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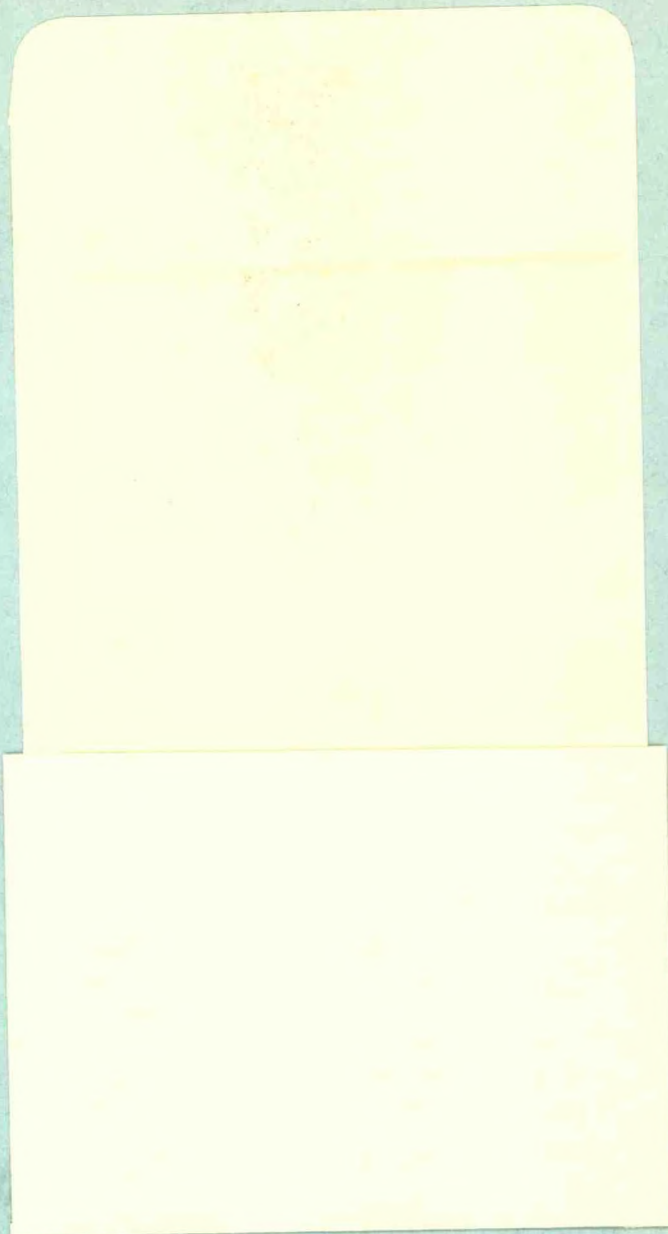
Report of the Second Interorganization Bowhead Whale Research Planning and Technical Coordination Meeting, 15-16 December 1982

by
Howard W. Braham

April 1983

U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
National Marine Fisheries Service

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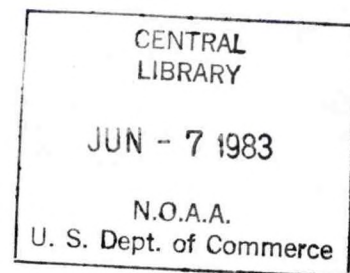
REPORT OF THE SECOND INTERORGANIZATION
BOWHEAD WHALE RESEARCH PLANNING AND TECHNICAL COORDINATION MEETING,
15-16 DECEMBER 1982

by

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ABSTRACT

Nineteen participants representing government, industry, and the Alaska Eskimo community attended the second interorganization bowhead whale research planning and technical coordination meeting on 15-16 December 1982 in Anchorage, Alaska, and agreed that the highest priority, short-term research (1983) should be to 1) continue the study of recruitment by means of photographic measurements of body lengths of individual whales and increase the effort to identify individual whales from low altitude photography; 2) complete the evaluation of sources of bias in the census and determine precision of the counts made near Barrow, Alaska, since 1978 and continue the census at Barrow with the aim of improving the accuracy of the count and subsequent minimum population estimate(s); 3) obtain greater coverage of seasonal distribution in summer in the Chukchi and Bering Seas to determine whether a significant number of bowheads do not migrate past Barrow in spring, and study the distribution of whales offshore in the central Beaufort Sea pack ice in summer; 4) identify and evaluate possible feeding areas in the Beaufort Sea in summer and autumn; 5) conduct a directed seismic boat-whale interaction and behavior study; and 6) initiate a project to develop a review report which synthesizes current knowledge on bowhead whales from published and unpublished reports of organizations funding bowhead research since the mid-1970s.

Long-term research was not discussed, but continuation of the spring census, further analysis and study of life history schedules, and greater understanding of the effects of Outer Continental Shelf development activities were stressed. No firm agreement or commitment to fund any of the recommended research was made at this meeting, although most organization representatives indicated that they generally plan to continue in 1983 the research conducted in 1982.

Significant progress was made in 1982 in addressing bowhead research recommended at the first meeting held 11-12 March 1982 in Seattle, Washington. Of the nine research items considered high priority (rated number 1 on a scale 1-3), eight were conducted in 1982. Only the study of the distribution of whales across the lead(s) at the Point Barrow census site was not conducted. In addition, 8 of 12 items assigned second priority and 2 of 7 in the third priority group were investigated. In all, 64% (18 of 28) of the research recommended at the first meeting was actually addressed in 1982.

The next interorganization meeting will be held no later than mid-December 1983; suggested sites are Washington, D.C., Barrow, Anchorage, or Seattle.

