NOAA Technical Memorandum NMFS F/NWC-36

Report of the First Interorganization Bowhead Whale Research Planning and Technical Coordination Meeting, 11-12 March 1982

by
Howard W. Braham

October 1982

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

REPORT OF THE FIRST INTERORGANIZATION BOWHEAD WHALE RESEARCH PLANNING AND TECHNICAL COORDINATION MEETING, 11-12 MARCH 1982[1/]

by

Howard W. Braham

National Marine Mammal Laboratory
Northwest and Alaska Fisheries Center
National Marine Fisheries Service
National Oceanic and Atmospheric Administration
7600 Sand Point Way N.E., Building 32
Seattle, Washington 98115

October 1982

1/ Submitted as discussion document SC/34/PSWP1 during the Thirty-fourth meeting of the Scientific Committee of the International Whaling Commission (IWC) in Cambridge, England, on 26 June-8 July 1982.

ABSTRACT

Participants of the First Interorganization Bowhead Whale Research Planning and Technical Coordination Meeting agreed on the highest priority needs for the short term research, (1982-83) of the bowhead whale, Balaena mysticetus as follows: 1) provide more reliable estimates of the -annual gross recruitment rate through studies of body length -- measurements of individual whales by means of photographs-,:" taken from aircraft; 2) further evaluate sources of bias in the census and determine precision 'of the counts made near Barrow, Alaska, since 1978; 3) continue the census at Barrow with the aim of improving the accuracy of the count and subsequent minimum population estimate(s); 4) 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; 5) further evaluate movements and densities of whales in the pack ice and near or in the Beaufort Sea oil lease areas; and 6) evaluate the importance of feeding areas off the Alaska coast;

Long term research was not discussed at length, 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 agreement or commitment to fund any the recommended research was possible at this meeting.

CONTENTS

INTRODUCTION

The National Marine Fisheries Service (NMFS) is the U.S. government agency with the primary responsibility for the research and, under a cooperative agreement with the Alaska Eskimo Whaling Commission (AEWC), for management of the bowhead whale, Balaena mysticetus. Intermittently since 1979, representatives from the NMFS, Minerals Management Service (MMS)[2/], and Marine Mammal Commission (MMC), with assistance and advice of representatives from the Alaska Eskimo Whaling Commission (AEWC), Outer Continental Shelf Environmental Assessment Program. (OCSEAP), the petroleum industry (Industry), and the Alaska Department of Fish and Game (ADF&G) have met to discuss the objectives, activities, and concerns of each group.

The primary purpose of these meetings was to assess bowhead research needs, establish priorities, and coordinate activities of the various groups. One objective, never realized, was to develop a document that would identify important data gaps, list priorities, and outline intended activities of the various groups involved or interested in bowhead whale research.

To meet the continuing need for identifying research priorities and developing the desired document, a meeting was held in Seattle, Washington, on 11-12 March 1982, at the Northwest and Alaska Fisheries Center, NMFS, sponsored by the National Marine Mammal Laboratory (NMML). The 12 participants included scientists, administrators, attorneys, and managers, all knowledgeable about past bowhead research, who spoke for their respective organizations on future research needs and plans. The participants are listed in Table 1.

As a basis for discussion, I prepared a draft report, "Bowhead Whale Research in the United States" (Braham 1982), and circulated it for review by participants and others prior to the meeting. Material incorporated in this working paper was drawn from various reports, plans, and publications, including a document entitled "Bureau of Land Management and National Marine Fisheries Service Coordinated Bowhead Research Plan," a forerunner of the current NMFS report that was drafted in 1981 but was never completed and not released. The 1982 report was discussed at length by the meeting participants, and their additional written comments are being incorporated.

The meeting closely followed a prepared agenda (Table 2).

[2/] Formerly the Bureau of Land Management.

Table 1 .--List of participants at the First Bowhead Whale Research Planning and Technical Coordination meeting.

