, à un endroit situé à 10 km environ de Point Barrow en Alaska, durant la migration de printemps des baleines franches (du 14 avril au 10 juin). D'après les données acoustiques et visuelles, on a estimé que 665 baleines sont passées près des perchoirs d'observation au cours de ces quatre jours. Cependant, seulement 117 baleines (17%) ont été aperçues. Le reste des baleines est passé soit sous la glace, soit trop loin des observateurs pour que ceux-ci puissent les voir. Les baleines se servaient de leur tête, dans la zone de l'évent, pour repousser la glace (épaisseur maximum de 18 cm) et la fracturer, créant un hummock de glace où elles étaient capables de respirer. Souvent, au cours de ces respirations, même à des distances de seulement quelques centaines de mètres, l'animal n'était pas visible mais ses souffles étaient nettement audibles pour les observateurs visuels. La surveillance acoustique des baleines montrait qu'elles évitaient un gros floe de plusieurs années, en direction du large à partir du perchoir d'observation. On émet l'hypothèse que les baleines franches se servent de leurs cris pour évaluer l'épaisseur de la glace sur le parcours de leur migration. L'évaluation de leurs cris nous amène à suggérer que les baleines peuvent éviter des zones où la glace est trop épaisse pour qu'elles puissent la casser (pour respirer) ou pour qu'elles aient la place de nager en dessous, ou les deux à la fois.

Mots clés: *Balaena mysticetus*, Point Barrow, baleine franche, casser la glace, comportement, glace de mer, chanteuse, acoustique, anatomie, dénombrement

Traduit pour le journal par Nésida Loyer.

INTRODUCTION

The Inupiat Eskimo whale hunters of arctic Alaska have known for centuries and, more recently, researchers have observed that bowhead whales have the ability to break relatively thick sea ice in order to breathe (blow) (Scammon, 1968; Carroll and Smithhisler, 1980; Fraker, 1984; Krogman *et al.*, 1986). Carroll and Smithhisler (1980) reported an incident in the early 1960s at Little Diomed Island during which John J. Burns observed an individual whale breaking ice 23 cm thick. Accounts by Eskimo whaling crews of bowheads breaking ice < 20 cm are fairly common. However, in the 1930s a crew witnessed an unusual event in which a bowhead broke through ice approximately 60 cm in thickness about 6 km southwest of Barrow (H. Brower, pers. comm. 1988).

Bowheads likely begin their northward migration in March (during the maximal extent of the polar pack ice) from wintering areas in the Bering Sea en route to the Canadian Beaufort Sea (Braham *et al.*, 1980; Braham *et al.*, 1984; Miller *et al.*, 1986). Along the migratory route, they negotiate a tenuous system of leads (linear cracks in the sea ice), which often become refrozen or blocked by heavy multi-year ice (Jungblad, 1981). Accordingly, in order for bowheads to

extend their range into the High Arctic seas, morphological, physiological and behavioral adaptations to the ice-dominated environment, such as ice breaking and under-ice navigation abilities, would be expected.

Extensive observations of bowhead whales (over 8000 h of effort since 1978) have been made during the visual census of bowhead whales off Point Barrow, Alaska. During these observations, we have observed whales utilizing very small pools of open water, often just large enough to accommodate their blowholes. Sometimes, whales were detected by seeing or hearing only their distinctive blows (Carroll and Smithhisler, 1980; Dronenburg *et al.*, 1986).

In bowhead population estimates made from 1977 to 1984, it was assumed that under conditions when there was no open water (referred to as a closed lead condition), whales did not have access to openings in the ice for breathing and therefore would not migrate through the censusing area (International Whaling Commission, 1986; Zeh *et al.*, 1986a; Zeh *et al.*, 1986b).

However, during the 1984 spring census effort off Point Barrow, Alaska, a large number of bowhead whale calls (8958) were recorded throughout a four-day period, 3 May to 7 May, when the lead was closed by an extensive field of new and

¹Department of Wildlife Management, North Slope Borough, Box 69, Barrow, Alaska 99723, U.S.A.

²Laboratory of Ornithology, Cornell University, Ithaca, New York 14850, U.S.A.

³Marine Acoustics, 240 Oxford Drive, Cotuit, Massachusetts 02635, U.S.A.

©The Arctic Institute of North America

old ice. Acoustic location and tracking analyses were applied to a 31 h sample containing 2978 calls. These analyses revealed that, during the sample period, at least 139 whales passed, yet only three whales were seen (Clark *et al.*, 1986). These results clearly indicate that many whales can pass unseen through ice-covered leads. The results also indicate that the whales were (somehow) able to navigate through heavy ice and either find small openings or force their way through the ice to breathe.

Prior to our findings, there were no estimates of the numbers of whales migrating under the sea ice during spring migration, no detailed observations on how bowheads physically break sea ice, and no data on possible under-ice navigation techniques.

In this paper we describe (1) previously unreported observations of bowhead whales breaking ice for breathing holes and migrating through ice-covered water during April 1985. We present evidence that (2) many whales passed the census site unseen by visual observers and apparently (3) avoided swimming under a large floe of thick (10-20 m) multi-year ice. We also discuss the possibility that (4) bowheads use their loud (frequency modulated) FM calls as well as (5) visual cues to navigate around obstructions and to find areas of open water or thin ice.

METHODS

We made whale observations from a grounded pressure ridge, or "perch," on the shorefast ice about 10 km north of Point Barrow, Alaska (71°26.10'N latitude and 156°26.05'W longitude) (Fig. 1). Two visual observation sites, referred to as perches, were located 335 m apart on the edge of the shorefast ice very near the lead system where the water depth was 30 m. During these observations a large floe of multi-year pack ice approximately 10 km² was fixed approximately 2.0 km seaward of the perches. New, thinner ice had formed around it, essentially covering the entire lead. The floe had characteristics of old multi-year ice (LaBelle *et al.*, 1983) (Fig. 2). Such ice often has keels greater than 20 m in depth.

We made whale observations in a manner consistent with those made in past years (Krogman and Rugh, 1983). Observers used a theodolite to determine the position of whales when they were at the surface (Clark and Clark, 1980; Rugh and Cabbage, 1980; George *et al.*, 1987). For each theodolite (whale) sighting, the time, group position, number in the group, and whether it was a new or duplicate sighting was recorded.

Acoustic technicians made multiple-channel (sound) recordings from an array of three hydrophones located along the lead edge (Clark *et al.*, 1986). Each hydrophone was cabled directly to an FM sonobuoy transmitter (Sippican Ocean Systems, Marion, MA) that broadcast the signals from the hydrophone on a separate radio frequency channel. These signals were received and recorded on a four-channel tape recorder (TEAC R-61D, available from: J. Wolfe Enterprises Inc., North Hollywood, CA) operating in a mobile research hut located on stable ice, approximately 1-2 km from the sonobuoys. Acoustic observers monitored hydrophones and "field tallied" readily audible whale calls in 15-minute bins through the entire day. Later the tapes were converted into continuous two-channel spectrograms on which all (many

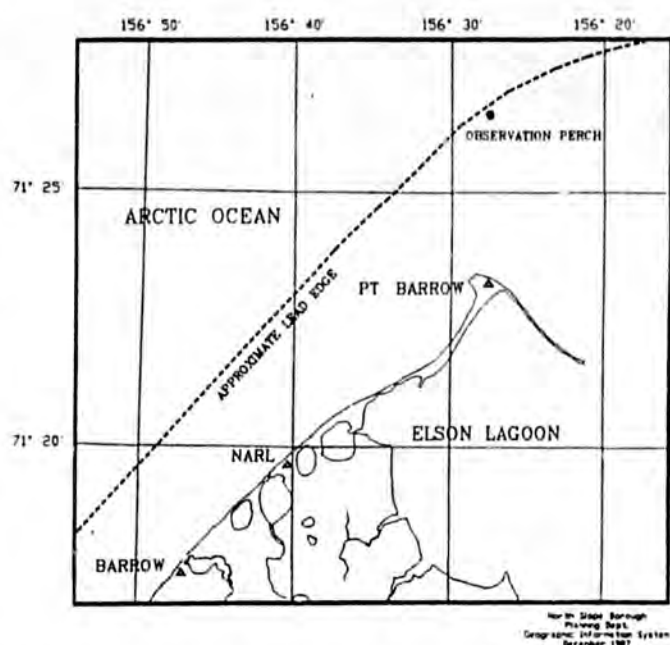


FIG. 1. The location of the observation site near Point Barrow during 27 April to 2 May 1985. The extent of the shorefast ice edge is indicated by a dashed line.

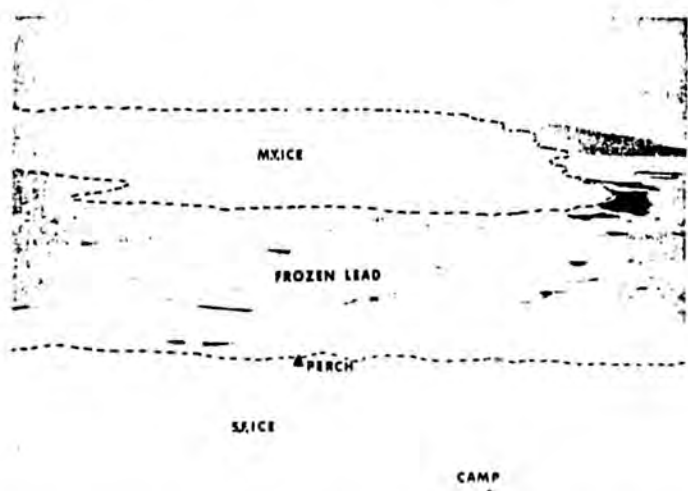


FIG. 2. Aerial photograph (looking northwest) of the sea ice in the region of the visual observation perch. A large multi-year ice floe (M.Y. ICE) was located ca. 2.5 km seaward of the shorefast ice (S.I. ICE). The region between is the refrozen lead through which the whales migrated. (Photo courtesy of David Rugh, National Marine Mammal Lab, Seattle, WA.)

calls were missed in the field tally) bowhead calls were identified and their times of occurrence noted. Attempts were made to locate all calling whales using a sound-location system (Clark *et al.*, 1986). After the sources of calls were located, the file of acoustic locations was processed by a program that linked the locations into whale swimming paths or tracks (Sonntag *et al.*, 1986). The southern and western margin of the multi-year ice (seaward of the perch) was determined by happenstance during a calibration experiment of the acoustic location system. In the experiment sounds were played into the water at various stations about 200-500 meters from the edge of the multi-year floe. We verified the station locations using horizontal theodolite bearings and

an electronic distance meter and approximated the overall shape of the multi-year floe by using aerial photographs.

Gentleman and Zeh (1987) combined the acoustic location and visual sighting data and, using a single mark recapture release model, estimated the number of whales that passed the census point during the study period.

RESULTS

Visual observations during the 1985 census operated from 9 April to 14 June, while acoustic surveillance extended from 14 April to 10 June. The first visual sighting and the first acoustic recording of a whale occurred on 21 April. The visual count for the entire season was 1251, and 22 007 calls were field tallied. A total of 3058 calls were field tallied during the four-day study period (Table 1). A summary of the daily observations and calls field tallied for the period from 27 April to 2 May is listed in Table 1. Combining the visual and acoustic data sets, Gentleman and Zeh (1987) estimated that 665 whales passed through the observation area during the 96-hour period beginning at 0000 h on 28 April and ending at 2400 h on 1 May.

TABLE 1. Numbers of whales sighted, calls field tallied per day and estimated number of bowhead whales passing Point Barrow between 28 April and 2 May 1985

Date	Whales sighted ¹	Calls/day ²	Estimated whales ³
4/27	1	22	—
4/28	6	1414	—
4/29	79	642	235 ⁴
4/30	14	702	—
5/1	18	300	430 ⁵
5/2	1	2	—
Totals	119	3082	665

¹Whales sighted refers to those seen for the first time.

²Calls/day refers to the number of bowhead calls field tallied per day.

³The estimated numbers of whales were derived from the integration of visual and acoustic data (Gentleman and Zeh, 1987).