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INTRODUCTION

On 15-16 December 1982, the Interorganization Bowhead Whale Research Planning and Technical Coordination group met at the Federal Building in Anchorage, Alaska. Nineteen individuals representing the Marine Mammal Commission (MMC - 1), Minerals Management Service (MMS - 4), National Marine Fisheries Service (NMFS - 5), North Slope Borough and Alaska Eskimo Whaling Commission (NSB/AEWC - 6), oil industry (Industry - 1), Outer Continental Shelf Environmental Assessment Program (NOAA/OCSEAP - 1) and U.S. Fish and Wildlife Service (FWS - 1) attended (Appendix 1).

This was the second meeting of this group. Previous meetings before this group was formed are discussed by Braham (1982). The first meeting, held 11-12 March 1982 in Seattle, Washington, was attended by 12 individuals representing MMC (1), MMS (2), NMFS (3), NSB/AEWC (5), and Industry (1). The purpose of the first meeting was to discuss current and future research in relation to management needs, review how research might best be implemented in light of reduced funding, and establish a list of short-term (1982-1983) research priorities (Braham 1982). A considerable amount of time was spent at the March 1982 meeting reviewing management concerns and research recommendations to meet those needs. The main purpose of the second meeting was to address research implementation and whether new problems dictate changes in research direction or effort.

Specifically, the objectives of the second meeting were to review research conducted in 1982, establish priorities for 1983, and discuss research implementation and coordination. The meeting closely followed

a prepared agenda (Appendix 2) with emphasis on research currently in progress. A few new research items were proposed, and the priority ranking of several was changed since the first meeting.

As a basis for discussion, lead participants from MMS, NMFS, NSB, and NOAA/OCSEAP were asked to bring written materials relevant to the meeting objectives, and to make a short presentation of research conducted in 1982 and proposed for 1983. A list of tabled documents is in Appendix 3. These were made available for others to review, but were not discussed in detail.

At the first meeting in March 1982, it was recommended that the second meeting be held in December 1982 to provide more time for funding agencies or groups to evaluate the research recommendations and for researchers to plan. This was crucial since in July 1983 the International Whaling Commission (IWC) will implement the new procedures for aboriginal-subsistence whaling. Also, the U.S. Department of the Interior has accelerated the Outer Continental Shelf (OCS) lease schedule in U.S. waters.

RESEARCH CONDUCTED IN FISCAL YEAR 1982

Numerous bowhead whale research projects were conducted or completed in fiscal year 1982 (October 1981-September 1982) by MMS, NMFS, NSB/AEWC, and NOAA/OCSEAP. A summary outline of their activities follows. (For more detail I suggest the reader contact the respective organizations listed.)

Minerals Management Service

The MMS directly supported five research efforts in fiscal year 1982 and supplied funds to OCSEAP for three additional studies (see NOAA/OCSEAP, page 8).

1. Aerial surveys were conducted in the northern Bering, Chukchi, and Beaufort Seas during spring (April-May), summer (July-August), and fall (August-October) 1982 to determine the temporal and spatial distribution and migration patterns of bowheads related to proposed OCS lease areas. Spring surveys concentrated in the Bering Sea, and autumn surveys in the Beaufort Sea mainly for bowheads (e.g., Ljungblad 1981). Summer surveys concentrated on gray and bowhead whales in the Bering and Chukchi Seas, but only gray whales were seen. Two aircraft were deployed in the Beaufort Sea in autumn in support of a joint MMS-NMFS monitoring program on the movements of bowheads adjacent to the central Beaufort Sea OCS lease areas. This work was done by Donald Ljungblad, Naval Ocean Systems Center, San Diego.
2. Aerial surveys were conducted in the eastern Beaufort Sea in August 1982 to assess the possible effects of acoustic and other stimuli associated with OCS exploration-development on the behavior of bowheads. Playback experiments and observations of whales during periods of exposure to geophysical sounds were conducted. The work was performed by Dr. John Richardson and associates,

LGL Ltd., Toronto, Canada. A final report of the 1980-81 work was released in 1982 (Richardson 1982).

3. A feasibility study on development of satellite-linked methods of large cetacean tagging and tracking, similar to that of Hobbs and Goebel (1982), was initiated and progress made. No field work occurred in fiscal year 1982, for technological reasons, and a laboratory analysis of the transmitter was scheduled for fiscal year 1983 (December 1982). The work was conducted by Dr. Bruce Mate, Oregon State University.
4. Research on the analysis of bowhead tissue was completed during fiscal year 1982 by Dr. Thomas Albert, North Slope Borough, Barrow, Alaska.
5. Research on oiling bowhead baleen plates and feeding efficiency was completed by Dr. Lee Braithwaite, Brigham Young University.

National Marine Fisheries Service

The NMFS National Marine Mammal Laboratory contracted one field research study in fiscal year 1982, and continued analyses and report preparation on research results from 1978 to 1981.

1. In cooperation with NSB, NMFS provided training, equipment, supplies, computer analysis, and field assistance for the 1982 bowhead spring census (see Dronenburg et al. in press). In addition, the NMFS data base was recompiled, carefully sorted for quality control, and a copy supplied to the NSB for future analysis.

2. Prepared the first draft of the final report on 4 years of the bowhead whale census results (1978-81), which is currently under revision in cooperation with the NSB (Krogman et al. 1982 ms).
3. Conducted a study of recruitment by means of a contract to Dr. Rolph Davis, LGL Ltd., Toronto, Canada, to photograph bowhead whales in the eastern Beaufort Sea in August, improve the calf count, and assess the length-frequency distribution and identification of individuals in the population, following similar work done in 1981 by Davis et al. (1982) supported by Industry.
4. Continue the analysis of reproductive parameters and age determination (Nerini in press; Nerini et al. 1982 ms).
5. An analysis of population modelling and trends was continued using data on the takes of whales past and present and more recent life history information (Breiwick et al. 1982 ms).
6. Conducted a contract study on the biochemistry of bowhead stomach contents. The work is being done by Dr. Richard Staley and Russell Herwig, University of Washington, and a preliminary paper was submitted for publication.
7. Completed a vessel survey for bowhead whales in the northern Bering and western Chukchi Seas, 10 July-20 August 1982, as part of the U.S.-U.S.S.R. Cooperative Agreement on the Protection of the Environment, and the 1981 survey was published (Marquette et al. 1982).

