

Hudson Bay-Foxe Basin Bowhead Whales

Background

The Hudson Bay-Foxe Basin bowhead aggregates during summer, mainly in northwestern Hudson Bay around Repulse Bay and Frozen Strait and in northern Foxe Basin, north of Igloolik (Figure 1). The location of the wintering area is not known but may be in Hudson Strait or eastern Hudson Bay (McLaren and Davis 1982).

Inuit in the Keewatin and Baffin Regions historically hunted bowheads for subsistence and were involved in commercial whaling during the late 19th and early 20th century. Although large scale commercial hunting ended in 1915 (Ross 1975), some hunting, in association with the Hudson Bay Company and free traders, continued up until about 1951 (Mitchell and Reeves 1982). Some kills also occurred in northern Foxe Basin and around Repulse Bay in the 1960s and early 1970s for subsistence. Commercial hunting was banned in Canada in 1935 and restrictions on subsistence hunting were introduced in 1979 (Reeves and Mitchell 1990).

A limited subsistence hunt resumed in Nunavut in 1996. The hunt is co-managed by the Nunavut Wildlife Management Board and the Canada Department of Fisheries and Oceans. Hunting regulations are implemented under the Fisheries Act and the Marine Mammal Regulations by DFO. This review was undertaken at the request of the Nunavut Wildlife Management Board.

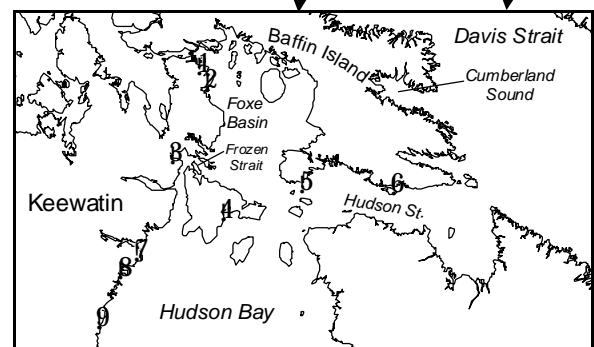
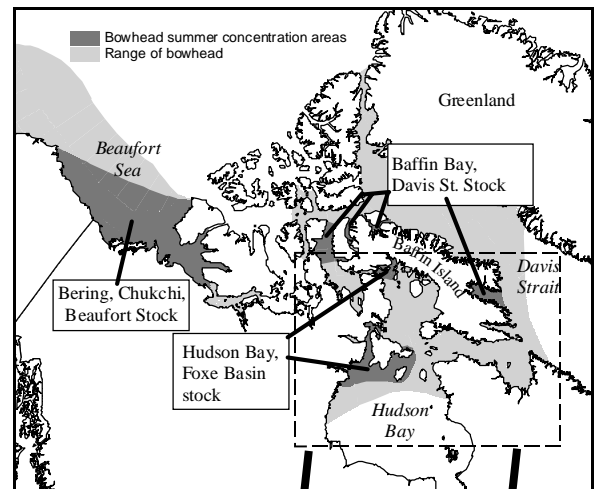


Figure 1. Range and main summer distribution of bowhead whale stocks in Canada (after Moore and Reeves 1993); inset map provides additional place names referred to in text (numbers refer to communities: 1=Igloolik, 2=Hall Beach, 3=Repulse Bay, 4=Coral Harbour, 5=Cape Dorset, 6=Lake Harbour, 7=Chesterfield Inlet, 8=Rankin Inlet, 9=Arviat).

Summary

- Hudson Bay-Foxe Basin bowheads occupy two main summering areas including northern Foxe Basin and northwestern Hudson Bay.
- Genetic evidence is consistent with the hypothesis that Hudson Bay-Foxe Basin and Baffin Bay-Davis Strait bowheads belong to different stocks.

- Two surveys of northern Foxe Basin in 1994 produced an estimate of 270 (95%CI = 210-331) whales and a survey of northwestern Hudson Bay in 1995 resulted in an estimate of 75 (95% CI = 17-133) whales.
- The Inuit Bowhead Knowledge Study has concluded that Inuit in Nunavut are seeing more bowheads now than they did 30 to 40 years ago.
- Total Allowable Removal was estimated to be 1 whale every 2 years, using a method called Potential Biological Removal. This method was considered to be precautionary.

