BOWHEAD WHALE (*Balaena mysticetus*): Western Arctic Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

Bowhead whales are distributed in seasonally ice-covered waters of the Arctic and near-Arctic, generally north of 54/N and south of 75/N in the western Arctic Basin (Braham 1984). For management purposes, five stocks are currently recognized by the International Whaling Commission (IWC 1992). Small stocks occur in the Sea of Okhotsk, Davis Strait, Hudson Bay, and Spitsbergen. These small bowhead stocks are comprised of only a few tens to a few hundreds of individuals (Braham 1984, Shelden and Rugh 1996). The largest remnant population, and only stock that is found within U. S. waters, is the Western Arctic stock (Fig. 36). The Western Arctic stock migrates annually from wintering areas (November to March) in the northern Bering Sea, through the Chukchi Sea in the spring (March through June), to the Beaufort Sea where they spend much of the summer (mid-May through September) before returning again to the Bering Sea in the fall (September through November) to overwinter (Braham et al. 1980; Moore and Reeves 1993). The bowhead spring migration follows fractures in the sea ice around the coast of Alaska, generally in the shear zone between the shorefast ice and the mobile polar pack ice. There is evidence of whales following each other, even when their route does not take advantage of large ice-free areas, such as polynyas (Rugh and Cubbage 1980). As the whales travel east past Point Barrow, Alaska, their migration is somewhat funneled between shore and the polar pack ice, making for an optimal location from which to study this stock (Krogman 1980). Most of the year, bowhead whales are closely associated with sea ice (Moore and DeMaster 1997). Only during the summer is this population in relatively ice-free waters in the southern Beaufort Sea, an area often exposed to industrial activity related to petroleum exploration (Richardson et al. 1985).

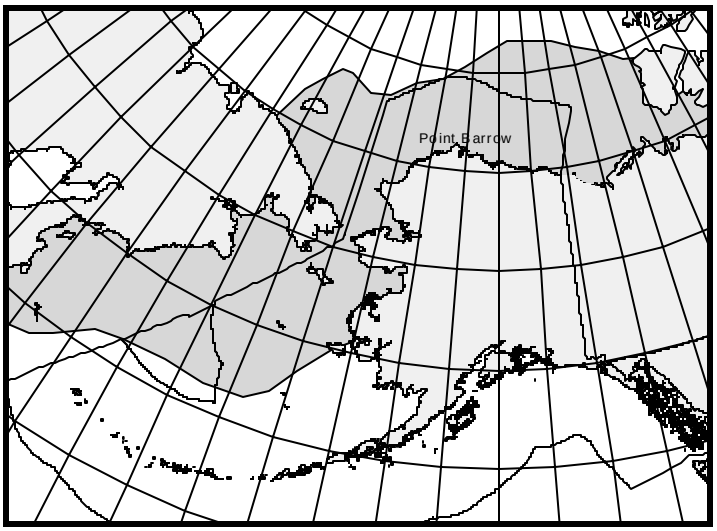

Figure 36. Approximate distribution of the Western Arctic stock of bowhead whales. The shaded area includes regions used during both the winter and summer by whales from this stock.

POPULATION SIZE

All stocks of bowhead whales were severely depleted during intense commercial whaling prior to the 20th century, starting in the early 16th century near Labrador and spreading to the Bering Sea in the mid-19th century (Braham 1984). Woodby and Botkin (1993) summarized previous efforts to approximate how many bowheads there were prior to the onset of commercial whaling. They reported a minimum worldwide population estimate of 50,000, with 10,400-23,000 in the Western Arctic stock (dropping to less than 3,000 at the end of commercial whaling).

Since 1978, counts of bowhead whales have been conducted from sites on sea ice north of Point Barrow, Alaska, during the whales' spring migration (Krogman et al. 1989). These counts have been corrected for whales missed due to distance offshore (through acoustical methods, described in Clark et al. 1994), whales missed when no watch was in effect, and whales missed during a watch (estimated as a function of visibility, number of observers, and distance offshore) (Zeh et al. 1994). However, in some years a small proportion of the population may not migrate past Point Barrow in spring, resulting in estimates which could be negatively biased. In 1993, unusually good counting conditions resulted in a population estimate for this stock of 8,000 (CV = 0.073) animals, with a 95% confidence interval from 6,900 to 9,200 (Zeh et al. 1994). A refined and larger sample of acoustic data from 1993 has resulted in an estimate of 8,200 animals (95% CI = 7,200-9,400), and is considered a better abundance estimate for the Western Arctic stock (IWC 1996). The CV for this abundance estimate is 0.069 (Zeh et al. 1995).