8. Continued reviewing available published and unpublished articles on bowhead whales to develop an annotated bibliography of the species.

North Slope Borough and Alaska Eskimo Whaling Commission

The NSB supported several studies related to population assessment, biology, and predicting the effects of oil on bowheads. Results of some of these studies were presented at the Second Conference on the Biology of Bowhead Whales sponsored by the NSB, 7-9 March 1983.

1. Conducted an ice-based census of spring migrating bowhead whales at Point Barrow and monitored the harvest. A population abundance estimate of approximately 3,800 (range 3,400-4,300) was made and accepted by the IWC (IWC in press). This work was done in cooperation with NMFS (Dronenburg et al. in press).
2. Supported statistical analyses to evaluate parameter bias in the 1978-81 census data (Dr. Judith Zeh, private consultant). Also, reformatting and an additional quality control check of the NMFS data base was done for future storage and analysis by NSB (Richard Grotefendt, private consultant, and CEREN^{1/} Corporation).
3. Contracted for a simulation study on population trends in bowhead whales based on the effect of various harvest levels, abundance estimates, and life history parameters (Murphy and Jarrell in press).

^{1/} Now named Analytical Software, Seattle, Washington.

4. Instituted the Inupiat Marine Science Training and Research Program: Bioacoustics/Training 1982. Drs. Cummings, Holiday, and Ellison (Tracor, Inc., San Diego, California) conducted field work during spring 1982. The data are still being evaluated. An attempt was made to establish the position of vocalizing whales in order to determine the extent to which whales may pass by the census camps beyond the range of human visual detection.
5. Contracted work to evaluate the vocalization of bowheads to determine the distribution of whales within the leads near Point Barrow. Dr. Chris Clark, private consultant, utilized data collected by NMFS during 1979 and 1980 (Clark and Johnson 1982 ms). This study was strongly recommended to the acoustics working group at the First Conference on the Biology of the Bowhead Whale (e.g., Cummings et al. in press).
6. Contracted studies on the structure of the reproductive tract, digestive tract, and bone of bowhead whales. This work was to provide basic information on reproduction, digestive abilities, and possible differences between regular bowheads and Ingutuks (e.g., Braham et al. 1980; Fetter and Everitt in press). This work is being done by Dr. Ray Tarpley and associates at Texas A&M University.
7. Contracted research on the structure of the skin, eyes, kidney, and respiratory tract of the bowhead whale to provide basic information useful in predicting any effects

of spilled oil on bowheads (Haldiman et al. 1982). This is being done by Dr. Jerry Haldiman and associates at Louisiana State University.

8. Contracted research on the bacteria of the skin and respiratory tract of bowheads to provide basic information useful in predicting any disease-related effects of spilled oil upon bowheads. Of major interest are the bacteria inhabiting identified eroded areas of the skin. This research is being done by Dr. Emmett Shotts and associates at the University of Georgia.
9. The NSB is contributing financial support to the University of Alaska Biological Papers Series program since several of the proposed topics for publication relate directly to the bowhead's habitat.
10. The AEWC sponsored the First Conference on the Biology of the Bowhead Whale in Anchorage, Alaska, 25-28 January 1982. The theme of the conference was population assessment.

NOAA/Outer Continental Shelf Environmental Assessment Program

Independent from but funded by MMS, OCSEAP supported the following research in fiscal year 1982.

1. Aerial surveys for bowheads were conducted in the Beaufort Sea from Barter Island to Demarcation Bay during August and September 1982 to supplement another study being conducted in Beaufort Lagoon. The work was conducted by LGL Ltd., Edmonton, Canada.

2. Semiseasonal fixed-wing aerial surveys in the southeastern Bering Sea were begun in March and continued into the late autumn 1982. While the work was designed to collect data on all marine mammals, primarily in and near the St. George OCS lease area, bowheads were an important target species. The work was done by J. Stephen Leatherwood, Hubbs-Sea World Research Institute, San Diego, California.
3. Ship and aerial surveys (NOAA ship Surveyor and UH1H helicopters) were conducted by Jay Brueggeman, Envirosphere, Bellevue, Washington, in and near the west-central Bering Sea pack ice in late winter and early spring 1982 to further determine the distribution of bowheads near the Navarin OCS lease area, following the earlier work by NMFS (Brueggeman 1982).

EVALUATION OF FISCAL YEAR 1982 RECOMMENDED RESEARCH-MANAGEMENT NEEDS

The highest priority research recommended for fiscal year 1982 related to recruitment, annual spring census and population estimation, and delineation of feeding grounds and distribution relative to the central Beaufort Sea OCS lease areas.

Recruitment

Past estimates of calf production have ranged from about 2-5% (3.5% median estimate), which is believed too low for several reasons (discussed by Nerini et al. 1982 ms). Therefore, at the 1982 meeting it was agreed that alternate methods were needed to estimate gross reproductive rate. Based on preliminary work carried out from 1979 to 1981, it was suggested that aerial surveys could be made in which body

lengths of individual whales are estimated from photographs, as well as photoidentifications made. In May 1982 NMFS funded such a study. The purpose of this study was to determine the distribution of length-classes of whales in the population, make direct calf counts, and estimate the proportion of the female population which is sexually mature. In addition, if an unbiased sample can be obtained of the various classes of whales (a minimum breakdown would be of calves, perhaps yearlings, other immatures, and sexually mature animals), then it may be possible to approximate the natural mortality rate for each group or length-class. Estimates of the number of calves produced each year and natural mortality are essential if net recruitment is to be determined.

