Introduction: A Scientific Perspective of the Bowhead Whale Problem

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Introduction

In June 1977 the International Whaling Commission (IWC) banned the hunt for bowhead whales, *Balaena mysticetus*, by Alaskan Eskimos. Although this species had been fully protected from commercial exploitation since the formation of IWC in 1947, a Native exemption had been in force since then which allowed a subsistence harvest. Deletion of this exemption fomented a crisis within the United States which has yet to be fully resolved.

At issue is whether the Federal Government can formulate a policy and a management regime which not only accommodate the cultural and subsistence needs of the Eskimos but also provide for the biological welfare of the bowhead whale, an endangered species. Developing an adequate plan has proved to be a difficult task with emotional confrontations occurring between those who espouse the cause of Native or human rights and those who are concerned with the conservation of whales. The inability to resolve this dilemma quickly has greatly reduced the effectiveness of the United States in fostering these two causes within the world community.

This paper contains a brief review of the historical, scientific, and legal background of the bowhead whale problem. The discussion is focused primarily on the research results upon which the IWC, rightly or wrongly, acted in 1977. By examining the state of knowledge up to that time, I intend to set the stage for the collection of papers contained in this special issue.

Life History and Stock Identity

The bowhead whale is one of the baleen or whalebone whales. The common name refers to the whale's most distinctive feature: the strongly arched or bowed upper jaw which produces a distinctly shaped head and neck, in contrast with the fusiform shape of other whales. The head can measure up to one-third the total body length, and a full-grown animal can have 600 baleen plates in its mouth, the longest of which might be 427 cm (14 feet). A large whale could produce up to 1,452 kg (3,200 pounds) of baleen, which was worth as much as $5 a pound during the heyday of Yankee whaling at the end of the 19th century.

Prior to exploitation, the bowhead whale was circumpolar in distribution, inhabiting Arctic and subarctic waters in four principal areas (Rice, 1977): Spitsbergen west to east Greenland; Davis Strait, Baffin Bay, James Bay, and adjacent waters, including Hudson Bay; Bering, Chukchi, and Beaufort Seas[1]; and Okhotsk Sea. Due to excessive harvesting in the past, all populations are now thought to be seriously depressed (International Whaling Commission, 1978), and Jonsgaard[2] considers the Spitsbergen population to be extinct.

Of concern to the United States is the western Arctic bowhead population which occurs in waters extending from the Bering Sea in winter, to the northern Chukchi and Beaufort Seas in summer and autumn. The bowheads primarily inhabit the loose pack ice and migrate with seasonal ice movements. Cracks or leads in the ice during spring form natural corridors through which the whales migrate and in which they are hunted by Eskimos.

Calving apparently occurs from late winter to early summer following a gestation of about 1 year. Mating behavior has been observed during the spring migration. Feeding apparently occurs during the summer and early autumn in shallow waters of the Beaufort and Chukchi Seas where the bowheads feed primarily upon euphausiids, copepods, and amphipods.

History of Utilization

According to Bockstoce[3], Alaskan Eskimos have exploited the bowhead whale's nearshore migratory behavior for over 2,000 years; he estimated that prior to the influence of Yankee whalers, Eskimos were capable of taking 45-60 bowhead whales annually using traditional methods. Bowheads were hunted from boats covered with sealskin or walrus hides and were taken with harpoons to which were attached a series of sealskin floats. The floats impeded the whales' swimming and indicated their direction and points of reappearance at the surface. Whales were chased until exhausted and then killed with handheld lances.

During this era of traditional hunting the Eskimo used all parts of the whale for food and for tools, weapons, utensils, and toys (Carroll, 1976). Of course the most important parts of the whale, as in modern times, were the meat and muktuk (a layer of blubber with skin attached), providing protein, vitamins A, B, and D, and the large quantities of calories needed for Arctic survival.