⁴Estimated whale passage for the period 00:00 on 28 April to 02:39 on 29 April.

⁵Estimated whale passage for the period 0:4:57 on 29 April to 24:00 on 1 May.

Ice-Breaking Behavioral Observations

From 15 to 21 April, in the region of the perches, there was an open lead of water but only one whale was seen. The lead began refreezing on 21 April, leaving 10-15% open water. However, 43 different whales were sighted in small areas of open water between 21 and 23 April. By 26 April observers estimated there was 1% open water. The new ice covering the lead averaged 14-18 cm in thickness. Beginning on 28 April and continuing until 1 May, an estimated 665 bowhead whales migrated past the perch (Table 1; Fig. 3). Virtually all of the whales must have either broken through the ice in order to breathe or used existing holes produced by earlier passing whales. That is, the lead was refrozen over several kilometers, which required the animals to surface in the refrozen zone. In breaking the ice, the whales slowly exerted pressure with the dorsal surface of their head (in the blowhole region) until the ice fractured (Fig. 4). To exert this pressure the whales likely used fluke and flipper strokes and/or their buoyant force. In breaking through the ice, the

whales formed hummocks in the ice sheet. These hummocks were raised areas of fractured ice measuring approximately 1.0×0.7 m, with a ragged central opening of several cm² (Fig. 5). On one occasion a whale thrust its chin (lower mandible) through the ice. The animal's body was angled sharply upward as it broke the ice, thrusting its rostrum about 1 m above the ice. The whale then submerged and placed its blowhole into the fresh opening.

In several cases the whales' exhalations blew a muddy substance out of the hummocks. The mud bespattered the ice tens of meters downwind (Fig. 5). We inspected the underside of ice near two hummocks but found no mud.

Later whales repeatedly used many of the same hummocks over the four-day period, but these quickly refroze when the

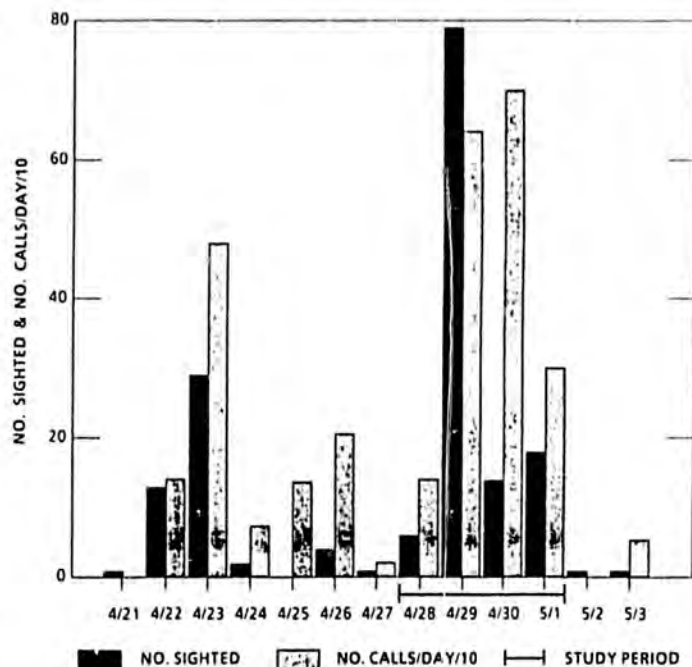


FIG. 3. Field counts of bowhead calls per day along with visual sightings per day made from the shorefast ice.

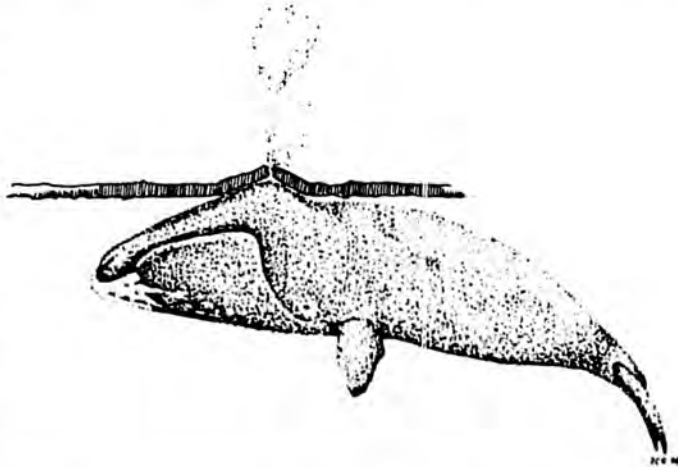


FIG. 4. Drawing of a bowhead whale using its protruding blowhole to break sea ice in order to breathe. (We could only see the whale's rostrum and approximated its body orientation for the drawing.)



FIG. 5. A photograph of a whale hummock measuring 1.0×0.7 m that was pushed up through ice 14.5 cm thick. There were 50-100 such hummocks in a 1 km^2 area seaward of the observation sight. The streaks and spatters around the hummock are bottom sediments blown out of the hummock during the whale's exhalation.

passage of whales temporarily ended on 1 May (Fig. 3). There were approximately 50-100 hummocks in a 1 km^2 area directly seaward of the observation perches. A few small pools of open water (100 m^2) were available, but the whales seldom made use of them.

On many occasions during this period, blows alerted us to the presence of whales that were never seen. During the study period observers sighted 117 out of an estimated 665 whales (17%) that migrated past.

Ice Navigation-Avoidance Observations

Of the 3058 calls field tallied (28 April to 1 May), 1422 were of sufficient quality to be located. Some of the calls were from "singing" bowheads (called singers), which called nearly continuously as they passed. We plotted the 1422 call locations (Fig. 6) and locations of calls from a single "singing" bowhead (Fig. 7). Examination of the plotted locations showed an obvious absence of calls that coincided with a large multi-year ice flow (Fig. 6). Similarly, when we plotted the singer track over the approximate boundary of the floe, the whale's course indicated it deflected around the floe (Fig. 7). Hence, to explain the absence of calls in Figure 6, we surmised that the whales avoided the multi-year floe during the study period.

DISCUSSION

Ice-Breaking Behavior

Our observations confirm that bowheads can push up through ice to breathe, demonstrating one means by which whales breathe in waters entirely covered by ice. Bowheads also use existing cracks and very small holes to breathe.

The bowhead's protruding blowhole is likely an adaptation to an ice-dominated environment (Fig. 8). In support of this, the tissue between the external nares and the underlying rostral bone is composed of dense fibrous connective tissue up to 25 cm thick (Henry *et al.*, 1983). This tissue ap-

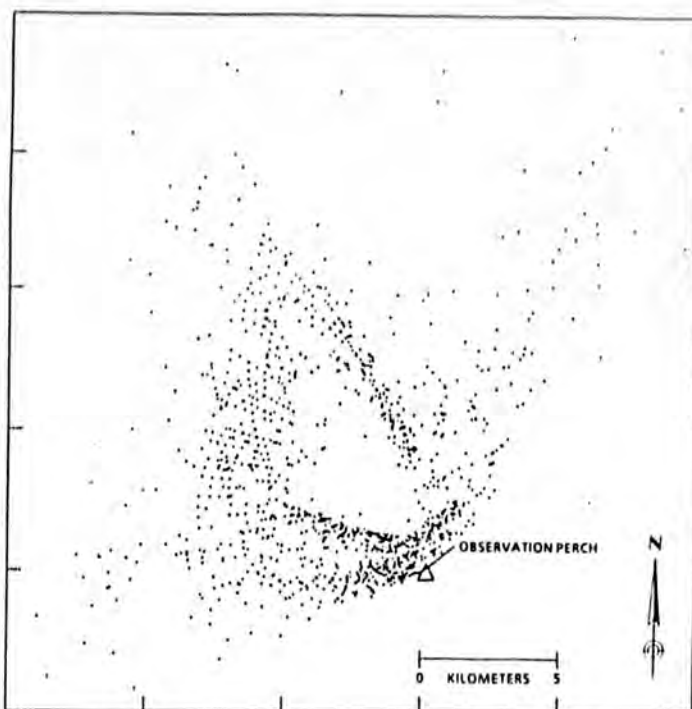
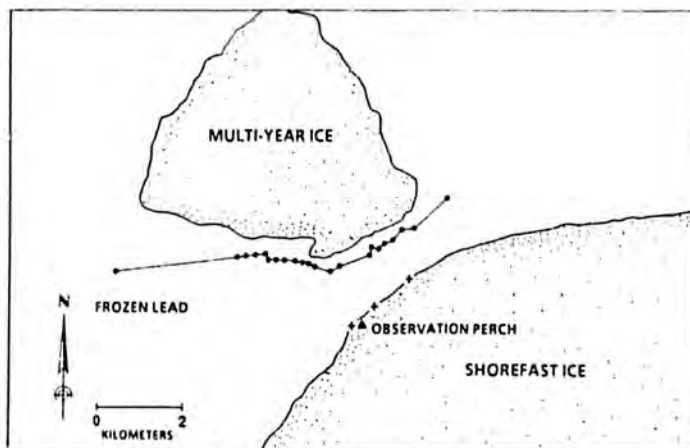


FIG. 6. Plot of the source locations of all calls from bowhead whales during the period 28 April through 1 May 1985 near Point Barrow, Alaska. The absence of calls in the center of the figure corresponds to the large multi-year ice floe. (The Y-axis is oriented to True North.)



• LOCATION OF CALLING BOWHEAD

+ HYDROPHONE LOCATION

FIG. 7. Plot of "singing" bowhead track shows deflection around the multi-year ice floe that was seaward of the observation perch. The position of the multi-year ice floe was determined using aerial photographs and station positions made during a calibration test of the acoustic location system. (The Y-axis is oriented to True North.)

pears to be specialized for absorbing the impact experienced when breaking ice. We made close observations of feeding bowheads in late May 1985 and noted that the blowhole region in particular was roughened and abraded, possibly from ice breaking (Carroll *et al.*, 1987). We also regularly see abraded skin around the blowholes of whales landed by Eskimo hunters. Most bowheads have numerous scars on them, particularly on the dorsal areas of the head and on the flukes. Researchers and Eskimo hunters suggest that many



FIG. 8. A bowhead whale prior to sounding under landfast ice. Note the protruding blowhole showing several white scars. These wounds were likely ice inflicted. (Photo by Geoff Carroll.)

of these scars are ice-inflicted injuries (Albert *et al.*, 1980; Nerini *et al.*, 1984).

Other arctic and Antarctic cetaceans and some pinnipeds are known to break sea ice in order to breathe. Beluga whales (*Delphinapterus leucas*) can "maintain breathing holes and break through thin ice" (Hazard, 1988:206). However, there have been entrapments in which the belugas showed no ability to break thick (> 60 cm) ice during an entrapment near Senjavin Strait (in the Bering Sea) (Ivashin and Shevlyagin, 1987). Pacific walrus (*Odobenus rosmarus divergens*) are capable of breaking ice up to 20 cm thick (Fay, 1982). However, walrus entrapped in stable multi-year ice have become "extremely emaciated" (Fay, 1982:238). Killer whales (*Orcinus orca*) and Ringed seal (*Phoca hispida*) have also been noted to break sea ice in order to breathe (Slijper, 1979; Kelly, 1988).

The ice that the whales broke through in 1985 was 14-18 cm thick. This ice easily supported the combined weight of three men and a heavily loaded sled and snow machine (approximately 500 kg). The ice was strengthened, in part, from the relatively low air temperatures (-17° to -6°C) during the study period (Cox *et al.*, 1984).

Although there were a few small pools of open water seaward of the perch, the whales made little use of them. This failure to use these open water areas contrasts markedly with past observations in which whales sometimes used very small pools of open water and did not break through ice (Carroll and Smithhisler, 1980).

It could not be confidently determined from visual sightings whether the animals were migrating or just milling in the vicinity of the perches. Aerial and acoustic data, however, indicated that the animals were migrating. On 2 May 1985, one day after the end of the intensive acoustic activity, an aerial survey was flown by National Marine Mammal Labora-

tory (NMML) personnel to locate and photograph whales. Researchers flew northeast up the lead system (which was open northeast of Point Barrow) and encountered groups of migrating whales from 114 to 208 km northeast of Point Barrow (NMML field notes, 1985). These whales likely migrated past the observation perch one to two days earlier.