Initial impressions are that several years will be needed, including greater coverage of the range of this population to ensure that an unbiased estimate is obtained. However, the data collected in 1981 and 1982 by LGL Ltd., and MMS may provide useful input for the analysis of this problem. Use of photoidentification of individuals will be important in determining the representativeness of annual data. (Author's note: A workshop on photoidentifying bowheads was convened 6-7 January and 21-24 March 1983 and the results are encouraging (Braham and Rugh 1983 ms).)

Assess Biases in Past Censuses

It was recognized that numerous biases possibly existed in sighting bowheads at the spring census camps. Most have been partially addressed and some fully taken into account, but further consideration of not accounting for "missed whales" in the presence and absence of observers was necessary. Effects of such biases were resolved or

addressed in 1982 (Krogman et al. 1982 ms), but additional problems will be addressed in fiscal year 1983. In evaluating biases to date, presumably all recognizable sources of error have been identified and are being investigated. Although some modification of the current estimate is expected from further analysis of bias (discussed later), the revised population estimate of the Point Barrow counts is not expected to be significantly different from that presented by Krogman et al. (1982 ms); Richardson (1982); Dronenburg et al. (in press); and IWC (in press).

Evaluation of other factors, some unrelated directly to the Point Barrow counts, such as seasonal distribution and movement of whales away from the ice camp observers, are being investigated (NMFS unpublished data). A draft report of this work, evaluating all information necessary to make a complete population estimate, was presented as preliminary information at the AEWC First Conference on Bowhead Whales and to the IWC in 1982 and will be available before the 1983 IWC meeting.

Spring Census at Point Barrow

NSB, in cooperation with NMFS, conducted the 1982 spring census and is publishing these findings (Dronenburg et al. in press). The census proved successful, generating a new estimate similar to Krogman et al. (1982 ms), but significantly larger than obtained from earlier years (e.g., Braham et al. 1979). A principle reason for the increased population estimate was development of improved estimating procedures since 1978. Some of these were developed during subsequent studies in

1979-81 (Krogman et al. 1982 ms) and used directly by Dronenburg et al. (in press) in 1982. However, the actual count of whales in 1982 was also greater than in previous years.

Summer Distribution in the Soviet Chukchi Sea

Results of the third U.S.-U.S.S.R. survey for bowheads in the western Chukchi Sea and along the coast of Chukotka suggests that few if any bowheads spend the summer away from the Beaufort Sea. In the 1982 study no bowheads were sighted in the area surveyed during late July and August, whereas in 1979 and 1980 bowheads were found in abundance during September and October. These surveys appear to address the possibility of the spring census missing those whales (if any) which go directly to the western Chukchi Sea and do not pass Point Barrow. It does not address the possibility of whales passing in the leads beyond the observers' view at Point Barrow.

Evaluate Beaufort Sea Feeding Areas

A preliminary study of distribution near the U.S.-Canadian border in autumn 1982 by NOAA/OCSEAP resulted in delineating some places where bowheads were apparently feeding. Research supported by NOAA/OCSEAP and MFS in 1975-78 (Braham and Krogman 1977; Marquette et al. 1982; Braham, Krogman and Carroll in press); MMS in 1979-82 (Ljungblad et al. 1980; Ljungblad 1981; Richardson 1982; Donald Ljungblad pers. commun.); and Industry in 1980-81 (Davis et al. 1982) provide additional information on general areas where whales are known to feed.

Identification of site specific feeding areas needs to be extracted from the literature and unpublished field notes (if available), and consideration needs to be given to further study in areas such as from Flaxman Island to Herschel Island, near the barrier islands of the central Beaufort Sea, and near Point Barrow.

RESEARCH PRIORITIES AND RECOMMENDATIONS, FISCAL YEAR 1983

Planned research for fiscal year 1983 by the MMS, NMFS, NSB, NOAA/OCSEAP, and Industry are listed in Table 1. This work is generally a continuation of the work started during fiscal year 1982, or has been added (e.g., NOAA/OCSEAP) as a result of identifying a particular need by that agency.

The participants agreed that six priority research subjects be addressed in fiscal year 1983. These are listed below (Nos. 1-6) in their approximate order of priority, although individual agencies or groups have priorities which may not necessarily reflect this ordering. Other important research is also discussed (No. 7 below).

The group agreed that the research priorities recommended were a result of several critical management mandates; the two most important are 1) the determination of the size and current growth of this population (a question of population dynamics), and 2) the effects of human intervention. Consideration of future management strategies will depend on the "best estimates" of population parameters, and thus an immediate and long-term commitment to study recruitment and population enumeration was deemed the most important consideration of any research planning.

Table 1.--Planned bowhead research activities for fiscal year 1983 by reporting organizations as of December 1982.

Minerals Management Service

- 1) Aerial surveys of the Beaufort and Chukchi Seas to identify summer migration patterns and feeding areas, relative to OCS lease areas.
- 2) Test radio tagging equipment on gray whales for future satellite monitoring of bowheads.
- 3) Direct effects study of oil on behavior and physiology of porpoise as a tool to assess effects on cetaceans in general.
- 4) Behavior effects of seismic activities will be monitored during the autumn migration in the Beaufort Sea, and response characteristics described.

National Marine Fisheries Service

- 1) Final report of 4 years (1978-81) of census data including an analysis of observer biases and variance estimation (partially supported by the North Slope Borough).
- 2) Final analyses and report(s) of available information on life history including growth, reproduction, and aging.
- 3) Conduct second year aerial survey contract study of recruitment using photographic length-frequency analysis, and photo-identification.
- 4) Final report of preliminary modelling of life history and removals to assess population growth and status of this stock.
- 5) Assist the North Slope Borough/Alaska Eskimo Whaling Commission with spring census and related analyses as needed.
- 6) Review available data files and literature to identify specific feeding areas throughout the bowhead's range.
- 7) Report on an updated estimate of the bowhead population sizes at the beginning of commercial whaling, 1848, and at the presumed low point of population abundance, about 1914-17.
- 8) Convene a workshop on the identification of individual bowheads from photographs.

