

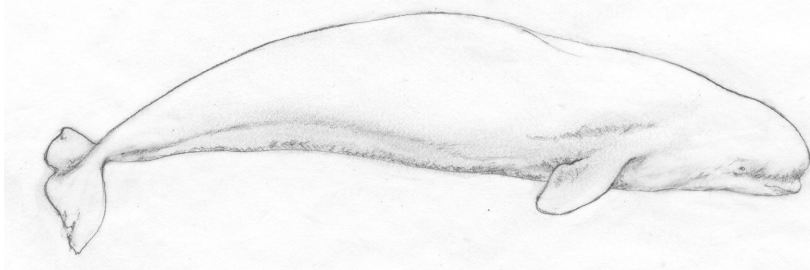
COSEWIC Assessment and Update Status Report

on the

Beluga Whale *Delphinapterus leucas*

in Canada

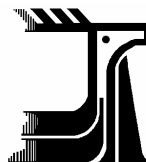
Eastern Hudson Bay Population
Ungava Bay Population
Cumberland Sound Population
St. Lawrence Estuary Population
Eastern High Arctic/Baffin Bay Population
Western Hudson Bay Population
Eastern Beaufort Sea Population



EASTERN HUDSON BAY POPULATION – ENDANGERED
UNGAVA BAY POPULATION – ENDANGERED
CUMBERLAND SOUND POPULATION – THREATENED
ST. LAWRENCE ESTUARY POPULATION – THREATENED
EASTERN HIGH ARCTIC/BAFFIN BAY POPULATION – SPECIAL CONCERN
WESTERN HUDSON BAY POPULATION – SPECIAL CONCERN
EASTERN BEAUFORT SEA POPULATION – NOT AT RISK

2004

COSEWIC
COMMITTEE ON THE STATUS OF
ENDANGERED WILDLIFE
IN CANADA



COSEPAC
COMITÉ SUR LA SITUATION
DES ESPÈCES EN PÉRIL
AU CANADA

COSEWIC status reports are working documents used in assigning the status of wildlife species suspected of being at risk. This report may be cited as follows:

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(www.sararegistry.gc.ca/status/status_e.cfm).

Previous report(s):

- Pippard, L. 1983. COSEWIC status report on the beluga whale *Delphinapterus leucas* (St. Lawrence River population) in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. 46 pp.
- Finley, K.J., J.P. Hickie and R.A. Davis. 1985. COSEWIC status report on the beluga whale *Delphinapterus leucas* (Beaufort Sea/Arctic Ocean population) in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. 24 pp.
- Reeves, R.R. and E. Mitchell. 1988. COSEWIC status report on the beluga whale *Delphinapterus leucas* (Eastern Hudson Bay population) in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. 60 pp.
- Reeves, R.R. and E. Mitchell. 1988. COSEWIC status report on the beluga whale *Delphinapterus leucas* (Ungava Bay population) in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. 60 pp.
- Richard, P.R. 1990. COSEWIC status report on the beluga whale *Delphinapterus leucas* (Southeast Baffin Island/Cumberland Sound population) in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. 29 pp.
- Doidge, D.W. and K.J. Finley. 1992. COSEWIC status report on the beluga whale *Delphinapterus leucas* (Eastern High Arctic/Baffin Bay population) in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. 45 pp.
- Richard, P. 1993. COSEWIC status report on the beluga whale *Delphinapterus leucas* (Western Hudson Bay population) in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. 27 pp.
- Lesage, V. and M.C.S. Kingsley. 1997. Update COSEWIC status report on the beluga whale *Delphinapterus leucas* (St. Lawrence River population) in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. 31 pp.

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COSEWIC Assessment Summary

Assessment Summary – May 2004

Common name

Beluga whale (Eastern Hudson Bay population)

Scientific name

Delphinapterus leucas

Status

Endangered

Reason for designation

The population was reduced by at least 50% and continues to decline. Overhunting continues throughout its summer and migratory range. Mathematical models predict that it will likely disappear under present hunting levels in less than 10 to 15 years. Concerns have been expressed about habitat degradation of estuaries by hydroelectric projects, and by small vessel traffic disturbance.

Occurrence

Nunavut, Quebec, Arctic Ocean, Atlantic Ocean

Status history

Designated Threatened in April 1988. Status re-examined and designated as Endangered in May 2004. Last assessment based on an update status report.

Assessment Summary – May 2004

Common name

Beluga whale (Ungava Bay population)

Scientific name

Delphinapterus leucas

Status

Endangered

Reason for designation

All signs indicate that the population residing in Ungava Bay is very low and may be extirpated. However, it is difficult to definitely conclude that they have been extirpated because beluga from other populations may visit Ungava Bay. Hunting caused the population decline and continues in Ungava Bay, posing a threat to any remaining beluga.

Occurrence

Quebec, Arctic Ocean, Atlantic Ocean

Status history

Designated Endangered in April 1988. Status re-examined and confirmed in May 2004. Last assessment based on an update status report.

Assessment Summary – May 2004

Common name

Beluga whale (Cumberland Sound population)

Scientific name

Delphinapterus leucas

Status

Threatened

Reason for designation

Numbers of belugas using Cumberland sound have declined by about 1500 individuals between the 1920s and the present. The population decline is believed to have been caused by hunting by the Hudson Bay Company into the 1940s and by the Inuit until 1979. Hunting has been regulated since the 1980s. Current quotas (41 in 2003) appear to be sustainable. Concerns have been raised about increased small vessel traffic and the associated noise of outboard motors, as well as fishery removals of Greenland halibut, a food of belugas.

Occurrence

Nunavut, Arctic Ocean

Status history

The Southeast Baffin Island-Cumberland Sound population was designated Endangered in April 1990. In May 2004, the structure of the population was redefined and named "Cumberland Sound population", and the Southeast Baffin Island animals were included as part of the Western Hudson Bay population. Status re-examined and designated as Threatened in May 2004. Last assessment based on an update status report.

Assessment Summary – May 2004

Common name

Beluga whale (St. Lawrence Estuary population)

Scientific name

Delphinapterus leucas

Status

Threatened

Reason for designation

The population was severely reduced by hunting, which continued until 1979. High contaminant loads may have also contributed to the population decline. Aerial surveys since 1973 suggest that the decline has ceased, but do not provide clear evidence of a significant increase in numbers. Levels of many contaminants remain high in beluga tissues. The whales and their habitat are threatened by contaminants, vessel traffic, and industrialization of the St. Lawrence watershed.

Occurrence

Quebec, Atlantic Ocean

Status history

Designated Endangered in April 1983 and in April 1997. Status re-examined and designated as Threatened in May 2004. Last assessment based on an update status report.

Assessment Summary – May 2004

Common name

Beluga whale (Eastern High Arctic/Baffin Bay population)

Scientific name

Delphinapterus leucas

Status

Special Concern

Reason for designation

The population overwinters in Baffin Bay and west Greenland and may consist of two distinct populations. It is heavily hunted in west Greenland. However, most of the population winters in Baffin Bay and the High Arctic where it is not hunted. Hunting pressure in Canadian waters is low in summer.

Occurrence

Nunavut, Arctic Ocean

Status history

Designated Special Concern in April 1992 and May 2004. Last assessment based on an update status report.

Assessment Summary – May 2004

Common name

Beluga whale (Western Hudson Bay population)

Scientific name

Delphinapterus leucas

Status

Special Concern

Reason for designation

The population appears to be relatively abundant, although it has not been surveyed for 15 years and may consist of more than one population. The population is subject to substantial removals by hunting in parts of its range, and is potentially threatened by shipping and hydroelectric dams.

Occurrence

Manitoba, Nunavut, Ontario, Arctic Ocean, Atlantic Ocean

Status history

Designated Not at Risk in April 1993. The population was redefined in May 2004 to include those Southeast Baffin Island animals outside Cumberland Sound, previously considered part of the "Southeast Baffin Island-Cumberland Sound population," which is now called "Cumberland Sound population". Status re-examined and designated as Special Concern in May 2004. Last assessment based on an update status report.

Assessment Summary – May 2004

Common name

Beluga whale (Eastern Beaufort Sea population)

Scientific name

Delphinapterus leucas

Status

Not at Risk

Reason for designation

This population is currently large and hunted at sustainable levels under an international agreement.

Occurrence

Northwest Territories, Arctic Ocean

Status history

Designated Not at Risk in April 1985 and in May 2004. Last assessment based on an update status report.



COSEWIC
Executive Summary

Beluga Whale
Delphinapterus leucas

Species information

The beluga, *Delphinapterus leucas*, is a medium-sized toothed whale, which becomes completely white when it reaches sexual maturity around seven years of age. Adult males attain a length of 4.5 meters and females 3.5 meters. Both are similar in appearance. Young are born a dark grey and gradually become paler as they mature.

Belugas are also known as white whale, béluga in French, and *qilalugaq* or *siqsuaq* in the Inuktitutt, Inuvialuktun and Inupiat dialects.

Distribution

Currently available evidence supports continuing to divide the Canadian belugas into seven populations, based on largely disjunct summer distributions and genetic differences: (1) the St. Lawrence Estuary population occupying the area of the estuary centered around the Saguenay River mouth; (2) the Ungava Bay population occupying the whole of Ungava Bay in the summer; (3) the Eastern Hudson Bay population occupying the area from Kuujjuaraapik to Inukjuak, in the area of the Little Whale and Nastapoka Rivers during the summer months; (4) the Western Hudson Bay population occupying the areas of the Seal, Nelson and Churchill Rivers and further north to Southampton Island and Roes Welcome Sound during the summer and early autumn months; (5) the Eastern High Arctic – Baffin Bay population spending its summer in the Lancaster Sound, Barrow Strait, Prince Regent Inlet and Peel Sound areas of the Canadian high Arctic (6) the Cumberland Sound population which seems restricted to the Cumberland Sound area and concentrates in Clearwater Fiord during July and August; (7) the Eastern Beaufort Sea population occupying the Delta of the Mackenzie River and into the Amundsen Gulf and as far north as Viscount Melville Sound during late summer.

Migrations of all the populations occur from overwintering areas in the areas of open water to their spring and summer calving and feeding areas, which are usually river estuaries.

Population sizes and trends

There are large differences in both the extent of the range and size of the seven beluga populations. (1) The St. Lawrence population is estimated to be in the order of 900-1,000 individuals. There is no evidence of a significant trend in abundance indices since 1988. (2) The Ungava Bay population is too small to estimate. It might have been extirpated. (3) The Eastern Hudson Bay population is declining rapidly in size and numbers around 2,000 individuals. Recent harvest levels could cause this population to be extirpated in less than 10 years. (4) The Western Hudson Bay population has a minimum of about 23,000 animals, but is the subject of a substantial hunt. (5) The Eastern High Arctic – Baffin Bay population is estimated to be in the order of 20,000 animals. It might consist of two distinct populations: the West Greenland population numbering around 5,000 belugas, which is heavily exploited, and the North Water population, which numbers approximately 15,000 belugas, and is only lightly hunted. (6) The Cumberland Sound population numbers about 1,500 animals and is thought to have increased since the 1980s. (7) An estimate of the Eastern Beaufort Sea population of 39,000 animals is considered conservative and this population is exploited at a level well below the sustainable yield.

Habitat

Belugas spend the summer in coastal and offshore areas. Their distribution is centred on certain river estuaries, which they visit shortly after ice break-up and where they moult. They frequent these areas occasionally throughout the summer months. In the autumn they begin migrating to other locations, including certain deep-water areas, where they may feed intensively. They then continue to move to areas where pack-ice is of about 4/10-8/10 cover, in which they spend the winter.

Biology

Belugas have mean lifespans in the range of 15 to 30 years, although they may live beyond age 40, and are sexually mature at the ages of 5-7 years. Scientific evidence suggests that adults are capable of giving birth, on the average, every 3 years. They feed on a variety of fish and invertebrates. Little is known of their mating behaviour as this occurs in the winter offshore areas. Polar bears, killer whales and Inuit hunters are their main predators. Belugas occupy the level above fish, but below bears, in the Arctic trophic pyramid.

Limiting factors and threats

Sources of natural mortality include killer whales and polar bears, which often prey on belugas when they become entrapped in ice. Belugas are made vulnerable to both bear and human predation by their habit of returning to specific rivers and continuing to use these sites in spite of intense hunting pressure. Belugas in the St. Lawrence are further stressed by disturbance, pollution and loss of habitat.

Existing protection or other status designations

The hunting of belugas of the St. Lawrence Estuary has been prohibited since 1979 under the Fisheries Act. The St. Lawrence Beluga Recovery Plan has focused research and management efforts on this population. Under the Quebec Endangered Species Act, this population has been classified as Endangered. The St. Lawrence belugas have also received special protection from harassment under the law creating the Saguenay St. Lawrence Marine Park. The Ungava and Eastern Hudson Bay belugas are the subject of quotas, and closed hunting seasons in certain areas under a co-management plan between Nunavik and Department of Fisheries and Oceans Canada in an effort to remedy the critical status of these populations. The Cumberland Sound population is co-managed by the Pangnirtung Hunters and Trappers Association, the Department of Fisheries and Oceans Canada, and the Nunavut Wildlife Management Board with a current (2003) annual quota of 41 beluga whales. Community quotas also exist for Nunavik communities, and recommendations have been made to drastically reduce the harvests of belugas in the possibly separate West Greenland population. The Eastern Beaufort Sea population is co-managed by Hunter and Trappers Committees, the Inuvialuit Game Council, the Department of Fisheries and Oceans and the Fisheries Joint Management Committee.

The St. Lawrence belugas are the subject of ongoing research and discussions in an effort to protect the population and its habitat from various negative anthropogenic factors.

For both the Cumberland Sound and the St. Lawrence populations, efforts of management appear to have helped these populations to stabilize their numbers.



COSEWIC HISTORY

The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) was created in 1977 as a result of a recommendation at the Federal-Provincial Wildlife Conference held in 1976. It arose from the need for a single, official, scientifically sound, national listing of wildlife species at risk. In 1978, COSEWIC designated its first species and produced its first list of Canadian species at risk. On June 5, 2003, the *Species at Risk Act* (SARA) was proclaimed. SARA establishes COSEWIC as an advisory body ensuring that species will continue to be assessed under a rigorous and independent scientific process.

COSEWIC MANDATE

The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) assesses the national status of wild species, subspecies, varieties, or other designatable units that are considered to be at risk in Canada. Designations are made on native species and include the following taxonomic groups: mammals, birds, reptiles, amphibians, fishes, arthropods, molluscs, vascular plants, mosses, and lichens.

COSEWIC MEMBERSHIP

COSEWIC comprises members from each provincial and territorial government wildlife agency, four federal organizations (Canadian Wildlife Service, Parks Canada Agency, Department of Fisheries and Oceans, and the Federal Biosystematic Partnership, chaired by the Canadian Museum of Nature), three nonjurisdictional members and the co-chairs of the species specialist and the Aboriginal Traditional Knowledge subcommittees. The committee meets to consider status reports on candidate species.

DEFINITIONS (AFTER MAY 2004)

Species	Any indigenous species, subspecies, variety, or geographically or genetically distinct population of wild fauna and flora.
Extinct (X)	A species that no longer exists.
Extirpated (XT)	A species no longer existing in the wild in Canada, but occurring elsewhere.
Endangered (E)	A species facing imminent extirpation or extinction.
Threatened (T)	A species likely to become endangered if limiting factors are not reversed.
Special Concern (SC)*	A species that may become a threatened or an endangered species because of a combination of biological characteristics and identified threats.
Not at Risk (NAR)**	A species that has been evaluated and found to be not at risk.
Data Deficient (DD)***	A species for which there is insufficient scientific information to support status designation.

* Formerly described as “Vulnerable” from 1990 to 1999, or “Rare” prior to 1990.

** Formerly described as “Not In Any Category”, or “No Designation Required.”

*** Formerly described as “Indeterminate” from 1994 to 1999 or “ISIBD” (insufficient scientific information on which to base a designation) prior to 1994.



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The Canadian Wildlife Service, Environment Canada, provides full administrative and financial support to the COSEWIC Secretariat.