The acoustic evidence that the whales were migrating during the study period was more convincing than the aerial sighting. The acoustic analysis consisted of 1422 acoustic locations for the period 28 April to 1 May and from singer tracks. Sonntag *et al.* (1986) present results from applying the tracking algorithm to the acoustic locations using several migration directions. The maximum number of linkages occurred between 65 and 85° (True heading), a value almost identical to the migration angle as determined from visual sightings before and after the lead refroze (Gentleman and Zeh, 1987). Tracks of singing whales indicate that singing bowheads were, in fact, moving (migrating) in the 65 - 85° direction. Singer tracks do not require the tracking algorithm and therefore provide an independent and more precise means of demonstrating migration.

Under-ice migratory behavior has important implications for population estimates of bowhead whales passing Point Barrow, Alaska. That is, this behavior in part explains the wide variation in visual counts between seasons, i.e., 669 in 1984 to 1888 in 1986 (George *et al.*, 1987). The low proportion of visual sightings during the study period (17%) is primarily a result of the ice cover obscuring the whales from the observers' view, although many whales acoustically recorded were also beyond visual range. Previous to the acoustic censusing efforts, it was assumed that very few bowheads were migrating during periods of heavy ice, since few if any whales could be seen. As a result of acoustic information, however, it is now known that many whales continue to migrate even during heavy ice conditions. For instance, during a 31-hour period in May 1984 when there was nearly 100% ice cover, at least 139 different whales were located acoustically when only 3 were seen (Clark *et al.*, 1986). In past years, the highest visual counts correspond with seasons during which the lead was generally open (George *et al.*, 1987).

While there is evidence that bowheads can migrate through most ice conditions, some conditions have blocked the northward migration of bowheads. In spring of 1980, Ljungblad (1981) made aerial observations of bowheads that were apparently blocked by continuous multi-year ice in the Bering Strait region. Consequently, the typical arrival date for bowhead whales at Barrow was delayed approximately one month (Johnson *et al.*, 1981).

Nerini *et al.* (1984) summarized historic literature regarding ice entrapments and drownings of bowhead whales. Several drownings, sometimes involving 10 or more animals in some cases, were reported in the Soviet Chukchi Sea, the Bering Sea, and Disco Bay, Greenland. In 1981 we observed a small bowhead (from 3 m away) that seemed to be entrapped in a closing lead filled with slush ice. Unfortunately, we had to evacuate the sea ice and do not know the fate of the animal.

Documented entrapments represent only a few cases over 200 years. They do, however, indicate that the bowheads' ability to assess ice conditions is not infallible. These observations further suggest (indirectly) that there is strong selection for adaptations that allow the bowheads to perceive a

variety of ice conditions, navigate through heavy ice, and find breathing areas during hazardous situations.

Ice Navigation-Assessment Behavior

Bowheads probably find breathing holes, small polynyas, and areas of thin ice through a combination of visual and acoustic cues. Several lines of evidence indicate that whales use ambient light for this purpose. The eye of the bowhead has a tapetum, which suggests that it is adapted to low-light conditions (Dubielzig and Aguirre, 1981). Such an adaptation would be useful for living in dark, turbid waters and, perhaps, for detecting cracks in the sea ice. Use of ambient light might explain the repeated use of the hummocks by different animals. We also observed, in a large ice pan (approximately 400 × 400 m), a single hummock precisely centered in a lone snow machine trail made hours earlier (Fig. 9). The snow machine compressed the thin snow layer onto the wet sea ice, causing the snow to melt and allowing more light to penetrate. The animal may have judged the track to be a small crack and broke through the ice beneath the track. The maximum distance at which a bowhead can detect a crack or other suitable breathing site remains unknown.



FIG. 9. A hummock from a bowhead whale that pushed up underneath a track made earlier by a snow machine. The ice was 18-20 cm thick in this area. The whale may have mistaken the track for a thin crack in the sea ice.

In addition to using ambient light, Ellison *et al.* (1987) suggest that bowhead whales may be able to assess ice conditions acoustically by using their FM calls. Their calculations show that the reflection of a bowhead call off the underwater keels of heavily ridged pack ice (10 m in thickness) is 20-30 dB greater than its reflection off new ice (0.25 m in thickness). Thus, a bowhead could determine where there is thin (flat) or thick (generally rough) ice ahead by perceiving the relative level of its own call as it is reflected off the ice. There is other circumstantial evidence that bowheads avoid thick-ridged ice based on the acoustic location data gathered during the 28 April to 1 May period. When all the whale call locations were plotted, they showed an obvious absence of acoustic locations northwest of the perch (Fig. 6). This paucity of call locations corresponds with the position of the large multi-year ice floe in front of the perch (Fig. 2). The absence of calling whales in the area of the floe implies that the whales either avoided swimming underneath it or swam underneath it but made no sounds. It would seem rather unusual for all whales to stop calling when they were underneath the floe, but we have no data on this subject.

The floe may also have been grounded in places, preventing the whales from swimming underneath it. Furthermore one singer, for which there is an extensive track during this period, clearly changed its course while singing and swam around the floe (Fig. 6). The precise distance the singer was from the ice floe when it changed course could not be determined. Based on this evidence, we suspect that the whales detected the floe by perceiving the strength of their reflected calls off its deep walls and keels and swam around it. Though we can only suggest the use of reflected calls, it seems logical that such a huge animal as a bowhead whale migrating through turbid and/or dark waters would require some system to avoid collisions with deep ice keels.

A matter that is not entirely resolved is the source of sediments on the ice around the hummocks. This mud was probably on the whales' blowhole area when they respired. We have noted mud on blowholes of whales landed by Eskimo hunters. The Eskimo hunters and observations by Würsig *et al.* (1985) tell us that bowheads do, at times, swim in an inverted position. However, whales following each other through churned-up mud (via fluke strokes near the bottom) could become coated with sediments while upright. Aerial observers often see whales with mud on them in the Point Barrow area during spring migration (Carroll *et al.*, 1987).

All of the hummocks that we inspected had some amount of sediment in and around them. We cut two test holes in the surrounding ice 1-2 m from the hummocks to determine if the mud was specific to the hummocks or generally coated the underside of the ice. No mud was noted below the ice, which supports our feeling that the mud originated from the whales.

CONCLUSIONS

Our data indicate that large numbers of bowhead whales can travel underneath the ice and apparently can easily break ice less than 20 cm thick. Eskimo hunters, however, have witnessed bowheads break ice approximately 60 cm thick. This behavior, in part, explains the wide variation in visual counts at Point Barrow over the last 10 years and has significant effects on population estimates. There are, however, ice conditions that block the northward migration of bowheads. For under-ice navigation and avoidance of large multi-year floes, bowheads appear to use ambient light cues and, perhaps, the echoes of their calls off the keels of thick ice. The protruding blowhole is probably a morphological adaptation to living in ice-dominated waters and is used to break through ice in order to breathe. The substance that was blown from the ice hummocks by the whales' exhalations was likely bottom sediment that adhered to their blowhole area.

ACKNOWLEDGEMENTS

We would like to thank the crew members and supporting agencies of the bowhead census. The field crew included Perry Anashugak, Salena Brotherton, Joe Burgener, Susan Carver, Diana Dronenburg, Kurt Johnson, Ruth Johnson, Brendan Kelly, Simon Koonook, Donna McDonald, Mary Moore, Elaine Patkotak, Mike Pielorz, Lori Quakenbush, Dave Ramey, Kip Redington, Ellen Sales, Karen Schalka, Kathy Turco, Rick Yackley, and Joanne Young.

Thomas Albert, of the Department of Wildlife Management, North Slope Borough, provided editorial advice on the manuscript.

Judy Zeh, of the Department of Statistics, University of Washington, kindly reviewed and provided information for the manuscript. We are indebted to Thomas Brower, Sr., and Harry Brower, Sr., for sharing their knowledge gained from many years on the sea ice at Barrow, Alaska.

David Rugh, of the National Marine Mammal Laboratory, NMFS, Seattle, and John Richardson, of LGL, Ltd., made excellent editorial suggestions and substantive additions.

Funding was provided by the Alaska Department of Natural Resources and the North Slope Borough.