Table 1.--continued

North Slope Borough

- 1) Support additional analyses of bias and variance estimation in the 1978-82 data base.
- 2) Conduct an ice-based spring census near Point Barrow.
- 3) Monitor the spring and autumn harvest and collect and analyze biological data collected from the harvested whales, and report on struck but lost rate, etc.
- 4) Final report of preliminary modelling of life history and removals to assess population growth and status of stocks.
- 5) Contract review of the population assessment, life history, and census-related studies conducted since about 1978.
- 6) Continue contract studies on the morphology of selected tissues and systems (skin, digestive, reproductive, respiratory, etc.) and on the bacterial flora of bowheads.
- 7) Review Eskimo whalers' logbooks for information on the hunt (such as bombs used), occurrence and location of whales, observations of calves, etc.
- 8) Further develop a radiotag to be attached to a harpoon line and/or float in an effort to enhance recovery of struck but lost whales.
- 9) A study on the concentrations of trace metals, chlorinated and petroleum hydrocarbons in bowhead tissues.
- 10) Convene a Second Conference on the Biology of the Bowhead Whale, 7-9 March 1983.

NOAA/Outer Continental Shelf Environmental Assessment Program

- 1) A study of the winter distribution of bowheads in the central Bering Sea.
- 2) A study of the toxicity of oil on euphausiids.

Oil Industry (represented by Standard Oil Company of Ohio (SOHIO))

- 1) No specific plans to conduct research, but SOHIO is contemplating developing a research plan to conduct a directed seismic boat-whale interaction study.

1. Estimating Population Recruitment

Braham (1982) described the rationale and methods needed to determine the rate of population growth. The NMFS is currently completing the first year of a study using low altitude aerial surveys to photoidentify individuals and determine the length-frequency distribution method to estimate recruitment as recommended at the first interorganization meeting. It was recommended that this study be continued in fiscal year 1983. One objective of the research is to see if a life table can be constructed representing approximate size, and thus age-related, categories. If a life table can be developed including calves, presumed immatures, and adults, then it may be possible to make a preliminary estimate of natural mortality rate. This estimate is essential before net recruitment can be determined. (Author's note: On 17 January 1983 NOAA/NMFS transferred funds to the NMML to conduct this work in fiscal year 1983.)

As noted above, estimates of gross reproductive rate from calf counts are unsatisfactory. It was suggested that past survey data be reviewed to determine whether it is possible to estimate the probability of sighting a calf (as compared to the probability of sighting other bowhead whales). Braham and Cowles agreed to have this possibility reviewed by their contractors.

Additional recommendations from the group were to 1) further develop the photoidentification study and consider developing a catalog of bowhead photographs (see Braham and Rugh 1983 ms), 2) increase the survey coverage in order to spend more time photographing each whale, thus potentially increasing the accuracy of the measurements of lengths,

and also to provide a more representative sample of the spatial distribution of the population in the eastern Beaufort Sea, and 3) try to determine the comparative probabilities of sighting calves versus other animals in future surveys.

2. Continuation of the Spring Census

The participants acknowledged that the NSB will continue the spring bowhead census at Point Barrow in fiscal year 1983 in cooperation with the NMFS as in fiscal year 1982. It was also stressed that study of the distribution of whales across the lead was necessary to validate the spring census. Aerial survey methods have been shown to be potentially reliable (Marquette et al. 1982). Analysis of this problem, using indirect means such as acoustics conducted by the NSB in 1982, could be of value and thus evaluation of those results was considered important.

3. Summer Distribution Studies

Additional study of the distribution of bowheads in summer is required to further augment estimating total abundance and migratory behavior adjacent to OCS lease areas. As discussed at the first meeting, it is possible that some bowheads may remain in the Chukchi or Bering Seas during summer and not migrate past Barrow in spring. To investigate this and thus further validate the Point Barrow counts, continuation of the joint U.S.-U.S.S.R. cooperative program to survey the northwestern Bering Sea and western Chukchi Sea during summer 1983, in a converted Soviet whaling vessel, was recommended. This would be the fourth joint cruise of its kind. A request for a 1983 survey will be presented at the April 1983 U.S.-U.S.S.R. meeting.

The participants also recommended that aerial surveys be conducted in and adjacent to the pack ice in July and August offshore in the Beaufort Sea, as conducted in 1982 by the MMS, to further elucidate the migration patterns of bowheads in summer. Work conducted in 1982 suggested that some bowheads may be moving west in August in the pack ice (offshore) before the presumably more nearshore autumn migration (September and October). If true, then this August component may be part of the same group of animals seen along the north coast of the Chukotka Peninsula (U.S.S.R.) in September at the same time whales are seen in the Beaufort Sea.

4. Identify Possible Feeding Areas

Some members felt strongly that identifying specific bowhead feeding sites required additional field work and geographic delineation, such as first described for the Point Barrow area by Braham and Krogman (1977). Much of this information was believed by other members to be available in the existing literature or in unpublished data files. It was agreed that Naval Ocean Systems Center (NOSC), MMS, NMFS, Industry, NSB/AEWC, and NOAA/OCSEAP would make an inventory of their reports and data to help further describe feeding areas, if possible. Usefulness of these data depends on whether 1) sufficient behavioral notes were taken in the past, and 2) the whales were actually feeding when observations were thought to be of feeding animals. No specific study was proposed but certain areas (e.g., Barter Island to Demarcation Bay and east of Point Barrow in autumn) were suggested as likely candidates. Many felt, however, that the Barter Island-Demarcation Bay area was merely an extension of the known eastern Beaufort Sea feeding ground and, as such, is important to the species for seasonal feeding.