**Update
COSEWIC Status Report**

on the

Beluga Whale
Delphinapterus leucas

in Canada

2004

TABLE OF CONTENTS

SPECIES INFORMATION.....	4
Name and classification.....	4
Description.....	4
HABITAT.....	5
BIOLOGY.....	6
General.....	6
Reproduction.....	6
Demographic parameters.....	7
Feeding and nutrition.....	8
Behaviour / adaptability.....	9
POPULATION IDENTIFICATION.....	9
St. Lawrence Estuary population.....	12
Ungava Bay population.....	13
Eastern Hudson Bay population.....	14
Western Hudson Bay population.....	14
Eastern High Arctic - Baffin Bay population.....	15
Cumberland Sound population.....	16
Eastern Beaufort Sea population.....	17
Problems with the identification of beluga populations in Canada.....	18
DISTRIBUTION.....	19
Global range.....	19
Canadian range.....	19
St. Lawrence Estuary population.....	19
Ungava Bay population.....	21
Eastern Hudson Bay population.....	22
Western Hudson Bay population.....	23
Eastern High Arctic – Baffin Bay population.....	25
Cumberland Sound population.....	26
Eastern Beaufort Sea population.....	28
POPULATION SIZES AND TRENDS.....	29
St. Lawrence Estuary population.....	29
Ungava Bay population.....	30
Eastern Hudson Bay population.....	31
Western Hudson Bay population.....	32
Eastern High Arctic – Baffin Bay Population.....	33
Cumberland Sound population.....	34
Eastern Beaufort Sea population.....	34
LIMITING FACTORS AND THREATS.....	35
St. Lawrence Estuary population.....	37
Ungava Bay population.....	38
Eastern Hudson Bay population.....	38
Western Hudson Bay population.....	39
Eastern High Arctic – Baffin Bay population.....	39

Cumberland Sound population	39
Eastern Beaufort Sea population	40
SPECIAL SIGNIFICANCE OF THE SPECIES	40
EXISTING PROTECTION OR OTHER STATUS	41
SUMMARY OF STATUS REPORT	42
TECHNICAL SUMMARY: (1) St. Lawrence Estuary population	44
TECHNICAL SUMMARY: (2) Ungava Bay population	46
TECHNICAL SUMMARY: (3) Eastern Hudson Bay population	48
TECHNICAL SUMMARY: (4) Western Hudson Bay population	50
TECHNICAL SUMMARY: (5) Eastern High Arctic – Baffin Bay population	52
TECHNICAL SUMMARY: (6) Cumberland Sound population	54
TECHNICAL SUMMARY: (7) Eastern Beaufort Sea population	56
ACKNOWLEDGEMENTS	58
LITERATURE CITED	58
BIOGRAPHICAL SUMMARY OF THE REPORT WRITER	69
AUTHORITIES CONTACTED	70

List of figures

Figure 1. Line drawing of beluga whale, <i>Delphinapterus leucas</i>	4
Figure 2. Location of the Canadian Beluga Populations.....	10
Figure 3. Beluga mtDNA haplotype frequencies at 13 locations in North America and Greenland	12
Figure 4. Extent of occurrence and summer core area of the St. Lawrence Estuary population of belugas	20
Figure 5. Extent of occurrence and summer core area of the Ungava Bay population of belugas	21
Figure 6. Extent of occurrence and summer core area of the Eastern Hudson Bay population of belugas	23
Figure 7. Extent of occurrence and summer core area of the Western Hudson Bay population of belugas	24
Figure 8. Extent of occurrence and summer core area of the Eastern High Arctic – Baffin Bay population of belugas	25
Figure 9. Extent of occurrence and summer core area of the Cumberland Sound population of belugas	27
Figure 10. Extent of occurrence and summer core area of the Eastern Beaufort Sea population of belugas	28

List of tables

Table 1. Summary of seven Canadian beluga populations with approximate estimates for the total population, a qualitative rating of the current population size relative to its pre-whaling value, and trends.....	29
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SPECIES INFORMATION

Name and classification

The beluga whale, *Delphinapterus leucas* (Pallas, 1776), derives its name from the Russian *belukha*, which means white. In English, it is also called the white whale; in French *béluga* is the current common name although *marsouin blanc* or *baleine blanche* were previously used; in the various Inuit dialects they are called *qilalugaq* (Inuktitutt, Inuinactun, Inuvialuktun) and *sigsuaq* by the Inupiat of the Alaskan north slope.

The beluga belongs to one of two monotypic genera of the family Monodontidae (Rice 1998), which includes the narwhal, *Monodon monoceros*, as the other member. These two species as well as the Arctic bowhead whale, *Balaena mysticetus*, lack dorsal fins, a common characteristic thought to be an adaptation to life in ice-filled Arctic waters.

Description

Adult belugas are distinct in being pure white and can weigh up to 1,900 kg (Fig. 1). They range in total length from 2.6 to 4.5 meters, adult females are approximately 80% of the adult male length (Degerbøl and Nielsen 1930, Vladykov 1944, Brodie 1989, Doidge 1990).

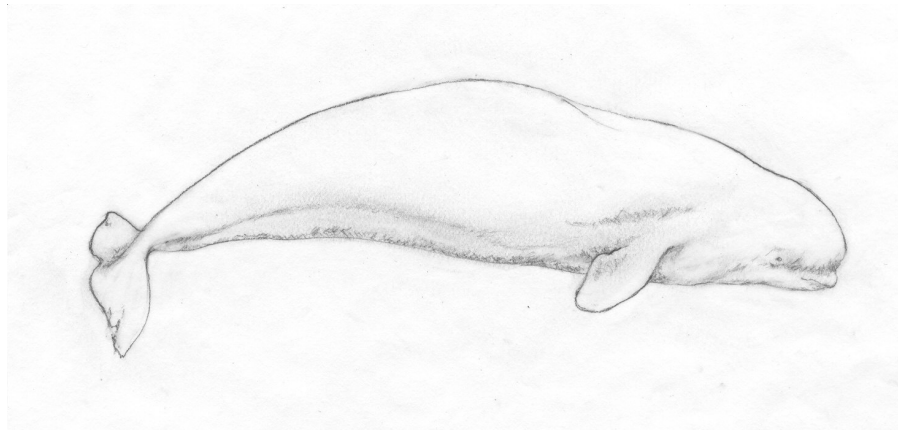


Figure 1. Line drawing of beluga whale, *Delphinapterus leucas*, by D. Codère, E.M.C. Eco Marine Corporation.

Newborn calves are grey at birth, sometimes with a darker mottled coloration, and 150 cm in length, which is 48% of the length of their mothers. Yearling calves are 60-65% of their mothers' length (Caron and Smith 1990). Older juveniles gradually become paler in colour until they turn pure white at, or shortly after, the age of sexual maturity (Sergeant 1973, Heide-Jørgensen and Teilmann 1994).

Belugas are easily sighted in calm water because of their white coloration. During the spring migrations along the ice edges, or in leads, they may be seen in aggregations of several hundred animals in certain parts of the Arctic (Lønø 1961, Sergeant and Brodie 1975). Belugas are the only Arctic cetacean species that commonly frequent river estuaries, sometimes numbering thousands of individuals, where they may predictably be seen shortly after the break-up of the sea ice. There they rub on the bottom of the shallow river channels and frequent the warmer fresh-water for several weeks (Fraker *et al.* 1979, Smith and Martin 1994).

HABITAT

The habitat used by beluga whales varies seasonally. As the fast ice breaks up in late spring, beluga whales mass along the ice edges and penetrate the leads, which provide access into the ice-covered areas (Stirling 1980). Belugas will often appear in their traditional river estuaries, which have become ice-free, several weeks before the large areas of sea ice, outside these bays, have completely broken up.

During the summer when the fast ice has broken up or completely disappeared, belugas are found along the coastlines and in relatively shallow waters (Sergeant 1973, Brodie 1971, Ognetrov 1981, Michaud *et al.* 1990, Smith and Martin 1994). It is during this period that belugas frequent specific river estuaries (Sergeant 1973, Smith and Martin 1994), and glacier fronts (Lydersen *et al.* 2001).

There remains some uncertainty about whether belugas are moulting (St. Aubin *et al.* 1990), feeding or calving (Stewart and Stewart 1989) in these areas of summer aggregation. All three are possible and activity might vary from one geographical location to the other.

Beginning in mid-August, belugas commence to move away from the estuarine areas. Some populations, such as those of the High Arctic – Baffin Bay and the Eastern Beaufort Sea, appear to make long journeys to deep-water areas away from land (Smith and Martin 1994, Richard *et al.* 2001b) where they spend several weeks diving to the sea floor and engage in what appears to be intensive feeding activity. In mid-to late September, belugas begin to actively move towards their winter areas.

Aerial surveys in March indicate that belugas are found in loose pack ice or polynyas, preferring ice cover of 4/10 to 8/10 (Jonkel 1969, Finley and Renaud 1980, Koski and Davis 1979). Because satellite tag retention has been limited, their specific areas of feeding and possible interactions with other beluga populations sharing these

same areas, during the winter, are not yet known. Many of the prey species of belugas have been described from stomach content collections obtained from shallow coastal waters during the summer (Vladykov 1946, Kleinenberg *et al.* 1964, Watts and Draper 1986). Nothing is yet known of their feeding strategies, or prey availability, as related to specific habitat features during the long winter season.

Barber *et al.* (2001) examined beluga habitat relationships using telemetry. They found a bimodal distribution with respect to depth, animals preferring either shallow waters or those about 500m deep. Ice-free waters were proportionally more used than those with cover, and ice cover of 10/10 was avoided.

BIOLOGY

General

The ages of belugas are determined by counting annual growth layer groups (GLGs) in the dentinal or cemental tissues of their teeth. Uncertainty still exists as to whether one or two GLGs represent a year of growth (Sergeant 1973, Perrin and Myrick 1980, Brodie 1989). It is still generally accepted, and there is some pertinent evidence (Goren *et al.* 1987, Heide-Jørgensen *et al.* 1994), that two GLGs represent a one-year interval. The following description of life history is based on this assumption.

Reproduction

Female belugas mature sexually between 4-7 years, males somewhat older at 6-7 years (Brodie 1971, Sergeant 1973, Burns and Seaman 1985, Doidge 1990a, Heide-Jørgensen and Tielmann 1994). Mating occurs during late winter to early spring; there is likely a spread in the timing of implantation from March until late June (Kleinenberg *et al.* 1964, Brodie 1971), with the peak of mating occurring before mid-April (Burns and Seaman 1985). It is generally held that there is no delay in implantation of the single blastocyst but Burns and Seaman (1985) note that this cannot yet be stated with certainty. Gestation is estimated to be in the order 12.8 (Doidge 1990b) to approximately 14.5 months (Kleinenberg *et al.* 1964, Brodie 1971, Sergeant 1973).

The peak calving time is not well established. It appears to occur during the late spring migration in offshore areas (Béland *et al.* 1990) and thus is not easily observed. Calving in estuaries, in early summer, has been postulated (Sergeant 1973), but detailed studies, in at least two Canadian estuaries, have never recorded a calving event (Caron and Smith 1990, Smith *et al.* 1994). Instead it was seen that females arriving in these areas were already with neonate calves. Their number would gradually increase from mid-June to early July. It is assumed that calving is probably spread out from June to August (Brodie 1971, Sergeant 1973), with the peak probably occurring in mid-June to early July. Lactation is estimated to last from 20 months (Brodie 1971, Sergeant 1973, Burns and Seaman 1985, Heide-Jørgensen and Tielmann 1994) to 32 months (Doidge 1990).

Doidge (1990a) estimated that there was a period overlap of lactation and pregnancy of 175 days, resulting in a complete cycle between successive pregnancies of 3.25 years. This is similar to the estimates of other authors for full reproductive cycles of 36 months (Sergeant 1973, Burns and Seaman 1985), but differs in that the actual lactation period is estimated to be much longer and overlapping the new pregnancy.

Almost nothing is known of the breeding behaviour of belugas since mating occurs in the offshore ice-filled waters. Adult males segregate from females with calves and juveniles during their period of summer aggregation in estuaries (Michaud 1993, Smith and Martin 1994, Smith *et al.* 1994). Some evidence from commercial net fishing in Russian and Norwegian (Ognetov 1981, Lønø 1961) waters indicates that there is also sexual segregation during the seasonal migrations. No direct information exists on mating systems in belugas which, in the future, might be elucidated by nuclear DNA studies.

Aboriginal traditional knowledge on the reproductive biology of belugas varies considerably between Inuit hunters and also differs depending on the location of their hunting areas. Mating is reported to occur along ice floe edges in the spring or far offshore. The timing of calving is reported to occur from spring to late autumn (Thomsen 1993, McDonald *et al.* 2002). Inuit from areas with major estuarine concentrations of belugas, such as Cumberland Sound or the Mackenzie Delta, report calving from July to September (Byers and Roberts 1995, Stewart *et al.* 1995, Stewart 2001).

Inuit hunters believe that adult females still accompanied by calves do give birth (Thomsen 1993). They cite this as evidence that the three year reproductive cycle postulated by scientists is wrong (Anon. 2001b, McDonald *et al.* 2002). In contrast, the Inuvialuit of the Beaufort Sea rarely see females with more than one calf. They feel that females with dependent offspring will not give birth (Byers and Roberts 1995).

Demographic parameters

Belugas are long-lived mammals with mean life spans in the range of 15-30 years. Results from aging of beluga whale jaws in the Eastern Beaufort Sea have identified whales reaching the age of 63 years, with many harvested whales of this population estimated to be in their 40s and 50s (Harwood *et al.* 2002). Most population parameters available for belugas have been derived from samples of animals harvested by Inuit.

The age specific frequencies obtained from hunted belugas, which form a survivorship series (l_x) type of life table, are subject to various collecting biases that make the accurate calculation of the survivorship of the neonate and juvenile age classes virtually impossible. Estimates of adult survivorship are in the 0.90 or greater range. In the older age classes, inaccuracy occurs because of tooth wear, which leads to underestimation of age. An independent estimate of the instantaneous rate of

increase of the population is rarely available for whale populations so that accurate estimates of survival rates are difficult to obtain (Caughley and Birch 1971).

A different approach, but not free of sampling bias, is the attempt to obtain mortality rates from the age structure of recovered carcasses of animals that were not hunted. The problems of estimating such mortality factors as they occur in the live population (Martineau *et al.* 2002a) stem from the lack of representativeness in the age structures of the recovered carcasses (Therriault *et al.* 2002). Additionally when these rates are compared to other beluga populations, the comparisons are invalid largely because the age structures are derived using different sampling methods (Hammill *et al.* 2003).

From other lines of evidence in similar odontocete populations (Smith 1999) and a limited amount of data from repeated aerial surveying (Kingsley 1998), it is felt that unexploited beluga populations, which are below carrying capacity, could increase at a rate in the range of 2.5 to 3.5 percent per annum.

Feeding and nutrition

Belugas have the lowest body fat content when they first occupy their estuarine summer habitat (Doidge 1990b). In late summer they appear to begin to feed intensively, often in deep areas somewhat distant from their centres of summer distribution (Smith and Martin 1994, Richard *et al.* 2001a,b). While we have as yet no direct evidence of the prey species involved, the Arctic cod, *Boreogadus saida*, is known also to have a deep water distribution in these same areas (Bradstreet *et al.* 1986, Welch *et al.* 1993). Large concentrations of Arctic cod in surface waters are also occasionally seen in the early autumn, which provide important feeding opportunities for belugas and other Arctic marine mammals and birds (Finley *et al.* 1990, Welch *et al.* 1993). The Inuit of Arctic Bay and Cumberland Sound also report that belugas feed extensively on Greenland halibut, *Reinhardtius hypoglossoides*, at the floe edge (Stewart *et al.* 1995, Kilabuk 1998). In the Beaufort Sea they feed on a variety of fish (Byers and Roberts 1995). Elsewhere in the Arctic they consume capelin (*Mallotus villosus*) and saffron cod (*Eleginus novaga*). In most areas invertebrates are also frequently found in the stomachs of belugas (Vladykov 1946, Seaman *et al.* 1982, Sergeant 1962, 1973, Watts and Draper 1986).

To date there has been no indication of inter-annual changes in the body condition or nutritional state of wild-harvested belugas in any scientific studies. In Cumberland Sound, Inuit harvesters have noted that belugas appear to be thinner than in the past. They relate this to increased energy expenditure caused by avoidance of increased boat traffic (Kilabuk 1998). No detailed studies of energy budgets of free ranging belugas have yet been conducted.

Behaviour / adaptability

Belugas are vulnerable to predation and to over-hunting, and to other anthropogenic threats because of their strong philopatry to certain sites of summer aggregation. Belugas occupy these estuarine sites to moult, to avoid predation or to feed. It is thought that exposure to warm fresh water helps the sloughing of the dead *stratum externum*, and accelerates the epidermal cell growth (St.-Aubin *et al.* 1990). Past theories postulated that estuaries provided a thermal benefit to neonates and that they were calving areas (Sergeant 1973, Fraker *et al.* 1979), but this has been contradicted by behavioural studies in estuaries (Finley 1982, Smith *et al.* 1994), and by measurement of the insulative values of the epidermis of newborn belugas (Doidge 1990b). In some areas, river estuaries might be feeding sites and also provide shelter from predators such as killer whales (Brodie 1971).