REFERENCES

- ALBERT, T.F., MIGAKI, G., CASEY, H.W., and PHILO, L.M. 1980. Healed penetrating injury of a bowhead whale. *Marine Fisheries Review* 42(9-10):92-96.
- BRAHAM, H.W., FRAKER, M.A., and KROGMAN, B.D. 1980. Spring migration of the western arctic population of bowhead whales. *Marine Fisheries Review* 42(9-10):36-45.
- BRAHAM, H.W., KROGMAN, B.D., and CARROLL, G.M. 1984. Bowhead and white whale migration, distribution, and abundance in the Bering, Chukchi, and Beaufort Seas, 1975-78. NOAA Technical Report. NMFS SSRF-778 NOAA, Rockville, MD. 39 p.
- CARROLL, G.M., and SMITHHISLER, J.R. 1980. Observations of bowhead whales during spring migration. *Marine Fisheries Review* 42(9-10):80-85.
- CARROLL, G.M., GEORGE, J.C., LOWRY, L.F., and COYLE, K.O. 1987. Bowhead whale (*Balaena mysticetus*) feeding near Point Barrow, Alaska during the 1985 spring migration. *Arctic* 40(2):105-110.
- CLARK, C.W., ELLISON, W.T., and BEEMAN, K. 1986. A preliminary account of the acoustic study conducted during the 1985 spring bowhead whale, *Balaena mysticetus*, migration off Point Barrow, AK. Report International Whaling Commission 36:311-317.
- CLARK, J.M., and CLARK, C.W. 1980. Sound playback experiments with southern right whales, *Eubalaena australis*. *Science* 207:663-664.
- COX, G.F.N., RICHTER-MENGE, J.A., WEEKS, W.S., MILLER, M., and BOSWORTH, H. 1984. Mechanical properties of multi-year sea ice. C.R.R.E.L. Report 84-9. 105 p.
- DONENBURG, R.B., GEORGE, J.C., KROGMAN, B.K., and SONNTAG, R.M. 1986. Report of the 1984 spring bowhead whale (*Balaena mysticetus*) ice-based census. Report International Whaling Commission 36:293-298.
- DUBIELZIG, R., and AGUIRRE, G. 1981. Morphological studies of the visual apparatus of the bowhead whale, *Balaena mysticetus*. In: Albert, T.F., ed. *Tissue Structural Studies and Other Investigation on the Biology of Endangered Whales in the Beaufort Sea*. Report to the Bureau of Land Management from the Department of Veterinary Science, University of Maryland, College Park, MD 20742. 157-172. Unpubl. report. Available from: Minerals Management Service, 949 E. 36th St., Room 110, Anchorage, AK 99508-4302.
- ELLISON, W.T., CLARK, C.W., and BISHOP, G.C. 1987. Potential use of surface reverberation by bowhead whales, *Balaena mysticetus*, in under-ice navigation: preliminary considerations. Report International Whaling Commission 37:329-332.
- FAY, F.H. 1982. Ecology and biology of the Pacific walrus, *Odobenus rosmarus divergens* Illiger. *North American Fauna* 74. 279 p.
- FRAKER, M. 1984. *Balaena mysticetus*: whales, oil, and whaling in the arctic. Sohio Alaska Petroleum Company and BP Alaska Exploration Inc., P.O. Box 6612, Anchorage, AK 99502-0612. 63 p.
- GENTLEMAN, R., and ZEH, J. 1987. A statistical model for estimating the number of bowhead whales, *Balaena mysticetus*, passing a census point from combined visual and acoustic data. Report International Whaling Commission 37:313-328.
- GEORGE, J.C., CARROLL, G.M., TARPLEY, R.J., ALBERT, T.F., and YACKLEY, R.L. 1987. Report of field activities pertaining to the spring 1986 census of bowhead whales, *Balaena mysticetus*, off Point Barrow, Alaska with observations on the subsistence hunt. Report International Whaling Commission 37:301-308.
- HAZARD, K. 1988. Beluga whale, *Delphinapterus leucas*. In: Lentfer, J.W., ed. *Selected marine mammals of Alaska: species accounts with research and management recommendations*. Marine Mammal Commission, 1625 I Street N.W., Washington, D.C. 195-236.
- HENRY, R.W., HALDIMAN, J.T., ALBERT, T.F., HENK, W.G., ABDEL-BAKI, Y.Z., and DUFFIELD, D.W. 1983. Gross anatomy of the respiratory system of the bowhead whale, *Balaena mysticetus*. *The Anatomical Record* 207:435-449.
- INTERNATIONAL WHALING COMMISSION. 1986. Report of the subcommittee on protected species and aboriginal subsistence whaling (Annex H). Report International Whaling Commission 36:95-111.
- IVASHIN, M.V., and SHEVLYAGIN, K.V. 1987. The white whale (*Delphinapterus leucas* Pallas, 1776): entrapment and escape in the ice of Senjavin Strait, USSR. Report International Whaling Commission 37:357-360.
- JOHNSON, J.H., BRAHAM, H.W., KROGMAN, B.D., MARQUETTE, W.M., SONNTAG, R.M., and RUGH, D.J. 1981. Bowhead whale research: June 1979 to June 1980. Report International Whaling Commission 31:461-475.
- KELLY, B.P. 1988. Ring Seal, *Phoca hispida*. In: Lentfer, J.W., ed. *Selected marine mammals of Alaska: species accounts with research and management recommendations*. Marine Mammal Commission, 1625 I Street N.W., Washington, D.C. 57-76.
- KROGMAN, B.D., and RUGH, D. 1983. Instructions for conducting a census of bowhead whales from ice-based observation points near Point Barrow, Alaska. NOAA Technical Memorandum NMFS F/NWC-45. U.S. Department of Commerce. Available from: National Marine Mammal Laboratory, Building No. 4, 7600 Sand Point Way NE, Seattle, WA 98115.
- KROGMAN, B.D., GEORGE, J.C., CARROLL, G.M., ZEH, J., and SONNTAG, R.M. 1986. Preliminary results of the 1985 spring ice-based census of the Bowhead Whale, *Balaena mysticetus*, conducted near Point Barrow, Alaska. Report International Whaling Commission 36:343-352.
- LABELLE, J.C., WISE, J.L., VOELKER, R.P., SCHULZE, R.H., and WOHL, G.M. 1983. Alaska marine ice atlas. Arctic Environmental Information and Data Center, University of Alaska, 707 A Street, Anchorage, AK 99501. 302 p.
- LJUNGBLAD, D.K. 1981. Aerial surveys of endangered whales in the Beaufort Sea, Chukchi Sea and northern Bering Sea. NOSC Technical Document 449, Report from Naval Ocean Systems Center, San Diego, CA, for U.S. Bureau of Land Management, Washington, D.C. 302 p.
- MILLER, R.V., RUGH, D.J., and JOHNSON, J.H. 1986. The distribution of bowhead whales, *Balaena mysticetus*, in the Chukchi sea. *Marine Mammal Science* 2(3):214-222.
- NATIONAL MARINE MAMMAL LABORATORY. 1985. Unpubl. aerial survey field notes from Spring 1985. National Marine Mammal Laboratory, Building No. 4, 7600 Sand Point Way NE, Seattle, WA 98115.
- NERINI, M.K., BRAHAM, H.W., MARQUETTE, W.M., and RUGH, D.J. 1984. Life history of the bowhead whale, *Balaena mysticetus*. (Mammalia: Cetacea). *The Journal of Zoology (London)* 204:443-468.
- RUGH, D.J., and CUBBAGE, J.C. 1980. Migration of bowhead whales past Cape Lisburne, Alaska. *Marine Fisheries Review* 42(9-10):46-50.
- SCAMMON, C.M. 1968. The marine mammals of the northwestern coast of North America: described and illustrated, together with an account of the American whale fishery. 2nd ed. New York: Dover. 319 p.
- SLIJPER, E.J. 1979. Whales. Ithaca, N.Y.: Cornell University Press. 511 p.
- SONNTAG, R.M., ELLISON, W.T., CLARK, C.W., CORBIT, D.R., and KROGMAN, B.D. 1986. A description of a tracking algorithm and its application to bowhead whale acoustic location data collected during the spring migration near Point Barrow, Alaska 1984-85. Report International Whaling Commission 36:299-310.
- WURSIG, B., DORSEY, E.M., FRAKER, M.A., PAYNE, R.S., and RICHARDSON, W.J. 1985. Behavior of bowhead whales, *Balaena mysticetus*, summering in the Beaufort Sea: a description. *Fishery Bulletin U.S.* 83(3):357-377.
- ZEH, J.E., KO, D., KROGMAN, B.D., and SONNTAG, R.M. 1986a. Statistical considerations in estimating the number of bowhead whales, *Balaena mysticetus*, from ice-based visual census data. Report International Whaling Commission 36:317-323.
- . 1986b. A multinomial model for estimating the size of a whale population from incomplete census data. *Biometrics* 42:1-14.

Latitude 71 18 N
Longitude 156 47 W

Barrow, Alaska
Sunrise and Sunset for 1991

Nautical Almanac Office
U.S. Naval Observatory
Washington, D.C. 20392-5100

Alaska Standard Time

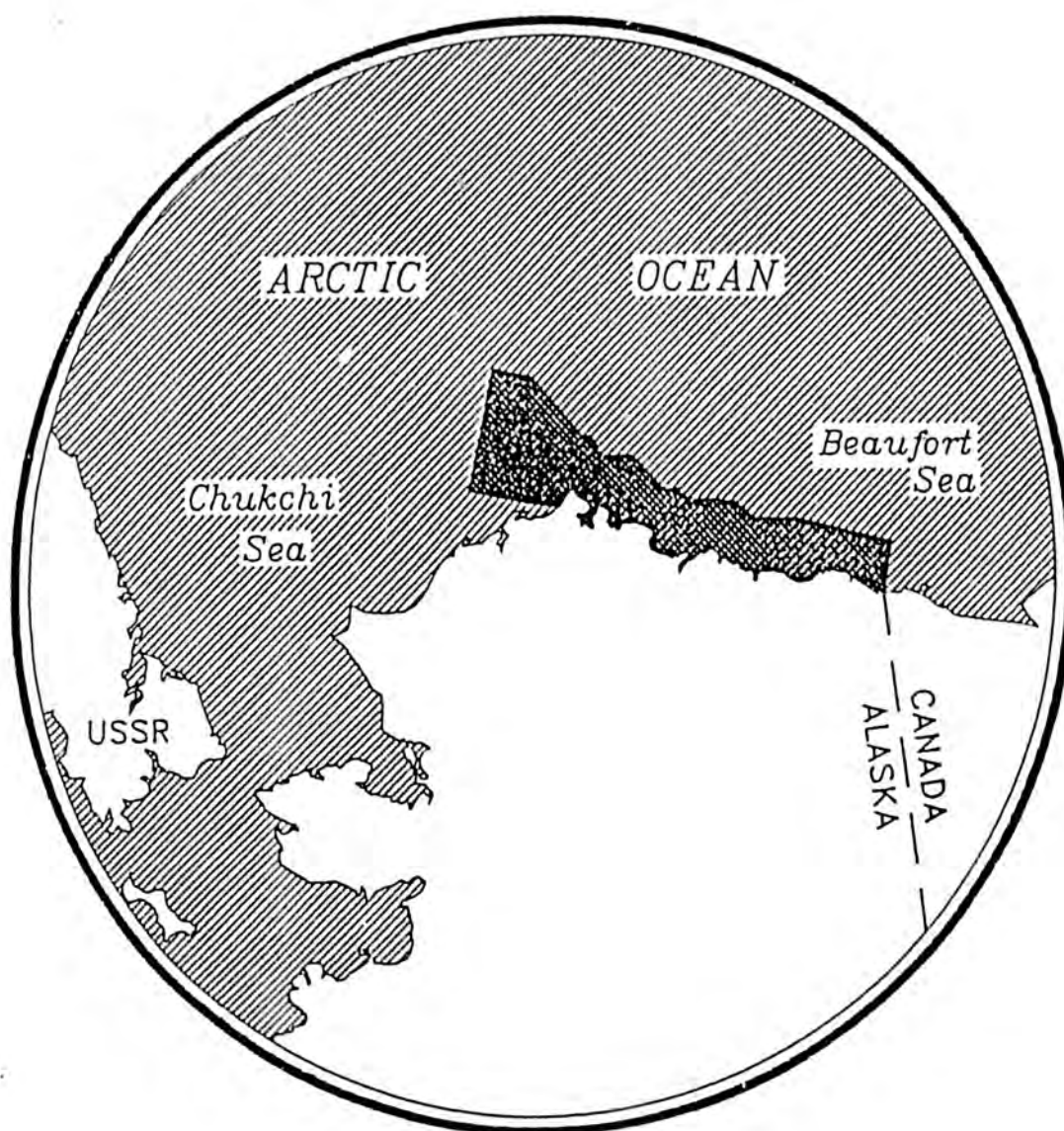
	Jan.		Feb.		Mar.		Apr.		May		June		July		Aug.		Sept.		Oct.		Nov.		Dec.	
Day	Rise	Set	Rise	Set	Rise	Set	Rise	Set	Rise	Set	Rise	Set	Rise	Set	Rise	Set	Rise	Set	Rise	Set	Rise	Set	Rise	Set
	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
1	****	****	1138	1545	901	1820	626	2038	336	2318	****	****	****	****	****	****	533	2118	744	1847	1013	1607	****	****
2	****	****	1131	1552	856	1825	621	2043	329	2326	****	****	****	****	147	120	538	2113	748	1842	1019	1601	****	****
3	****	****	1124	1559	851	1829	616	2048	321	2334	****	****	****	****	216	052	542	2108	753	1838	1025	1555	****	****
4	****	****	1118	1606	846	1834	611	2052	313	2342	****	****	****	****	231	036	547	2102	757	1833	1031	1549	****	****
5	****	****	1111	1612	841	1839	606	2057	305	2351	****	****	****	****	244	024	551	2057	802	1828	1037	1543	****	****
6	****	****	1105	1619	836	1843	601	2101	256	****	****	****	****	****	255	013	556	2052	806	1823	1044	1537	****	****
7	****	****	1059	1625	831	1848	556	2106	246	000	****	****	****	****	304	003	600	2047	810	1818	1050	1530	****	****
7															2354									
8	****	****	1053	1631	826	1852	550	2111	235	011	****	****	****	****	313	2345	605	2042	815	1813	1057	1524	****	****
9	****	****	1047	1637	821	1857	545	2115	222	024	****	****	****	****	321	2337	609	2037	819	1808	1104	1517	****	****
10	****	****	1041	1643	816	1901	540	2120	207	039	****	****	****	****	329	2330	614	2032	824	1803	1111	1510	****	****
11	****	****	1036	1649	811	1906	535	2125	142	104	****	****	****	****	337	2322	618	2027	828	1758	1118	1503	****	****
12	****	****	1030	1654	806	1910	529	2130	****	****	****	****	****	****	344	2315	623	2022	833	1753	1126	1455	****	****
13	****	****	1025	1700	801	1914	524	2135	****	****	****	****	****	****	350	2308	627	2017	837	1748	1135	1447	****	****
14	****	****	1019	1705	756	1919	519	2140	****	****	****	****	****	****	357	2302	631	2012	842	1743	1144	1439	****	****
15	****	****	1014	1711	751	1923	513	2145	****	****	****	****	****	****	403	2255	636	2007	847	1738	1153	1429	****	****
16	****	****	1008	1716	746	1928	508	2150	****	****	****	****	****	****	409	2249	640	2002	851	1733	1204	1419	****	****
17	****	****	1003	1721	741	1932	502	2155	****	****	****	****	****	****	415	2242	644	1957	856	1727	1216	1407	****	****
18	****	****	957	1726	736	1937	457	2200	****	****	****	****	****	****	421	2236	648	1952	901	1722	1232	1352	****	****
19	****	****	952	1732	731	1941	451	2206	****	****	****	****	****	****	427	2230	653	1947	905	1717	1300	1324	****	****
20	****	****	947	1737	726	1945	445	2211	****	****	****	****	****	****	432	2224	657	1942	910	1712	****	****	****	****
21	****	****	942	1742	721	1950	440	2216	****	****	****	****	****	****	438	2218	701	1937	915	1707	****	****	****	****
22	****	****	937	1747	716	1954	434	2222	****	****	****	****	****	****	443	2213	706	1932	920	1702	****	****	****	****
23	1310	1409	931	1751	712	1958	428	2228	****	****	****	****	****	****	449	2207	710	1927	925	1656	****	****	****	****
24	1252	1428	926	1756	707	2003	422	2233	****	****	****	****	****	****	454	2201	714	1922	930	1651	****	****	****	****
25	1238	1442	921	1801	702	2007	416	2239	****	****	****	****	****	****	459	2156	718	1917	935	1646	****	****	****	****
26	1227	1453	916	1806	657	2012	409	2245	****	****	****	****	****	****	504	2150	723	1912	940	1640	****	****	****	****
27	1217	1504	911	1811	652	2016	403	2252	****	****	****	****	****	****	509	2145	727	1907	946	1635	****	****	****	****
28	1208	1513	906	1815	647	2021	356	2258	****	****	****	****	****	****	514	2139	731	1902	951	1629	****	****	****	****
29	1200	1522			642	2025	350	2305	****	****	****	****	****	****	519	2134	736	1857	956	1624	****	****	****	****
30	1152	1530			637	2030	343	2311	****	****	****	****	****	****	524	2129	740	1852	1002	1618	****	****	****	****
31	1145	1538			631	2034			****	****	****	****	****	****	528	2123			1008	1613			****	****