5. Directed Seismic Effects Study

The effects of seismic operations are unknown. A few participants felt strongly that seismic operations have and will continue to have a negative effect on the bowhead population. No evidence is available, however, to substantiate or refute this allegation. Because seismic operations have been allowed in open water periods in the Beaufort Sea, and the effects are unknown, it was recommended that a study be planned and conducted in late summer or autumn 1983. A preliminary, short-term monitoring program conducted in autumn 1982 by MMS and NMFS was designed to identify the presence or absence of migrating bowheads at the time and in the vicinity of seismic operations off Prudhoe Bay in the Beaufort Sea.

The group felt that a boat should be chartered and rigged with seismic equipment, and be directed to the site of bowheads to observe and quantify the whales' responses to seismic activities. Control experiments using the same vessel were also considered essential. Fraker (SOHIO) indicated that he will develop a plan along these lines, and circulate it to obtain agreement among the participants and their agencies as to the nature, rationale, and extent of this research need.

6. Comprehensive Review of Past Bowhead Research

The group felt that a single review of bowhead whale research was in order as there has been considerable growth in the amount of research activities in the Arctic since the mid-1970s. The details of this recommendation could not be sorted out, so the representatives from MMS, NSB, Industry, NOAA/OCSEAP, and NMFS agreed to each develop a

comprehensive list of all published and unpublished reports and papers either generated or supported by their organizations since about 1975 and send it to me for compilation. While waiting for the completion of the annotated bowhead bibliography by Willman M. Marquette, National Marine Mammal Laboratory, it would be preferable to have the synthesis done sooner than 1984, since the annotated bibliography is not scheduled for completion until the end of fiscal year 1984. The group, therefore, recommended that if any of the participating organizations could partially fund this project, perhaps the others might join in as an interorganization cooperative venture. A true synthesis of all work done in recent years (since about 1975 when NOAA/OCSEAP first funded bowhead research) would be extremely valuable to management and research by providing the kind of overview which does not now exist.

7. Other Research Activities

Several other research topics were discussed and previewed in light of research-management priorities. These as well as the above priority studies are outlined in Table 2. As at the first meeting, priority rankings by the group were given to the problems relative to human activities. One subject was dropped from the first meeting (Discovery tagging), and three new subjects were added: 1) mark-recapture "census" using the photoidentification method (NMFS), 2) further identification of winter habitat use (NOAA/OCSEAP), and 3) review of past bowhead research (discussed above).

Table 2.--Research implementation schedule, fiscal year 1983, and proposed priority topics for 1983 and beyond.

Research topic	Minimum years needed to meet management aims ^{a/}	Potential responding organization ^{b/}	Estimated cost (annual thousands) ^{c/}	Priority ^{d/} (rank)
<u>A. Population enumeration</u>				
1. Spring census				
a. Counts from ice edge	c	NSB(*) NMFS(*)	\$195	1
b. Validate sighting distribution across lead using aircraft	2	None	\$ 50	1
c. Aerial survey distribution of early and late migrants	2	NSB NMFS	\$150	2
d. Further analysis of biases in past census data	f	NSB(*) NMFS(*)	\$ 30	1
e. Remote acoustic monitoring	?	NSB	\$100?	3
2. August-September census in Canadian Beaufort Sea	2	None	\$175- 600 ^{e/}	2
3. Mark-recapture evaluation and maintenance of photo-identification file for census and life history	c	NMFS(*)	\$ 15	2
<u>B. Distribution and migration</u>				
1. Summer U.S.-U.S.S.R. vessel survey of Soviet Chukchi and Bering Seas	1	NMFS	\$ 5	2
2. Summer aerial surveys of the Beaufort Sea pack ice and open water	1	MMS(*)	\$150	2

Table 2.--continued

Research topic	Minimum years needed to meet management aims ^{a/}	Potential responding organization ^{b/}	Estimated cost (annual thousands) ^{c/}	Priority ^{d/} (rank)
3. Autumn surveys of				
a. eastern U.S. Beaufort Sea	f	MMS(*)	\$200	2
b. U.S. Chukchi Sea	2	MMS	\$200	3
4. Tagging: radio-satellite	2	MMS(*)	\$265	2
5. Identification of feeding areas in the Beaufort Sea from past studies	1-2	MMS(*) NMFS(*)		1
6. Identification of wintering areas	2	OCSEAP(*)	\$725	3
<u>C. Biology and life history</u>				
1. Collect biological information and material from harvested whales	c	AEWC/NSB(*) NMFS	\$ 15	1
2. Examination of specimen material (e.g., reproductive tissues, etc.)	c	NSB(*) NMFS(*)	\$ 75	1
3. Recruitment and length-frequency distribution				
a. low-altitude flights	2	NMFS(*)	a. \$200	1
b. high-altitude flights	2		b. \$ 25-300	3
4. Population modelling				
a. continue running existing models	c	NMFS(*) NSB(*)	\$ 30	1
b. development of models	1-2	NMFS NSB		2

Table 2.--continued

Research topic	Minimum years needed to meet management aims ^{a/}	Potential responding organization ^{b/}	Estimated cost (annual thousands) ^{c/}	Priority ^{d/} (rank)
5. Aging bowheads	c	NMFS(*) ^{f/}	\$ 30	1
6. Trophic relations, biological oceanography, and prey productivity distribution in the Beaufort Sea	2		\$300+	3
7. Biochemistry and microbiology of stomach contents	1	NMFS(*) NSB	\$ 25	3
8. Morphometrics and growth for length-frequency study	c	NMFS(*) NSB	\$ 10	2
<u>D. Effects and behavior</u>				
1. Oil effects on prey (e.g., euphausiids)	1+	OCSEAP(*) MMS(*)	\$125	2
2. Behavioral responses				
a. to oil and products	1	MMS(*)		3
b. noise				
1) vessel	2	MMS		3
2) directed seismic study	2	MMS(*)	\$300?	1
3) drilling	c	MMS		3
4) aircraft	2	MMS(*)		3
5) cumulative effects	c	MMS		1
3. Seasonal habitat use: ice and open water classification scheme	3	MMS OCSEAP NMFS		3

Table 2.--continued

Research topic	Minimum years needed to meet management aims ^{a/}	Potential responding organization ^{b/}	Estimated cost (annual thousands) ^{c/}	Priority ^{d/} (rank)
4. Direct effects of oil	1	MMS(*)	\$	3
<u>E. Whaling</u>				
1. Historical shore-based removals, U.S. & U.S.S.R.	1-2	NMFS	\$ 50-75	1
2. Monitor current take including "struck and lost" mortality rate	c	AEWC/NSB(*) NMFS(*)		2
3. Analysis of Eskimos' logbooks	c	AEWC/NSB(*)	\$ 2	3
<u>F. Review of past bowhead research</u>	1+	All organizations	\$100	1

^{a/} c = continuous annual data needed; f = to be completed in fiscal year 1983.