Belugas are extremely tenacious in their occupation of their traditional centres of aggregation, even in the face of continued disturbance and threat of being killed (Caron and Smith 1990). In the past, commercial hunts, which harvested large numbers of belugas from such areas as the Mucalic Estuary in Ungava Bay (Finley *et al.* 1982, Reeves and Mitchell 1989) and the Great Whale River in eastern Hudson Bay (Francis 1977, Reeves and Mitchell 1987), are thought to have exterminated whole populations. The Inuit of Ungava Bay, Hudson Strait and eastern Hudson Bay all mention that many small river estuaries, formerly frequented by belugas are now rarely used by the whales. It is generally held by Inuit that increased noise from outboard motors is the primary cause and that this has shifted distribution of belugas offshore (Doidge *et al.* 2002, Lee *et al.* 2002). In the St. Lawrence, the southernmost beluga population lives in a heavily traveled maritime route. There, its range has been reduced significantly and the remaining belugas continue to face anthropogenic challenges, such as increasing noise (Lesage 1993, Lesage *et al.* 1999), loss of habitat, and pollution (Béland *et al.* 1993).

In the autumn belugas leave their summer areas and migrate long distances to their winter habitats. Often these areas are shared by more than one population, but details of behaviour and distribution are still lacking from this time of year. It is in those areas that mating takes place.

POPULATION IDENTIFICATION

In the past, for management purposes, seven separate populations of belugas were recognized to be present in Canadian waters during at least part of the year (Fig. 2). These consist of (1) the St. Lawrence Estuary population (Pippard 1985) (2) the Ungava Bay population; (3) the Eastern Hudson Bay population (Reeves and Mitchell 1989, DFO 2001); (4) the Western Hudson Bay population (Richard 1993); (5) the Eastern High Arctic - Baffin Bay population (Doidge and Finley 1993); (6) the Cumberland Sound population (Richard and Orr 1991, DFO 2002a); (7) the Eastern Beaufort Sea population (DFO 2000).

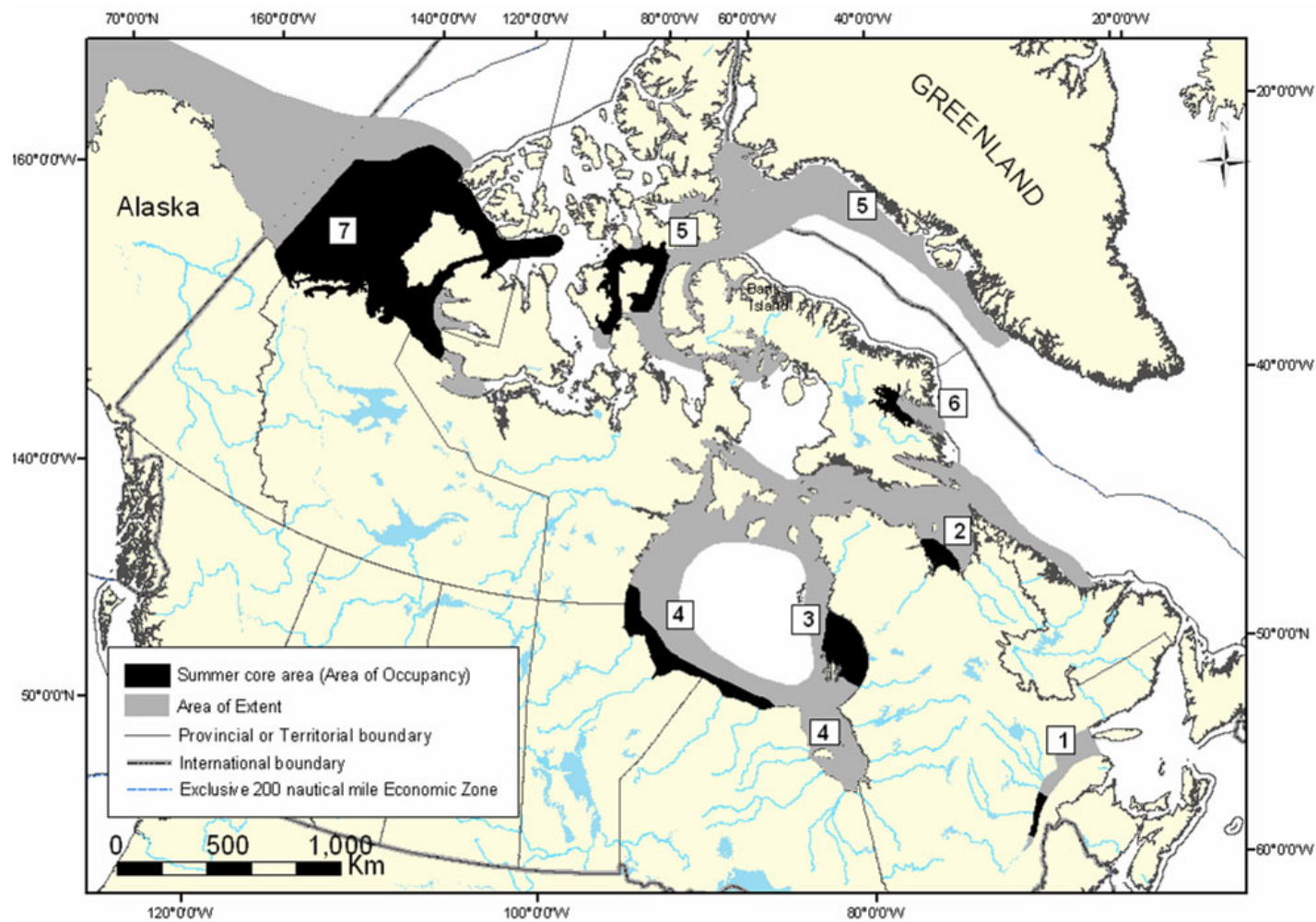


Figure 2. Location of the of Canadian Beluga Populations: (1) St. Lawrence Estuary population (2) Ungava Bay population (3) Eastern Hudson Bay population (4) Western Hudson Bay population (5) Eastern High Arctic – Baffin Bay population (6) Cumberland Sound population (7) Eastern Beaufort Sea population (modified from DFO 2002b).

Using this scheme of population division, the Canadian populations of belugas all have estuarine centres of aggregation during the summer open-water season. In most cases their summer coastal and offshore distribution is separate from other populations. Autumn, winter, and spring ranges are often contiguous or overlapping with other populations.

The first evidence for discriminating between beluga populations was based on apparent size differences between belugas collected in different parts of the Arctic (Sergeant and Brodie 1969). Reexamination of the data and methods of analysis confirm that minor differences do occur, but not to the degree that they might be practically used as criteria to differentiate closely adjacent beluga populations (Doidge 1990). Stewart (1994) found significant size differences between several populations, which were well separated geographically, but notes that body size differences are of waning importance to population identity issues, especially in the light of new genetic population discrimination techniques.

More generally accepted was the delineation of geographical populations based on their summer distributions, which were thought to be mainly coastal and centred on sites such as the estuaries where significant numbers of individuals gathered (Sergeant and Brodie 1975, Smith *et al.* 1985). This was supported by behavioural studies in estuaries, which showed that belugas are philopatric and strongly site tenacious (Caron and Smith 1990, Smith *et al.* 1994). In one of those estuaries, individuals known by distinct scars were seen to return frequently, and in a short time, to the estuary after hunting had taken place (Caron and Smith 1990).

Recently, emphasis has been placed on the use of genetic analyses, both mitochondrial DNA (mtDNA) and microsatellites to differentiate populations of belugas (de March *et al.* 2001, 2002) (Fig. 3). There has been a gradual realization that there are a number of complex problems associated with the representative sampling of animals, the scope and breath of the genetic analyses themselves, and their standardization between studies, as well as in the types of statistical analyses which are appropriate in analysing the complex genetic data sets (de March *et al.* 2002, Palsbøll *et al.* 2002, de March and Postma 2003). These genetic studies confirm the existence of some previously defined populations. They also indicate the existence of new populations. Other types of studies, aimed at defining the timing of migration and routes, used satellite-tagged belugas (Martin *et al.* 1993), detailed aboriginal traditional knowledge, and other markers such as contaminant signatures (Innes *et al.* 2002a).

This report attempts to determine Designatable Units based on range disjunction and genetic divergence (COSEWIC APPENDIX F5 2003). In recent years, new genetic studies have indicated that there are more beluga populations than was once thought, but because of sampling inadequacies, have not yet been able to define these precisely or practically for management purposes. Since none of the new genetic data contradict the existence of the previously recognized populations, which have all received status designations, these will form the basis and departure point of the present review. Where there exist strong genetic, range, migration or other ecological evidence for designating other Evolutionarily Significant Units (Waples 1991), these are noted.

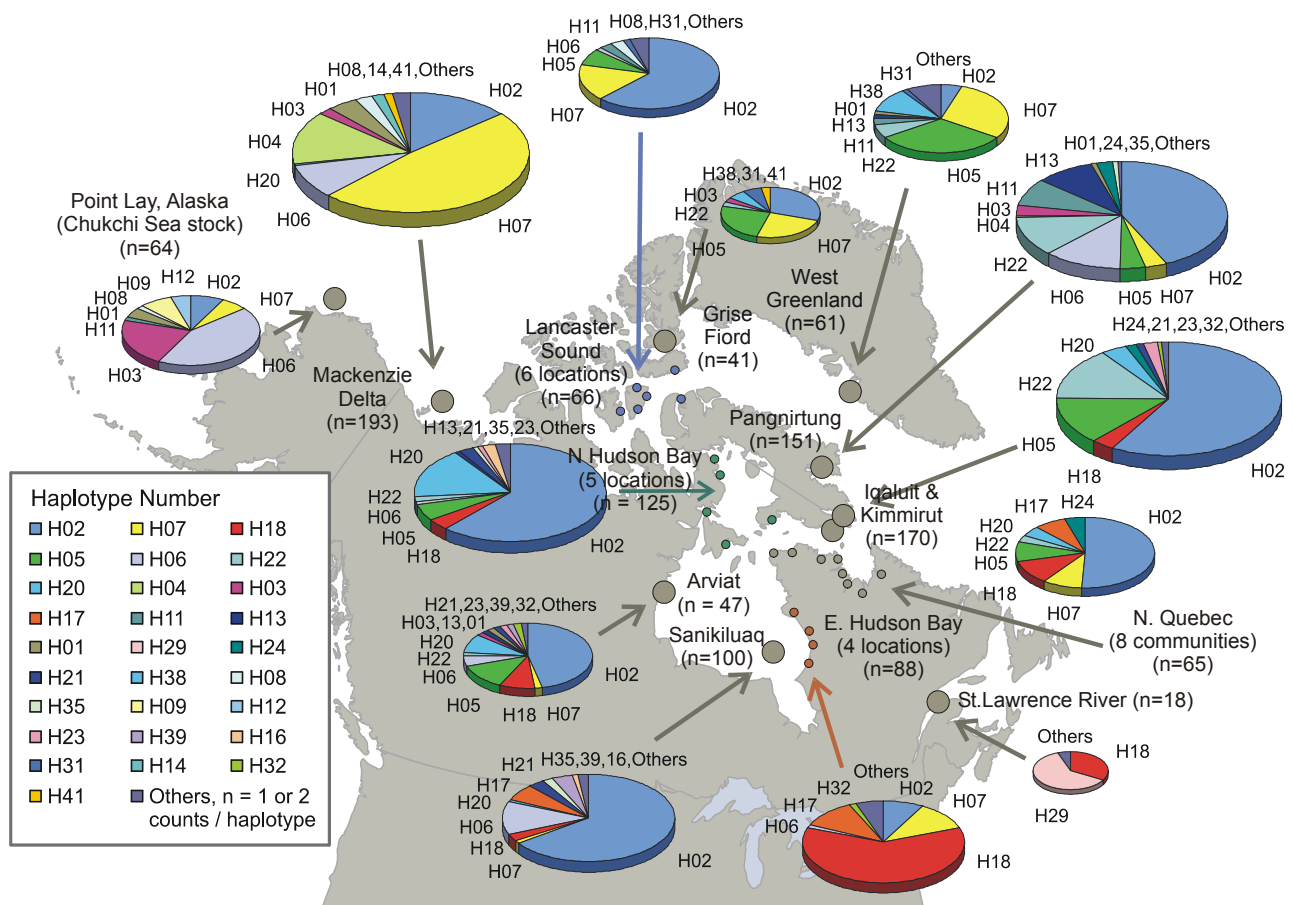


Figure 3. Beluga mtDNA haplotype frequencies at 13 locations in North America and Greenland. Areas of the pies are proportional to sample size (from de March *et al.* 2002, p 25, figure 2).

St. Lawrence Estuary population

The St. Lawrence Estuary population has long been presumed to be a relict Arctic population. Recognition of the discreteness of this small population of belugas, mainly centred near the mouth of the Saguenay River, relied on the absence of any significant numbers of belugas in the areas contiguous to their location. Few belugas are found along the north shore of the St. Lawrence or the south Labrador coast, confirming the lack of an extant connection between the belugas of the St. Lawrence and those populations occupying the sub-Arctic coastline of Quebec (Reeves and Mitchell 1984, Michaud *et al.* 1990, Curren and Lien 1998).

The St. Lawrence belugas are more genetically distinct than all other Canadian beluga populations. This population has one haplotype which has not yet been found anywhere else. It contains another haplotype which is common only in belugas of eastern Hudson Bay, particularly those sampled in the Nastapoka River Estuary. The

geographically isolated St. Lawrence population and the Eastern Hudson Bay population show the lowest diversities of mtDNA haplotypes and microsatellite alleles within Canadian populations (de March *et al.* 2002). It has been postulated that both the St. Lawrence and Eastern Hudson Bay beluga might have originated from the inland sea of the Lakes Agassiz and Ojibway, a refugium extant during the Wisconsin period of glaciation. More recently, de March *et al.* (2002) postulate that the Eastern Hudson Bay belugas might have been the first arrivals from an Atlantic refugium after the first ice barrier disappeared some 8,000 B.P. (Fulton 1989). It is postulated that all the other Canadian populations originated from a western refugium (Brown 1996, Brown-Gladden *et al.* 1997, Brown-Gladden *et al.* 1999). This would have included the other eastern Arctic populations and that of Western Hudson Bay. More studies are needed, especially of belugas in western Russian waters, in order to elucidate the post-glacial dispersion of this species.

Ungava Bay population

The belugas of the postulated Ungava Bay population were defined by their summer distribution, primarily centred near the Mucalic River estuary, although other small estuarine concentrations, such as the George and Whale Rivers, were also known. Never very large (Reeves and Mitchell 1989), this population was reduced significantly by both commercial and subsistence hunting. The Mucalic River no longer is a significant gathering place for belugas (T. Smith unpublished data, personal observations 1985). Because of the low numbers of animals taken in this area in recent years, there have been few samples obtained to study the genetic structure. Mancuso (1995), from a small sample of belugas (n=11) taken in the Ungava Bay area, found the diversity of haplotypes to be higher than expected given the small population size (Smith and Hammill 1986). This has since been corroborated by further sampling and analyses (de March and Maiers 2001) in which high haplotype diversity was demonstrated in 33 belugas from several locations in the Ungava Bay area, although there are concerns that the locations of some of these kills were not within the core range of the Ungava Bay population, and thus that they may be animals from other populations. The high genetic diversity leads to the hypothesis that animals in Ungava Bay area now are part of one or more other populations. Since the main centres of aggregation, such as the Mucalic, are now almost unoccupied, we may never know if Ungava belugas had different allele frequencies than belugas from other areas of the Arctic.

All available genetic, distribution, and abundance data indicates that this population is at undetectably low levels or has been extirpated.

Belugas were fairly common along the northern Labrador coast in summer until the 1950s, but have been very scarce since (Brice-Bennett 1978). The Labrador Inuit Association receives reports of approximately a dozen summer sightings, and 2-3 summer catches, of belugas per year (J. Rowell, Labrador Inuit Association, *pers. comm.*, 2004). Based upon geographic proximity, these may have had affinities with the Ungava Bay population.

Eastern Hudson Bay population

This population was originally defined by its centres of estuarine concentration at the Nastapoka and Little Whale Rivers, with the main area of summer coastal occupation being from Kujjuarapik to Inukjuak. Aerial surveys, which began in 1983, showed that there was an offshore distribution of animals throughout this area as far offshore as the Belcher Islands (Smith and Hammill 1986, Kingsley 2000, Gosselin *et al.* 2002).