When sunlight, twilight, or darkness exceeds 24 hours, the beginning and end of such intervals are physically uncertain and no limits of precision can be stated. Add one hour for daylight time when and if in use. (**** = NO PHENOMENON)

Alaska Outer Continental Shelf

Beaufort Sea Planning Area Oil and Gas Lease Sale 124

Final Environmental
Impact Statement



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

MMS

NORTH SLOPE BOROUGH

OFFICE OF THE MAYOR

P.O. Box 69
Barrow, Alaska 99723

Phone: 907-852-2611

George N. Anmaogak, Sr., Mayor



May 8, 1990

Alan D. Powers
Regional Director
Minerals Management Service
949 East 36th Avenue, Room 110
Anchorage, AK 99503-4302

RECEIVED
MAY 22 1990

RE: PROPOSED BEAUFORT SEA LEASE SALE 124

REGIONAL DIRECTOR, ALASKA OCS
Minerals Management Service
ANCHORAGE, ALASKA

Dear Mr. Powers:

As should have been very evident from the testimony of our residents at the well-attended public hearings in Barrow, Kaktovik, and Nuiqsut on April 17, 18, & 19 respectively, the North Slope Borough remains strongly opposed to this proposed offshore lease sale. The reasons given for opposition to the sale by Borough and local officials, our elders, whaling captains and crews, wives and mothers, social and health workers, tribal representatives, biologists, and many others were varied, but together left little doubt about the local sentiment against offshore activities in the Beaufort Sea. We continue to believe that oil and gas leasing, exploration, and development should be restricted to onshore or shallow-water tracts, where proven techniques and technologies can be employed to significantly limit impacts from both day to day operations and catastrophic events. No one can yet make the same claim with respect to offshore operations requiring the use of drillships. These comments will be in two major parts; Section I will discuss our general position that leases should not be sold in the arctic OCS in waters which would require drilling from floating structures, and Section II will deal with specific provisions of the Sale 124 Draft EIS.

SECTION I. OCS LEASE SALES IN THE ARCTIC NOT SUPPORTABLE

We believe that the path from leasing to development is a downhill one; that a bias in the regulatory process increases the likelihood with each successive step that the following step will find approval. Recognizing this, we do not believe that the first

NSB
1

Letter to Alan Powers
May 8, 1990
Page 2

step (leasing) should be undertaken unless and until firm assurances can be made, based on good scientific evidence, that the intermediate step (exploration) and final steps (development and transportation) can be undertaken safely and with minimal disturbance of wildlife and subsistence activities. Without that essential base scientific evidence, including a much broader understanding of arctic ecosystems, noise impacts, and the effectiveness of oil spill clean-up techniques in the region, the leasing and regulatory agencies are playing a high stakes guessing game with our shared biological heritage and the Inupiat culture.

NSB
1

We are not alone in questioning the sufficiency and quality of the scientific information which has underlain federal and state decisions concerning offshore industrial activities. The Arctic Research Commission was created by the Arctic Research and Policy Act of 1984 (15 USCS § 4102) to "promote Arctic research and to recommend Arctic research policy", and is composed of five members appointed by the President. In December 1989 the Commission published a fourth in its series of FINDINGS AND RECOMMENDATIONS reports with the title IMPROVEMENTS TO THE SCIENTIFIC CONTENT OF THE ENVIRONMENTAL IMPACT STATEMENT PROCESS. The report states that the Commission undertook a review of the EIS process "(b)ecause accurate scientific and technical information and adequate data bases are such a fundamental requirement, and because the Arctic presents very unique environmental problems". (p. vii) The Commission identified an imperative need to improve the EIS process in several respects, but concluded that the "most critical deficiency is the absence of impartial external quality-control mechanisms for the data and information used in the stages of scoping, synthesis and EIS preparation, and the follow-up monitoring programs." (p. 1) While we urge you to carefully review and respond to the entire brief report before proceeding with this lease sale or permitting any other industrial activity on the Alaskan OCS, several of the document's findings and conclusions merit special mention here:

p.5. The effects of man-made environmental insult are aggravated by the relatively small number of species in arctic ecosystems and the slowness of environmental recovery (environmental fragility). The result is that there are few comparable precedents on which to base EIS predictions in Alaska, and that the environmental consequences of erroneous predictions can be far more serious and long-lasting than in temperate regions.

NSB
2

In the Arctic, including the Alaskan Arctic, there is a serious lack of data and information concerning the

NSB
3

physical and biological (ecological) environment covering long periods of time, on a decadal scale.

NSB
3

p.6. The scoping process is sometimes perceived to be organized to support decisions already made.

NSB
4

EIS's are often viewed as supporting agency opinions rather than being the basis for such opinions.

NSB
5

Too many nonverifiable hypotheses and unstated assumptions are included in the EIS, and much of the documentation is based on the "gray literature."

NSB
6

p.11. To improve the EIS process, impartial external scientific and engineering review mechanisms should be established for each of the following three stages: The scoping plan; Synthesis and preparation of the EIS; and Environmental monitoring programs.

NSB
7

Some decisions stipulate that an environmental monitoring program is to become part of the project. Peer review of the design of the monitoring procedures will help assure accurate and usable results.

Also instructive is the February 1990 final report of the Alaska Oil Spill Commission, entitled "SPILL: The Wreck of the Exxon Valdez". While this report focuses primarily on the Prince William Sound tragedy, it also contains several important general observations, as well as specific recommendations concerning continued industrial activities in the arctic. We ask that you consider the entire report and respond to these points before you proceed with this lease sale:

p.100. The consequences of the Exxon Valdez oil spill have brought into question the usefulness of existing oil spill containment and pollution-abatement technologies, not only for a catastrophic spill the size of that from the Exxon Valdez (10.8 million gallons) but also for any major oil spill in an offshore, remote or sensitive area.

NSB
8

In general, none of the currently available technologies are adequate for these incidents. In the United States, almost all existing technology has been developed for use in harbors and other protected waters, not in offshore, remote or environmentally sensitive waters.

p.125. Conclusions reached for Prudhoe Bay were that in summer the spill response would be effective for small spills, but that there was insufficient equipment to contain and recover a large spill. Contingency planning at Prudhoe Bay relies heavily on the ARCAT skimmer, but there have been no tests to see how well it recovers oil, specifically how well it would recover highly weathered Prudhoe Bay crude.

NSB
9

During fall at Prudhoe Bay the spill response in a growing offshore ice field would be only marginally effective with present equipment. Spill response on shorefast ice would not be easy, but there would be more time to marshal heavy equipment and personnel out on the ice where scrapers and front-end loaders could recover the pooled oil. During breakup there could be a period of several weeks in which the only action response crews could undertake would be to watch the interaction of the ice and the spilled oil....

NSB
10

The picture is bleak for remote areas. An effective response effort for a large spill from a drill ship or a tanker accident very far from Prudhoe Bay or Barrow would be extremely difficult...[u]sing airborne applications of chemicals, either dispersants or gelling agents, has received no testing whatsoever in these conditions, and none is known to work on heavy crude oils at typical arctic temperatures.

NSB
11

p.144. The long-term need to develop environmental safety regimes of great stringency cannot be ignored. Development of arctic oil discoveries dependent on maritime transportation should await the preparation of approved systems of oil transportation using experience gained from the trans-Alaska pipeline system.

NSB
12

p.201. The commission does not think that oil should be developed to production in any arctic area without a substantial planning effort on the transportation leg.

NSB
13

We have long argued that drilling from floating structures, and therefore lease sale terms which would permit such drilling, are insupportable in arctic waters. You simply do not have enough good baseline scientific data to appropriately assess the environmental risks posed. You do not know how bowhead (and belukha) whales are impacted by industrial noise; just how vital their ability to communicate is to navigation in heavy ice

NSB
14

NSB
15

Letter to Alan Powers
May 8, 1990
Page 5

conditions, whether heavy seismic activity has damaged the hearing of individual whales, whether whales have already been driven from traditional migratory and feeding areas, or if intense localized drilling, support, or seismic noise could act as a migratory barrier and subject a large aggregation of animals to increased risk from environmental hazards. You are not certain how whales and other organisms would be affected by exposure to spilled oil in the arctic environment; whether an entire migratory pulse of whales could be harmed by even a comparatively small spill which could not be avoided due to environmental conditions, how long oil and its toxic byproducts would persist and migrate in the cold and ice of the arctic, or how spilled oil would affect krill, mollusk, and fish populations, and the higher organisms which feed on them, including seals, walrus, whales, and man. You are unsure of industry spill response, clean-up, and containment technologies under ideal conditions and in accessible locations, much less in the harsh and remote environment of this proposed sale. All this and more is the information which must be known before the true risks of oil exploration, development, and transportation can be determined. Without really understanding these variables, rather than just paying lip service to them, you cannot know whether the risks outweigh, or are outweighed by, the supposed benefits which you also accept with little basis. We strongly recommend that the final EIS contain as a preferred alternative a sale which would only offer for lease those tracts in water depths which could be explored and drilled from islands or bottom-founded drilling structures.

SECTION II. PREFERRED ALTERNATIVE AND PROPOSED MITIGATING MEASURES OF DEIS DO NOT ADEQUATELY PROTECT SALE AREA ENVIRONMENT OR SUBSISTENCE ACTIVITIES

As explained above, we do not believe any Beaufort Sea tracts should be leased which would require exploratory drilling to be conducted from floating structures. Drilling from floating structures, whether anticipated under the low, base, or high case scenarios offered in the DEIS, would not comply with the provisions of the North Slope Borough Coastal Management Program prohibiting (1) significant interference with subsistence whaling, (2) jeopardy to the continued availability of whales for subsistence, (3) depletion of subsistence resources below the needs of local residents, (4) preclusion of reasonable access to subsistence resources, and (5) noise disturbance in areas of concentrated wildlife, and those provisions requiring effective oil spill control and clean-up plans. Our belief that drilling cannot now be conducted from floating structures with the required assurances of safety and non-interference with wildlife and subsistence

NSB
15

NSB
16

Letter to Alan Powers
May 8, 1990
Page 6

activities is reflected in the Offshore Drilling Policy contained in the revised Land Management Regulations recently adopted by the Borough Assembly.