The advent of Yankee whaling, however, completely altered the Eskimo's

[1]In this issue of *Marine Fisheries Review*, the stock of bowhead whales inhabiting the Bering, Chukchi, and Beaufort Seas is designated the western Arctic population

[2]Jonsgaard, A. 1979 Bowheads reported from the Spitsbergen-Barents Sea area in postwar years. Unpubl. document, IWC Panel Meeting of Experts on Aboriginal/Subsistence Whaling, Seattle, Washington, 5-9 February 1979, 3 p. Universitetet i Oslo, Institutt for Marin Biologi og Limnologi, Postboks 1064, Blindern, Oslo 3, Norway.

[3]Bockstoce, J 1976. Alaskan Eskimo shore whaling: Its impact on the bowhead whale, *Balaena mysticetus*, of the western Arctic. (Abstr.) Food Agric. Organ. U.N., Advis. Comm. Mar. Resour. Res., ACMRR/MM/SC/70, 1 p.

ancient way of life. Yankee whalers took their first bowhead whales in 1843 off the Kamchatka Peninsula in the Bering Sea and first sailed through the Bering Strait into the Arctic Ocean in 1848. News of the new, rich whaling ground spread quickly and by 1852 over 200 whaleships operated in the area (Bockstoce, 1978). Whale oil and, later, baleen were the main products taken. Oil was used as fuel for lamps and baleen was used by the fashion industry for, among other uses, "whalebone" corset stays and skirt hoops.

Starting in 1885 the nature of commercial whaling changed considerably. Shore-based whaling stations utilizing Eskimo crews were established and essentially eliminated traditional subsistence hunting. During this latter commercial period the Eskimos were introduced to Yankee technology, which included the darting gun and shoulder gun. These weapons fired small bombs whose detonation within a whale's body increased the likelihood of recovery.

By 1915 the commercial hunt for bowhead whales had ended, due to the decline of the population and a collapse of the "whalebone" market. Based on an analysis of historical whaling records, Bockstoce (1978) determined that over 19,000 bowheads were killed during 1848-1915. This figure accounts for the fact that a number of whales struck by harpoons or darting guns were not recovered but escaped and possibly died.

The Alaskan Eskimos subsequently returned to subsistence hunting. Only this time they were harvesting a severely depleted population and were armed with Yankee weapons.

Research Activities

Lack of Data Stimulates U.S. Research

Starting in 1972, the Scientific Committee of the IWC expressed concern about the lack of data on the status of the western Arctic bowhead population relative to the hunt by Alaskan Eskimos. In particular, no information had been provided by the United States on population abundance, on size of or trends in the subsistence catch, nor on the number of whales which were struck and lost during the hunt.

Consequently, the National Marine Fisheries Service (NMFS) undertook research in 1973, focusing first on monitoring the harvest to determine the scope of the hunt, to gather basic harvest data, and to obtain biological samples from landed whales. This effort was expanded in 1976, through participation in NOAA's Outer Continental Shelf Environmental Assessment Program, to include censusing activities which would determine the bowhead population's distribution, migratory patterns, and indices of abundance.

Harvest Monitoring Results

Harvest monitoring by NMFS teams determined that in Alaskan waters, Eskimos hunt during the spring and autumn as the bowhead whales migrate past whaling villages. Residents of the two St. Lawrence Island villages, Gambell and Savoonga, and the mainland villages of Wales, Kivalina, Point Hope, Wainwright, and Barrow engage in spring whaling. Ice conditions east of Barrow do not permit spring whaling, but the eastern villages of Nuiqsut and Kaktovik, as well as Barrow, do participate in an autumn hunt.

Data on the number of bowhead whales struck and landed or struck but lost have been obtained directly by NMFS scientists since 1973[4]. An extensive literature search has also been conducted to obtain data on the historical subsistence kill prior to 1973 (Marquette, 1979). The historical and recent harvest data are compared in Table 1. For 1915-69, the table presents 5-year averages of the total killed and landed, both spring and autumn, in all villages; data on the losses sustained during this period are incomplete. The last entry in the table is the 8-year average of recent data. Clearly, subsistence landings had increased through 1977.