Name	Affiliation
Thomas F. Albert, VMD, PhD	North Slope Borough, Barrow, Alaska
Howard W. Braham, PhD	National Marine Mammal Laboratory, National Marine Fisheries Service, Seattle, Wash.
Douglas G. Chapman, PhD	Marine Mammal Commission, Seattle, Wash.
Cleveland J. Cowles, PhD	Minerals Management Service, Anchorage, Alaska
Raymond B. Dronenburg	North Slope Borough, Barrow, Alaska
Deborah M. Gottheil	Alaska Eskimo Whaling Commission, Washington, D.C.
James H. Johnson	National Marine Mammal Laboratory, National Marine Fisheries Service, Seattle, Wash.
Percy Nusunginya	Alaska Eskimo Whaling Commission, Barrow, Alaska
Patricia, E. Starratt	SOHIO Alaska Petroleum Company, Anchorage, Alaska
Timothy F. Sullivan	Minerals Management Service, Washington, D.C.
S. Lynn Sutcliffe	Alaska Eskimo Whaling Commission, Washington, D.C.
Michael F. Tillman, PhD	National Marine Mammal Laboratory,. National Marine Fisheries Service, Seattle, Wash.

Table 2.--First Bowhead Whale Research Planning and Technical Coordination meeting agenda (revised 18 March 1982).

Date, Place: 11-12 March 1982, Northwest and Alaska Fisheries Center, NMFS, Room 369 West 2725 Montlake Boulevard East Seattle, Washington 98112

Purpose: Interagency and organization discussions on bowhead whale research recommendations and priorities.

Convenor: Howard W. Braham, National Marine Mammal Laboratory, NWAFC,NMFS, Seattle, Washington.

Meeting Objectives:

1. Come to a consensus on needed bowhead whale research and priorities to meet appropriate management concerns.
2. Discuss how research can and should best be implemented in light of current and future funding and available personnel.
3. Correct and clarify technical information in the working draft research report prepared for this meeting titled "Bowhead Whale Research in the United States."

Agenda Discussion:

11 March

9:30 AM	Introductions and review of agenda.
9:35 AM	Explanation of this exercise, and a historical overview of interagency coordination meetings.
10:00 AM	Explanation of tabled research document.
10:15 AM	Discussion of draft research report. 1. The Problems - The Mandates (pp. 2-10) 2. Primary Management and Research Objectives (p. 10-12) 3. Bowhead Whale Research: A Brief Overview (D. 12-16)
12:30 PM	Lunch (Century Restaurant).
2:00 PM	Continue discussing draft report. 4. An Assessment of Progress (pp. 16-26) 5. Research Recommendations versus Knowledge Gained (p. 26-34)
5:oo PM	Review of meeting progress, adjourn.
7:00 PM	Dinner at the Smuggler (at Pier 70).

12 March

9:30 AM	Brief discussion of day's agenda and expected accomplishments.
9:45 AM	Continue discussing draft report. 1. Research Recommendations: 1982,and Beyond (p. 34-41) 2. Implementation Schedule (Appendix IV, p. 49-51)
12:30 PM	Lunch (open)
1:30 PM	Discussion and agreement on research recommendations and priorities.
5.:00' PM	Closing comments and adjourn.

RESEARCH PRIORITIES, 1982-83

Research proposed for 1982 by the NMFS, MMS, and AEWC-North Slope Borough (NSB) is listed in Table 3. Much of this work is a continuation of past efforts. Research activities planned as of April 1982, however, will not completely address several questions discussed by the meeting participants. These were 1) improve life history information, such-as calf production and aging determination; 2) improve the accuracy of the annual spring census for missed whales, and variance estimation; 3) investigate whether alternate or multiple migration pathways occur in spring and summer in the western Chukchi Sea, and in summer and autumn in the U.S. Beaufort Sea; 4) determine seasonal distribution and the proportion of the total population likely to enter or pass by the various Outer Continental Shelf (OCS) lease areas (especially the Beaufort Sea); and 5) investigate biologicial and ecological effects of oil and associated OCS activities on bowheads and their prey.