Mitochondrial DNA analyses have shown that there is a genetic difference between eastern and western Hudson Bay belugas (Mancuso 1995, Brennin *et al.* 1997, Brown-Gladden *et al.* 1997, de March and Postma 2003). Further analyses of mitochondrial DNA and microsatellites showed that Belcher Island belugas are consistently different from both Eastern Hudson Bay and Western Hudson Bay populations. These belugas may be a separate population or a consistent mixture of more than one population (de March and Postma 2003).

The southern boundary of the Eastern Hudson Bay population has not been clearly delineated. Sanikiluaq, in the Belcher Islands, close to the summer range of the Eastern Hudson Bay belugas, appears to harvest whales either from a separate population or from a consistent mixture of other populations. A large group of belugas spends the summer months in James Bay, an area contiguous to the south with both the Eastern Hudson Bay population and Sanikiluaq. Belugas also occupy the northern Ontario coastline from James Bay west to Churchill, Manitoba. The few genetic samples from these neighboring animals that have been analysed indicate relatedness to the Western Hudson Bay population (B. de March, pers. com.). Recent tagging of belugas in the Nelson River, Manitoba, also shows that Western Hudson Bay belugas frequent the northern Ontario coastline and travel into James Bay (P. Richard pers. com.).

Belugas taken during the spring and autumn hunts, along the south coast of the Hudson Strait, contain a mixture of genotypes as do the small number of belugas actually harvested in Ungava Bay. These areas receive belugas from Eastern Hudson Bay (Bourdages *et al.* 2002), Western Hudson Bay and southeastern Baffin Island because of the favorable winter ice regime immediately to the north of Ungava Bay and in the offshore areas of Hudson Strait (de March and Postma 2003).

There appears to be a strong genetic basis for designating belugas of Eastern Hudson Bay as a separate population and increasingly good evidence that they contribute to the harvests in other Nunavik communities as far distant as Ungava Bay.

Western Hudson Bay population

The belugas of this population contain many of the haplotypes common to all other Canadian populations. However, the haplotypes most common in Eastern Hudson Bay, the St. Lawrence Estuary, and some from the Beaufort Sea population are relatively rare in Western Hudson Bay (de March and Postma 2003). Western Hudson Bay

genetic samples were obtained from communities as far distant from one another as Churchill, Manitoba, Sanikiluaq, Repulse Bay, and the Northwest Territories, and have a high haplotype and microsatellite diversity. This group, as a whole, is thus genetically less homogeneous than the Eastern Hudson Bay belugas. For example, in recent studies only 75/103 (73%) of Western Hudson Bay samples were correctly reassigned to their population of origin as compared to 79/96 (83%) in Eastern Hudson Bay (de March and Postma 2003).

It is possible that the Churchill area belugas from the Western Hudson Bay represent a distinct population centred on the Churchill River since a large percentage of these animals all contain a common haplotype (de March and Postma 2003). Because Western Hudson Bay has been considered one large population and exploitation is assumed to be sustainable, little genetic sampling has been done to cover the whole range of this presumed, but little studied, single population. The genetic identities of Western Hudson Bay belugas are, however, of interest to managers since they travel into Hudson Strait and form part of the annual harvest of the southeast Baffin and the Hudson Strait communities, which also harvest belugas from depleted populations in northern Quebec. Animals summering off southeast Baffin Island, but outside Cumberland Sound, are (in the scheme used here) also tentatively assigned to the Western Hudson Bay population (see below).

Eastern High Arctic - Baffin Bay population

Belugas occupying the Canadian High Arctic regions of Lancaster Sound, Barrow Strait, Peel Sound and Baffin Bay during the summer open water season were commonly assumed to occupy the ice-free or pack-ice area along the West Greenland coast during the winter months. High harvests of belugas have been common in West Greenland during the last century (Reeves and Mitchell 1987).

In the 1980s, prior to genetic sampling and satellite telemetry studies, aerial surveys documented the presence of belugas in the pack-ice areas as far south as 66°N along the Greenland side of Baffin Bay (Koski and Davis 1979). The western side of Baffin Bay, along the Canadian Baffin Island coast, has always had much more extreme land-fast ice and heavy concentrations of pack ice. Late winter aerial surveys found that an unknown number of belugas apparently remained to over-winter in the north Baffin Bay area of the North Water polynya (Finley and Renaud 1980, Stirling 1980, Richard *et al.* 1998a).

From 1987 to 2000 a significant number of belugas were tagged with satellite transmitters in the Canadian High Arctic, but only one of 39 animals was observed to move into the West Greenland area (Smith and Martin 1994, Richard *et al.* 1998b, Reeves and St. Aubin 2001). In 2001, 3 of 5 belugas tagged in Creswell Bay in the Canadian High Arctic, ended up in West Greenland (Heide-Jørgensen *et al.* 2003). This was the same location from which originated the only previous tagged beluga to end up in West Greenland (Smith and Martin 1994). A reanalysis of all belugas that retained their tags after October 1 (n=26), reveals that 15% of these animals ended up in West

Greenland. This is still based on a small sample size and there are problems with the apparent non-random distribution of West Greenland belugas while they are in their summer Canadian High Arctic habitat. This makes it difficult to obtain a clear picture on the proportion of belugas from the Canadian High Arctic which might over-winter in either the North Water / Lancaster Sound area, or along the West Greenland coast (Heide-Jørgensen *et al.* 2003).

Genetic evidence also suggests that at least two populations inhabit this large geographic area (de March *et al.* 2002). A high percentage of the belugas sampled from West Barrow Strait and Somerset Island locations have the most common Western Hudson Bay haplotype, which is less common in samples from Peel Sound and West Greenland (de March *et al.* 2002). One of the common haplotypes from Peel Sound is also common in West Greenland and the Beaufort Sea, but less common in West Barrow Strait and Somerset Island. Microsatellite allele frequencies also differ significantly in these two areas.

Genetic results to date point to overall differences between Lancaster Sound and Greenland belugas (de March *et al.* 2002). However, individual lots of samples from the same location, taken at different times, show different affiliations confirming that a mixture of populations coexist during the summer and also during the fall and spring movements. A clear picture of the number and geographical distribution of these populations will not emerge until much more systematic sampling is done.

Inuit from several West Greenland communities report the presence of distinctive belugas in their catches, which they assume come from Canadian waters (Thomsen 1993). These are generally described as longer animals that have an elongate caudal peduncle and are thought to be adapted to swimming in areas with strong currents. Some hunters also mention belugas with long teeth, which they term kigutikaat. Another type, infrequently seen, is nujalik, which refers to a hairy head (see Smith and Sleno 1986 for a possible explanation).

In summary, there exists considerable distributional (Richard *et al.* 1998a), movement, (Heide-Jørgensen *et al.* 2003), and genetic evidence (de March and Postma 2003) to indicate that the High Arctic – Baffin Bay population occupies two distinct winter habitats, one in the North Water and the other along the West Greenland coast. It is not yet clear how or if those populations also separate in their summering areas in the Canadian High Arctic. Indications are that the belugas in West Greenland have been reduced significantly in numbers in the last decade (Heide-Jørgensen *et al.* 1993, Heide-Jørgensen and Aquarone 2002) and that current harvest levels cannot be sustained (Innes and Stewart 2002).

Cumberland Sound population

The belugas found during the summer in the Cumberland Sound area have long been thought of as a distinct population (Sergeant and Brodie 1975), possibly because of their summer aggregation, in significant numbers, in the inner reaches of Cumberland

Sound, at Clearwater Fiord. There the Ranger River forms an estuary, which is utilized by belugas in much the same way as many other estuaries throughout the Canadian Arctic (Brodie 1971, Sergeant and Brodie 1975, Fraker *et al.* 1979, Smith *et al.* 1994). There is no other such estuarine or other centre of aggregation for belugas in the southeastern Baffin area. The Cumberland Sound belugas are genetically diverse, with a notable number of uncommon haplotypes and microsatellite loci that are not found elsewhere.

In a reconsideration of the populations for management purposes, Richard and Orr (1986) argued that the belugas of Cumberland Sound belonged to a more dispersed group of belugas frequenting the Iqaluit, Kimmirut and Cumberland Sound region. They described this population collectively as the Southeast Baffin population (Richard and Orr 1991). However, recent evidence from satellite tagging, genetics, organochlorine contaminant signatures, and traditional knowledge (Kilabuk 1998), seem to point to Cumberland Sound as a separate population. Aerial surveys (Richard and Baratin 2002) and studies of belugas tagged with satellite linked VHF transmitters (Richard 2002) have shown that the Cumberland Sound whales remain within their immediate area, possibly throughout the winter (P. Richard pers. com., DFO, Winnipeg). DNA samples obtained over the years since the late 1980s also differentiate between Cumberland Sound belugas and others sampled elsewhere in the southeast Baffin region and the High Arctic (Brown-Gladden *et al.* 1997, de March *et al.* 2002).

The delimitation of the beluga populations occupying the rest of the southeastern Baffin region is not at all clear (see below). Genetic samples collected there show that many resemble the Western Hudson Bay haplotypes. They appear to be a mixed stock dominated by Western Hudson Bay belugas.

It is possible that more than one population summers in Cumberland Sound. Genetic and organochlorine contaminant signatures, even though showing significant differences among belugas hunted in Pangnirtung, Iqaluit, and Kimmirut, are not inconsistent with this possibility (B. de March, pers. com. DFO Winnipeg). Hunters in Cumberland Sound recognize three types of belugas (Kilabuk 1998, DFO 2002a). Those hunted at the floe edge in spring are smaller, thinner and very white. Those taken during July-August, in Clearwater fiord, are larger and have a yellow colouration showing signs of epidermal moult. Those taken outside of Clearwater Fiord, on the west side of Cumberland Sound, are smaller and thinner. Their epidermis (maayak or muktuk) is thicker and stronger tasting.

Overall, recent genetic, distributional and abundance data reinforce the historical view that the belugas of Cumberland Sound form a discrete population.

Eastern Beaufort Sea population

A large population of belugas spends the early part of the summer in the southeastern Beaufort Sea, frequenting the Mackenzie River estuary (Fraker *et al.* 1979, Harwood *et al.* 1996, DFO 2000). Fraker (1980), without direct evidence,

considered this a separate population because of its known migratory movements and the lack of a contiguous summer concentration of belugas along the Alaskan coast. More recent aerial surveys (Harwood *et al.* 1996) and tagging studies (Richard *et al.* 2001b) have strongly reinforced this view.

Genetic analyses have confirmed that Beaufort Sea belugas are clearly separated from other Canadian populations (Brown-Gladden *et al.* 1997) and also from the more closely adjacent Alaskan populations with which they may share a common wintering habitat (Brown-Gladden *et al.* 1997, O'Corry-Crowe *et al.* 1997, Brown-Gladden *et al.* 1999). This separation is primarily on the basis of the maternally inherited mitochondrial DNA haplotypes and weakly on the basis of microsatellite data. Thus these populations may interbreed in winter, but separate in their summering areas

Problems with the identification of beluga populations in Canada

There are three principal areas of uncertainty with the beluga population identification scheme outlined above:

1. Southeast Baffin Island. The status of animals found off Southeast Baffin Island, but outside Cumberland Sound, is uncertain. Current information indicates that they are not part of the Cumberland Sound population. Inuit hunters from Iqaluit and Kimmirut, on the southeast Baffin coast, mention different body sizes and shapes in their landed catches and believe that they are harvesting from several different populations (Kilabuk 1998). These two villages are located near the assumed wintering areas of the Hudson Bay populations, and appear to harvest animals from these populations. Some of the genetic and organochlorine contaminant (de March *et al.* In press) sampling of Southeast Baffin belugas indicates that this might be the case. Since individual, or grouped samples, taken during spring or autumn migratory periods are expected to contain mixed populations of belugas, areas such as Southeast Baffin which are contiguous with wintering grounds shared by several populations pose a particularly difficult problem in population identification and management. Animals using these regions in the summer may share closest affinities with the Hudson Bay populations.
2. Southern Hudson Bay. There are few data on the animals that summer in James Bay and the waters off the neighbouring Ontario coastline. However, the data that are available (see above) suggest that they are more closely related to the Western Hudson Bay population than the Eastern Hudson Bay population.
3. High Arctic. There is increasing evidence that the Eastern High Arctic - Baffin Bay population has important substructure (see above). However, with the data currently available splitting this population is probably not justified under COSEWIC guidelines.

DISTRIBUTION

Global range

Belugas are circumpolar in their distribution, being found in Alaskan, Canadian, Greenlandic, Norwegian and Russian waters. They are found in the Arctic as far north as 82°N, in the Pacific sub-Arctic, as far south as Cook Inlet, Alaska (60°N), and, on the Atlantic side, in the Canadian St. Lawrence Estuary further south to 47°N.

Sixteen populations of beluga whale were previously tentatively enumerated for the world-wide range in the Nearctic, based primarily on geographic distribution during the summer months (Donovan 1992). More recently, and in light of behavioural, genetic and contaminant signatures a total of 22 possible populations have been enumerated (Martin and Reeves 2000).

Many of these populations, which maintain distinct or contiguous geographical ranges during the summer months, mix together during the spring and autumn migrations and share common wintering quarters in areas of light ice or in reoccurring polynyas.

Canadian range

Considerable new information on the range of several of the seven previously designated Canadian beluga populations (Fig. 2) has been gained in recent years by the tagging of animals with satellite linked transmitters and from more intensive aerial surveys. The documentation of traditional knowledge of Inuit hunters (ATK) also has added to the information of movements and migrations of these populations.

St. Lawrence Estuary population

This is centred on the region influenced by the outflow of the Saguenay River. The summer distribution is well known and has changed little in the last twenty years (Michaud *et al.* 1990, Michaud 1993, Lesage and Kingsley 1995) (Fig. 4). Recent aerial surveys have enumerated belugas in the whole of their summer range (Kingsley and Hammill 1991, Kingsley 1996, Kingsley 1998, Michaud and Chaderet 1990, Gosselin *et al.* 2001). No significant numbers are reported downstream past Île du Bic or upstream past Île aux Coudres (Reeves and Mitchell 1984).

Little is known of the winter distribution of St. Lawrence belugas. There appears to be a slight increase in the use of the areas a little further downstream during the winter months (Kingsley 1998).

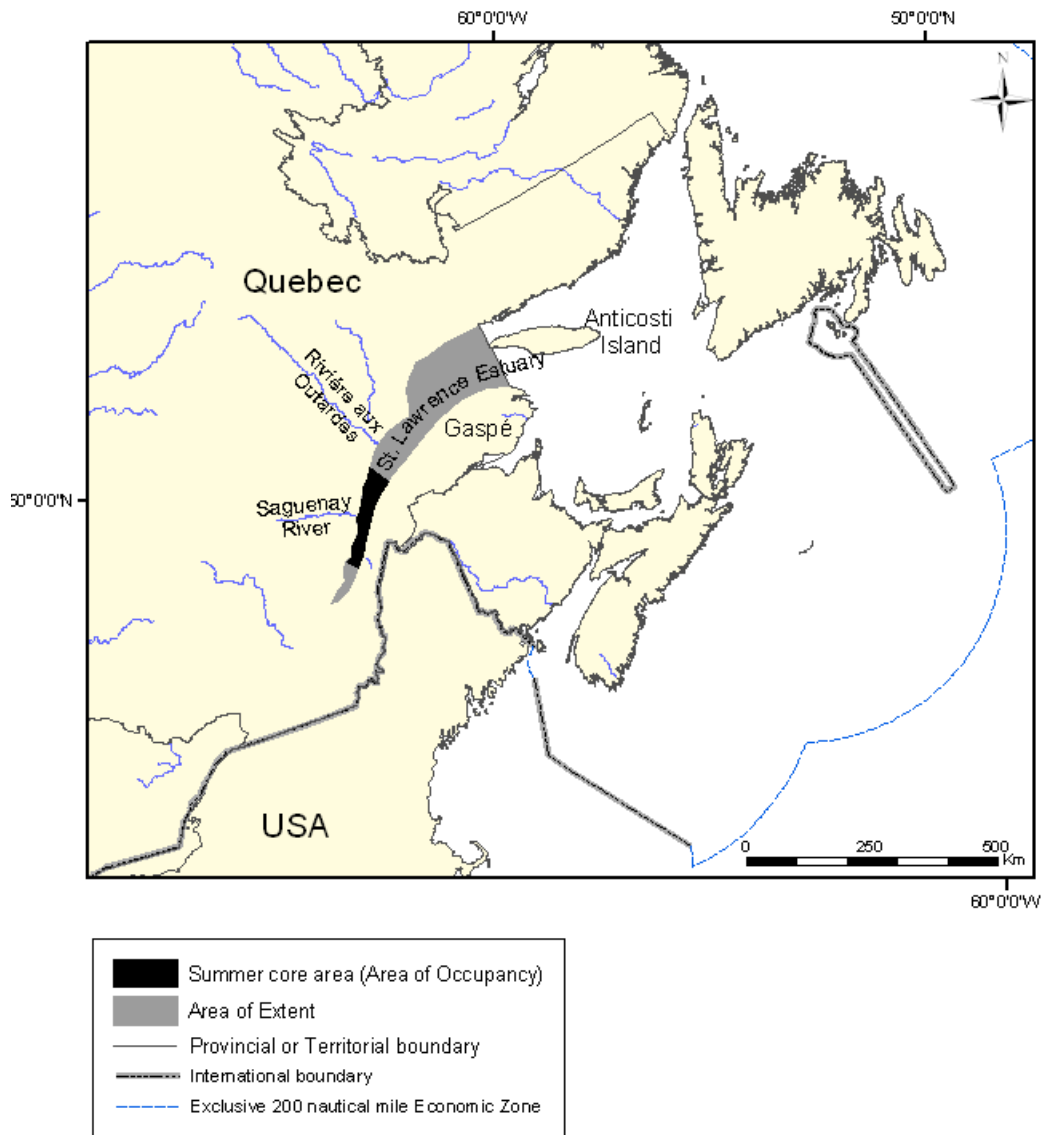


Figure 4. Extent of occurrence (area of extent) and summer core area of the St. Lawrence Estuary population of belugas. Sporadic sightings of belugas have been reported outside the main range i.e., from Cap Gaspé to the Bay of Fundy, but these are considered to be vagrants.