A detailed examination of historical catch data reveals that between 1945 and 1969 the annual landings varied considerably but did not exceed 23 and averaged 10. Upon examining the recent data in detail (Table 2), one finds that in the 8 years, 1970-77, the annual landings exceeded 23 bowhead whales six times and averaged 30.

Table 2 also points out the problem of additional losses caused by the hunt. The information on whales struck but lost was obtained by interviewing Eskimo whaling captains and may be biased; i.e., some Eskimos, realizing the purpose of the interviews, may have underreported their strikes and losses. Despite these difficulties, a trend is obvious: Losses increased disproportionately as total landings increased. Whales that have been struck but lost present a problem since it is unknown how many have been injured severely enough to die.

Table 3 indicates that the number of

Table 1.—Average annual landings of bowhead whales by Alaskan Eskimos 1915-77[1].

Years	Average landings	Years	Average landings
1915-19	9	1945-49	9
1920-24	13	1950-54	10
1925-29	17	1955-59	7
1930-34	8	1960-64	13
1935-39	10	1965-69	12
1940-44	11	1970-77[2]	30

[1]Source: Marquette (1979).
[2]Compared with average catch of 10 during 1945-69.

Table 2.—Landings and losses of bowhead whales by Alaskan Eskimos, 1970-77.

Season	Struck and landed	Struck but lost[1]	Total struck
1970	25	—	—
1971	24	—	—
1972	38	—	—
1973[2]	37	10	47
1974	20	31	51
1975[3]	15	28	43
1976	48	43	91
1977	29	82	111

[1]Includes those known struck and killed but lost.
[2]NMFS monitoring began.
[3]Severe sea ice conditions occurred.

Table 3.—Number of Alaskan Eskimo crews participating in spring whaling at three major villages, 1971-77.

Season	Barrow	Point Hope	Wainwright	Total
1971	25	—	—	
1972	27	—	—	
1973[1]	28	11	6	45
1974	21	10	2	33
1975	30	13	4	47
1976	36	14	8	58
1977	35	15	8	58

[1]NMFS monitoring began.

[4]Marquette, W. M. 1977. The 1976 catch of bowhead whales (*Balaena mysticetus*) by Alaskan Eskimos, with a review of the fishery, 1973-76, and a biological summary of the species. Processed rep., 80 p. Natl. Mar. Mammal Lab., Natl. Mar. Fish. Serv., NOAA, 7600 Sand Point Way N.E., Bldg. 32, Seattle, WA 98115

crews at three major whaling villages had generally increased through 1977. This trend could account for the observed increase in the take of bowhead whales and might be correlated to the exploitation of north slope petroleum resources starting in 1970 and the economic impacts of the Alaska Native Claims Settlement Act of 1971. The rising economic conditions of Eskimos apparently provided capital for new and inexperienced whaling captains to establish crews. According to Marquette (footnote 4), this inexperience as well as increased competition for whales apparently encouraged the use of poor whaling techniques. This state of affairs no doubt exacerbated the struck and lost problem inherent in the Eskimo hunts.

Needless to say, these trends of increasing landings, losses, and efforts, as well as the possibility of improper whaling practices alarmed the Scientific Committee of the IWC. In fact, concerned about the record high landings in 1976, the IWC (International Whaling Commission, 1977) passed a resolution recommending ". . . that contracting governments as early as possible take all feasible steps to limit expansion of the fishery and to reduce the loss rate of struck whales." The 1977 harvest data (Table 2) speak for themselves concerning the efficacy of U.S. actions in limiting the hunt that year.

