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Recommendations for Bowhead Whale Research in 1984

Results of the Third Interorganization Planning Meeting

by
Howard W. Braham

June 1984

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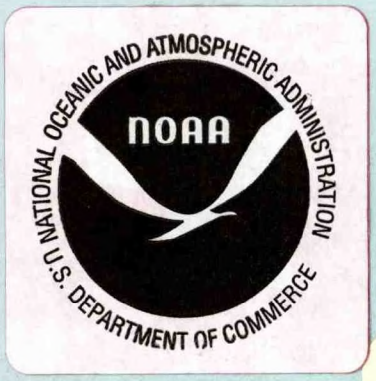

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RECOMMENDATIONS FOR BOWHEAD WHALE RESEARCH IN 1984:

Results of the Third Interorganization Planning Meeting

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June 1984

ABSTRACT

Eighteen participants representing government, industry, and the Alaska Eskimo community attended the third interorganization bowhead whale research planning and technical coordination meeting on 13-14 December 1983 in Seattle, Washington. Recommendations from this meeting were very similar to the two previous meetings. The participants agreed that the highest priority, short-term research (1984 and 1985) 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 and publish the evaluation of sources of bias in the ice-camp census and determine precision of the counts made near Barrow, Alaska, since 1978; 3) continue the census at Barrow with the aid of ice-based observers, acoustic monitoring and across-the-lead aerial surveys; 4) identify and evaluate possible feeding areas in the Beaufort Sea in summer and autumn, especially near Barter Island and Demarcation Bay; 5) determine the effects of seismic activities on the behavior of whales; and 6) develop a report which reviews current knowledge on bowhead whales using, principally, published and unpublished reports of organizations which have funded research over the past decade.

CONTENTS

INTRODUCTION

On 13-14 December 1983, a meeting of interested scientists and managers from government and nongovernment organizations met at the Western Regional Center of NOAA in Seattle, Washington to discuss bowhead whale research priorities for 1984. Representatives from the Alaska Eskimo Whaling Commission (AEWC); Marine Mammal Commission (MMC); U.S. Department of Interior, Minerals Management Service (MMS); National Marine Fisheries Service (NMFS); North Slope Borough (NSB); oil industry (Industry); Outer Continental Shelf Environmental Assessment Program/NOAA (OCSEAP); and U.S. Fish and Wildlife Service (FWS) were in attendance (Appendix 1). This was the third such meeting. Two previous meetings were held in 1982.

The purpose of the first meeting in March 1982 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 (1982-83) research priorities. The purpose of the second meeting in December 1982 was to review results of research conducted in 1982, establish priorities for 1983, and discuss how research would be implemented and, where possible, coordinated. Results of these meetings were reported earlier (Braham 1982, 1983).

The purpose of the third meeting was to address research implementation and whether new problems dictated changes in research direction and effort. The meeting followed the prepared agenda (Appendix 2) with emphasis on research currently in progress. Participants from the MMS, NMFS, NSB, and other organizations were

asked to bring written summaries of their activities, and to make short presentations on research conducted in 1983 and proposed for 1984 (and/or 1985). The summary documents are presented in Appendix 2. Not all documents were discussed.

This report presents only the recommendations and a brief account of discussions during the meeting. For greater details of research results or plans discussed at the meeting, please contact the respective participants (Appendix 1).

RESEARCH ACTIVITIES

Research activities reported by the participants for fiscal year 1983 (October 1982-September 1983) are listed in Appendix 2 (documents 2, 3 and 5). A brief verbal summary of these activities was given by several participants at the meeting.

After a review of past work, attention was directed at planned activities for fiscal year 1984 (Appendix 2, documents 3, 8 and 9). All organizations reported that they would continue essentially similar programs as conducted in 1983: MMS--aerial survey of endangered whales in the Bering, Chukchi and Beaufort Seas, and studies dealing with the interaction of whales and Outer Continental Shelf (OCS) activities; NMFS--photographic assessment of whales in support of recruitment studies; and NSB--spring census and biological studies of landed bowheads.

The group reiterated the 1982 and 1983 conclusion that research priorities should be governed by two critical management mandates: determination of 1) size and current growth of this bowhead whale population and 2) the effects of OCS activities and Eskimo whaling.

The most important short- and long-term commitments, then, were asked thought to be those related to understanding population dynamics and habitat/behavioral interactions.

DISCUSSION

During the 1982 meetings, 34 research topics were proposed as needing attention (see Braham 1983). Of these, 13 were given a high priority rating (i.e., a rating of "1" on a scale of 1 to 3). Of these, one was completed (population modelling by Breiwick, Eberhardt and Braham 1984) and one was demoted to a lower priority (U.S. and U.S.S.R. historical shore-based whaling information). The remaining 11 require some additional work. Ageing bowheads was originally rated among the highest priorities and was also completed during 1983 (based upon available biological material; see Nerini 1983a, 1983b). However, it remained on the 1984 high priority list because of the possibility that new ageing methods might be developed.

The results of the highest priority ranking (ranking of "1") of research on bowhead whales as a result of discussion at the 1984 meeting were as follows (not further ordered below by priority):

1. Census bowheads in spring using ice-based visual counts (as has been done since 1976) to estimate current abundance.

2. Use remote passive acoustics to support the spring census results by determining how many whales might be missed.

3. Validate the distribution of bowheads across the lead adjacent to the ice-camps by means of aerial survey to determine how many whales migrate unseen past the ice-camps.