St. Lawrence Estuary belugas now occupy only a small part of their former range, which extended further downstream to Pointe des Monts and Cap Chats and upstream well past Île aux Coudes (Vladykov 1944, Reeves and Mitchell 1984). It has been speculated that there might have been two populations of belugas in the St. Lawrence, one centred on the Saguenay River and the other on the Manicouagan River (Kingsley 2002). The latter was heavily exploited (Laurin 1982) and the damming of the river might have resulted in the disappearance of this population.

Ungava Bay population

Aerial surveys were flown in 1985 (Smith and Hammill 1986), 1993 (Kingsley 2000), and in 2001 (Gosselin *et al.* 2002) along the same transect lines covering 25% of Ungava Bay (Fig. 5). No belugas were seen on any of the transect lines across the Bay in an east-west direction.

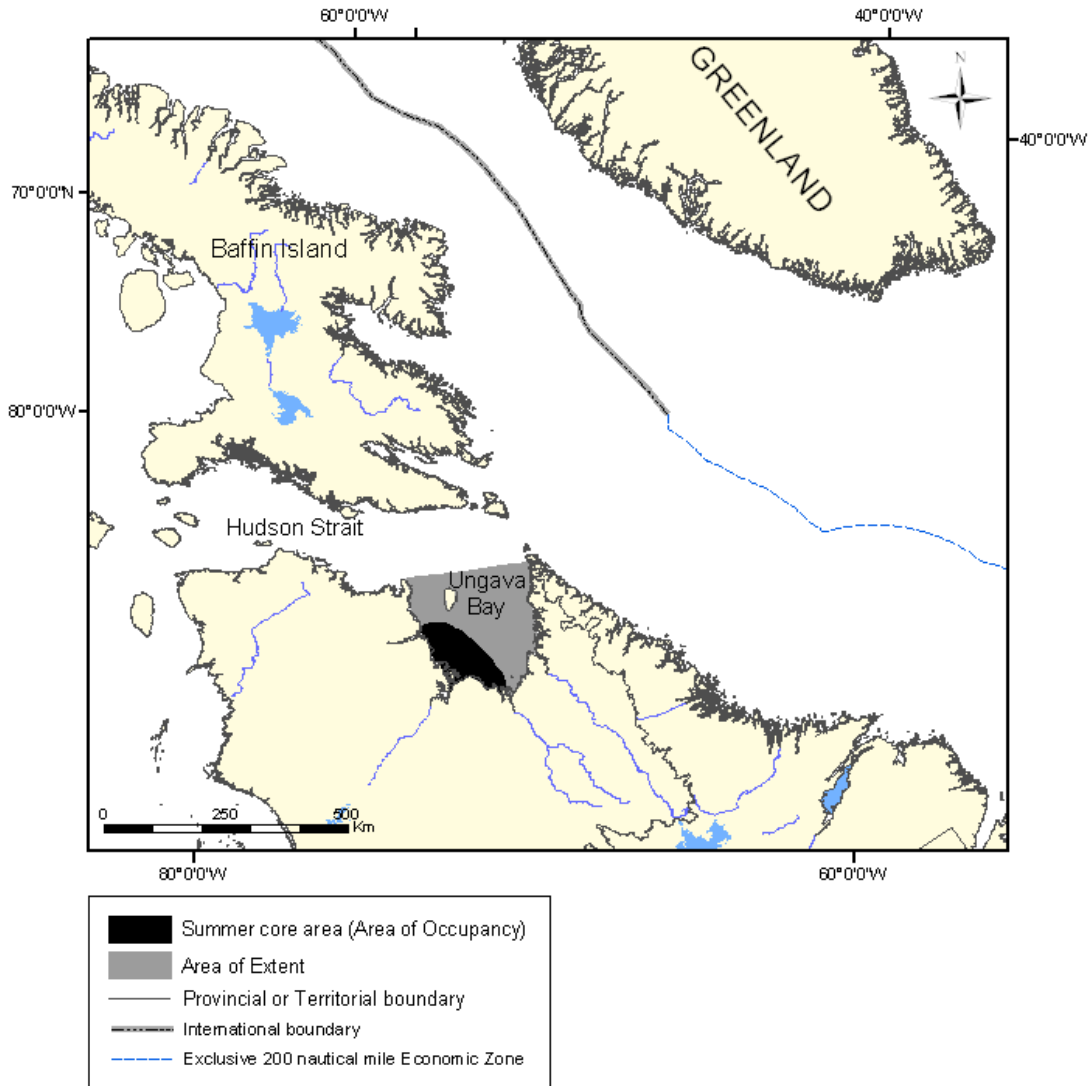


Figure 5. Extent of occurrence (area of extent) and summer core area of the Ungava Bay population of belugas.

During the same surveys, reconnaissance flights along the shorelines covering estuaries of former known beluga aggregations, such as the Mucalic River, also failed to find more than a few belugas. In 1986, a small group of scientists occupied an observation site at the mouth of the Mucalic River, and intensively studied the area from a tower for 18 days during the period of July 18 to August 7, 1986. Only 12 belugas were seen during this whole period, the largest group being of 8 whales (T.G. Smith, E.M.C. Eco Marine Corp. *unpubl.* observations, 1986).

Little is directly known of the seasonal movements of belugas in Ungava Bay. Belugas of several populations spend the winter in the Hudson Strait area, which is contiguous with northern Ungava Bay. Some of the early spring and late fall belugas taken in Ungava Bay are probably from this mixed population (de March and Postma 2003).

The Inuit of Ungava Bay report seeing beluga moving north as the ice edge recedes in the spring. In the autumn belugas are observed moving south, but offshore. There is general agreement that these belugas have declined in numbers, being rarely seen in areas of former aggregation near rivers (Lee *et al.* 2002).

Eastern Hudson Bay population

Three major aerial surveys (Smith and Hammill 1986, Kingsley 2000, Gosselin *et al.* 2002) have shown that belugas are found in the inshore and offshore areas of the Nastapoka Arc, from Inukjuak to Kuujjuaraapik during the summer months (Fig. 6). They are found as far offshore as the Belcher Islands (Sanikiluaq). The Nastapoka River and Little Whale River are the main areas of estuarine concentration, being frequented by belugas from mid-July to the end of August (Caron and Smith 1990, Doidge 1994, Doidge and Lesage 2001).

A certain amount of direct scientific data exists on seasonal movements from satellite-linked tags. Four animals tagged in 1993 at the Little Whale River, stayed in the area of the Nastapoka well into late September, when their signals were lost (Kingsley *et al.* 2001). None of the animals went into the area of the Belcher Islands. One beluga tagged in Hudson Strait in early October 1995 remained in deep water and gradually moved to the east until its signals were lost one month later (Kingsley *et al.* 2001). Recently 7 belugas tagged in Eastern Hudson Bay were followed from July 2002 to January 2003. Most of the animals left Eastern Hudson Bay by October and went into Ungava Bay, remaining there until December. The last locations for two tagged animals in January were near Nain, Labrador (Lewis *et al.* 2003). At least some of the belugas found off northern Labrador in the winter and spring may be from this population (Brice-Bennett 1978).

There is agreement amongst the Inuit of communities along the Hudson Strait and Eastern Hudson Bay coast that many of the rivers formerly frequented are no longer used by belugas. Most feel that noise has caused them to shift offshore. Two elderly Inuit from Inukjuak mention that one stock of belugas, which spent the summer months north of their village, has been decimated (Doidge *et al.* 2002).

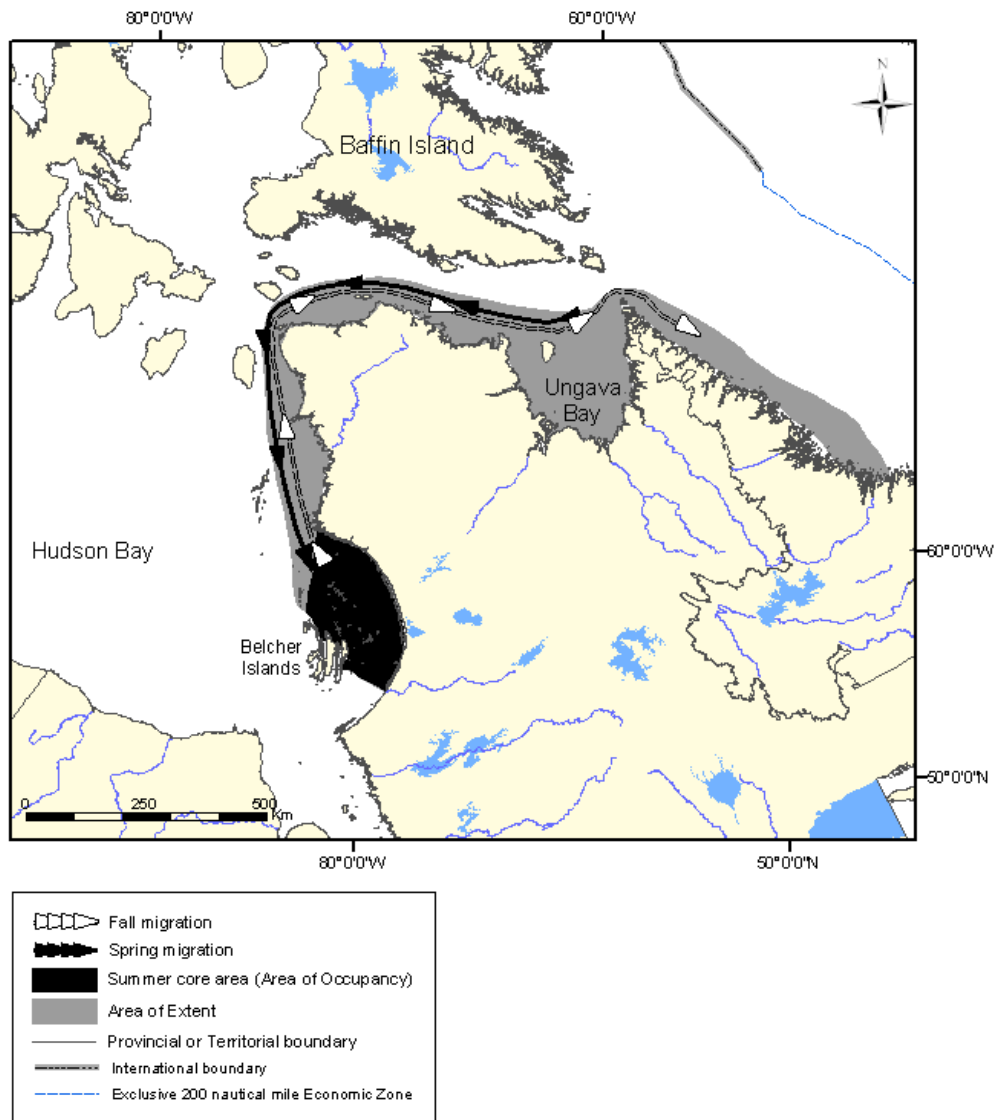


Figure 6. Extent of occurrence (area of extent) and summer core area of the Eastern Hudson Bay population of belugas (modified from DFO 2002b).

Western Hudson Bay population

Belugas aggregate in the Churchill, Nelson and Seal River estuaries on the southwest coast of Hudson Bay arriving in the area in mid-June and building in numbers in the estuaries until late July. They then begin moving northward along the coast as far as Repulse Bay (Sergeant 1973) (Fig. 7). The exact timing and route used by belugas in these autumn migrations is not yet known. Recent work using satellite-linked radio tags show that belugas of the Churchill estuary spend the whole of the summer months in shallow coastal waters. In early September, an easterly migration begins, which is marked by diving in deep water (Martin *et al.* 2001). All four tags ceased functioning by

late September and thus yielded no information about late autumn migration routes, which ultimately probably lead into Hudson Strait, and perhaps to the Labrador coast (see Brice-Bennett 1978).

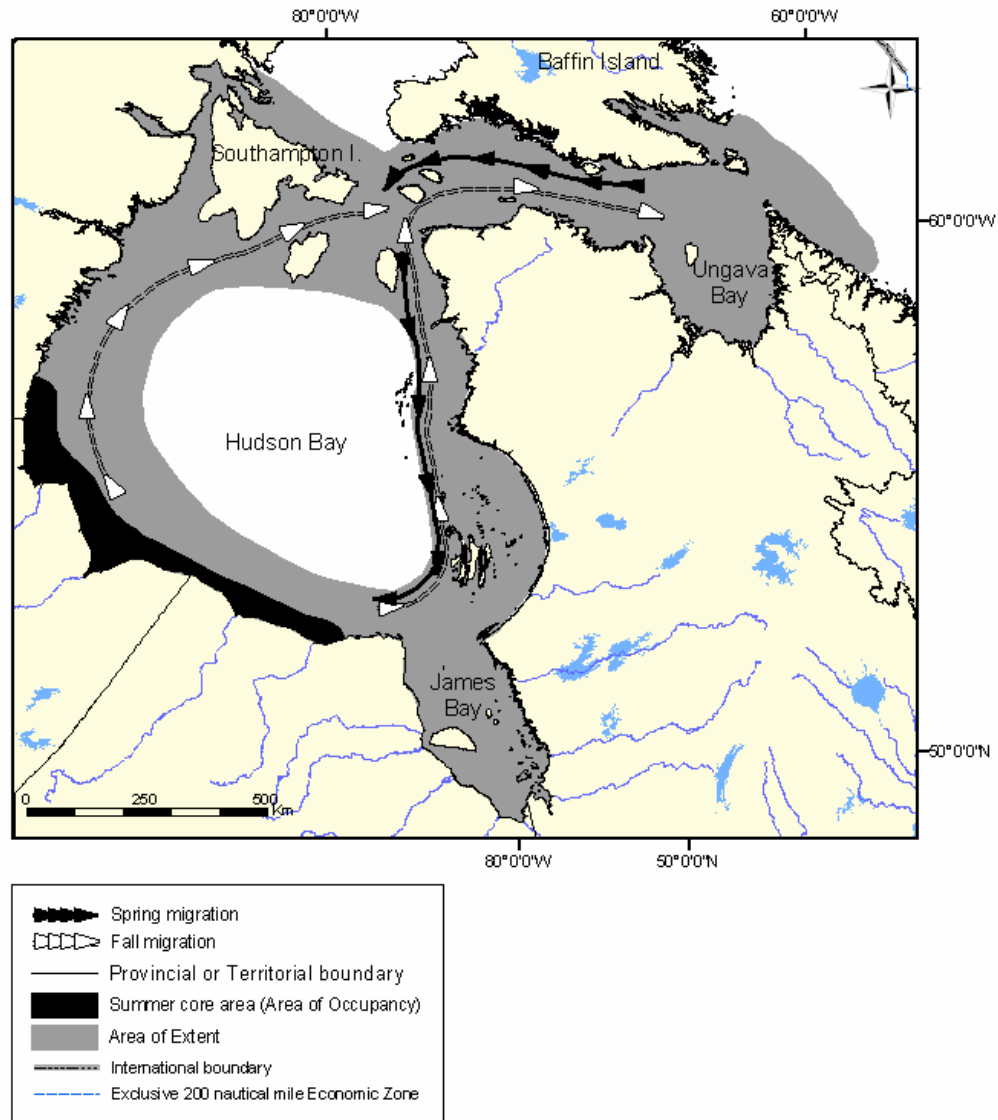


Figure 7. Extent of occurrence (area of extent) and summer core area of the Western Hudson Bay population of belugas (modified from DFO 2002b).