Species Biology

The bowhead whale or *arvik* (in Inuktitut) (*Balaena mysticetus*) is a large heavy-bodied baleen whale with a discontinuous circumpolar distribution. Worldwide, there are thought to be five populations. Within Canadian waters, three populations are recognized (Figure 1). All populations were depleted by commercial whaling. The species is currently listed as endangered by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC). The species is listed in Appendix 1 of the Convention on International Trade in Endangered Species (CITES) and all stocks are listed as protected by the International Whaling Commission (IWC).

Much of the biological information available on this species has been acquired from hunter-killed animals in Alaska. Bowhead whales measure 4.5 m at birth and grow to lengths of 20 m or more at maturity (Nerini *et al.* 1984). Measurements of maximum length, reported by Nerini *et al.* (1984), include eastern arctic bowheads. They grow slowly from the time they are weaned until they reach about 4 years of age, when their baleen plates are large enough to permit

them to feed efficiently (Schell and Saupe 1993). Adult females are larger than adult males (Koski *et al.* 1993).

Several lines of evidence suggest that bowheads may live to 150 years of age or more. George *et al.* (1999) looked at age-related changes in aspartic acid in eye lenses of bowheads landed in the Alaskan hunt. They estimated one animal to be as old as 211 years. Their results are consistent with other studies (see Schell and Saupe 1993). Ivory and stone harpoon heads, recovered from whales landed in the Alaskan hunt, are thought to be 100 to 130 years old (Weintraub 1996).

Females in the Bering-Chukchi-Beaufort (BCB) stock begin to calve at about 13.5 m in length and are thought to be about 20 (15 to 24) years of age (Schell and Saupe 1993, George *et al.* 1999, Koski *et al.* 1993). The smallest female in the Bering-Chukchi-Beaufort stock to be photographed with a calf was 12.2 m long (Koski *et al.* 1993). Cosens and Blouw (1999) found that the size range of females with calves in northern Foxe Basin was similar to that in the Beaufort Sea. Of six bowheads photographed in close association with calves, the smallest was 12.4 m long. The others ranged in size from 14.7 to 16.9 m.

Based on photographic re-identification of females with calves, calving interval in the Bering-Chukchi-Beaufort stock was estimated to be 3-4 years (Rugh *et al.* 1992). Calves are weaned within 9 to 12 months after birth (Koski *et al.* 1993). The calving interval for the Hudson Bay-Foxe Basin stock is unknown.

The Hunt

Subsistence hunting of bowheads in Canada was restricted in 1979. Between 1979 and

1996, there was no licensed hunt of bowheads in the Hudson Bay-Foxe Basin stock. There is currently a limited subsistence hunt of Hudson Bay-Foxe Basin bowheads. One adult male was landed in 1996 in Repulse Bay. One female young-of-the-year calf was landed in 1994 near Igloolik in northern Foxe Basin.

Resource User Perspective

Within Nunavut, traditional hunting practices are encouraged, as is the hunting of animals that were traditionally used. The bowhead hunt is being revived but there are still many people in Nunavut who have not tasted bowhead *maktak*. There is support among the Inuit for resuming the subsistence hunt of bowheads that are considered to be of significant cultural and traditional value. Inuit do not view this stock of bowheads as being endangered and wish to see COSEWIC delist it. Bowheads are also considered by the tourism and whale-watching industries to be a valuable resource.

Resource Status

Stock Delineation

Mitochondrial DNA haplotypes of northern Foxe Basin bowheads are more similar to those found in Beaufort Sea bowheads than they are to those found in Cumberland Sound bowheads (Maiers *et al.* 1999). Analysis of nuclear DNA shows that northern Foxe Basin and Cumberland Sound bowheads belong to different breeding populations. If Cumberland Sound whales are representative of the Baffin Bay-Davis Strait population, then Hudson Bay-Foxe Basin bowheads and Baffin Bay-Davis Strait bowheads should be treated as separate populations. Additional samples from the high Arctic are needed to determine whether

Baffin Bay-Davis Strait whales consist of one stock and to determine the relationship between high Arctic and northern Foxe Basin bowheads.