4. Complete the analysis of biases in the ice-camp observer techniques, 1978-83, and publish the results.

5. Characterize the habitat use and behavior of bowheads from Demarcation Bay to Barter Island to determine whether this is a particularly important feeding area.

6. Continue to collect biological samples and obtain descriptive information from harvested bowheads.

7. Conduct a photographic assessment of the length-frequency distribution of the bowhead population, and individual photoidentification, so as to help determine the approximate proportion of calves, yearlings, juveniles, and adults.

8. Assess the available information on morphometrics from landed whales to determine its utility for the photogrammetric, length-frequency study.

9. Continue ageing bowheads, either using a larger sample of material which might prove helpful, such as tympanic bullae, or attempt new methods such as discovery marking (or something similar) of young animals (e.g., yearlings).

10. Conduct seismic studies to determine their effects on whale behavior, and ascertain, where possible, the cumulative effects of seismic and other "noise" on the presence of bowheads.

11. Prepare a report summarizing and "synthesizing" the published and unpublished literature concerning bowhead whales with particular emphasis on determining the effects of human intervention.

Besides these high priority research recommendations, two new topics (1 and 2 below) were added to last year's list (Table 2 in Braham 1983), and another was rewritten to give greater clarity. These were also not listed in priority order.

1. Determine whether bowheads have been displaced seaward as they pass Point Barrow during the autumn migration over the past decade. Recommended by the NSB/AEWC. (Given a priority rating of "2".)

2. Conduct computer simulations of the movement of oil in relation to bowheads and their habitat. Recommended by MMS/OCSEAP. (Given a priority rating of "3".)

3. Determine habitat use patterns, especially, whether bowheads are feeding and calving in and adjacent to the polynya near St. Matthew and St. Lawrence Islands during late winter-early spring (usually February to April). Recommended by NMFS. (Given a priority rating of "2").

The participants agreed that of the 11 high priority research topics listed earlier, six required immediate attention. These were essentially the same recommended in 1983 and emphasized work on 1) estimating recruitment, supported by the length-frequency photogrammetric study by the NMFS; 2) completing assessment of the biases, and annual estimates of abundance, 1978-82, from the spring census conducted by NMFS and NSB; 3) conducting the spring census at Point Barrow using ice-camp observers, passive acoustics, and aerial surveys for the across-the-lead distribution of whales; 4) identifying whether the area from Demarcation Bay to Barter Island is an important autumn (August-September) feeding habitat for

bowheads in the Beaufort Sea; 5) determining the effects of seismic activities on bowhead behavior; and 6) developing a summary status report which reviews published and unpublished research results on bowheads, and other species or relevant topics to further determine research and management directions.

These six topics are listed in their approximate order of priority, as discussed. However, as expected, individual agencies or groups have priorities which may differ from this ordering.

There was general agreement that management concerns are being satisfactorily met from current research, with some exceptions. These include effects of seismic activity, the importance of certain areas for feeding (e.g., Demarcation Bay), across-the-lead distribution of whales during the spring census, and the possible displacement of the autumn migration route near Point Barrow. Proposed research on these subjects, if completed, will greatly aid management in determining human effects and population abundance.

ACKNOWLEDGEMENTS

The meeting participants were particularly helpful in focusing on specific issues and research topics needed to better understand what directions should be taken next. I am particularly grateful to Jeff Breiwick, Marilyn Dahlheim, Leola Hietala, Mary Nerini and David Rugh of NMML and Ethel Zweifel and the publication branch at the Northwest and Alaska Fisheries Center for their assistance.

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Appendix 1.--List of meeting participants.

Name	Affiliation
Thomas F. Albert, VMD, Ph.D.	North Slope Borough, Barrow, Alaska
Howard W. Braham, Ph.D.	National Marine Mammal Laboratory, NWAFC NMFS, Seattle, Washington
Jeffrey M. Breiwick	National Marine Mammal Laboratory, NWAFC, 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
Cleveland J. Cowles, Ph.D.	Minerals Management Service, Anchorage, Alaska
Lee L. Eberhardt, Ph.D.	Marine Mammal Commission, and Battelle Northwest Laboratories, Richland, Washington
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.
Javed Hameedi	Outer Continental Shelf Environmental Assessment Program, NOAA, Juneau, Alaska
Bruce Mate, Ph.D.	Marine Mammal Commission and Oregon State University, Newport, Oregon
James Meehan	National Marine Fisheries Service, Washington, D.C.
Jerome Montegue	Minerals Management Service, Anchorage, Alaska
Byron Morris, Ph.D.	National Marine Fisheries Service, Anchorage, Alaska
Mary K. Nerini	National Marine Mammal Laboratory, NWAFC, NMFS, Seattle, Washington
David J. Rugh	National Marine Mammal Laboratory, NWAFC, NMFS, Seattle, Washington
Dean Swanson, Ph.D.	National Marine Fisheries Service, Washington, D.C.

Appendix 2.--Documents submitted to the Workshop.

No. 1	Workshop agenda
No. 2	"North Slope Borough Bowhead Whale Research Program (Projects conducted or finalized during 1983)"
No. 3	"Bowhead Whales and the NMFS: Research in Fiscal Years 1983 and 1984"
No. 4	"Bibliography of Minerals Management Service's endangered whale reports: preliminary"
No. 5	FY1983 Minerals Management Service and OCSEAP research.
No. 6	"North Slope Borough - Bowhead Whales: some major areas of concern"
No. 7	NMFS response to Minerals Management Service's drilling decisions for the Beaufort Sea (submitted to workshop by MMS).
No. 8	FY1984/85 Minerals Management Service-OCSEAP research
No. 9	"North Slope Borough bowhead whale research program (Projects funded or planning to be budgeted for during 1984)"

WORKSHOP AGENDA

Third Interorganization Bowhead Whale Research Planning and Technical Coordination Meeting

Date, Place: 13-14 December 1983, NOAA Western Regional Center, 7600 Sand Point Way N.E., Seattle, WA 98115, Cafeteria Conference Room, Building 2.