Population Estimates

Results from censuses undertaken by the NMFS in 1976 and 1977 added to the IWC's growing concern over the status of the western Arctic population. During the spring, a camp was established each year on the ice next to the nearshore lead at Point Barrow. Depending on ice conditions, a team of observers attempted to maintain watch on a 24-hour basis to count all whales which passed by. Actual counts obtained were 352 whales in 1976 and 327 in 1977. Extrapolations of these data to account for the periods when no watch was possible gave abundance indices, respectively, of 762 and 715 whales (Braham et al., 1979).

These figures were not considered to be complete population estimates because it was thought that: Counters may have missed some whales which swam by submerged; some whales may have migrated before and after the survey periods; some animals may have migrated through offshore leads; and some whales (perhaps females and calves) may have stayed behind in the Chukchi Sea. An additional source of error was that counters may have double-counted some whales passing by. Considering these possibilities, the Scientific Committee of the IWC believed that the counting data indicated a possible range of abundance of 600-2,000 whales (International Whaling Commission, 1978), with a best estimate of 1,300[5].

Mitchell[6] also presented an analysis of historical whaling data to the Scientific Committee's 1977 meeting which indicated that, during the peak period 1851-60, 8,852 bowhead whales had been taken in the western Arctic. Based upon a summary of published data on loss rates, he adjusted this cumulative catch by 24 percent to account for additional whales which were struck, lost, and died and obtained 11,700 as a minimum estimate of original population size. Adjusting for a residual component that contributed to the catch for an additional 20 years, he then obtained 18,000 as an upper bound for pre-exploitation estimates.

Comparing the best current estimate with these two pre-exploitation estimates indicated that the western Arctic population had declined to 7-11 percent of its original abundance. This apparent degree of endangerment plus the desultory results of the 1977 harvest prompted the Scientific Committee of the IWC (International Whaling Commission, 1978) to conclude that ". . . any taking of bowhead whales could adversely affect the stock and contribute to preventing its eventual recovery, if in fact such recovery is still possible." Moreover, it recommended, and the IWC agreed, that ". . . on biological grounds exploitation of this species must cease . . . ."

Legal Background

In deciding how to respond to the IWC's action, the U.S. Government considered three pieces of domestic legislation. Under the Whaling Convention Act of 1949, which implemented U.S. participation in IWC, the Secretary of State, in concurrence with other departments, could within 90 days object formally to the IWC's ruling. Such an objection, which is allowed under the IWC's rules of operation, would allow the United States legally not to adhere to the ban. Otherwise, the Secretary of Commerce was authorized by this act to adopt regulations which would carry out the "purposes and objectives" of the IWC's regulations, including the ban.

The Marine Mammal Protection Act of 1972 (MMPA) and the Endangered Species Act of 1973 (ESA) both allowed aboriginal whaling to occur in U.S. waters under certain conditions. Under the MMPA, the subsistence hunt could not be accomplished in a wasteful manner and, if the population were determined to be depleted, the Secretary of Commerce could then prescribe protective regulations. Under the ESA, if it were demonstrated that the subsistence hunt materially and negatively affected the population, the Secretary of Commerce could again prescribe protective regulations. Both acts, however, required a rather lengthy and rigorous hearing procedure, as well as quite thorough proof that the circumstances warranted protective regulations.

Problem Resolution

The U.S. Government determined that a formal objection to the IWC would jeopardize its hard-won gains in fostering international conservation measures for the great whales. Furthermore, it decided that the most expeditious procedure for implementing regulations affecting the subsistence hunt was through the aegis of the Whaling Convention Act, since it did not require a formal hearing process. By

[5]Breiwick, J., and D. Chapman 1977 Population analysis of the Alaska bowhead whale stock Document SC/SPC/13, IWC Scientific Committee Special Meeting on North Pacific Sperm Whale Assessments, Cronulla, Australia, 21-26 November 1977, 5 p. Natl Mar. Mammal Lab., Natl. Mar. Fish. Serv., NOAA, 7600 Sand Point Way N.E., Bldg. 32, Seattle, WA 98115.