Minimum Population Estimate

The minimum population estimate (N_{MIN}) for this stock is calculated from Equation 1 from the PBR Guidelines (Wade and Angliss 1997): $N_{MIN} = N/\exp(0.842\times[\ln(1+[CV(N)]^2)]^{½})$. Using the population estimate (N) of 8,200 and its associated CV(N) of 0.069, N_{MIN} for the Western Arctic stock of bowhead whales is 7,738.

Current Population Trend

Raftery et al. (1995) reported the Western Arctic stock of bowhead whales increased at a rate of 3.1% (95% CI = 1.4-4.7%) from 1978 to 1993, when abundance increased from approximately 5,000 to 8,000 whales. This rate of increase takes into account whales that passed beyond the viewing range of the ice-based observers. Inclusion of the revised 1993 abundance estimate results in a similar, though slightly higher rate of population increase 3.2% (95% CI = 1.4-5.1%) during the 1978-93 period (IWC 1996).

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

The current estimate for the rate of increase for this stock of bowhead whales (3.2%) should not be used as an estimate of (R_{MAX}) because the population is currently being harvested and because the population has recovered to population levels where the growth is expected to be significantly less than R_{MAX}. Thus, until additional data become available, it is recommended that the cetacean maximum theoretical net productivity rate (R_{MAX}) of 4% be employed for the Western Arctic stock of bowhead whale (Wade and Angliss 1997).

POTENTIAL BIOLOGICAL REMOVAL

Under the 1994 re-authorized Marine Mammal Protection Act (MMPA), the potential biological removal (PBR) is defined as the product of the minimum population estimate, one-half the maximum theoretical net productivity rate, and a recovery factor: $PBR = N_{MIN} \times 0.5R_{MAX} \times F_R$. The recovery factor ($F_R$) for this stock is 0.5 rather than the default value of 0.1 for endangered species because population levels are increasing in the presence of a known take (see guidelines Wade and Angliss 1997). Thus, PBR = 77 animals (7,738 × 0.02 × 0.5) for the Western Arctic stock of bowhead whale. The development of a PBR for the Western Arctic bowhead stock is required by the MMPA even though the Alaska Eskimo subsistence harvest of bowhead whales is managed under the authority of the International Whaling Commission (IWC). Accordingly, the IWC bowhead whale quota takes precedence over the PBR estimate for the purpose of managing the Alaska Native subsistence harvest from this stock. The IWC quotas authorized Alaska Natives to strike up to 67 bowhead whales in 1996, and 66 in 1997, and 65 in 1998 (IWC 1995). For 1999 to 2002, a block quota of 280 bowhead strikes was allowed, of which 67 (plus up to 15 unharvested in the previous year) could be taken each year.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

Fisheries Information

Several cases of rope or net entanglement have been reported from whales taken in the subsistence hunt, including those summarized in Table 27 (Philo et al. 1993). Further, preliminary counts of similar observations based on reexamination of bowhead harvest records indicate entanglements or scarring attributed to ropes may include over 20 cases (Craig George, pers. comm. Dept of Wildlife Mgt., North Slope Borough, Box 69, Barrow, AK 99723). There are no observer program records of bowhead whale mortality incidental to commercial fisheries in Alaska. In addition, the self-reported fisheries information required of vessel operators by the MMPA during the period between 1990-96 reported no injuries or mortalities of bowhead whales for any Alaska fishery. Logbook data are available for part of 1989-1994, after which incidental mortality reporting requirements were modified. Under the new system, logbooks are no longer required; instead, fishers provide self-reports. Data for the 1994-95 phase-in period is fragmentary. After 1995, the level of reporting dropped dramatically, such that the records are considered incomplete and estimates of mortality based on them represent minimums (see Appendix 4 for details).

Based on the lack of reported mortalities, the estimated annual mortality rate incidental to commercial fisheries is zero whales per year from this stock. Therefore, the annual human-caused mortality level is considered to be insignificant and approaching a zero mortality and serious injury rate.

Table 27. Reported scarring of bowhead whales attributed to entanglement in ropes and description of observations collected during subsistence harvests in Alaska since 1978.