Purpose: Review, evaluate, and recommend research concerning bowhead whales for 1984.

Convenor: Howard W. Braham, National Marine Mammal Laboratory, NMFS, 7600 Sand Point Way N.E., Building 32, Seattle, WA 98115, 206-442-4711 (FTS 399-4711)

Meeting Objectives:

1. Review research conducted in 1983 and any other significant past results.
2. Determine whether past research has satisfactorily addressed scientific objectives and management concerns.
3. Establish research needs and priorities for 1984, and perhaps 1985, in light of management concerns.
4. Discuss ways to implement and coordinate research among groups, if needed.

Agenda:

13 December, Tuesday

9:00 a.m.	Introduction, review objectives and approve agenda.
9:15 a.m.	Review meeting documents and papers.
9:30 a.m.	Review research in 1983 -- North Slope Borough/ Alaska Eskimo Whaling Commission, and National Marine Fisheries Service.
10:30 a.m.	Break

11:00 a.m.	Review research in 1983 -- Minerals Management Service and NOAA/OCSEAP.
12:00 noon	Lunch
1:00 p.m.	Review management concerns and priorities by organization, considering past (1983 and prior) and current (proposed in 1984 and perhaps 1985) research, and whether research and management needs are being met/addressed.
2:30 p.m.	Break
3:00 p.m.	Continue review of management concerns and needs met.
4:30 p.m.	Adjourn
7:00 p.m.	Group dinner

14 December, Wednesday

9:00 a.m.	Review days' objectives and agenda progress.
9:15 a.m.	Outline needed research for 1984, and discuss in light of priorities established in 1983 or in relation to changing management needs since the December 1983 meeting. (This should be an outgrowth of yesterday's afternoon session.)
10:30 a.m.	Break
11:00 a.m.	Continue priority listing and discussion of proposed research.
12:00 noon	Lunch
1:00 p.m.	Discussion of research coordination; information scheduling; develop a timetable for information needs/research results.
2:30 p.m.	Break
3:00 p.m.	Review of accomplishments; list recommendations to management and researchers; final comments and future directions (e.g., should this working group continue to meet?).
5:00 p.m.	Adjourn

(December 13, 1983)

NORTH SLOPE BOROUGH
BOWHEAD WHALE RESEARCH PROGRAM
(Projects conducted or finalized during 1983)

The Borough supported a number of projects relating to bowhead population estimation and to predicting the likely effects of contact with spilled oil. The projects are listed below.

1. Visual Census of Spring (1983) Migrating Bowhead Whales (Barrow) and Monitoring of the Harvest. NSB personnel and temporary employees.

2. Minimum Population Estimates of the Western Arctic Stock of the Bowhead Whale From Ice Based Census Results 1978-1982. Bruce Krogman and associates (Analytical Software, Inc.).

3. Simulation Studies of Population Trends in Bowhead Whales. Gordon Jarrell and Ed Murphy (University of Alaska). A simulation of the effects of various harvest levels upon various estimates of the population.

4. Inupiat Marine Science Training and Research Program: Bioacoustics/Training 1982. Drs. Cummings, Holiday and Ellison, (Tracor, Inc.). Field work done during spring 1982, data analysis completed. A demonstration of the feasibility of localizing vocalizing whales in order to get some idea of the extend to which whales may pass beyond the range of visual dectection.

5. The Use of Bowhead Vocalization to Determine the Distribution of Whales Within the Leads. Dr. Chris Clark utilized data collected during 1979 and 1980.

6. Structural Studies of the Reproductive Tract, Digestive Tract, and Bone of the Bowhead Whale. To provide basic information on reproduction, digestive abilities, and possible difference between "regular" bowheads and Ingutuks. Dr. Ray Tarpley and associates at Texas A & M University.

7. Structural Studies of the Skin, Eyes, Kidney, and Respiratory Tract of the Bowhead Whale. To provide basic information useful in predicting likely effects of spilled oil upon the whale. Dr. Jerry Haldiman and associates at Lousianna State University.

8. Studies on the Bacteria of the Skin, and Respiratory Tract of the Bowhead Whale. To provide basic information useful in predicting likely disease related effects of spilled oil upon the whale. Dr. Emmett Shotts and associates at the University of Georgia.

9. Instrumentation of Whale Harpoon Floats with Radio-Transmitters. Dr. Erich Follmann (University of Alaska). An effort to enhance recovery of struck but lost whales.

10. Pollutant Levels in Tissues of the Bowhead Whale. Drs. Ed Overton and John Laseter (University of New Orleans). Basic information on concentrations of trace metals, chlorinated pesticides and pet roleum hydrocarbons in tissues of subsistence harvested bowheads.

11. University of Alaska Biological Papers Series. NSB contributed to this program since several of the proposed topics for publication relate directly to the bowhead's habitat.