Each of these points has been addressed by and preliminary conclusions reached from past research. Although the problems are not fully resolved and it is not clear how much more will be achieved towards their resolution in 1982 or 1983, these topics are of such high priority that the group urged that long-term research should be initiated simultaneously with. current, short-term work. For example, the group discussed the need for a method of determining age or to better understand growth in young whales from birth to sexual maturity. Use of discovery tags as a means of understanding aging and growth was recommended as a long term project perhaps requiring up to 50 whales per year be tagged for 5-10 years. After the meeting Dr. Tillman and I explored the possible availability of tags and found that the best chance to obtain 0.410 tags to implant in small (i.e., supposed yearling) bowheads is through the IWC. The AEWC and NSB representatives have proposed that the Eskimo whalers tag the whales.

The research priorities recommended were agreed to be a result of several critical management mandates: the two most important are the determination of what is the expected current growth of this population (a question of population dynamics), and the need to know the absolute versus the relative size of the population. Consideration of future management strategies will depend on the "best estimates" of these values, and thus an immediate and long-term commitment to study recruitment and population enumeration were deemed the most important considerations of any research planning.

The participants agreed that the following six priority research subjects should be addressed in fiscal years 1982-83 (i.e., a fiscal year extends from 1 October to 30 September). These are listed in their approximate order of priority, although individual agencies or groups have priorities which may not necessarily reflect this ordering.

Table 3. --Summary of fiscal year 1982 projected major bowhead whale research activities as of April 1982.

NMFS

1) Analysis and report of 4 years of census data including analysis of precision based on variance estimation.
2) Analysis of biological and life-history information and continuation of contracted or in-house studies of aging and biochemistry and genetics.
3) Further documentation and development of an annotated bowhead whale bibliography.
4) Continuation of a preliminary modelling exercise, considering life history and Eskimo take, to evaluate current status of the stock with regard to population growth.
5) Conduct a joint US-USSR vessel survey (Soviet ship) into the western Chukchi Sea, 10 July to 20 August 1982 to determine if bowheads may have been missed at the Point Barrow census camps.

MMS

1) Aerial and/or vessel surveys of bowheads from the Bering to Beaufort Seas; seasonal distribution and density.
2) Testing radio tagging and tracking gear on humpback whales for future use on bowheads.
3) Behavior and acoustic studies of bowheads during summer in the Canadian Beaufort Sea.

AEWC/NSB

1) Ice-based census near Point Barrow of the spring migration.
2) Harvest monitoring and collection of morphological data and biological samples as well as laboratory analysis.
3) Acoustical studies in support of the census camps during the spring migration.
4) Support for evaluation of biases and variance estimation of previous NMFS census data.
5) Population modelling to assist in the evaluation of status of stocks in relation to harvesting bowheads.

Estimation of Annual Production

The number of calves entering a population each year can be empirically determined in two ways: 1) by direct counts or 2) indirectly, by obtaining an unbiased estimate of the lengths of individuals in the population-,, Method 2) allows for the development of a length-frequency distribution of the entire population and is preferred because length presumably is, determined by age such that the data can be used to assess age structure, at least with regards to the approximate proportion of mature versus immature animals. Furthermore, a much larger sample size is possible with length-frequency studies than direct calf counts. In addition, an indirect estimate of survivorship may be possible if a life table can be constructed from the length-frequency data.

Length-frequency distribution in the population may be determined using calibrated high resolution photographs (large to medium format) taken from low-flying and high-flying aircraft. Both low- and high-altitude methods can be employed during the spring migration (from St.. Lawrence Island to Point Barrow) and in summer while whales are feeding in the eastern U.S. Beaufort Sea and Canadian waters; From a practical standpoint, the summer period is the best because the animals are relatively stationary, they spend more time at the surface in a still position, there is more daylight, and weather is generally good.