[6]Mitchell, E. 1977 Initial population size of bowhead whale (*Balaena mysticetus*) stocks: Cumulative catch estimates. Document SC/29/33, IWC Scientific Committee Annual Meeting, Canberra, Australia, 6-24 June 1977, 113 p. Arctic Biological Station, Fisheries and Marine Service, Fisheries and Environment Canada, P.O. Box 400, Ste Anne de Bellevue, Quebec, Canada H9X 3L6

avoiding the long, arduous hearing procedure of the MMPA and ESA, the regulations needed to protect the bowhead whale could be implemented quickly. However, such rapid implementation ran the risk of abrogating the civil rights of Eskimos since they would be excluded from the decision making process.

Fortunately the circumstance of a special meeting of the IWC in December 1977, to reconsider the status of North Pacific sperm whales, gave the United States an opportunity to reopen the issue of the hunt for bowhead whales. Eskimo participation was obtained in developing a management proposal for submission to the IWC. The plan allowed a limited hunt with quotas on numbers struck as well as on numbers landed and promised to increase significantly the level of research undertaken[7]. Regulations for the hunt were to be implemented and enforced through the Whaling Convention Act.

On reviewing the U.S. proposal, the IWC's Scientific Committee reiterated its findings that on biological grounds the hunt should not be allowed but recognized that the IWC might wish to consider subsistence or cultural needs which were beyond its expertise[8]. The IWC did consider these other aspects of the problem and finally agreed to remove the ban and to allow a take in 1978 of 12 whales landed or 18 struck, whichever occurred first.

This decision by the IWC established in 1978 the most ambitious U.S. research program ever devoted to a single species of large cetacean. As indicated by the following papers, dramatic results have already emanated from this effort. However, a far more encouraging aspect of the research program has been the willing participation by Eskimos in all of its phases. Such participation and cooperation must necessarily be the keynotes of any successful effort to balance the legitimate needs of both the Eskimo people and the bowhead whale.

[7]U.S. Department of Commerce. 1978. Bowhead whales: A special report to the International Whaling Commission, 63 p. + 3 Append. U.S. Dep. Commer., Natl. Oceanic Atmos. Admin., Washington, D.C.

[8]International Whaling Commission. 1977 Report of the Scientific Committee Special Meeting: North Pacific Sperm Whale Assessments. Cronulla, Australia, 21-26 November 1977, 31 p. Int Whaling Comm., The Red House, Station Road, Histon, Cambridge CB4 4NP, England.

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Historical Shore-Based Catch of Bowhead Whales in the Bering, Chukchi, and Beaufort Seas

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Introduction

The Eskimos of northwestern Alaska have hunted the bowhead whale, *Balaena mysticetus*, since about A.D. 800, and there is archaeological evidence to suggest that the practice developed about 1,000 years earlier on St. Lawrence Island and the Siberian coast near the Bering Strait (Bockstoce, 1977; Fig. 1, 2). Whaling during an 8-week spring hunt and during a 4- to 8-week autumn hunt at some villages provided the Eskimos with perhaps one-half of their winter food supply; until the 19th century, bowheads and Eskimos existed as co-inhabitants of a presumably stable ecosystem (Dunbar, 1953; Bockstoce, 1976).

In 1848, however, an event occurred that destroyed that stability. In that year a Yankee whaleman, Captain Thomas Roys of Sag Harbor, N.Y., discovered the rich bowhead whaling grounds north of the Bering Strait. Not only were the whales plentiful, but he found the bowheads to be slow, docile, and, most important, they had such a thick layer of blubber and great quantity of whalebone (baleen) that an average sized whale yielded 11,923 liters (100 barrels) of oil and 681 kg (1,500 pounds) of baleen (Bockstoce, 1980).

Word of Captain Roys' success spread quickly, and in 1852 more than 200 ships were operating in the Bering Strait region. The ice and weather took a terrible toll of ships and men, but the profits were worth the risk. The whalers continued to press farther north into the