12. Second Conference on the Biology of the Bowhead Whale. Held in Anchorage on March 7, 8, 9, 1983.
Tech. Doc. 486.

BOWHEAD WHALES AND THE NMFS: RESEARCH IN FISCAL YEARS 1983 AND 1984[1]

The following is a summary outline of National Marine Fisheries Service, Northwest and Alaska Fisheries Center research activities for fiscal year 1983 and proposed for 1984, and related information for discussion covered in the Agenda for the third interorganization bowhead whale research and technical coordination meeting.

I. Research accomplishments from late 1982 through 1983.

The bowhead whale research group at the National Marine Mammal Laboratory (NMML) conducted eight research projects during FY1983, including life history and ageing from biological data, length measurements and photoidentification of whales for studying recruitment, modeling to assess current population status, distribution during the autumn migration, and analysis of stomach biochemistry. Lab scientists also assisted the North Slope Borough and Alaska Eskimo Whaling Commission with their census effort; and development of a comprehensive annotated bibliography was continued. In addition, a related study to OCS activities concerning acoustics and sound playback with gray whales is being conducted principally through the University of British Columbia. Below are abstracts of these activities except the census and bibliography. The study of length measurements was completed by one contractor in early FY1983, and a second contractor continued the field work in summer 1983. A list of papers and reports completed and in press by NMML scientists is in Item V (pages 8-10).

LIFE HISTORY

All available data pertaining to life history parameters of the bowhead whale were summarized in a paper by Nerini, Braham, Marquette, and Rugh (in press). This study synthesized data collected from whales landed by Alaskan Eskimos between 1973 and 1982 as well as information gathered from the literature. Lengths of bowheads were calculated to be 4-4.5 m at birth, 8.2 m at one year, 14 m for sexually mature females, and 20 m as a maximum. Sexual activity, possibly mating, has been observed in March through May. The length of gestation is estimated to be 13 months. The calving period appears to extend from March through August with the peak in births occurring in May. Lactation may extend for one year. The pregnancy rate is at least 0.15, and calving occurs every 3 to 6 years. Gross annual reproductive rate (based on calf sightings) is estimated to range from 3.6% to 11.6%. Sources of mortality, other than man-caused, are difficult to assess and quantify. The sex ratio of animals taken by Eskimos was 0.83:1.00 (females to males) and is not significantly different from unity.

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[1] Prepared in November for the third interorganization bowhead whale research planning and technical coordination meeting, 13-14 December 1983.

AGE DETERMINATION

Two techniques of determining age have been applied to bowhead whales. The first method, involving the racemization of aspartic acid in the eye lens, was first used on fin whales in order to establish a conversion rate for the aspartic acid stereoisomers (Nerini 1983a). The second method used laminae present in the tympanic bullae (Nerini 1983b). Layers were distinctly visible in the periosteal zone of the bullae although the number of layers was influenced by the area of the bullae from which the sample was collected. In contrast to previous research, there appeared to be no distinct relationship between the number of layers in the bullae and the number of growth layers in the ear plugs of gray whales. Consequently, the deposition rate of the bullae laminae is unknown. Further problems to be addressed in the bullae technique include the evident resorption of interior layers.

PHOTOIDENTIFICATION

Photographs of bowhead whales, primarily vertical views from aircraft, are being studied for possible resightings of individual whales. Two workshops were held in 1983 to evaluate the feasibility of identifying bowheads from aerial photographs (Braham and Rugh 1983). White areas on the chin and tail serve as features which help to generally recognize individuals, but specific recognition must be made through irregular scars and marks commonly appearing on whales' dorsal surfaces. Results from the workshops indicate that reidentifications are possible with several resightings occurring within each season of directed effort (Davis et al. 1983). Of 73 identifiable whale images collected in 1983, there were 16 matches with some 25 photographs yet to be examined. No matches have yet been made between years.

LENGTH FREQUENCY

A study of the measured lengths of individual bowhead whales was conducted from 12 August to 5 September 1982 in the eastern Beaufort Sea of Canada (Davis et al. 1983). A total of 728 bowheads was photographed of which 436 were considered of sufficient quality to use in the measurement study, and included repeat measurements of reidentified whales from the same year (1982). The probability of reidentifying a whale was related to the length of the whale, and although the relationship was weak, immature animals were more difficult to measure than adults. Calves were more likely to be photographed than their apparent mothers, but likely to be less measurable than other adults, resulting in an overestimate of the proportion of calves by about 12% of the calf total. Other results indicate that first parturition occurs at lengths greater than 13.5 m, and that about 22% of the whales sampled (n=95) were cows

with calves. The investigators concluded that all animals over 13 m (37.2% of the total sample of 436 whales) were capable of breeding; 18% of those 13 m and greater had calves with them. The immature category (9-13 m lengths) equalled 49.3%, and calves 10.6%. Estimates of the proportion of calves in this sample (GARR or gross annual reproduction rate) were 9.3-12.4% for 1982. From an analysis of calf counts and measured animals greater than 13 m, the authors estimate the proportion of female adults with calves to range from 36% to 68.9% with 49.4% their best estimate. This is significantly greater than the estimate of the birth rate of 14-28% by Nerini et al. (in press) and, based upon a smaller sample collected in 1981 by the contractors, suggests that some bias perhaps exists in the 1982 data or that a higher birth rate occurred that year. As the authors state: "It is probable that adult males and/or resting and pregnant females were not fully represented in our sample" (Davis et al. 1983). Right whales in Argentina and South Africa also differentially segregate spatially, and many whales (especially apparent barren females) are seen only every 2-4 years.