The Inuit of Hudson Bay have long known the timing and coastal routes of belugas, which live during the winter in Hudson Strait and enter Eastern Hudson Bay, James Bay and western Hudson Bay to spend the summer. In addition to these populations, Inuit believe that there are one or two other populations that remain in both southern Hudson Bay and James Bay, and perhaps in the northwestern Hudson Bay area throughout the winter (Jonkel 1969, McDonald *et al.* 2002).

Eastern High Arctic – Baffin Bay population

Aerial surveys indicated that a small number of belugas were present in March north of Baffin Bay in the area of the North Water polynya (Finley and Renaud 1980, Stirling 1980, Richard *et al.* 1998a). From 1987-2000, studies of the movements of tagged belugas showed that most belugas tagged in summer in the High Arctic archipelago remained in the High Arctic – North Water polynya area, at least until the tags stopped transmitting in early winter (Richard *et al.* 2001a; Fig. 8).

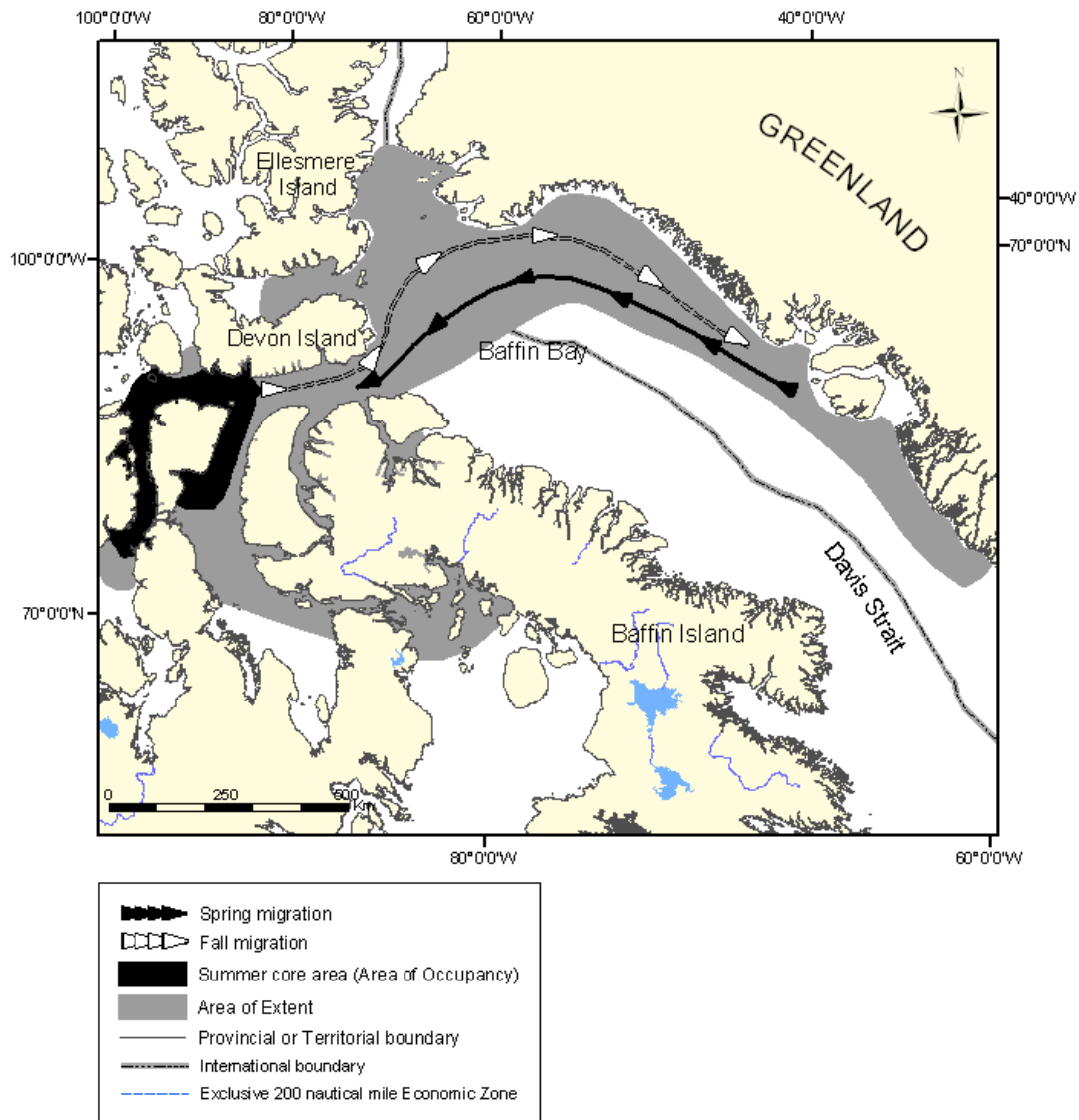


Figure 8. Extent of occurrence (area of extent) and summer core area of the Eastern High Arctic – Baffin Bay population of belugas (modified from DFO 2002b).

Baffin Island hunters note the gradual disappearance of belugas as the ice forms along the coastline. On northeast Baffin belugas appear to be moving to the east at that time. The Inuit living in Grise Fiord on Ellesmere Island are the only group of hunters who sight belugas throughout the winter along the floe edges of Jones Sound. In the spring belugas make their way into the hunting areas along east and north Baffin as the fast ice is broken up (Remnant and Thomas 1992, Stewart *et al.* 1995, Stewart 2001).

The presence of belugas during the winter along the West Greenland coast has long been known (Degerbøl and Nielsen 1930) and they have been the target of continuing subsistence hunting by the Inuit of that area (Thomsen 1993). A recent telemetry study of belugas tagged during the summer in one major summering area, Creswell Bay on Somerset Island, indicates that belugas from this area, are part of the population that goes to West Greenland in the winter. Heide-Jørgensen *et al.* (2003) have estimated from this study that approximately 15% of the belugas spending their summer in the High Arctic move to West Greenland in the winter.

Aerial surveys in 1998-1999 have been done during the winter along the West Greenland coastline between Qeqertarsuaq (69°30'N) and Paamiut (62°00'N) some extending as far as 80 km west off the coast (Heide-Jørgensen and Aquarone 2002). Previous similar surveys were flown in this area in 1981-1982 and 1993-1994 (Heide-Jørgensen and Reeves 1996). The pattern of winter distribution of belugas in all surveys since 1981 along the West Greenland coast has remained fairly constant. Most animals are sighted within 50 km of the coast. The greatest number of sightings were made in the northern strata, particularly on the northern edge of Store Hellfiske Banke, where the coastal shelf ends and where there is the edge of the dense pack-ice covering Disko Bay (Heide-Jørgensen and Aquarone 2002). In southern areas, between Maniitsoq and Paamiut (65° N to 62° N), the distribution of belugas appears to be similar between survey years (Heide-Jørgensen and Reeves 1996).

In Western Greenland, belugas appear in late fall, and spend the winter in a large area of pack ice and open water from Disko Bay to Upernavik. Belugas are hunted mainly on their southward migration in late October or during their northward return in May – June (Thomsen 1993).

Cumberland Sound population

Aerial surveys in Cumberland Sound and along the south-east Baffin coast, have shown that the major summer aggregation of belugas is limited to the Clearwater Fiord area where they occupy the estuary of the Ranger River from mid-July to mid-September. Previous studies speculated that some belugas seen in areas as far distant as Frobisher Bay and along the coast near Kimmirut during the summer months came from Cumberland Sound, which at that time was designated the South East Baffin population (Richard and Orr 1986). More recent aerial surveys and tagging of belugas with VHF satellite linked transmitters suggest that belugas remain in the Cumberland Sound area throughout the year (P. Richard, DFO, Winnipeg, *pers. com.*) (Fig. 9).

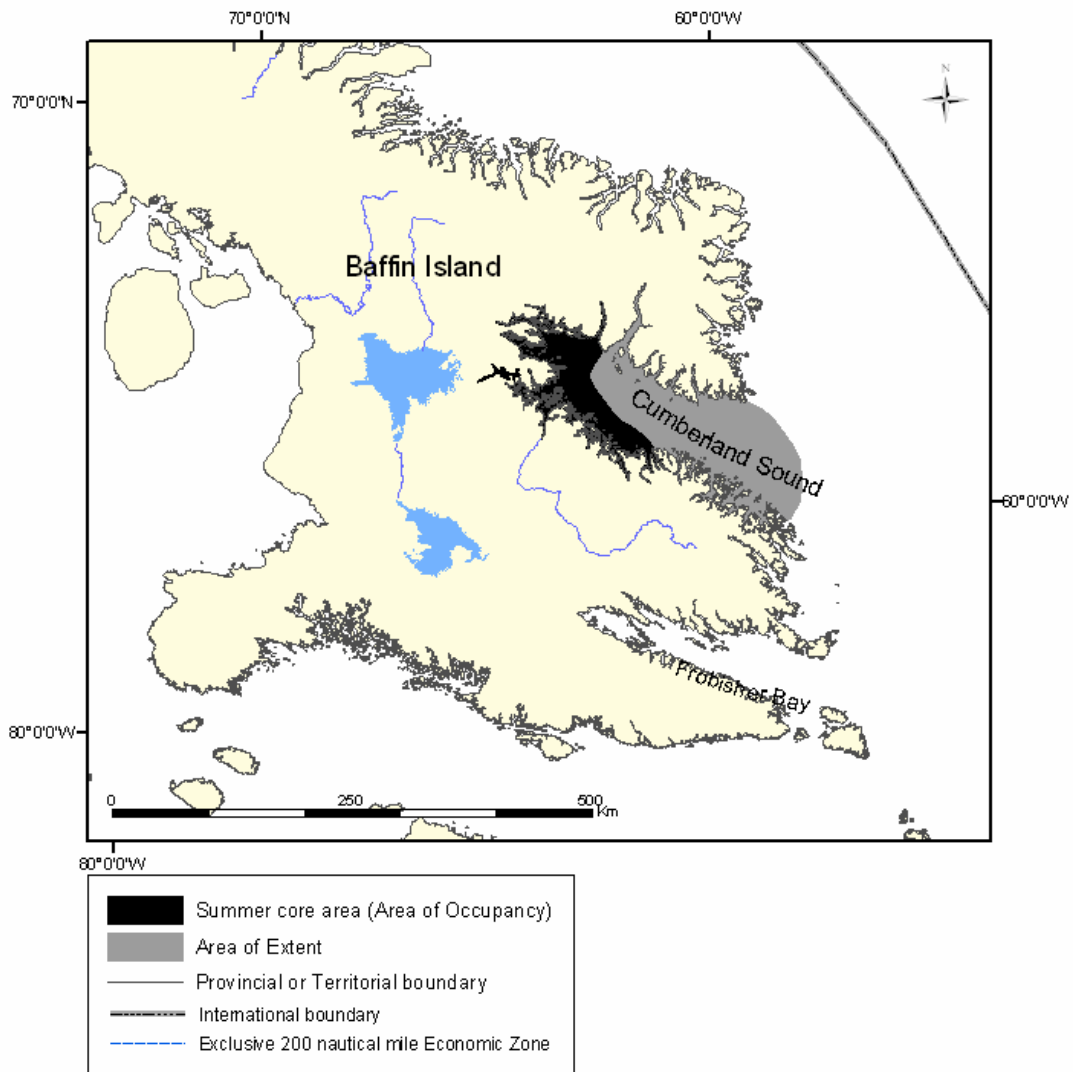


Figure 9. Extent of occurrence (area of extent) and summer core area of the Cumberland Sound population of belugas (modified from DFO 2002b).

Inuit of Cumberland Sound report that belugas spend less time on their migration into Clearwater Fiord than previously. They relate this to the increased disturbance by motorboat traffic. They also feel that belugas leave Clearwater Fiord earlier in the season than in the past (Kilabuk 1998).

Eastern Beaufort Sea population

Belugas are known to aggregate in the Mackenzie River Estuary during July but are also found dispersed in the adjacent offshore areas (Fraker *et al.* 1979, Harwood *et al.* 1996, Richard *et al.* 2001b). In late July they begin to disperse toward the east, mainly into the Amundsen Gulf and further north (Fig. 10). During two years of satellite tagging studies, 11 of 14 male belugas, but none of the 9 tagged females, traveled to distant Viscount Melville Sound, and penetrated an area of 9/10 ice cover as far east as Stefansson Island (DFO 2000). In September all the tagged belugas migrated westward to the western Chukchi Sea and more continued to the Bering Strait area. All tags had stopped transmitting by late November.

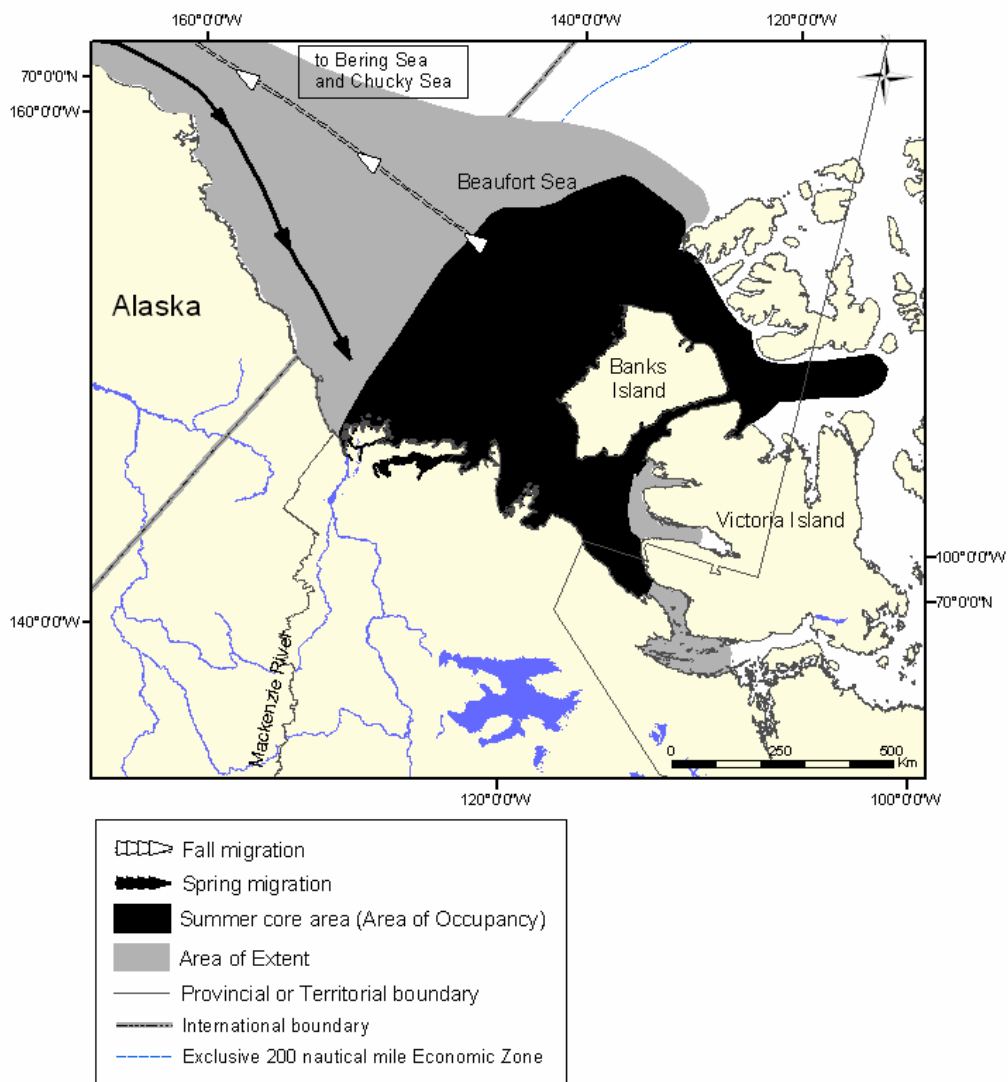


Figure 10. Extent of occurrence (area of extent) and summer core area of the Eastern Beaufort Sea population of belugas (modified from DFO 2002b).

The Inuvialuit report that the first belugas to be seen in the late winter-early spring are often sighted in the open-water ice shear zone, off the west coast of Banks Island. Depending on ice conditions they may first appear near Herschel Island in late April or early May. Belugas come to the shallow waters of the Mackenzie Delta in June to early July. They spend some time in the delta, and then disperse offshore to appear in Darnley Bay and in the Amundsen Gulf. Migrations begin towards the west in late August to early September (Byers and Roberts 1995).