The debate over the need for, and scope of, any seasonal drilling restriction (SDR) to protect migrating bowhead whales has often dominated the discussions preceding previous Beaufort Sea lease sales, including Sale 97, held in March 1988. We have consistently argued that the burden falls on those desiring to lease and explore offshore tracts to prove that exploration, development, transportation and related activities will not have an adverse impact on these endangered animals or the subsistence harvest. To its credit, the State of Alaska has acknowledged the potential threats posed by industrial activities, and has recently adopted a revised Beaufort Sea SDR. This new policy, unfortunately, only addresses potential noise impacts, and has left to a later date further improvement of measures to minimize oil spill threats.

The SDR embodied in our Offshore Drilling Policy, though applicable directly only in State waters, addresses both noise and oil spill threats, and will be our guide in any consistency review of proposals in federal waters as well. The policy is as follows:

19.70.040 Offshore Development Policies. The following policies are intended to guide the approval of development and uses in the portion of the Beaufort Sea within the Borough boundary. Case by case extensions to the time periods below may be granted during approval or as a use permit if the activity will not significantly impact subsistence activities, will have minimal environmental risk, and all review agency comments have been addressed.

- A. Drilling shall be conducted from bottom founded structures.
- B. Drilling above threshold depth may occur year-round.
- C. Drilling below threshold depth shall be conducted during the winter (November 1 through April 15) and be completed as early in this period as practicable.
- D. Confirmation, extension or delineation drilling, well testing and other well completion activities shall be completed by June 15. Consistent with C above, any additional drilling or other activities shall not penetrate any new oil or gas bearing formations, or significantly increase the risk of an oil spill.

NSB
16

NSB
17

- E. All nonessential boat, barge and air traffic associated with drilling activity shall occur prior to or after the period of whale migration through the area. Essential traffic (traffic that could not reasonably occur prior to or after the period of whale migration through the area) shall avoid disrupting the whale migration, subsistence activities, and be coordinated with the Alaska Eskimo Whaling Commission.

- F. Year-round drilling can occur following the unitization and approval of the Plan of Operation and Borough approval of a Master Plan and rezoning to the Resource Development district for the proposed development.

By comparison, the proposed Stipulation 8 of the DEIS falls short of providing adequate protection for whales, other wildlife resources, and the subsistence harvest. While if imposed, the stipulation is an incremental step in the right direction for MMS, its time frames are not restrictive enough, drilling from floating structures is permitted when adequate spill response capability does not exist, and it fails to address the potential cumulative impacts of development.

Alternative I is unacceptable in other respects as well. Both the Barrow and Kaktovik Deferral Areas should be removed from consideration for this proposed sale and future sales. You should refer to our October 27, 1988 comments during the scoping process for Sale 124, and again to our Sale 97 comments, for extended discussions of the need to defer these areas. The Spring lead system around Barrow remains a unique and sensitive area of concentrated biological diversity and subsistence activities. Although the DEIS states that the risk of oil contact with bowheads is low, we think it is clear that the consequences of an oil release into the Spring lead system could be catastrophic. The Bering Sea stock of bowheads typically migrates through a very confined area (Pt. Franklin, Pt. Hope, Pt. Barrow) in a relatively short period of time. In some years (e.g. 1980 and 1988) more than 90% of the population may move past Point Barrow in less than two weeks. This behavior, and the nature of the confining lead system itself, could make a dangerously high percentage of the population vulnerable to harm should oil be released or persist in this migratory corridor.

As we stated in our previous comments, you should accept as true the long-held Inupiat belief that the waters to the east of Barter Island are an important bowhead feeding area. So often in

the past, outsiders were slow to accept Inupiat claims about their environment which were later proven correct only after much time-consuming and expensive research. In addition, information available only since our last comments has indicated the importance of the ANWR coastal plain and adjacent waters to denning polar bears. With the continued closure of ANWR to industrial activity, far greater consideration must also be given to the difficulties of oil transportation over extended distances offshore before tracts in the eastern Beaufort are leased.

In addition, the DEIS understates the potential negative cumulative impacts of oil exploration, development, and transportation. The document states that in the cumulative arctic case, there is a 99% chance of an oil spill in excess of 1000 barrels, with it most likely that there will be eight such spills. Looking at only the Beaufort Sea, the probability of one or more spills of at least 1000 barrels is stated to be 49% in the base case, and 91% in the high case. These are disturbing predictions to our coastal residents who subsist largely off the resources of the ocean.

The DEIS also states that since 1964, there have been twenty OCS spills of greater than 1000 barrels. While this is touted as an impressive statistic, it means to us that the eight spills predicted for the arctic represent a number of incidents equal to a full 40% of those occurring on the entire OCS over a period of 26 years. Unless arctic activity is expected to be at a level approaching 40% of all OCS activity over the past 26 years, it appears that MMS is anticipating greater difficulty in operating safely in the arctic than has been experienced elsewhere. Coupled with the far greater difficulty in responding to such significant spills in the arctic, we have little confidence that we should not expect significant cumulative impacts over the life of arctic OCS development.

There is also information available, but not discussed in the DEIS, which should raise serious concerns over the possibility that vastly increased vessel traffic associated with development could impact the bowhead population. The Borough has documented scarring on whales which is believed to be the result of collisions with ships. The incidence of bowhead/ship collisions appears to be low (ca. 2%), and is probably not a significant source of mortality for the Bering Sea stock. This low rate is most likely attributable to the low level of vessel traffic within their range. Socializing right whales, however, have been found particularly vulnerable to collisions when they become apparently oblivious to approaching

NSB
20

NSB
21

NSB
22

NSB
23

NSB
24

NSB
18

NSB
19

NSB
20

Letter to Alan Powers
May 8, 1990
Page 9

vessels (Goodyear 1989).¹ That the same may be true of bowheads is evident in film recently shot by scientists having just completed a tagging effort in the eastern Beaufort Sea. Individual animals repeatedly collided with their vessel while the boat moved among a large aggregation of apparently socializing and feeding bowheads.

Ship collisions are not infrequent for the North Atlantic Right Whale (NARW), a species closely related to the bowhead. Kraus (1990) has found evidence that perhaps 33% of NARW mortality is human induced, and that ship collisions are a significant problem.² He suggests that such human-induced mortality may be preventing recovery of the NARW stock despite a more than 70-year ban on commercial hunting. Our concern is that increased vessel traffic, including ice breakers operating in lead systems, will lead to a dangerous increase in the incidence of bowhead/ship collisions.

SECTION III. CONCLUSION

We have discussed the State of Alaska's position on the Sale 124 DEIS with agency officials, and agree with much of their analysis regarding the shortcomings of the document's proposed mitigating measures and the need for the Barrow and Kaktovik Deferrals. Because our position, however, is that lease tracts should not be sold in waters which cannot be explored and drilled from bottom-founded structures, we find it unnecessary to comment on much of the DEIS. We do ask that you carefully consider and where appropriate, specifically respond to, the comments of those who testified at the public hearings in our villages. The elders who spoke particularly deserve a response to their concerns that bowheads and other subsistence resources have already been significantly displaced by industrial activity, and that current technology can neither withstand worst-case ice and weather conditions, nor deal with significant oil spills in this environment. You should respect the fact that no one knows this environment better than its Inupiat residents, and no one will

¹ Goodyear, J. 1989. Feeding ecology, night behavior, and vessel collision risk of Bay of Fundy right whales. In: Abstracts of the Eight Biennial Conference on the Biology of Marine Mammals. Available from: The Marine Mammal Society.

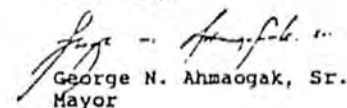
² Kraus, S. 1990. Rates and potential causes of mortality in North Atlantic right whales. Marine Mammal Science. (In press).

Letter to Alan Powers
May 8, 1990
Page 10

suffer more if your best guesses as to the potential impacts of offshore oil development prove wrong.

Thank you for this opportunity to comment.

Sincerely,


George N. Ahmaogak, Sr.
Mayor

cc: Steve Cowper, Governor
Ron Morris, NMFS
Mayor Don Long, Barrow
Mayor Thomas Napageak, Nuiqsut
Mayor Herman Aishanna, Kaktovik
Dan Fauske, Acting CAO
Warren Matumeak, Director, Planning
Ben Nageak, Director, Wildlife Management
Edward Hopson, Chairman, AEW
Jessica LeFevre, AEW Attorney
Elizabeth Benson, Division of Governmental Coordination
Dennis Roper, Federal Affairs
Anthony Kesler, State Affairs
Eugene Brower, President, BWCA
Tom Albert, Borough Senior Scientist
Tom Lohman, Assistant Borough Attorney
mayor/powers5.gna/k

receive statements on actions of the kind proposed.

The agencies, institutions, groups, and individuals that were sent copies of the DEIS for review and comment are listed in Section VI.C. The distribution of the Sale 124 DEIS provides an opportunity for many individuals from many professions—including the natural and social sciences, legal, regulatory, health care, and engineering, as well as private citizens—to comment on the adequacy of the statement, merits of the alternatives, or both. Responses to comments received might include the following: (1) modifying alternatives, including the proposed action; (2) developing and evaluating alternatives not previously considered; (3) supplementing, improving, or modifying the analyses; or (4) making factual corrections. The MMS considers this review and comment process ensures a full and fair analysis of the potential effects that the proposed oil and gas lease sale might have on the environment. The scoping process is part of the EIS process and thus subject to review, comment, and responses as are other parts of the EIS.

Monitoring programs are developed in conjunction with other Federal agencies and with State and local agencies that either have jurisdiction with respect to the program by law or special expertise or are authorized to develop and enforce environmental standards. The MMS considers that the consultation process used to develop monitoring programs will result in the acquisition of information to address the environmental concerns the programs are established to monitor.

NSB-8:

The quoted conclusion from the Alaska Oil Spill Commission is consistent with the analysis of effectiveness of oil-spill response in Section IV.A.2. The analyses of effects in this EIS do not assume mitigation through response efforts. See also Response MMC-16.

NSB-9:

The "large spill" discussed by State of Alaska, AOSC (1990), was an instantaneous, unconfined spill of 50,000 bbl. By "effective," the AOSC meant recovery of at least the bulk of the spilled oil. It is unlikely that effective recovery would occur for such a spill anywhere offshore, much less than in Prudhoe Bay. Such effectiveness is not presumed in this EIS as discussed in Section IV.A.2. The AOSC conclusion is based more on circular reasoning than on an analysis (State of Alaska, AOSC, Appendix L, p. 4, regarding a Prudhoe Bay-spill response): "For large spills, there probably would not be enough equipment to contain and recover the oil so large quantities of spilled oil would escape into the environment. It is never possible to anticipate exactly how much recovery equipment will be necessary for spill response, but experience has shown that there is never enough."

The likely effectiveness of the ARCAT skimmer in recovery of highly viscous crude (such as weathered Prudhoe Bay crude) is discussed in Section III.D of Appendix M in this EIS. Rope-mop skimming devices, such as used by the ARCAT, are generally more effective with higher viscosity oils than with lower viscosity oils. Part of the concern of AOSC with the ARCAT is based on an assumption that Prudhoe Bay crude at 0 °C (32 °F) is near its pour point (temperature at which oil will no longer flow). The pour point of Prudhoe Bay crude is actually much lower, -23 °C (-10 °F) (Payne et al., 1984a).

NSB-10:

Potential response efforts during freezeup and breakup are discussed in Section IV.A.2 and Appendix M (Sec. III.E) of the EIS. Figure IV-A-2-4 summarizes the applicability of oil-

spill-response techniques in the proposed sale area. There are few response options for both breakup and freezeup, and these are undemonstrated in the Arctic. Complicating matters, spills frozen into winter multiyear ice—the dominant winter-ice form in the sale area—would gradually melt out during the following summer, with about 10 percent of the oil not melting out until a second summer. In a freezeup spill, the spilled oil would be scavenged by grease ice and would either have to be mechanically separated from the ice or removed with the ice for recovery. Once the grease ice solidified, the oil would be trapped within the ice matrix and would be recoverable only by cutting and removing the ice or by waiting until meltout the next summer. In addition, landfast ice beyond about a 10-m water depth does not dependably thicken sufficiently to allow mobilization of heavy equipment until January. Thus, heavy equipment may not be usable for up to a 3-month period during fall freezeup and early winter.