POPULATION MODELING

Leslie-type projection matrices were used to model the Western Arctic bowhead whale population in two stages: (1) from 1848 to 1970, and (2) from 1970 to 2000 (Breiwick, Eberhardt, and Braham, 1984). Several constraints were imposed on adult and immature survival rates and several combinations of age through which immature survival applies (a), age at sexual maturity (m), and maximum age (w) were assumed. Fecundity was derived by assuming that the population was stationary in 1848 (start of commercial exploitation). Estimated kill and struck and lost data, as well as an assumed mortality rate for whales struck and lost, were used to iteratively solve for the 1848 population size assuming the 1970 level was 4,000 bowheads. The 1970 level (4,000) was then projected forward to the year 2000 with constant kill regimes for 1983-2000 of 0, 20, and 40 animals per year. Results indicate that there is an apparent incompatibility between the observed proportion of immature whales in the population and the proportions predicted by population modeling. Improved estimates of calf production and of the proportion of immature bowheads in the population are therefore needed. Maximum net recruitment rate is shown to be very sensitive to adult survival rate and thus accurate estimates of the current growth rate of the bowhead whale population are not possible at present. The parameter combinations used in the model indicate some increase in the population may have occurred from 1910 to 1970. The modeling suggests that the population will remain at about the current size if annual removals are no greater than those prior to 1970.

STOCK IDENTITY

Under a U.S.-U.S.S.R. cooperative research program, ship surveys were made in 1979, 1980, and 1982, primarily to determine whether there is a substock of western Arctic bowhead whales that summers in the western Chukchi Sea instead of migrating to the Beaufort Sea. Over 100 bowheads were sighted along the north Chukotka coast of Siberia in October 1979, and over 200 bowheads were sighted there in September 1980. None were seen anywhere in the Chukchi Sea in late July and August 1982. Based on these surveys as well as others by Soviet scientists, we conclude that the September-October sightings are of bowheads returning from the Beaufort Sea and that there is no western Chukchi substock.

STOMACH BIOCHEMISTRY

Baleen whales have a multichambered stomach divided into three distinct compartments. The forestomach (first compartment) consists of noncornified and nonglandular squamous epithelium and appears to be analogous to the tissue of the rumen. The exact function of the forestomach is unknown; however, we have detected volatile fatty acids in forestomach samples from seven bowhead and four gray whales. Acetic, propionic, and butyric acids were found in all samples. The whales sampled also contained valeric, isobutyric, isovaleric, and isocaproic acids. The types, concentrations, and relative proportions of volatile fatty acids and the morphology of the digestive tract support the hypothesis that microbial fermentation occurs in the forestomach of these two species (Herwig et al. 1984).

ACOUSTICS AND SOUND PLAYBACK

Underwater acoustical investigations were conducted in Laguna San Ignacio, Baja California Sur, Mexico, in 1981-83, to determine 1) the levels of ambient noise prevalent in the lagoon system, 2) to record the underwater signals produced by the gray whale, and 3) to determine the responses of gray whales to projected sound sources. At 32 stations, estimated levels of biological noise (excluding cetaceans) ranged from 94 to 110 dB re 1 µPa, with most energy occurring at frequencies between 2-5 kHz. Received levels of noise from vessels, ranging in length from 25m to 35m occurred between 89 and 105 dB re 1 µPa, with most energy below 2 kHz. "Curious" whales were apparently attracted to underwater sound generated by skiffs powered by outboard engines. This outboard engine noise occupied the same frequency ranges as signals produced by the gray whale (< 2kHz). Six distinct sound types (S1 to S6) were classified for the gray whale on its breeding grounds. An integration of our categorized sound types with published sounds resulted in a definition of a total of seven distinct sound types produced by this species throughout its range. Sound produced by the gray whales and dolphins occurred at frequencies below or above the main concentration of energy of the biological noise, respectively. An acoustical 'niche' hypothesis is proposed for the cetaceans occupying Laguna San Ignacio (Dahlheim et al. in press).

In order to focus on the problem of increasing non-biological noise in the environment of the gray whale and to answer the question as to how this species uses its acoustic signaling most efficiently, a series of underwater "playback" experiments were conducted (Dahlheim and Fisher 1983). The acoustical and behavioral responses of the whales were recorded during pre-trial, trial and post-trial playback periods. Sounds were projected back only during the trial period. With the onset of increased levels of man-made noise, the gray whale's acoustical activities decreased. Observations on the behavioral activities of these whales in response to increased noise resulted in 1) prolonged dive times and 2) direct movements on the part of the whales away from the transducers. The acoustical and visual responses of the whales varied depending upon the sound stimuli being presented.

II. NMFS research mandate to address management issues.

The principle responsibility of the NMFS is to ensure that the recovery of the bowhead whale is not thwarted as a result of human activities (Marine Mammal Protection Act of 1982 (MMPA) and the Endangered Species Act of 1973 (ESA)). Under this responsibility of stewardship, we are concerned with the continued existence of the species. Specifically, this means ensuring that the Alaskan Eskimo harvest does not exceed whale production and that the population is not jeopardized by coastal development such as oil and gas activities. These mandates are legislatively based and managed by agreement with the International Whaling Commission, Alaska Eskimo Whaling Commission, and via Section 7 of the ESA, with the U. S. Department of the Interior.

The effects of the Eskimo hunt and determination of the status of the population have been addressed through a comprehensive 5-year research program begun in fiscal year 1978. The research objectives were to determine:

1. current and pre-commercial whaling population size;
2. temporal and spatial distribution and migration;
3. life history parmameters; and
4. growth and recovery of the population and effect of the subsistence take.