POPULATION SIZES AND TRENDS

The Canadian populations of belugas have been a subject of conservation attention for some time (Table 1). All of the seven populations have received status designations from COSEWIC. Since the original COSEWIC population status assignments much research has been conducted, particularly to gain new information on their population size. Recent population estimates have contributed to several new population status reports produced by Department of Fisheries and Oceans Canada. Beluga populations are usually assessed by aerial surveys. Some estimates are not corrected for diving animals missed by the survey, and these will be substantial underestimates (a factor of very roughly two; National Marine Fisheries Service 2002).

Table 1. Summary of seven Canadian beluga populations with approximate estimates for the total population (see text), a qualitative rating of the current population size relative to its pre-whaling value, and trends. The estimated numbers of mature animals (in Technical Summaries) are approximately 60% of these total estimates.

Stocks	Approximate current population size	Population size compared to original	Population growth trend
St. Lawrence	~952	Low	Stable or Increasing
Ungava Bay	< ~50	Low or extirpated	?
E Hudson Bay	~2,045	Low	Decreasing
W Hudson Bay	~50,000 *	Large	?
Eastern High-Arctic - Baffin Bay	~21,213	?	?
Cumberland Sound	~1,547	Low	Increasing or stable
Eastern Beaufort Sea	~39,258 *	Large	Increasing?

*For survey estimates which were not corrected for diving animals, given here is the most recent population estimate multiplied by two (following the procedure in National Marine Fisheries Service 2002)—this procedure is very approximate (see text).

St. Lawrence Estuary population

Surveys of this population have been conducted since 1973. Kingsley (1998) attempted to develop correction factors in order to compare results from 10 surveys carried out between 1973 and 1995. He concluded that the population had increased on average by 17 belugas per year (SE = 4) and that the 1995 index of abundance was 650 (SE = 40) belugas, possibly more than double some of the lower estimates made in

the early 1980s (Pippard 1985). There remains considerable debate on whether the population is really showing a significant positive trend. Michaud and Béland (2001) have argued that only surveys since 1988 are comparable and that the apparent trend was not significantly different from that of a stable population. The most recent photographic aerial survey (Gosselin *et al.* 2001) analysis also has indicated no significant increase in numbers of belugas since 1988.

While aerial surveys provide an index of abundance, recent studies based on aerial photography (Sergeant and Hoek 1988, Kingsley 1996) and studies of diving behaviour, using telemetry, are providing means of correcting for animals which are missed during surveys because they are submerged (Martin and Smith 1992). In the St. Lawrence a different approach has been used to obtain a correction factor for submerged belugas. Groups were watched from a hovering helicopter and their disappearances and re-appearances were timed. Full-size and calf-size, white- and grey-coloured models of belugas, suspended at various depths, were also photographed and observed from the air. Results yielded a correction factor of +109% (Kingsley and Gauthier 2002). This is in the range of the various estimates for Arctic belugas (+75% to +100%) derived from satellite telemetry studies of their diving behaviour (Martin and Smith 1992, Heide-Jørgensen *et al.* 1998). It should be noted that the different methods might not produce exactly comparable correction factors because of the additional visual clues which might be present when viewing moving groups of live belugas from an aircraft.

Standardization of survey methods and periodic monitoring of this population in the future will probably result in good estimates of the population trend. Recent population estimates, corrected for submerged animals, were 1209 (SE=189) for 1997 (Kingsley and Gauthier 2002) and 952 (SE=16%) for 2000 (Gosselin *et al.* 2001).

Ungava Bay population

Three aerial strip- or line-transect surveys, covering 25% of Ungava Bay each time, were flown in 1983, 1993 and 2001 (Smith and Hammill 1986, Kingsley 2000, Gosselin *et al.* 2002). No whales were seen on any of the transect lines in any of the surveys. Coastal reconnaissance surveys done in conjunction with the offshore transect surveys sighted very few belugas even in areas known for estuarine concentration such as the Mucalic, George and Whale Rivers. In the latest survey, no whales were seen even during the coastal reconnaissance flights.

It has been estimated that a minimum of 200 belugas would have to be present in Ungava Bay for them to be detectable on survey transects. From sightings made outside his line transects, Kingsley (2000) estimated the population in Ungava Bay could possibly be as large as 50 animals.

During the period 1980-2000, there has been a noticeable reduction in the median age of belugas taken by the Nunavik communities of northern Quebec, dropping from 14 years in the period 1980-87 to 9 years during 1993-99 (Lesage *et al.* 2001). For

belugas caught by communities in Ungava Bay, the median age is even lower at 8.5 years.

The Inuit of Kangirsuk on the northeast coast of Ungava Bay indicate that there has been a decline in the number of belugas in their area. They are uncertain of the causes but mention increased noise disturbance as a probable factor.

All evidence indicates that the resident beluga population of Ungava Bay is very low if, in fact, it does still exist. No significant estuarine aggregations are presently known and observations made at the principal estuaries do not reveal any important concentrations of belugas during the summer months.

Eastern Hudson Bay population

The impact of continued over-harvesting of the Eastern Hudson Bay population has been a major concern in recent years (Bourdages *et al.* 2002). The latest aerial surveys flown in the summer of 2001 (Gosselin *et al.* 2002) and reanalysis of a 1985 survey (Smith and Hammill 1986) indicate that the Eastern Hudson Bay population has declined by almost 50% since 1985. Readjusted abundance estimates for belugas, corrected for diving animals, were 3,849, 2,137, and 2,453 for the years 1985, 1993 and 2001 respectively (Bourdages *et al.* 2002). When these estimates are used in population models, the median estimated population size in 2001 was 2,045 beluga (Bourdages *et al.* 2002). Bourdages *et al.* (2002) estimated population trajectories until 2011 using various hunting scenarios and population models. If current harvest rates continue, five of their nine models predicted a greater than 95% probability of extirpation in 2011.

A Five Year Beluga Management Plan (Anon. 1996) was put into place recommending harvests of 90 animals in eastern Hudson Bay, 100 belugas in Hudson Strait, and 50 animals in Ungava Bay. It is now felt that the total allowable annual catch for Eastern Hudson Bay has been too high (DFO 2001) and has resulted in a continuing decline of the population. This is also supported by a significant decline in the mean age of the harvested animals (Lesage *et al.* 2001), and a marked decline in the number of animals observed in the main area of summer estuarine concentrations (Doidge 1994, Hammill 2001).

Management of the Eastern Hudson Bay belugas is complicated by the fact that an unknown proportion of this population is harvested in Hudson Strait during the spring and autumn migration. Recent genetic evidence shows that Eastern Hudson Bay belugas are taken in a significant proportion of the harvests of the Nunavut and Nunavik communities. The proportions are not yet well defined and more years of sampling are required to obtain meaningful estimates (de March and Postma 2003). Models incorporating the best estimates for harvests, including struck and lost whales, and population estimates for Eastern Hudson Bay conclude that the present annual removals will result in the disappearance of the Eastern Hudson Bay population in a relatively short time. Hammill (2001) calculated that a continuing present average

harvest of 106 per year is too high (Lesage *et al.* 2001), and that a reduction to 40 annually would be sustainable. A more recent evaluation concluded that the total removals from the Eastern Hudson Bay population should be less than 20 belugas per year to allow some population recovery (Bourdages *et al.* 2002). Eastern Hudson Bay belugas are also taken in Hudson Strait, making the annual harvest from the Eastern Hudson Bay population difficult to control. One recommendation is a complete closure of hunting in Eastern Hudson Bay, and a reduction of harvest to 100 belugas annually in Hudson Strait, based on the present best estimates (19%) of the proportion of Eastern Hudson Bay belugas caught there (de March and Postma 2003).

A number of factors remain uncertain in the evaluation of harvesting impact on the Eastern Hudson Bay population. Improved estimates of total removals will require better data on hunting losses, more genetic sampling from Hudson Strait and other areas, and better harvest reporting. Improved estimates of total population size will also require refined correction factors for animals that are underwater during aerial surveys.

Abundance estimates of 1842, 3141 and 7901 belugas, uncorrected for submerged animals, have been derived for James Bay in 1985, 1993 and 2001 respectively, an area contiguous with the Eastern Hudson Bay population (Gosselin *et al.* 2002). The genetic affiliation of these belugas is not known since virtually no samples have yet been taken there. The apparent increase in numbers over the years of aerial surveys cannot be explained by population growth, but probably results from different survey coverage and seasonal movements of animals in and out of this area. No harvesting occurs in James Bay during the summer, but the contribution from this group to the spring and autumn harvests in other Nunavut and Nunavik communities must be considered in order to refine the management plans in the future.

The Inuit of Nunavik report that belugas have become scarce in certain areas. Belugas were once common along the coast and in small river mouths near Inukjuak (Elie Weetaltuk, *pers com.* 1983) and the Nastapoka River (Doidge *et al.* 2002). Other areas such as Salluit and the Great Whale River now have few whales. It is generally held that these changes are related to increased disturbance from motorboat traffic and commercial shipping, as well as over-harvesting (Doidge *et al.* 2002, McDonald *et al.* 2002).

Western Hudson Bay population

No aerial surveys have been made of this population for over 15 years. Richard *et al.* (1990) and Richard (1993) estimated the size of this population, from surveys between 1978 and 1987, to be in excess of 23,000, with another 1,300 belugas along the south Hudson Bay - Ontario coastline, and some 700 animals in the Northern Hudson Bay area. None of these estimates were corrected for submerged whales so will be substantial underestimates.

Belugas in western Hudson Bay spend all of the summer months in shallow coastal areas. Results for four belugas, instrumented with telemetry tags, showed that

they rarely exceed 40 meters in depth during their dives in August. They begin deep diving as soon as they start to migrate east in September (Martin *et al.* 2001). Since they remain in shallow water for the whole of the summer period, aerial survey correction factors, generally applicable to other deep-water Arctic beluga populations (Martin and Smith 1992, Heide-Jørgensen *et al.* 1998), might not be appropriate for this population. A larger proportion of Western Hudson Bay belugas in shallow water might be seen during surveys, but other factors such as turbidity and clumping might also influence the estimates.

In 2003 the hunt for members of the Western Hudson Bay Population was 502 for western Hudson Bay and southeast Baffin communities (S. Cosens, DFO Winnipeg *pers. comm.* 2004). To that should be added the number of western Hudson Bay whales taken in the Belcher Islands (Sanikiluaq); perhaps 88% of the 70 caught in 2003 were from the Western Hudson Bay Population, i.e. about 62, and the number of western Hudson Bay animals caught in the Hudson Strait from northern Quebec, about 200 (S. Cosens and P. Richard, DFO Winnipeg *pers. comm.* 2004). Thus the total catch in 2003 from the Western Hudson Bay Population was about 764, which is a considerable rise from levels in recent years, when there was a total catch of about 500 per year (S. Cosens and P. Richard, DFO Winnipeg *pers. comm.* 2004).

Eastern High Arctic – Baffin Bay Population

Recent aerial surveys of belugas occupying the Canadian High Arctic during the summer yield an estimate of abundance, corrected for submerged animals, of 21,213 (95% CI = 10,985 to 32,619) (Innes *et al.* 2002b). It is not possible to compare the results of this survey with previous ones (Smith *et al.* 1985), because the timing and area covered by the surveys were different. The detection of trends in abundance of belugas by aerial surveys of the Canadian high Arctic summer habitat will always remain problematical, because of the wide area of occupation by belugas, and the inter-annual differences in timing of ice break-up with its effect on the seasonal movements of belugas (Smith and Martin 1994, Richard *et al.* 2001a).

The summer harvest of belugas in the High Arctic totals less than 100 individuals a year (DFO 1999). Innes and Stewart (2002), in a modeling exercise, estimated that the number of belugas spending the summer in the High Arctic, and which also remained in the Baffin Bay – North Water area in the winter, was 17,328 (5,750 - 27,996) with a maximum sustainable yield of 317 (25 - 1,107). They conclude that current harvests are below MSY.

The aerial surveys of belugas spending the winter along the West Greenland coast have indicated a decline in numbers between 1981 and 1999. The estimate of abundance from 1998 and 1999 was 7,941 (95% CI = 3,650 – 17,278) and does not differ significantly from the estimate of 11,563 (8,560 – 15,621) from 1993-1994. However, when the 1981-82 index of abundance (3,302 SE=958) and the 1998-99 estimates (735, SE=025) are compared, the difference is significant (Heide-Jørgensen and Acquarone 2002, Innes and Stewart 2002).

Annual catches of belugas off West Greenland, corrected for under-reporting and sinking loss, including ice entrapment mortalities, for the period from 1979 to 1999, ranged from an estimated low of 650 to a high of 941 (Heide-Jørgensen and Rosing-Asvid 2002). Innes and Stewart (2002), using the largest estimates of abundance for the West Greenland group, calculated that the sustainable yield for 1999 would have been a total of 109 landed belugas. Their model suggested a decline of 50% in this wintering group during the period 1981 to 1994, compared with 62% based on all winter aerial surveys analysed by Heide-Jørgensen and Reeves (1996).

Inuit from three of four west Greenland communities believe that the numbers of belugas have slightly decreased or remained stable. One community notes a possible increase. Most hunters indicate that there is a noticeable variation in beluga numbers from year to year (Thomsen 1993).

Cumberland Sound population

Large commercial hunts in Cumberland sound from 1868 to 1939, particularly in Clearwater Fiord, the main centre of aggregation, reduced the original population of some 5,000 whales (Mitchell and Reeves 1981) to less than 1,000 individuals in the 1970s (Brodie *et al.* 1981). Aerial surveys carried out in Clearwater Fiord have provided an index of abundance for this population. Surveys flown in 1979 produced a maximum count of 550 belugas; and from 1979 to 1982, a maximum count of 541 belugas (Richard and Orr 1986). In August 1990, maximum counts in Clearwater Fiord ranged from 454 to 497, while counts from two surveys in 1999 were in excess of 700 belugas. A significant number of belugas were also seen in 1999 in strip transect surveys of Cumberland Sound proper and offshore from Cumberland Sound (Richard and Baratin 2002).

The 1999 surveys estimated the numbers of belugas in the Cumberland Sound population, corrected for submerged animals, to be 1,547 (95% CI=1,187-1,970; DFO 2002a). The lack of past comparable data makes it difficult to comment on the trends of abundance in this population.

The numbers of belugas entering Clearwater Fiord in Cumberland Sound is reported to have declined from the 1940s to the present. The Inuit of Pangnirtung believe that the major cause of the decrease was the large commercial harvests in the early part of the 20th century (Kilabuk 1998). There is a current quota of 41 belugas for this population, taken by the community of Pangnirtung.

Eastern Beaufort Sea population

Aerial surveys in 1992 provide an index of abundance of 19,629 (95% C.L. = 15,131-24,125) (Harwood *et al.* 1996) for this population. This is uncorrected for submerged animals. It is also now known from VHF telemetry studies that some belugas in this population travel northwest into the ice-covered Viscount Melville Sound to feed in the summer (Richard *et al.* 2001b). The estimate of abundance is likely to have been an underestimation since it was based solely on surveys in the area of the

Mackenzie Delta (DFO 2000). The US National Marine Fisheries Service (2002) tried to correct the Harwood et al. (1996) estimate for diving animals, coming up with an estimate of 39,258 which was still considered conservative.

The Inuvialuit harvests for this population have been well documented since 1973. While the human population has increased in the area during this period, the number of whales harvested has slightly declined. The estimated total annual removal from this population, including struck and lost animals and Alaskan harvests, is 186 (Harwood *et al.* 2002). There might also be a few removals from Russian hunts when the animals occupy the winter areas, but this is thought to be very low. The continued harvest of large old individuals in the landed catch indicates that this harvest level has little impact on the population and that the present catch is well below the sustainable yield (DFO 2000).

The Inuvialuit have long depended on the beluga as a principal resource (McGhee 1974). The past 100 years have seen an evolution of hunting techniques from kayaks to whale boats to boats equipped with outboard motors (Day 2002). Even with the increasing human population in the Mackenzie Delta, the total annual catch of belugas has remained relatively constant during the past 20 years as has the age structure of the landed catch (DFO 2000, Harwood and Smith 2002). The Inuvialuit have not noticed any changes in abundance or distribution of belugas in their hunting areas.

LIMITING FACTORS AND THREATS

Limiting factors may be viewed as belonging to two main categories; those which would generally be classed as natural and those which are anthropogenic.