Low-flying aircraft (75-600 m altitudes, 150 m preferred) allow for repeated passes over individuals and groups of whales, to increase the precision and accuracy of both the photographs and counts of whales present. This method also increases the chances of taking multiple photos for future identification of individual whales, which may provide the basis for considering "mark-recapture" estimating methods. Costs for low-fly-ing aircraft were estimated to be $200,000 to $450,000 per year depending upon type of aircraft, salaries and other costs. Meeting participants agreed that low-altitude work was more likely to be successful and therefore preferable to the high-altitude method.

High-flying (l,OOO-6,000 m) NASA and military aircraft, such as the Convair 990 and U-2, equipped with fixed cameras, cover a large area in a few hours. The photographs that can be obtained are of good quality; however, this approach has several limitations: 1) high ceilings (not common in the Arctic) are required; 2) maneuverability of the aircraft is restricted, yet maneuverability is a prerequisite for repeated photographs of groups of whales; 3) close examination of large numbers of photographs is required; 4) only a very small proportion of whales will be lying at the surface at any given time; and 5) from a high altitude, observers cannot see the whales and thus cannot direct the aircraft to stay over groups of whales. The method has been tested, however, and appears worthy of further investigation. The group felt that this method should be used in conjunction with the low-altitude flights, but could not recommend it as the only method. Cost estimates for the high-altitude photographic survey range from a low of $20,000 for only a few hours of flight "piggybacked" on the Convair 990 to a high of $300,000 using an aircraft chartered for 3-6 days each season.

Improve the Accuracy of the Spring Census

Not all bowheads are counted by the ice camp observers. Some whales go by undetected although within the viewing range of the observers, some go by beyond the observers' viewing range, and some pass by either before the census camps open or after they close, or some whales may not migrate into the Beaufort Sea at all.

In addition to increasing the accuracy of the annual ice camp census at Barrow (with increased personnel and computer techniques such as were employed by the NMML in 1980-81, Krogman et al. 1982), an estimate of how many whales are missed by the ice camp observers can be made in at least two ways: 1) by obtaining a statistically reliable sample (estimated to be at least 150 whales for any one year) of the distribution of whales across the lead and into the pack ice at the census site; and 2) by augmenting visual counting with acoustic monitoring, in order to detect phonating whales that are unseen from the ice camps. The AEWC/NSB is planning to conduct an acoustic monitoring project off Barrow, during the spring 1982 migration. The aerial survey method was tested by NMFS in 1979 and 1981 and found to be reliable (Marquette et al. 1982).

The most expeditious and perhaps the only statistically representative way of determining frequency distribution of whales across the lead and beyond the range of the observers is by use of aircraft. However, this method has been rejected by the AEWC/NSB as being too disturbing to the whalers. Should that decision be reversed, the costs for an aircraft to obtain across-the-lead data would be approximately $50,000 to $150,000, but this would include data collection for determining the number of animals missed preceding the counts and (moving by Barrow) after the census camps have closed.

Evaluation of Biases in the Analysis of Census Data

There is an immediate need to develop a variance estimator for the current abundance estimates derived from the Barrow counts. This will provide a means of measuring the precision of estimates by establishing statistical confidence limits around any estimate-produced value for each year's data. This can be achieved using the existing NMFS data base for 1978-81, and will take about 3-6 months. This project was subsequently funded by the AEWC/NSB after the March meeting and the work is currently underway by a private consultant for $10,000.

Summer Distribution Study to Further Validate Barrow Counts

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, planning is underway through the US-USSR Cooperative Agreement on the Protection of the Environment for NMML to survey the northwestern Bering Sea and western Chukchi Sea from 10 July to 20 August 1982, in a converted Soviet whaling vessel. This would be the third joint cruise of its kind; the former two surveys (1979 and 1980) were conducted in

September and October when bowheads can be expected to have migrated there from the Beaufort Sea. This project is funded for fiscal year 1982 by the NMFS. An additional estimated $25,000 for flight time in June and July would be necessary to cover areas south and west of Barrow to determine if there are bowheads migrating after the spring census period. The MMS/OCSEAP supported research on gray whales, Eschrichtius robustus, in summer 1982 in the Bering and Chukchi Seas may detect possible late migrating bowheads.