Year	Number of Whales	Location	Description
1978	1	Wainwright, AK	6 scars on caudal peduncle
1986	1	Kaktovik, AK	Scars on caudal peduncle and anterior margin of flukes
1989	1	Barrow, AK	12 scars on ridges of caudal peduncle
1989	1	south of Gambell, AK	Rope wrapped around head, through mouth and baleen
1990	1	Barrow, AK	Scars on caudal peduncle; 2 ropes trailing from mouth.

Subsistence/Native Harvest Information

Eskimos have been taking bowhead whales for at least 2,000 years (Marquette and Bockstoce 1980, Stoker and Krupnik 1993). Subsistence takes have been regulated by a quota system under the authority of the IWC since 1977. Alaska Native subsistence hunters take approximately 0.1-0.5% of the population per annum, primarily from 9 Alaska communities (Philo et al. 1993). Since 1977, the number of kills has ranged between 14-72 per year, depending in part on changes in management strategy and in part to higher estimates of bowhead whale abundance in recent years (Stoker and Krupnik 1993). The following statistics were compiled from animals taken in the subsistence harvest between 1973 and 1992: 1) the sex ratio of bowheads taken in the hunt was equal; 2) the proportion of adult females taken in the hunt increased from 5% in the early 1970s to over 20% in the late 1980s and early 1990s; 3) approximately 80% of the catch was immature animals prior to 1978 and since has been approximately 60%; and 4) modern Native whalers appear to harvest larger bowheads than precontact (prior to 1849) Native whalers (Braham 1995).

The total take by Alaska Natives, including struck and lost, was reported to be 51 whales in 1993 (Suydam et al. 1995), 46 in 1994 (IWC 1996), and 57 in 1995 (IWC 1997), and 44 in 1996 (Alaska Eskimo Whaling Commission, unpubl. data, AEWC, P. O. Box 570, Point Barrow, AK 99723). Canadian Natives are also known to take whales from this stock. Hunters from the western Canadian Arctic community of Aklavik killed one whale in 1991 and one in 1996. The annual average subsistence take (by Natives of Alaska and Canada) during the 3-year period from 1994 to 1996 is approximately 49 bowhead whales.

Other Mortality

Pelagic commercial whaling for bowheads principally occurred in the Bering Sea from 1848 to 1919. Within the first two decades of the fishery (1850-1870), over 60% of the stock was harvested although effort remained high into the 20th century (Braham 1984). It is estimated that the pelagic whaling industry harvested 18,684 whales from this stock (Woodby and Botkin 1993). During the same 1848-1919 period, shore-based whaling operations (including landings as well as struck and lost estimates from U. S., Canadian, and Russian shores) took an additional 1,527 animals (Woodby and Botkin 1993). An unknown percentage of the shore-based animals were harvested for subsistence, and not commercial purposes. The estimated mortality likely underestimates the actual kill as a result of under-reporting of the Soviet catches (Yablokov 1994).

STATUS OF STOCK

Based on currently available data, the estimated annual mortality rate incidental to commercial fisheries (0) not known to exceed 10% of the PBR (8) and, therefore, can be considered to be insignificant and approaching a zero mortality and serious injury rate. The level of human-caused mortality and serious injury (49) is not known to exceed the PBR (77) nor the IWC quota for 1996 (67). The Western Arctic bowhead whale stock has been increasing in recent years. However, the stock is classified as a strategic stock because bowhead whale is listed as "endangered" under the Endangered Species Act (ESA), and therefore designated as "depleted" under the MMPA. The development of criteria for classifying this stock under the ESA is currently underway and will be used in the next 5-year evaluation of stock status (Shelden and Rugh 1996).

Habitat Issues

Increasing oil and gas development in the Arctic will lead to an increased risk of various forms of pollution to bowhead whale habitat, including oil spills, toxic and non-toxic waste, and noise due to higher levels of traffic as well as exploration and drilling operations. Evidence indicates that bowhead whales are sensitive to noise from offshore drilling platforms and seismic survey operations (Richardson 1995, Davies 1997).

Another element of concern is the potential for Arctic climate change, which will probably affect high northern latitudes more than elsewhere. There is evidence that over the last 10-15 years, there has been a shift in regional weather patterns in the Arctic region (Tynan and DeMaster 1997). Ice-associated animals, such as the bowhead whale, may be sensitive to changes in Arctic weather, sea-surface temperatures, or ice extent. There are insufficient data to make reliable predictions of the effects of Arctic climate change on bowhead whales.

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