The 5-year study has met these objectives, with varying completeness. The principal study continuing beyond the 5-year plan to fulfill management concerns is to further refine the estimate of recruitment.

No current research by NMML is directly aimed at OCS activities. This concern is addressed through the ESA biological consultation process with the Interior Department's Minerals Management Service and NMFS management. Extensive review and consultation, however, is provided by the NWAFC, NMML.

III. NMFS research needs for fiscal year 1984.

Given that sufficient field research funds become available, the NMML will continue work on estimating parameters associated with recruitment and help validate the distribution of whales near the Point Barrow census camps. Specific activities will be:

1. Conduct aerial surveys north and west of Point Barrow to photograph bowheads and from which measure the lengths and identify individuals. This study will help to provide an independent analysis of the same studies conducted in the Beaufort Sea in 1981-83, and proposed for 1984.

2. Conduct aerial surveys across the lead(s) at Point Barrow to determine the distribution of whales adjacent to the census camp(s) and thus develop an independent validation for the number of whales included in the population estimate via visual counts and passive acoustics.

3. Conduct aerial surveys in the Canadian Beaufort Sea to determine the length-frequency distribution in the population. As with the spring study, photoidentification will be an integral part to help assess recruitment and habitat use.

4. Review the available literature to determine the accuracy of current use of mortality estimates for large whales; and, assess other life history parameters for large whales so as to better refine estimates of status and recovery.

Research topics 1-3 above are dependent upon a currently pending $300,000 Congressional appropriation. (Author's note: $350,000 was appropriated by Congress in March 1984; $50,000 for the AEWC and $300,000 to NMML research.) In addition to funding, items 1 and 2 above require permission by the Eskimo community in Barrow.

Additional, unfunded research topics developed by NMML scientists requiring attention are:

1. Ageing. Standard methods have not proven consistent. Internally tagging calves and/or injecting them with quinacrine (or another marker) will greatly aid ageing determination upon future recovery of tagged animals.

2. Feeding trophics. A comprehensive study of the food resources of bowheads in the Beaufort Sea is needed to determine the location, extent and importance of food types for bowheads. Determination of feeding outside the Beaufort, e.g., in the Chukchi and Bering Seas, is also warranted in order to determine the extent of habitat usage.

3. Logbook analysis. Some logbooks and other whaling records remain unanalyzed for bowheads taken during land-based operations along the shores of the U.S. and U.S.S.R. These records will help evaluate the extent of removal, perhaps add to estimates of early population size before and at the end of commercial whaling, and give additional details on the natural history of the species.

4. Winter distribution. Research on the wintering grounds is warranted to determine if mating and feeding occurs.

5. Acoustic detection. Determine the acoustic level in areas of high versus no use by humans along the spring migration and compare whale behavior, including extent of "vocalizations", to environmental sound. A comparison of noise type will be made (e.g., aircraft, snow machines, etc.).

6. Active sonar detection. Further test active sonar (Omni directional) methods which might determine the number of whales present, supplementing any census and behavior work.

7. Skull morphometrics. Analysis of skull measurements is needed to assess the distribution of relative ages of whales located near abandoned Eskimo villages and camps. This will help establish early whaling practices and provide better understanding of historical temporal and spatial movements of bowheads. Included in this will be coastal surveys for stranded whales.

8. Stomach biochemistry and energetics. Continue the study of the biochemistry of digestion and understand energetics through volumetric and caloric analyses (see Herwig et al. 1984).

IV. Research coordination and scheduling.

a. The NMML will cooperate with the North Slope Borough and AEWC again in 1984 with their census, mainly by providing equipment, supplies and advice, and with the final analysis of past census data. Review of research results from Minerals Management Service studies is a routine activity through NMFS management.

b. NMML activity and reporting time schedule.

Activity or research result (x-work ends; R-final report; M-meeting)	FY1984 Months O	N	D	J	F	M	A	M	J	J	A	S
1. 1983 contract on length-frequency and photoidentification	---------X		R									
2. Results of 1983 photoidentification workshop			R									
3. 3rd coordination meeting			M---------R									
4. Analysis of interspecific relationships and mortality estimates			----------X		R							
5. 1984 length-frequency and photoidentificaton study							--X		--X			
6. Annotated bibliography	----------X											

V. List of bowhead and topic-related papers and reports completed late 1982 through 1983 and in press (revised *April 1984).

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FY1983 Minerals Management Service Research and OCSEAP

MMS

1. Aerial Surveys of Endangered Whales in the N. Bering, Chukchi and Beaufort Seas.

2. Tissue Structured Studies and Other Investigations on the Biology of Endangered Whales in the Beaufort Sea.

3. The Effect of Oil on the Feeding Mechanisms of the Bowhead Whale.

4. Possible Effect of Acoustic and Other Stimuli Associated with Oil and Gas Exploration/Development on the Behavior of the Bowhead Whale.

5. Development of Satellite Linked Methods of Large Cetacean Tagging and Tracking Capabilities in OCS Lease Areas.

6. Computer Simualtion of the Probability of Endangered Whale Interactions with Oil spill in the Beaufort, Chukchi, and Bering Seas.

OCSEAP

7. Endangered Whale Surveys of the Norton Basin, Alaska.

(December 13, 1983)

NORTH SLOPE BOROUGH

Bowhead Whale: Some Major Areas of Concern

1. Continuation of the bowhead census activities off Barrow until it is felt that the best estimate of the population size has become available.