Distribution Study Relative to the Movement of Bowheads Whales in the Beaufort Sea

Aerial surveys of the pack ice, ice front zone, and open water in the Beaufort Sea in July and August are needed to help determine 1) whether there is early movement of some whales from the Canadian Beaufort Sea to the Chukchi Sea, thus accounting for the occurrence of bowheads in Soviet waters and Canadian waters simultaneously in September and October; and 2) the temporal and spatial distribution of whales relative to activities in or near the OCS oil lease sale area in the U.S. Beaufort Sea, particularly in September and October. In August 1982, the MMS may dedicate up to 50 hours of flight time to survey further offshore than in past years (C. Cowles, pers. commun.). Vessel work could augment flights over the nearshore, open-water areas.

Evaluation of Possible Feeding Areas off the Alaska Coast

The study of movements and behavior of whales from Demarcation Bay to the lease area in the U.S. Beaufort Sea is important to further delineate habitat used by whales, perhaps for feeding. Some of this-work could be accomplished by planned 1982 aerial surveys supported by the MMS, but that may not be possible. An estimated $300,000 per year for September and October would be needed for such a project, if aerial survey and vessel work were done in conjunction with biological oceanographic studies.

FINAL COMMENT

Understanding the ecology of the bowhead is the most important aim of research; it puts this whale and human activities into better. management perspective. However, in view of the fact that gaining complete knowledge about the bowhead is unattainable, certain specific problems must be addressed so that responsible organizations can make management decisions based on sound biological information. A summary of proposed research activities, estimates of time to collect a satisfactory data base and costs is provided in Table 4. This list also includes research other than the highest short-term priorities discussed above, but which were addressed at the meeting. Other high priority items such as population modelling are currently being conducted independently by the NMFS (Breiwick et al. 1982) and AEWC/NSB (Murphy and Jarrell in press) but will continue to be dependent on the collection of biologicaldata from the harvest and on life-history analyses.

It was agreed by the participants that coordination meetings should be an annual event. The next (second) meeting was recommended to be held in Alaska, in December 1982 or January 1983.

ACKNOWLEDGEMENTS

I am grateful to James H. Johnson, National Marine Mammal Laboratory, who helped me in developing the meeting and this report. Leola Hietala typed the drafts and final report. I also thank Drs. William Aron and Michael Tillman for making this group welcome and enthusiastically, endorsing the purpose of the meeting, and the meeting participants for their interest and support.

Table 4--Research implementation schedule, 1982 and beyond.

Research topic	Additional years needed 1/	Potential responding organization 2/	Cost 3/ (per yr thousands)	Priority 4/ (rank)
A. Population enumeration				
1. Spring census				
a. Counts from ice edge	c	AEWC/NSB(*) & NMFS (*)	$195	1
b. Validate sighting distribution across lead	3	None	$ 50	1
c. Distribution of offshore early and late migrants	2	AEWC/NSB & NMFS	$150	2
d. Further analysis of biases in past census data	1	AEWC/NSB(*) & NMFS(*)	$ 30	1
e. Remote acoustic monitoring	2	AEWC/NSB(*)	$100	2
2. August-September census on feeding grounds	2	None	$175	2
B. Distribution and migration				
1. Summer US-USSR surveys of Soviet Chukchi and Bering Seas	2	NMFS(*)	$ 5	1
2. Summer surveys of Beaufort pack ice and open water	2	MMS(*)		2
3. Autumn surveys of				
a. eastern U.S. Beaufort Sea	1	MMS(*)	$200	2
b. U.S. Chukchi Sea	2	MMS	$200	3
4. Tagging: a. Radio-satellite	2	MMS(*)	a. $265	2
b. Discovery tags (see C.5)	<10	AEWC/NSB & NMFS	b. $ 10	2

Table 4.-- Continued.