^{b/} Agency or group voicing an interest, currently evaluating possibilities or anticipated to conduct the research. These designations are not binding. Some topics are planned to be addressed by said organization (*) in fiscal year 1983.

^{c/} Preliminary minimum estimates; blanks mean no estimate attempted for proposed work. No agency or organization has agreed to fund any of the research.

^{d/} Considered the most immediate need (rank of "1") or lowest priority ("3") considering short-term (fiscal year 1983) research.

^{e/} In fiscal year 1981 a census and length-frequency (photoidentification) study was conducted by the oil industry for a cost of approximately \$600K; a census study alone presumably would cost less than that.

^{f/} Assuming material (e.g., tympanic bullae (ear bones)) are collected from harvested whales.

Other studies given high priority ranking, not covered in detail above were

- 1) Conduct aerial surveys across the lead(s) at Point Barrow in spring to help validate the census by providing an additional estimate of the number or proportion of the population missed during the counts. This was reviewed in greater detail by Braham (1982) and Marquette et al. (1982).

- 2) Continue to collect data and samples from harvested and stranded animals useful in studies of reproduction, feeding, morphometrics and growth, and other aspects of natural history and biology.

- 3) Continue running existing population trend models and update them as new information on life history and removals (natural or harvest mortality) become available.

- 4) The aging of bowheads must be continued using the best methods available, which at this time appear to be sectioning tympanic bullae (ear bones) and reading the laminations. Obtaining tympanic bullae from harvested bowheads was viewed by the group as an essential, high-priority task.

- 5) A study of cumulative effects of noise put into the water was deemed high priority, but the details of this proposal were not discussed.

- 6) There apparently exists an as yet unknown number of early logbooks, journals, and especially newspaper accounts which record the take of bowheads during shore-based whaling operations in the Arctic from about the 1880s to 1920s. This has important implications for estimating the size of the initial and post-commercial whaling bowhead population, and thus may influence estimates of recovery (since about

1917). Some important information has been published (Marquette and Bockstoce 1980), but there is good likelihood that more whales were landed during this era than we can currently identify. This project should take approximately 12-15 months to complete and would have to be an international cooperative effort in order to include important shore-based operations in the Soviet Union (Chukchi Peninsula).

DISCUSSION AND CONCLUSIONS

To conduct research in 1983 on all of the approximately 30 proposed research subjects (Table 2) would cost in excess of \$3,000,000. The estimated cost of the highest priority items (ranked "1") will be at least \$1,000,000. Given the current state of fiscal austerity, especially in federal coffers, it probably will not be possible to complete even the highest priority research in the next few years. Consideration of long-term research therefore seems particularly fruitless except for the more obvious concerns such as censusing and the desire for continued data collection on harvested whales.

However, as a result of recommendations from the first interorganization meeting, the highest priority research topics for fiscal year 1982 were addressed. Eight of nine high-priority topics in fiscal year 1982 were addressed, and 8 of 12 second-level priority and 2 of 7 of the third-priority research recommendations were studied. This means that by the end of fiscal year 1982, 64% (18 of 28) of all priority items recommended were actually addressed. Most of the fiscal year 1983 recommendations are a continuation of 1982 research.

It appears that a pattern of research has been established and that national needs are being met. But, because of the expense of bowhead research, it is unlikely that most of the proposed items in Table 2 will be accomplished in the next five years. Whether sufficient resources can be assembled in the short term to meet those needs remains to be determined. And, presumably federal management information needs will not change significantly in the near future.

Preliminary results of the 1982 research suggest that the new methods of estimating length and photoidentification represent real breakthroughs. However, it needs to be emphasized that, at best, obtaining all of the information needed for management needs for IWC and MMS will require continuation of such efforts as well as the continuation of other past efforts on census, surveys, aging, etc., for several years. It is therefore important that the total research on bowhead whales be coordinated to the greatest extent possible at both the working level and the decision-making level. To this end the participants agreed that an interorganization meeting be held in mid-December 1983. No discussion occurred as to where the next meeting would be held, but during review of this report, Washington, D.C., Barrow, Anchorage, and Seattle were recommended.

ACKNOWLEDGEMENTS

I am grateful to Byron Morris, National Marine Fisheries Service, Alaska Region, Anchorage Field Office, for hosting this meeting and assisting with arrangements. Leola Hietala typed the drafts and final report, James Johnson and Michael Tillman provided valuable editing, and Ethel Zweifel, NWAFC, provided copying. I also thank the meeting participants for their interest, support, and cooperation which greatly facilitated the success of this meeting.

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Appendix 1.--List of meeting participants.