The most effective procedure for spills during both freezeup and breakup may be to wait and ignite pools of oil on the ice as they form during the following breakup and summer(s).

NSB-11:

Crude tankers are not anticipated to be used for oil shipment in the Beaufort Sea Planning Area for either the Proposal or the cumulative case. Response would be difficult. As a rule of thumb, logistical constraints (e.g., fuel versus dispersant loads, flight and loading times, number of daylight and weather hours, airfield locations) may restrict effective aerial application of dispersants to spills within 50 nmi of land. There have been unsuccessful dispersant field tests—only partly attributed to cold-water effects—in the Canadian Beaufort Sea, resulting in the recommendation that dispersants not be considered a primary response tool in the Arctic (Swiss and Vanderkooy, 1988).

NSB-12:

The system used to transport any commercial oil discoveries will depend on where the oil is discovered and the environmental features at and near the discovery site: the amount and characteristics of the oil; the relative costs of constructing, operating, and maintaining various systems that might be used; regulatory requirements; and the possible use of existing transportation systems. Existing transportation facilities that might be utilized to transport any oil from the Beaufort Sea Planning Area might include TAP, the Kuparuk or Endicott Pipelines, and tankers from the Marine Terminal in Valdez, Alaska; these are approved facilities.

Before production can begin on a lease, the lessee must submit a Development and Production Plan to MMS in accordance with the requirements of 30 CFR 250.34. The plan must include a description of the means proposed for transportation of oil and gas to shore, the routes to be followed by each mode of transportation, and the estimated quantities of oil or gas, or both, to be moved along each route. After the plan has been deemed submitted, copies are sent to the Governor or the Governor's designated representative and also to the CZM agency of each affected State as well as the executive of each affected local government that requests a copy. Copies of the plan must be made available to appropriate Federal agencies, interstate entities, and the public. Comments and recommendations are submitted to MMS and are processed in accordance with regulations in section 30 CFR 250.34 and regulations governing Federal CZM consistency procedures, 15 CFR Part 930. A development and production plan may be (1) approved; (2) modified if it determined the lessee has failed to make adequate provisions for safety, environmental protection, or conservation of resources; or (3) disapproved if:

TELECOPY COVER SHEET

Barrow Legislative Information Office

Office - (907) 852-7111

Fax - (907) 852-7114

TO: (H) SPEC. COMM. ON OIL + GAS FAX: 465-2864 PHONE: _____

FROM: MARIE ADAMS - MEMBER, ALASKA + INUVIALUIT
BELUGA WHALE COMM. PHONE: 852-2611INSTRUCTIONS: WRITTEN TESTIMONY AS MS. ADAMS
WAS UNABLE TO TESTIFY AT 4/8 TELECONFERENCED
HEARING DUE TO COMMITTEE'S TIME CONSTRAINTS.

RECEIVED: Date _____ Time _____

SENT: Date 4/15/91 Time 12:05

DISPOSAL OF ORIGINAL: Discard _____ Hold for Pickup _____

NUMBER OF PAGES: 1 (Not counting cover sheet)

SENT BY: PJohn

Comments on House Joint Resolution No. 36
Marie Adams

Thank you for this opportunity to comment on the House Joint Resolution No. 36 relating to off-shore oil activities in arctic waters. My name is Marie Adams. I have been involved with marine mammal issues in the north slope for over ten years, first as Executive Director of the AEWG and currently with the Alask Marine Resource Commission and the Alaska & Inuvialuit Beluga Whale Committee organized in 1988 because of the concerns local hunters and researchers had about beluga whales in Alaska.

First of all, I want to express my deep concerns about the ability of the oil industry to clean up an oil spill in arctic conditions. The oil companies who operate in the arctic have impressive oil spill contingency plans in place on paper. However, in 1988 when the much publicized gray whale rescue attempts were being made local, state, federal representatives including the oil companies and the Russian ice breakers tried to help. The heavy equipment that was stored in Prudhoe Bay to help clean up an oil spill, in the event such a thing happen, were deployed to assist in the rescue effort and everyone waited to see what would happen. The equipment failed miserably. This equipment was too heavy and cumbersome and could not be easily transported.

The local residents who are most familiar with the arctic conditions came up with a way of getting the whales through the ice with the least amount of harm to the whales. I have no faith in the industries abilities since none of their equipment has been demonstrated to be effective in realistic arctic environmental conditions.

This leads me into the other area of concern, the local knowledge of experience whaling captains and hunters and researchers continue to be over looked. I would like to see our local experts actively participate in the assessment of the oil industries ability to clean up an oil spill. This includes monitoring oil spill clean up drills that the state calls for occasionally to see if the oil industry is ready to respond to a spill. Until I hear the assessment of the industries capabilities from our own local experts, I will not be at rest with this issue.

Finally, the House Joint Resolution number 36 which I strongly support is a call for fairness. President Bush called for a halt of offshore oil and gas lease sales in the lower 48 where there has been decades of experience in dealing with offshore oil and gas exploration and development. I can not understand why the arctic was not initially considered. It would seem appropriate to evaluate whether or not the oil spill plans will work in relatively unspoiled arctic waters.

Thank you.

(3) Locally Available Spill-Cleanup Equipment: The MMS, Alaska OCS Region, requires a lessee who wishes to drill to have an initial spill-response capability of 1,000 bbl per day. To date, during drilling of exploration wells in the Beaufort Sea, this requirement has been met with equipment warehoused at Deadhorse by ABSORB and with equipment positioned onsite by individual lessees.

(4) Mobilization Time: The MMS, Alaska OCS Region, requires that initial mobilization and deployment of response equipment be undertaken within 6 to 12 hours of a spill, geography permitting. However, the spiller must be prepared to respond before the spill reaches shore (in less than 6 hours, if necessary). Only onsite equipment and that which could be transported from Deadhorse by helicopter could meet this guideline for deployment for most of the sale area. The limited geographic and temporal presence of open water and slow vessel speeds in broken ice would preclude timely transport of spill equipment by sea. For large spills--those that could exceed the local cleanup-response capability--the MMS, Alaska OCS Region, requires that additional equipment be made available onsite within 48 hours. Additional response equipment to handle a large spill would be available from a multitude of sources.

Equipment stored at Deadhorse or airlifted to Deadhorse would be capable of meeting the criteria of the 48-hour-response time set by MMS. Additional, slower arriving equipment would still be useful in case of a major spill; but MMS would not consider such equipment in judging whether oil-spill-contingency plans met the MMS 48-hour-response criteria. Once spill-cleanup equipment reaches Deadhorse or Prudhoe Bay, it could be transported relatively quickly to the spill site only if it could be carried by helicopter and then only if weather permitted. A helicopter could reach any point in the sale area within 3 hours.

(5) Effectiveness of Oil-Spill Cleanup At Sea: The 6-to-12-hour and 48-hour response times required of drilling lessees by the MMS, Alaska OCS Region, are mobilization and deployment requirements. Cleanup would continue as long as necessary, without any timeframe or deadline. For example, a winter spill in pack ice might require initial onsite response followed by further cleanup of oil melting out and pooling on top of the ice in late spring or summer.

Mechanical cleanup at sea is usually much more effective on low-viscosity or medium-viscosity oils than on high-viscosity oils. A low-viscosity oil could be a diesel or a fresh, light crude. A medium-viscosity oil could be a lubricating oil or a light, flowing emulsion. A high-viscosity oil would be a weathered crude, bunker oil, or thick emulsion. An oil such as Prudhoe Bay crude would initially have low viscosity but would quickly weather and form a high-viscosity emulsion.

Because of natural dispersion, oil slicks in the open ocean are seldom tracked for more than about 10 days before the oil becomes too dispersed to locate or identify as a slick (USDOL, MMS, Gulf of Mexico [GOM] OCS Region, 1983). Out of necessity or otherwise, natural dispersion has frequently been the chosen response technique in Alaskan waters.

Uncontained burning also is a possible spill remedy. Experiments suggest that burn efficiencies on the order of 50 to 60 percent may be possible if the spill can be immediately set on fire (Laperriere, 1984). However, any delay in ignition would decrease combustion efficiency. The effectiveness of mechanical recovery and in situ burning of spilled oil at sea decreases rapidly with increasing sea state (roughness of the sea), while the effectiveness of dispersants and natural dispersion increases. Mechanical cleanup becomes nonfunctional between International Sea States 3 and 4. Question 1

During the months of July through September in the small fraction of the Beaufort Sea Planning Area with open water, sea states of 3 or greater occur from 13 to 30 percent of the time, and sea states of 4 or greater occur 9 to 18 percent of the time. Ice cover the remainder of the year would eliminate both high sea states and standard uses of most mechanical-cleanup equipment.

The review of the historical record of oil-spill cleanup at sea as contained in Section IV.B.5 of the Final Regional EIS (USDOL, MMS, GOM OCS Region, 1983) is incorporated by reference; a summary of this review follows. Offshore containment and cleanup are major tasks. Weather, sea conditions, and crew fatigue become critical factors; and cleanup at sea is generally only marginally effective. Recovery of oil usually ranges between 5 percent and 15 percent of that spilled. For example, in the Exxon Valdez oil spill, at-sea recovery of oil was estimated by Exxon at 0.01 percent through the first 2 weeks and 7 percent through the first 3 weeks (Oil Spill Intelligence Report, 1989a,b). Inshore (harbor) containment and cleanup operations generally occur in calmer waters and closer to logistical bases. Inshore operations are, therefore, more effective, with recovery of spilled oil on the order of 20 to 50 percent.

SALE 124 EIS

Historical demonstrations of the effectiveness by actual spill-response efforts in the Beaufort Sea are few and disappointing. Crowley Barge Tanker 570 spilled 1,600 barrels of heating fuel near Flaxman Island on August 20, 1988, apparently after ice ruptured one tank on the barge, with the leak not being immediately detected. Oil-spill-response equipment was mobilized from Barrow and Deadhorse, but an overflight was unable to locate any spilled fuel and none was recovered. In September 1985, an exploration spill of 2,440 bbl of diesel occurred from the Minuk I-53 artificial island in the Canadian Beaufort Sea during an intense storm (Birchard and Nancarrow, 1986). Plans were made only to apply dispersants and only if the slick approached shore. The slick did not approach shore, and 4 days after the storm ceased the slick had disappeared through natural dispersion and evaporation. No fuel was recovered. Canadian researchers released a total of 63 bbl of crude in field dispersant tests in the Canadian Beaufort Sea in August 1986 (Swiss and Vanderkooy, 1988). Application of even extremely high, up to a 1:2 dispersant-to-oil ratio, did not increase the rate of dissipation of the crude over that caused by natural dispersion on an untreated control slick.

(6) Effectiveness of Oil-Spill Cleanup in Ice: When a spill is dispersed far from its source or when ice is moving, containment and cleanup are more difficult. Planning of effective surface response with mechanical equipment to spills in pack ice has generally required that an icebreaker (or icebreaking-supply ship) be locally stationed in summer as a dedicated oil-recovery vessel (see Appendix M). An on-station icebreaker also would be necessary in winter.

In situ burning of spilled oil during heavy ice periods may be a more promising approach. Exposed oil would be ignited whenever possible. Existing response capabilities are more effective on landfast ice than on broken or pack ice. Spills in the latter two sorts of ice would be easiest to burn if the spill were contained within a small area close to its source. The ice itself can be useful in restricting the spreading of the oil, keeping the oil thicker and more amenable to burning. Experiments conducted to date indicate that in situ burning should be a more effective technique for spill response in the Arctic than is mechanical recovery in more temperate climates.