Research topic	Additional years needed 1/	Potential responding organization 2/	Cost (per yr thousands)	Priority 4/ (rank)
C. Biology and life history				
1. Collect biological information and material from harvested whales including "struck and lost" data	c	AEWC/NSB(*) & NMFS	$ 75	1
2. Analysis of reproductive tracts and other material	c	NMFS(*) & AEWC/NSB(*)	$ 15	1
3. Estimating calf production and length-frequency distribution a. low-altitude flights b. high-altitude flights	3	NMFS	a. $200-400 b. $150-300	1
4. Population modelling of life history and harvest removal	2	NMFS(*) & AEWC/NSB(*)	$ 30	1
5. Aging bowheads (also see B. 4)	c	NMFS(*)	$ 30	1
6. Prey life history	2	None	$ 50	3
7. Trophic relations, biological oceanography, and prey distribution in the eastern Beaufort Sea	2	MMS	$300	3
8. Biochemistry and energetics of food, and stomach contents	2	NMFS(*) & AEWC/NSB	$ 25	3
9. Morphometrics and growth	2	NMFS	$ 10	2

Table 4.--Continued.

Research topic	Additional years needed[1/]	Potential responding organization[2/]	Cost (per yr thousands)	Priority[4/] (rank)
D. Effects, habitat and behavior				
1. Oil effects on prey	2	MMS	$ 50	3
2. Sensing the environment:				
a. of oil and products	?	MMS		2
b. noise--vessel, seismic, and aircraft	2	MMS(*)		1-2
3. Seasonal habitat use classification scheme--in ice and open water behavior/interactions	3	MMS?		3
4. Direct effects of oil	1-2	MMS		
E. Whaling				
1. Historical shore-based removals, US & USSR	1+	NMFS	$ 25	3
2. Monitor current take including "struck and lost" mortality rate	c	AEWC/NSB(*) & NMFS(*)		2
3. Analysis of Eskimos' logbooks with an estimate of lengths of whales chased	c	AEWC/NSB	$ 2	2

1/ Estimated period needed to complete research; c = continuous.

2/ Agency or group voicing an interest, currently evaluating possibilities or anticipated to conduct the research. These designations are not binding. Some subjects are being conducted by said organization (*) in fiscal year 1982.

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

4/ Considered the most immediate need (rank of "1"), and lowest priority ("3") considering short-term research.

REFERENCES

Braham, H. W.
1982. Bowhead whale research in the United States: towards understanding national program needs and priotities. Unpubl. manuscr, 51 p. Available at the National Marine Mammal Laboratory, Northwest and Alaska Fisheries Center, National Marine Fisheries Service, NOAA, 7600 Sand Point Way N.E., Seattle, WA 98115.

Breiwick, J. M., H. W. Braham, and L. L. Eberhardt.
1982. Population modelling of western Arctic bowhead whales. Unpubl. rep., 32 p. Available at the National Marine Mammal Laboratory, Northwest and Alaska Fisheries Center, National Marine Fisheries Service, 7600 Sand Point Way N.E., Seattle, WA 98115. (Submitted to the. Scientific Committee, International Whaling Commission, Cambridge, England, in June 1982 as document SC/34/PS5.)

Krogman, B. D., R. M. Sonntag, D. J. Rugh, J. Zeh, and R. Grotefendt.
1982. Ice-based census results from 1978-81 on the western arctic stock of the bowhead whale. Unpubl. rep., 43 p. Available at the National Marine Mammal Laboratory, Northwest and Alaska Fisheries Center,National Marine Fisheries Service, NOAA, 7600 Sand Point Seattle, WA 98115. (Submitted to the Scientific Committee, International Whaling Commission, Cambridge, England, in June 1982 as document SC34/PS6.)

Marquette, W. M., H. W. Braham, M. K. Nerini, and R. V. Miller.
1982. Bowhead whale studies, autumn 1980-spring 1981: harvest, biology and distribution. Rep. Int. Whaling Comm. 32:357-370.

Murphy, E., and G. Jarrell.
In press. Simualtion studies of population trends in western Arctic bowhead whales. Rep. Int. Whaling Comm.