Name	Affiliation
Marie Adams	Alaska Eskimo Whaling Commission, Barrow, Alaska
Thomas F. Albert, VMD, Ph.D.	North Slope Borough, Barrow, Alaska
Howard W. Braham, Ph.D.	National Marine Mammal Laboratory, NMFS, Seattle, Washington
Gordon Broadhead	Alaska Eskimo Whaling Commission and Living Marine Resources, San Diego, California
Robert C. Brownell, Jr., Ph.D.	U.S. Fish and Wildlife Service, Piedras Blancas, California
Douglas G. Chapman, Ph.D.	Marine Mammal Commission and University of Washington, Seattle, Washington
David Cottingham	National Marine Fisheries Service, NOAA, Washington, D.C.
Cleveland J. Cowles, Ph.D.	Minerals Management Service, Anchorage, Alaska
Raymond D. Dronenburg	North Slope Borough, Barrow, Alaska
Paul Dubsky	Minerals Management Service, Anchorage, Alaska
Mark A. Fraker	SOHIO Alaska Petroleum, Anchorage, Alaska
Deborah M. Gottheil	Alaska Eskimo Whaling Commission and Van Ness, Feldman, Sutcliffe, Curtis, and Levenberg, Washington, D.C.
Jerry Imm	Minerals Management Service, Anchorage, Alaska
Byron Morris	National Marine Fisheries Service, Anchorage, Alaska
Guy W. Oliver	Outer Continental Shelf Environmental Assessment Program, NOAA, Juneau, Alaska
Percy Nusunginya	Alaska Eskimo Whaling Commission, Barrow, Alaska
Eileen Soback	NOAA General Counsel, Washington, D.C.
Timothy F. Sullivan	Minerals Management Service, Washington, D.C.
Dean Swanson	National Marine Fisheries Service, Washington, D.C.

Appendix 2.--Second interorganization bowhead whale research planning and technical coordination meeting agenda (revised 16 December 1982).

Date, place: 15-16 December 1982 National Marine Fisheries Service, Alaska Region
Field Office
Federal Building
701 C Street
Anchorage, Alaska 99513

Purpose: Interagency and organization discussions on bowhead whale research recommendations and priorities for fiscal year 1983.

Convenor: Howard W. Braham, National Marine Mammal Laboratory, NWAFC, National Marine Fisheries Service, NOAA, Seattle, Washington.

Meeting Objectives:

1. Review research conducted in fiscal year 1982.
2. Establish research needs and priorities for fiscal year 1983 in light of current management needs.
3. Discuss ways to implement research and improve or facilitate cooperation among research and management elements.

Agenda:

15 December	9:30 a.m.	Introduction, review objectives of the meeting, and approve agenda.
	9:50 a.m.	List tabled documents.
	10:00 a.m.	Review March 1982 first interagency organization meeting report and recommendations.
	10:30 a.m.	Summary review of fiscal year 1982 research results and management aims.
	12:45 p.m.	Lunch
	2:00 p.m.	Discussion of research needs and priorities for fiscal year 1983, and how proposed research will meet management needs.
	5:00 p.m.	Adjourn
	7:00 p.m.	Group dinner hosted by Mark Fraker, SOHIO

Appendix 2.--Continued.

16 December	8:30 a.m.	Complete discussion of fiscal year 1983 research needs.
	11:00 a.m.	Consideration of special subjects (see below).
	12:15 p.m.	Lunch
	1:30 p.m.	Discussion of research implementation and coordination in fiscal year 1983.
	4:00 p.m.	Review meeting results, discuss reporting of meeting, closing comments and adjourn.

Some Discussion Subjects:

1. Research and estimates of abundance and distribution relevant to censusing.
 2. Research on recruitment and relevant information needs to assess population growth.
 3. Research on movements and behavior of whales in relation to Outer Continental Shelf (OCS) lease areas and seismic operations.
 4. Definition and discussion of "monitoring."
 5. Review need for a (true) synthesis of all bowhead research, in particular that conducted since initiation of the Bureau of Land Management (i.e., now Minerals Management Service)-NOAA Outer Continental Shelf Environmental Assessment (OCSEAP) studies (ca. 1975).
 6. Need and utility of radio tagging bowhead whales.
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Appendix 3.--List of tabled documents for review at the meeting. Not all were discussed or reviewed.

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1. Report of the First Interorganization Bowhead Whale Research Planning and Technical Coordination Meeting, 11-12 March 1982. By H. W. Braham, October 1982.
 2. Behavior, Disturbance Responses and Feeding of Bowhead Whales, *Balaena mysticetus*, in the Beaufort Sea, 1980-81. W. J. Richardson (editor), August 1982.
 3. NOAA/OCSEAP Bowhead Whale Research - 1982-83. By G. W. Oliver, December 1982. (Not circulated.)
 4. Bowhead Size Estimates Using 35 mm Photo Technique. By D. Ljungblad and R. Van Schoik, 1982. (Not circulated.)
 5. North Slope Borough Bowhead Whale Research Program (1982). By T. Albert, December 1982. (Not circulated.)
 6. Distribution, Numbers and Productivity of the Western Arctic Stock of Bowhead Whales in the Eastern Beaufort Sea and Amundsen Gulf, Summer 1981. By R. A. Davis et al., April 1982.
 7. Bowhead Whale Research in the United States. By H. W. Braham, March 1982. (Not circulated.)
 8. Operating Plans and Objectives of the Cetacean Research Program for fiscal year 1983. By H. W. Braham, October 1982.
 9. Bowhead whales in the Western Arctic: Estimating Total Abundance. By H. W. Braham, December 1982. (Not circulated.)
 10. World Stocks of Bowhead Whales: Summary Status Review. By H. W. Braham, December 1982. (Not circulated.)
 11. Bowhead Whale Studies, Autumn 1980-Spring 1981: Harvest, Biology and Distribution. By W. M. Marquette et al., 1982.
 12. Synopsis of Bowhead Research Activities March 1982 - December 1982. By Minerals Management Service, December 1982.
 13. Summary Review of the NMFS 1982 Bowhead Whale Research. By National Marine Mammal Laboratory, December 1982.
 14. Feasibility of tracking whales using the Argos satellite system. Report prepared for USDI, Alaska Environmental Studies Program. By B. R. Mate and J. T. Harvey, 1982. (Not circulated.)
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