Samples from only two bowheads in the vicinity of Repulse Bay are available. Results are consistent with these whales being in the same stock as those from northern Foxe Basin. Additional samples are needed.

The Inuit Bowhead Knowledge Study (IBKS) (Hay in prep.) has developed maps of probable migration routes that show movement of bowheads between Frozen Strait and northern Foxe Basin.

Stock Size

There is no estimate of total stock size available. Surveys of bowheads in the main summering aggregation areas have been done. Aerial surveys flown on two days in August of 1994 in northern Foxe Basin estimated 256 ± 31.3 and 284 ± 48.6 whales. The average of these estimates is 270 bowheads (95% CI = 210 to 331). An estimate of 75 (95% CI = 17 to 133) whales was calculated from an aerial survey of bowheads in northwestern Hudson Bay in August, 1995 (Cosens and Innes in press). These estimates were not corrected for animals that were submerged or not seen by observers; therefore they underestimate total numbers.

Genetic evidence and traditional knowledge support the idea that bowheads in northern Foxe Basin and those around Repulse Bay belong to the same population and that these estimates could be added, giving a total estimate of about 345 bowheads in the stock. This represents a minimum number known to be present rather than an estimate of actual stock size.

Aerial photogrammetry of Hudson Bay-Foxe Basin bowheads (Cosens and Blouw 1999) in 1996, 1997 and 1998 indicates that a large proportion of the bowheads summering in northern Foxe Basin are juveniles ranging up to 11.5 meters in size (64%, 89% and 45% of photographed whales respectively). Calves and juveniles made up 88%, 96% and 79% of photographed bowheads in each of the three years. There is a direct correlation between the number of adults and the number of calves photographed, suggesting that adults summering in northern Foxe Basin are nursing females. Data available so far suggest that adult males and non-calving females are absent from northern Foxe Basin and that there are relatively few whales between 11.5 and 13.5 m long in northern Foxe Basin. It is possible that this portion of the stock aggregates in northwestern Hudson Bay but similar data are not available for Repulse Bay and Frozen Strait. However, the animal landed there in 1996 was an adult male.

Stock Trend

There are no previous systematic surveys on which to base an estimate of change in stock size. The Inuit Bowhead Knowledge Study (Anon. 1995, Hay 1997, Hay in prep.) reports that elders and hunters from Hall Beach and Igloolik are seeing more whales now than they did during the 1960s. Similarly, Repulse Bay and Coral Harbour residents report that they are seeing more bowheads now than they did in the 1970s.

Woodby and Botkin (1993) estimate that there were at least 575 whales in this stock prior to commercial exploitation. If this estimate is correct, then current estimates suggest that the stock may be up to 50% of its former size.

In northern Foxe Basin, calves represented 7 to 34% of animals photographed, thus calf production appears to be substantial in some years and to vary from year to year. It is not possible, at this time, to estimate calf production as a percent of total population. Calves are also seen around Repulse Bay and Coral Harbour.

Sustainable Hunting Rate

The post-commercial removal rate through hunting has been estimated to be 1 whale every 3 years (Cosens *et al.* 1998). This level of removal appears to be sustainable, given the conclusions of the Inuit Bowhead Knowledge Study (Hay in prep.) that the stock has been increasing in size.

Potential Biological Removal (PBR) (Wade 1998) is a method of estimating annual levels of human-caused mortality that can be sustained by populations. It is a precautionary method that uses conservative estimates for stock size and natural mortality. Following Wade (1998), PBR was calculated as:

$$PBR = N_{\min} \frac{1}{2} R_{\max} F_R$$

where N_{\min} = the 20th percentile of the abundance estimate (N. Foxe Basin: 245, NW Hudson Bay: 56, Combined: 312), R_{\max} = the expected maximum net recruitment rate (4% per year for cetaceans), and F_R = a recovery factor used as a safety factor to account for unknown biases or estimation problems. In the calculations, three scenarios including endangered, threatened or at optimum sustainable population (OSP) level were examined.