2. Trying to reduce the overall threat to the bowhead from offshore oil development
   - effects of spilled oil
   - effects of noise

3. Protection of bowhead migratory pathways so as to not interfere with subsistence activities.
   - Some Barrow hunters feel that industrial noise has already displaced the fall migratory route so that whales are further offshore when they reach Point Barrow.
   - Some Kaktovik (Barter Island) hunters wonder whether their fall hunt will be similarly impacted.

4. Documentation of importance of waters between Barter Island and Canadian border as feeding area and migratory route for bowhead whales.
   - Should this area by considered for designation as Critical Habitat?

Doc. #7

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
P. O. Box 1668
Juneau, Alaska 99802

A TRUE COPY

September 30, 1983

Ms. Esther Wunnicke
Commissioner
Department of Natural Resources
Pouch M
Juneau, Alaska 99811

Dear Ms. Wunnicke:

We did not attend the September 23 meeting called by your staff to discuss the tentative decision on whether or not the industry has adequate cleanup capability for oil spilled into the Beaufort Sea. Later that day, we met with Department of Natural Resources staff and agreed to provide our comments on the options under consideration.

The draft language provided via a September 22, 1983, memo signed by Commissioners Neve' and Wunnicke for a "Conditional Tier 2 Seasonal Drilling Approval" included the determination by the State of Alaska that, "Notwithstanding the good cleanup capability found, the State cannot insure in all cases that the path of the bowhead whale will be free of oil in the fall..." Based upon this determination and our review of the draft conditions and options provided us, we offer the following comments for consideration while reaching your decision on this matter.

Condition 1: Terms and conditions of the May 16, 1982, seasonal drilling decision remain in force.

We feel this is an important condition because of the requirement in the drilling decision document for a monitoring program to determine when whales are migrating through or near the area and for monitoring the effects of drilling above the threshold depths during the fall bowhead whale migration on locations or inside the barrier islands.

The September 1 through October 31 dates in our Beaufort Sea Biological Opinion were offered as a guideline on when bowhead whales are usually present in the area. Whales could be in the area as early as mid-August or as late as November. The actual presence of whales should be the primary decision criteria. During any given year, aerial monitoring or other surveys are needed to determine if whales are in the vicinity of drilling operations.

Condition 3: The lessee shall embark upon a research and development program to further advance the state-of-the-technology for cleaning up spilled oil in the Alaska Beaufort Sea, especially in broken ice conditions.

Although it is possible bowhead whales may be present in the western Beaufort during the spring period, it is not likely they will use the areas near exploration drill sites now operating or planned for operation on artificial or natural islands. Oil spilled during broken ice conditions in the spring could also affect other marine mammals and the local arctic ecosystems. It is possible advanced drilling technology may provide the oppotunity for drilling from platforms other than artificial or natural islands. More technological research is needed to minimize harm to marine mammals and other marine animals as well as nearshore habitats and ecosystems from oil spills in broken ice.

Conditional Tier 2 Drilling Approval

In our Biological Opinions, we stated that the Minerals Management Service should keep the bowhead whale migration path free of oil as a Reasonable and Prudent Alternative for avoiding jeopardy to the species. We further stated that exploratory drilling and associated activities should be prohibited when bowhead whales are present in the lease sale areas. We continue to support the reasonable and prudent alternatives as stated in the Lease Sale BF and Lease Sale 71 biological opinions.

To the extent that they are consistent with our biological opinions, we prefer Option 2 for areas on and inside the barrier islands, and Option 1 for areas outside the barrier islands. These options are preferable since they most closely parallel the reasonable and purdent alternatives offered in the biological opinions. It should be reiterated that NMFS provided as part of the reasonable and prudent alternatives that critical factors such as the time necessary for lessees to control a blowout and clean up spilled oil, as well as the environmental conditions that may affect the time necessary for clean up, be considered in ensuring that the lease sale areas are free of oil when migrating bowhead whales arrive. However, we stated that exploratory drilling should be suspended when bowhead whales are actually present, which may be from mid-August to November.

Sincerely,

(signed by James W. Brooks)

Robert W. McVey
Director, Alaska Region

FY1984/85 Minerals Management Service-OCSEAP* Research

FY1984

1. Aerial Surveys of Endangered Whales in the N. Bering, Chukchi and Beaufort Seas.

2. Possible Effects of Acoustic and Other Stimuli Associated with Oil and Gas Exploration/Development on the Behavior of the Bowhead Whale.

3. Development of Satellite Linked Methods of Large Cetacean Tagging and Tracking Capabilities in OCS Lease Areas.

*4. Computer Simulation of the Probability of Endangered Whale Interaction with Oil Spills in the Beaufort, Chukchi, and Bering Seas.

FY1985 (Proposed; as yet unapproved studies)

1. Aerial Surveys of Endangered Whales in the N. Bering, Chukchi and Beaufort Seas.

2. Development of Satellite Linked Methods of Large Cetacean Tagging and Tracking Capabilities in OCS Lease Areas.

3. Prediction of Site-specific Interaction of Acoustic Stimuli and Endangered Whales of Diapir Field Lease Offering Area.

4. Food Organism of Bowhead Whales in the Eastern Beaufort Sea.

(December 13, 1983)

NORTH SLOPE BOROUGH
BOWHEAD WHALE RESEARCH PROGRAM
(Projects funded or planning to be budgeted for during 1984)

The Borough is supporting and planning to support a rather wide range of projects during this period that relate to bowhead population estimation and relate to predicting the likely effects of contact with spilled oil. The projects are listed below.