The presence of landfast ice may actually improve response effectiveness by limiting the movement and spread of the oil and by providing a safe work platform for the cleanup. The only documented success story for offshore spill response in the Beaufort Sea was a planned experimental spill under landfast ice in the Canadian Beaufort Sea (Buist, Pistruzak, and Dickins, 1981). In this exercise, a total of 119 bbl of crude were spilled under landfast ice three times during the winter to simulate undersea oil blowouts. The following spring, 79 percent of the residual weathered (unevaporated) oil was manually recovered or burned as the oil surfaced on the ice prior to breakup. In winter 1977, 140 bbl of No. 2 diesel were spilled from an onshore tank at Nome, saturating adjacent snow and soil, with some diesel penetrating the ice cover of the Snake River (Allen, 1978). One-third of the spill was recovered, half of this amount by rope mops extended below the ice cover on the Snake River.

Spill-response efforts in the pack ice zone covering 90 percent of the sale area are undocumented and more problematic, particularly in winter. The January 1984 Cepheus spill of aviation fuel into broken ice in Anchorage harbor illustrates one problem with spill response in broken ice (USDOJ, MMS, Alaska OCS Region, 1985a). The Coast Guard attempted to monitor movement of 5,000 bbl of spilled fuel by several techniques, only to conclude that none of the available state-of-the-art techniques could distinguish spilled aviation fuel from broken ice. None of the fuel was recovered.

Subarctic Prince William Sound is much more logistically accessible and protected than the open pack-ice zone in the Beaufort Sea Planning Area; yet even shoreline cleanup operations for the Exxon Valdez spill were stopped in mid-September 1989 out of concern for worker safety during the cold and dark winter.

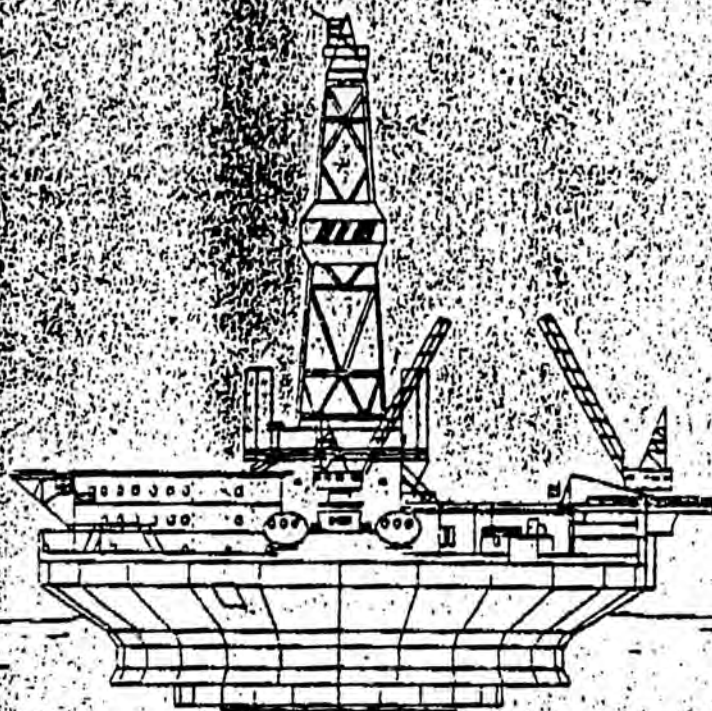
In the Bering Sea, the F/V Milos Reefer grounded on St. Matthew Island in November 1989, spilling at least 5,600 bbl of its 9,000 bbl of mostly bunker and diesel fuel (Akre, 1989a,b,c). Poor weather and logistics ended up prohibiting a response, even though response vessels did reach the site. The initial response vessel, the USCG cutter Midgett, took 6 days to get to the site; the second response vessel, the Fireball, coming from Kodiak with the bulk of the response equipment, arrived onsite 11 days after the spill. No cleanup or offloading of the still-leaking ship was attempted in 1989 because of the severe weather and approach of winter, and any further efforts have been deferred until summer 1990, following the retreat of the Bering Sea seasonal ice pack.

This confidence in burning is unsupported by any evidence

winter is easier than broken ice - which presents safety risks as well as technical difficulties

Exploration Plan

OCS Lease Sale Areas 109 and 97
Chukchi and Beaufort Seas, Alaska



Prepared for

Texaco Producing Inc.

Anchorage, Alaska

Prepared by

ENSR Consulting and Engineering

Anchorage, Alaska

April 1990

Texaco

During the ice-free period (July through October), storm surges do occur in the prospect areas. However, severe surges appear uncommon; a surge of 3.5 m (19 ft) occurred at Barrow in October 1963 and was thought to depict a 125-year event. Surges of 2 to 3 m (6 to 10 ft) are considered 10-year events (Brower *et al.*, 1988).

10.5 Visibility and Ceiling

There is a probability that fog may occur in the area throughout the year. This probability is higher in nearshore areas owing to the temperature difference between land and water masses. During the period when sea ice covers the area, the percent frequency of fog is 10 percent nearshore decreasing to less than 5 percent offshore. However, during open-water periods, this percent frequency rises. For instance, in the period of June through September the percent frequency may be as high as 30 offshore and 20 nearshore (Brower *et al.*, 1988). Tables 10-11 through 10-14 provide a summary of visibility and ceiling data for the prospect areas during the months of June through September.



Exploration Plan

OCS Lease Sale Area 109

Chukchi Sea, Alaska

Remote Offshore Prospects

Shell Western E&P Inc.

601 West Fifth Avenue • Suite 810
Anchorage, Alaska 99501

December 1988

SHELL

of the time (Wise, et al., 1981). Sustained winds of 50 to 56 knots, with higher gusts, have been recorded (Wilson, et al., 1982).

Offshore winds are also reported by the U.S. Naval Weather Service and are summarized on Tables 10-7 through 10-10 for the months of June through September. During the early summer (June and July) winds typically are out of either a general northerly or southerly direction. During August and September, they are more commonly out of the northeast. Mean speed are typically in the range of 10 to 15 knots.

10.4 Storm Occurrences

In the Chukchi Sea lease area, storm events are possible throughout the entire open water period from mid-June through November. October is the month of the most frequent storms in the Chukchi Sea. Storm movement is generally parallel to the Chukchi Sea coastline moving from the Bering Sea towards the Beaufort Sea.

Thirteen storm surges have been documented (Brower, et al., 1977) between 1960 and 1977 for the Chukchi and Beaufort Seas. The most severe recorded storm in the vicinity of Barrow produced westerly winds with sustained speeds of 42 knots and gusts to 64 knots, waves to 10 feet high, and a storm surge of 10 feet.

10.5 Visibility and Ceiling

Fog may be present in the Sale 109 area at anytime throughout the year (Brower, et al., 1977). During the period when sea ice covers the Chukchi Sea, fog occurs about 10 percent of the time. However, during open-water periods, fog becomes more common. In May through September, fog may occur between 20 and 30 percent of the time. Tables 10-11 through 10-14 provide a summary of visibility and ceiling data for the offshore areas during the months of June through September.

RECEIVED
Anchorage, Alaska

JUL 16 1990

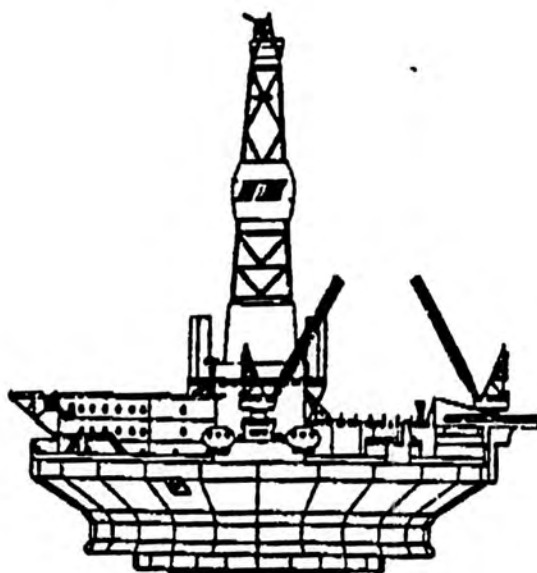
A Report Prepared for

REGIONAL SUPERVISOR
FIELD OPERATION
MINERALS MANAGEMENT SERVICE



CHEVRON U.S.A. INC.
6001 BOLLINGER CANYON ROAD
SAN RAMON, CALIFORNIA 94583-9432

EXPLORATION PLAN WEST MAKTAR PROSPECT Beaufort Sea, Alaska



HARDING LAWSON ASSOCIATES
601 EAST 57TH PLACE
ANCHORAGE, ALASKA 99518

JULY 1990

CHEVRON

Harding Lawson Associates

Table 10-1. Mean and Extreme Air Temperature
Summary for Barter Island, Alaska (°F)

Month	Mean Temperature	Mean Maximum Temperature	Mean Minimum Temperature	Highest Recorded Temperature	Lowest Recorded Temperature
January	-14.3	-7.8	-20.8	39.0	-54.0
February	-20.3	-14.1	-26.5	37.0	-59.0
March	-15.4	-8.6	-22.3	36.0	-51.0
April	-0.8	7.2	-8.8	43.0	-38.0
May	20.8	26.0	15.4	52.0	-16.0
June	34.2	38.1	30.2	68.0	13.0
July	39.9	45.1	34.7	78.0	24.0
August	39.1	43.7	34.3	72.0	24.0
September	31.5	35.1	27.8	64.0	4.0
October	15.3	20.3	10.2	46.0	-26.0
November	-0.1	5.7	-6.1	37.0	-51.0
December	-12.1	-6.5	-18.9	37.0	-51.0
ANNUAL	9.8	15.4	4.1	78.0	-59.0

Source: AEIDC, 1986.

10.3 Sky Cover and Visibility

Cloudy weather is prevalent along the Beaufort Sea coast. For over half of each year, the West Maktar Prospect area has low clouds with more than 50 percent coverage. Low clouds are defined as having bases less than 8,000 feet (2,600 meters) (AEIDC/NCC, 1988). Low clouds with more than 50 percent coverage occur most frequently in the summer. During August, September, and October, 50 percent and greater cloud coverage averages 23 days per month. Mostly clear skies are defined as total cloud coverage of 25 percent or less (AEIDC/NCC, 1988). Mostly clear skies occur an average of only 5 days per month during the same period (AEIDC/NCC, 1988).

Sky cover and visibility can be closely related. Low visibility can be caused by low clouds as well as dense fog, heavy precipitation, dust, and smoke. In general, visibility is good for most of the year near West Maktar Prospect. In Marine Area B, aircraft are restricted to Instrument Flight

CHEVRON

Harding Lawson Associates

Rules (IFR) flying an average of 45 days per year. Low visibility conditions can restrict even IFR aircraft operations. The frequency of low visibility conditions near West Maktar Prospect is presented in Table 10-2. The occurrence of "poor" and "optimum" visibility conditions is also presented in Table 10-2.

As shown by Table 10-2, periods of low visibility do not occur often, but are most frequent during August and September. Offshore operations are most likely to be affected by low visibility during these months. Poor visibility, which may restrict offshore operations, occurs much more frequently and uniformly throughout the year. Poor visibility is most frequent in July and August. In general, optimum conditions occur most frequently in the winter.

Darkness, while usually not a problem itself, aggravates the visibility restrictions caused by other conditions. The sun does not crown the horizon in the Beaufort Sea from mid-November to mid-February. A few hours of twilight are experienced from November to December and from mid-January to mid-February. Total darkness is experienced throughout December and part of January (ARCO Alaska, Inc., 1985).

Table 10-2. Frequency of Visibility Conditions Near West Maktar Prospect

Month	Low Visibility Conditions (days)	Poor ^a Visibility Conditions (days)	Optimum ^b Visibility Conditions (days)
January	3	10	6
February	2	10	4
March	<2	10	6
April	<2	11	5
May	<2	11	3
June	2	10	4
July	2	12	5
August	3	12	3
September	3	11	2
October	<2	9	3
November	2	9	5
December	<u>2</u>	<u>11</u>	<u>5</u>
TOTALS	19+	126	51

- ^a Any one of the following constitutes poor conditions: Low cloud ceiling (LCC) <300 feet or visibility <1 nautical mile.
- ^b Optimum conditions: LCC ≥ 5000 feet (or no LCC), visibility ≥ 5 nautical miles, and wind 11-21 knots.

Source: AEIDC/NCC, 1988