For a population considered to be endangered, $F_R = 0.1$. If the population were either threatened or at OSP, the safety factor

would increase to 0.5 or 1.0 respectively. Table 1 shows estimates calculated for the Hudson Bay-Foxe Basin population (Innes unpublished data) under these scenarios. The endangered status of this population requires that the lower estimate be used. Current information suggests that the endangered status may no longer be applicable to this stock and that the status should be reassessed.

Table 1. Potential Biological Removal calculated for the Hudson Bay-Foxe Basin bowhead whale population.

Options	Potential Biological Removal		
	Endangered	Unknown or threatened	Increasing or OSP*
N Foxe Basin	0.5	2.4	4.9
NW Hudson Bay	0.1	0.6	1.1
HB/FB total	0.6	3.0	6.0

*OSP = Optimum Sustainable Population Size

Options are presented for treating the main summering areas separately or combining them as a single stock. Given the available information that suggests that there is interchange of animals between summering areas, the PBR value of 0.6 or about 1 whale every 2 years is thought to be a sustainable harvest level.

Sources of Uncertainty

Aerial surveys have not sampled the complete summering range of this stock and underestimate total stock size. Surveys of the main summering areas do not correct for submerged animals or for those at the surface but not seen by observers. These biases underestimate numbers in the summering areas.

The strip widths of the 1994 surveys north of Igloolik were estimated to be 1.2 km (Cosens *et al.* 1997). If some of the bowheads seen and counted were, in fact, outside this boundary, then the calculated

numbers would be overestimates. Similarly, during the 1995 survey of northwestern Hudson Bay (Cosens and Innes in press), some sightings were recorded without declination angles. These sightings were assumed to be within a 4.4 km wide strip. If this assumption is wrong, then numbers would have been overestimated.

There is no genetic information from bowheads summering in the high Arctic, thus the stock relationships between northern Foxe Basin and high Arctic bowheads is unknown. Likewise, it is not known whether Cumberland Sound bowheads are genetically similar to high Arctic bowheads and, therefore, are representative of a single Baffin Bay-Davis Strait stock.

Outlook

The Inuit Bowhead Knowledge Study has concluded that numbers in this population are higher today than they were in the 1960s and 1970s (Hay in prep.). During the past 30 to 40 years, sightings of large groups have become more common.

Aerial photogrammetry indicates that calf production occurs in northern Foxe Basin. Calves are also seen outside of northern Foxe Basin. This, in combination with the conclusions of the Inuit Bowhead Knowledge Study, suggests that the stock has been recovering from depletion by commercial whaling.

Other Considerations

Predation by killer whales (*Orcinus orca*) has been suggested to be a major source of mortality for Baffin Bay-Davis Strait bowheads (Finley 1990). It is not clear how frequently killer whales prey on Hudson Bay-Foxe Basin whales. In a photo

identification study of bowheads in northern Foxe Basin, several individuals with scars on the flukes and truncated fluke tips were photographed (Weins 1998). This indicates that predation attempts do occur but the frequency of attacks or significance of predation to stock recovery has not been quantified (see also Reeves and Mitchell 1988). Community participants indicated that killer whales are sighted occasionally. The Inuit Bowhead Knowledge Study reports attacks on bowheads by killer whales.

Ice entrapment may also be another source of mortality.

Beached carcasses of bowheads are occasionally reported. Examination of these carcasses generally does not identify cause of death.

Management Considerations

In northern Foxe Basin, adult bowheads appear to be nursing females. Consistent with tradition (see Inuit Bowhead Knowledge Study, Hay in prep.), Inuit hunters do not intend to hunt bowheads accompanied by calves.

Selection of juveniles (those up to 11.5 m in length) reduces the likelihood of taking individuals, such as pregnant females, that are contributing to reproduction. Natural mortality of younger animals is also higher than that of adults so hunting mortality is more likely to replace rather than add to natural mortality.

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