1. Visual Census of Spring (1984) Migrating Bowhead Whales Off Barrow, Alaska and Monitoring of the Harvest. NSB personnel and temporary employees.

2. Acoustical Localization Studies of Spring (1984) Migrating Bowhead Whales Off Barrow, Alaska. To provide detailed spatial distribution data on vocalizing whales in the vicinity of the visual census site. To be done by Drs. Bill Ellison and Chris Clark.

3. Estimation of Water Current Speed and Direction in the Vicinity of the Barrow Census Station. These direct measurements will be useful in refining the present model used to differentiate between "new", "conditional" and "duplicate" whales. To be done by NSB personnel.

4. Estimation of the Proportion of the Bowhead Population Which Passes the Barrow Census Station Unseen. This estimate will be derived from an integration of the acoustic and visual census data bases. To be done by Bruce Krogman and associates (Analytical Software, Inc.)

5. Instrumentation of Whale Harpoon Floats with Radio-Transmitters. Dr. Erich Follmann (University of Alaska). A continuation study to enhance recovery of struck but lost whales.

6. Structural Studies of the Reproductive Tract, Digestive Tract, and Bone of the Bowhead Whale. A continuation study to provide basic information on reproduction, digestive abilities, and possible differences between "regular" bowheads and Ingutuks. Being done by Dr. Ray Tarpley and associates at Texas A & M University.

7. Structural Studies of the Skin, Eyes, Kidney, and Respiratory Tract of the Bowhead Whale. A continuation study to provide basic information some of which may be useful in predicting likely effects of spilled oil upon the whale. Being done by Dr. Jerry Haldiman and associates at Louisianna State University.

8. Studies on the Bacteria of the Skin, and Respiratory Tract of the Bowhead Whale. A continuation study to provide basic information useful in predicting likely disease related effects of spilled oil upon the whale. Of major interest are the bacteria inhabiting the eroded areas of the skin. Being done by Dr. Emmett Shotts and associates at the University of Georgia.

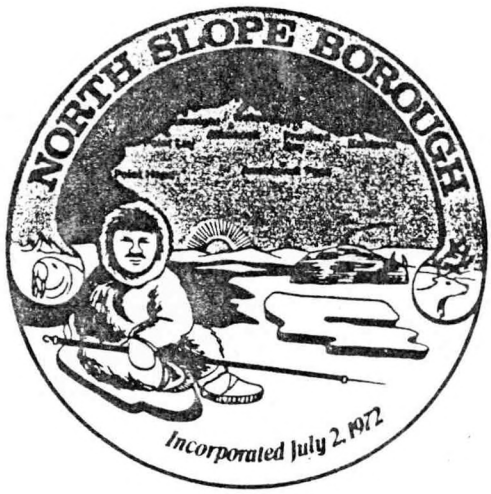
9. Pollutant Levels in Tissues of the Bowhead Whale. Drs. Ed Overton and John Laseter (University of New Orleans). A continuation study to obtain basic information on tissue concentrations of trace metals, chlorinated pesticides and petroleum hydrocarbons in subsistence harvested bowheads.

10. Third Conference on the Biology of the Bowhead Whale. To be held in Anchorage, January 1985. A major topic will be a review, prior to the 1985 IWC meeting, of population assessment techniques and data.

11. University of Alaska Biological Papers Series. NSB is continuing to contribute to this program since several of the proposed topics for publication relate directly to the bowhead's habitat.

FIRST ANNOUNCEMENT

THIRD CONFERENCE ON THE BIOLOGY OF THE BOWHEAD WHALE
Balaena mysticetus



SPONSORED BY
The North Slope Borough
Barrow, Alaska 99723

TENTATIVE DATE
Late January 1985
Anchorage, Alaska

GENERAL COMMENT

As part of its Bowhead Whale Management Plan, the Alaska Eskimo Whaling Commission encourages the scientific study of the Bowhead. In line with this, the North Slope Borough will sponsor a series of conferences dealing with various aspects of the Biology of the Bowhead Whale. Such conferences will serve to gather together concerned individuals for the timely exchange of information and ideas.

MAJOR OBJECTIVES OF THE CONFERENCE

1. To evaluate available methodologies and data regarding Bowhead Whale population assessment.
2. To evaluate available methodologies and data regarding the study of Bowhead Whale behavior.
3. To evaluate available methodologies and data regarding the study of certain aspects of the basic biology (morphology, vocalization, food habits) of the Bowhead Whale.

CONFERENCE FORMAT

The Conference will be three days in length. The first day will be devoted to the presentation of invited papers. The presented papers will serve to bring participants up to date in the various aspects of Bowhead Whale biology that will be considered in the group discussions.

The second and third days of the Conference will be devoted to group discussions in line with the above stated objectives of the Conference. Such discussions will obviously draw upon the experience and interests of the participants. Each group will prepare a written review of relevant data identifying areas needing additional study and, if appropriate, recommend study designs.

A proceedings document will be published that will contain the extended abstracts of the presented papers and the products of the group discussions.

ATTENDANCE

A wide range of individuals (scientists, subsistence hunters, managers) will be invited to participate. Conference attendance will be open to other interested individuals, however it is requested that they make prior arrangements with the Mayor of the North Slope Borough.

Additional materials regarding the timing of the Conference and the agenda will be sent to those individuals that had participated in the Second Conference. Others wishing to be so informed are requested to supply their name and address to the Mayor of the North Slope Borough (Box 69, Barrow, Alaska 99723).