Causes of natural mortality of Arctic mammals are difficult to document because animals may live far from human populations and carcasses are rarely ever found. The chance of finding dead mammals that live in the marine environment is even smaller. Here the combined scientific and aboriginal traditional knowledge (ATK) is relatively scarce and quantitative data are lacking. One exception to this is the beluga population in the confines of the St. Lawrence Estuary where ongoing long-term studies have gained considerable knowledge of disease and mortality factors from the recovery of dead carcasses (Martineau *et al.* 2002a, b)

Polar bears, *Ursus maritimus*, are a known predator of belugas throughout their Arctic range. They are known to kill belugas in the winter along the floe edges. At break-up, polar bears have been observed to take belugas by diving in on top of them from platforms of floating ice (Smith and Sjare 1990). During the open water season, polar bears are capable of killing belugas that have become entrapped in river streams when the tide has ebbed (Norris 1994).

Ice entrapments (*savsaat*, pl. *savsait*) of belugas are known to recur in several areas of the Beaufort Sea, Canadian High Arctic, in northern Foxe Basin and along the

West Greenland coast. Polar bears and Inuit hunters take advantage of these incidents to harvest belugas. The proportion of mortality in these situations that is attributable to predation is not well documented and remains debatable (Kilabuk 1998).

Killer whales, *Orcinus orca*, are known to take belugas throughout most of the eastern Canadian Arctic (Reeves and Mitchell 1989) and Greenland (Thomsen 1993). Observations of killer whale occurrence are fewer in the high Arctic and the Beaufort Sea areas, but occasional sightings (Byers and Roberts 1995) and attacks have been documented. In the St. Lawrence Estuary, killer whales might have once been somewhat more abundant than in the present day, when almost no sightings are made, even in the outer Gulf of St. Lawrence. One observation was made of killer whales killing belugas as far upstream as Les Escoumins in the early 1960s (L. Otis *pers. com.* 1967). No such incidents have been seen in the last 15 years, during which intensive beluga research has been conducted (R. Michaud, *pers. com.* 2002)

The Inuvialuit of the Mackenzie Delta mention that belugas are frightened of walruses, *Odobenus rosmarus*, and have possibly documented a wound resulting from a walrus tusk (Byers and Roberts 1995). There has also been an incident of a beluga that was found with the broken tip of a narwhal, *Monodon monoceros*, tusk imbedded in its melon (Byers and Roberts 1995, Orr and Harwood 1998). This might be indicative of aggressive interspecific behaviour (Reeves and Mitchell 1988), which could result in mortality. Belugas and narwhals occupy some of the same areas during the open water season in the Canadian High Arctic (Smith *et al.* 1985, Innes *et al.* 2002b).

The strong philopatry of belugas, which causes them to return to the same estuaries year after year, makes them highly vulnerable to overexploitation. This behavioural trait is undoubtedly the most important natural factor which has led to the extirpation of beluga populations by a combination of commercial and subsistence hunting (Francis 1977, Reeves and Mitchell 1987). Because of this strong philopatry and site tenacity (Caron and Smith 1990) native harvesters, hunting in these estuaries, continue to perceive that the numbers of belugas remain high even though the populations might actually be declining.

Little is known of the role of infectious diseases in belugas. Recently, *Brucella* antibodies have been found in the tissues of Beaufort Sea animals, but no indications have been found that this has caused health problems at the population level. While viruses have been known to cause large-scale die-offs of seals and toothed whales (Hinshaw *et al.* 1984, Lipscomb *et al.* 1994), no such event has yet been documented for any known beluga population.

Anthropogenic threats act as strong limiting factors for many of the Canadian beluga populations. They must be discussed for each population separately because they vary greatly over the wide geographical range of the beluga.

St. Lawrence Estuary population

The belugas of the St. Lawrence were much reduced in numbers by hunting (Vladykov 1944, Reeves and Mitchell 1984), and also perhaps by the loss of certain estuarine habitats (Kingsley 2002). At present this is the only population of belugas in Canada that has been completely protected from hunting, first under the 1979 Beluga Protection Regulations in the Fisheries Act, and then, in 1993, under the Marine Mammal Regulations of the Fisheries Act.

The area presently occupied by these belugas is a heavily used maritime shipping corridor. The St. Lawrence Estuary also is very heavily industrialized and has the Great Lakes, an area of large industry, as its headwaters. Because of the perceived low numbers of belugas present in the 1970s and the possibility that the population was in decline (Pippard 1985), a large amount of research has been conducted on the many anthropogenic factors which might be limiting the growth and recovery of this population (see references in: Muir *et al.* 1990, Béland *et al.* 1993, Martineau *et al.* 2002a).

The small size and lower genetic diversity of this population has led to the speculation that inbreeding might be suppressing the reproductive rates (Patenaude *et al.* 1994). While the genetic diversity of this population is the lowest of all Canadian populations (de March and Postma 2003), the degree to which inbreeding suppression is a limiting factor is hard to evaluate. It should be noted that marine mammals, particularly seal populations of several species, have experienced severe reduction to very low numbers where a genetic bottleneck could have occurred and yet have rebounded to high densities. Other genetic factors, such as changes at particular loci, might be implicated in a reduced capacity of the St. Lawrence Estuary population to respond to certain pathogens (Murray *et al.* 1999).

The loss and perturbation of habitat is a continuing threat for St. Lawrence belugas which live in a relatively restricted zone of a heavily traveled and populated area. Both commercial shipping and whale watching activities have increased significantly in the area over the last 40 years (Michaud 1993). Lesage *et al.* (1999) have demonstrated that boat traffic had a significant effect on the vocal behaviour of belugas. Little is known of the immediate or chronic stress responses which belugas might have to these various disturbances factors, and how it might affect their feeding, mating and nurturing behaviour.

Large numbers of beluga carcasses have been recovered along the inhabited shorelines of the St. Lawrence Estuary and have allowed considerable research into the causes of mortality. Links have been postulated between the prevalence of cancerous tumors and the exposure of St. Lawrence belugas to industrial pollutants (Martineau *et al.* 2002a). Debates continue on whether such correlations between pollutants and pathologies are truly indicative of a direct cause and effect relationship, and whether the sample of recovered carcasses is representative of measured cancer rates within the live population (Theriault *et al.* 2002, Martineau *et al.* 2002a, Hammill *et al.* 2003). Because little information exists from Arctic beluga populations on cancer rates and since the St. Lawrence beluga cancer samples come mainly from old animals, it is

difficult to evaluate this question (Geraci *et al.* 1987). There is no doubt that belugas of the St. Lawrence are more exposed to pollutants than any other beluga population in Canada (Muir *et al.* 1990).

Other possible limiting factors include competition for resources with commercial fisheries and other increasing populations of marine mammals such as harp seals, *Pagophilus groenlandica*, and grey seals, *Halichoerus grypus*, (Curren and Lien 1998). More detailed research must be conducted before the effect of competition can be critically evaluated (Nozeres *et al.* 2001), particularly since belugas eat a variety of food species (Vladykov 1944), and are capable of deep foraging dives (Martin and Smith 1992). It should be noted, however, that even with the high carcass recovery rate, no cases of starvation have been documented. Occasional extralimital sightings of belugas are reported either along the Labrador coast or south of the St. Lawrence Estuary (Curren and Lien 1998). These could be stray animals from this population, but appear to be very low in numbers. At least one such extralimital animal from Labrador was shown to belong to an Arctic population by genetic analysis (B. de March, *pers. com.*).

Ungava Bay population

This population is so severely depleted that its recovery is uncertain. Future hydroelectric developments in Ungava Bay have recently been indicated by the Quebec government. These might have the potential to affect the river outflow into some estuaries used by Ungava Bay belugas. The Inuit of Ungava Bay have expressed concern about the effect of increased noise disturbance by both commercial shipping and outboard motors (Lee *et al.* 2002).

Eastern Hudson Bay population

Continued overexploitation of this population by resource harvesters, at or near the present level, may lead to its disappearance within the next 10-15 years (Hammill 2001, Bourdages *et al.* 2002). The Eastern Hudson Bay belugas are the subject of quotas, and closed hunting seasons in certain areas under a co-management plan between Nunavik and Department of Fisheries and Oceans Canada in an effort to remedy the critical status of this population. To date however, a significant reduction in catches has not occurred (Lesage *et al.* 2001).

Disturbances from outboard motors and hunting in the estuaries used by belugas of this population have significantly increased over time (Doidge 1994), and could also be harmful to the population. Ironically, because this disturbance appears to reduce the numbers coming to the estuaries, it might have the positive effect of reduced harvests in the long run by driving the belugas further offshore.

The Inuit of Nunavik have also expressed concern in the past, about habitat degradation of estuaries by noise disturbance and hydroelectric projects, which could affect the outflow of rivers in Eastern Hudson Bay (Doidge *et al.* 2002; see also Doidge and Lesage 2001).

Expanding commercial fisheries, for instance for Greenland halibut (*Reinhardtius hippoglossoides*; also called turbot), in the Hudson Strait, southern Davis Strait, and off the northern Labrador coast, may degrade the winter habitat of this population, as well as the Western Hudson Bay population.

Western Hudson Bay population

This large population, centred on the Seal, Churchill and Nelson Rivers, is the subject of substantial, and rising (see above) catches, and might be subject to disturbance by increased shipping. Future hydroelectric projects could cause changes to river outflow and result in changes in the use of such sites as either moulting or feeding areas. This has not apparently been the case in the developments to date on the Churchill River.

Eastern High Arctic – Baffin Bay population

The Eastern High Arctic – Baffin Bay population, which spends its winter in the Jones Sound – North Water polynya area, does not appear to be adversely affected by over-exploitation or subject to any other negative anthropogenic impacts. The occasional ice entrapment occurs in this area (Freeman 1968, 1973, Heide-Jørgensen *et al.* 2002b), which is not unexpected since belugas are living throughout the winter in an area of heavy shifting and consolidating ice. The magnitude of mortality from these events is not well documented.

Overexploitation by Greenland Inuit, who harvest belugas along the West Greenland coast, is a serious concern for the animals which winter in this area (Innes and Stewart 2002). Although commercial fisheries for Greenland halibut and pink shrimp, *Pandalus borealis*, take place in the area occupied by belugas in the winter, deleterious effects of competition by fisheries for resources have not yet been studied.

Inuit of West Greenland report changes in the distribution of belugas which now are found more to the west of Disko Island, and in some cases are reported to stay further offshore. Increased trawler and hunting boat traffic and drive fisheries in such areas as Upernavik have been cited as the causative influence (Thomsen 1993).

Cumberland Sound population

Apart from subsistence hunting pressures there are no apparent important anthropogenic impacts on this population. Commercial fisheries for Greenland halibut, *Reinhardtius hippoglossoides*, are conducted in the area. Belugas are known to feed on this species at the floe edge (Stewart 2001).

Inuit of Pangnirtung report changes in the behaviour of belugas related to increased boat traffic and the associated noise caused by outboard motors (Kilabuk 1998). This noise is considered the reason for the decline in numbers of belugas, which were formerly more numerous in areas such as Clearwater Fiord. Hunters also note a

decrease in the fatness of whales, which they relate to more energy being spent in avoidance of motorboats. Less selective hunting resulting from faster-moving motorboats is blamed for higher proportion of belugas being scarred with bullet wounds. This is seen as being exacerbated by the annual quota which obliges hunters to rush their hunting period in order to obtain their part of the catch (Kilabuk 1998). The quota was increased from 35 to 41 in 2003.

Eastern Beaufort Sea population

This population has been continually monitored since 1973 and is not limited by over-hunting. There does not appear to be any indication of reduced body condition or negative effects of any infectious diseases (DFO 2000). Increasing commercial fisheries in the Bering Sea wintering grounds might, in the future, impact several species of Arctic marine mammals.

Much offshore petroleum exploration has already occurred in the Mackenzie Basin, with no measurable impact on this population (Fraker 1980, Finley *et al.* 1987). The proven offshore oil and gas reserves are important and will be developed in the near future. This will increase anthropogenic activities and might create disturbance.

Once the oil and gas wells and pipelines are built there will also be the potential threat of oil spills. While the short-term consequences of spills on cetaceans are not necessarily always lethal, effects on the food chain are also of concern (Geraci *et al.* 1983, Smith *et al.* 1983, St. Aubin *et al.* 1985). If oil transport is by pipeline down the Mackenzie rather than by tanker, the chances of a major oil spill affecting belugas are much reduced.

SPECIAL SIGNIFICANCE OF THE SPECIES

The beluga is the only species in the genus *Delphinapterus*. In southern Canada the population living in the St. Lawrence Estuary is a relict Arctic species, originating (together with the Eastern Hudson Bay population) from an eastern refugium that persisted during the Wisconsin Ice Age. Recently, with the reduction in the St. Lawrence Estuary population by hunting and the threat to the remaining population from industrialization, the beluga has become a symbol of marine conservation efforts in Canada.

For the Inuit in some communities, belugas are a preferred food item; they are extremely nutritious, and much-sought-after as a subsistence resource throughout the Arctic (McGhee 1974, Reeves and Mitchell 1987, Byers and Roberts 1995).

The beluga was one of the first cetaceans to be kept in aquaria, where it adapts readily and survives well under present modern husbandry. It has long been in the eye of the public. A number of aquaria throughout the world have successfully bred belugas and maintain breeding stocks.

Both captive and free-ranging belugas, because they are easy to handle, have helped further our scientific knowledge of cetaceans in many fields. These include marine mammal medicine (Ridgway 1973, St. Aubin *et al.* 2001), behaviour (Au *et al.* 1985, Sjare and Smith 1986, Caron and Smith 1990, Smith *et al.* 1994), and ecology (Reeves and St. Aubin 2001).

EXISTING PROTECTION OR OTHER STATUS

In Canada, belugas have been managed under the Fisheries Act since 1949. The history of legislation and amendments are reviewed in Reeves and Mitchell (1989). The Beluga Protection Regulations of 1979 (absorbed into the Marine Mammal Regulations of the Fisheries Act in 1993) limited beluga hunting without a permit to Indians and Inuit of Canada.

In 1979, the St. Lawrence beluga population was added to the Beluga Protection regulations of the Fisheries Act. In 1980, the regulations were amended to prohibit hunting and willful disturbance of the St. Lawrence beluga. In 1993, another amendment forbade any disturbance of marine mammals with exemptions under permit. Belugas are protected from being sought out and from direct approaches by commercial whale watching boats, and behavioural guidelines have been developed for vessels that unexpectedly encounter them (Ministère de Pêche et Océans Canada 1992). These regulations have been adopted and incorporated into the law, which has created the new joint federal and provincial Saguenay and St. Lawrence Marine Park.

St. Lawrence belugas have been the subject of continuing research and intense scrutiny under the umbrella of the Interdisciplinary Action Plan for the Survival of the Beluga of the St. Lawrence (Plan de rétablissement pour les bélugas du St.-Laurent) (Bailey and Zinger 1995). They have been listed as Endangered under the Quebec Endangered Species Act.

In the Arctic waters, where the belugas are subject to subsistence hunting, a number of populations are the subject of co-management by Inuit groups, Hunters and Trappers Associations, the Nunavut Wildlife Management Board, and Fisheries and Oceans Canada. In the northern Quebec territories of Nunavik, which comprises many beluga hunting communities (Lesage *et al.* 2001), a Beluga Management Plan (Anon. 2001a) specifies annual allowable catches, which are implemented by a system of community quotas. Under the current management plan, Ungava Bay and that part of the habitat of the Eastern Hudson Bay population encompassing the Hudson Bay arc are closed to hunting. Current hunting by Nunavik Inuit is limited to Hudson Strait and James Bay.

The Cumberland Sound population has been the subject of co-management action since the 1980s (Richard and Pike 1993). A recovery strategy for this population is being developed by Fisheries and Oceans Canada in collaboration with the Pangnirtung HTA, Qikiqtaaluk Wildlife Board, Nunavut Wildlife Management Board and Nunavut

Tunngavik Inc. (S. Cosens, DFO, Winnipeg, pers. com.). Presently the annual allowable catch is set at 41 landed belugas.

The Eastern High Arctic – Baffin Bay population is the subject of scrutiny and continuing research in view of the likely overexploitation in West Greenland (Innes and Stewart 2002). The West Greenland group might well be a separate population (de March et al. 2002, Heide-Jørgensen et al. 2003). The Canada - Greenland Joint Commission on Conservation and Management of Narwhal and Beluga was established in 1991 in order to develop and integrate research and manage the populations of Arctic monodontids whose total range is shared by both countries. This commission has paid close attention to the population of belugas hunted in western Greenland.

The other two largest beluga groups in Canada, the Western Hudson Bay population and the Eastern Beaufort Sea population, appear to be exploited at below sustainable yields, at least during the summer harvests and no quotas or special management plans are imposed on them. It should be noted, however, that the Western Hudson Bay population has not been surveyed for over 15 years, and that catches are substantial and rising. The Eastern Beaufort Sea population has been continuously monitored since 1980s and studied using a community-based harvest monitoring program (Harwood et al. 2002). The Fisheries Joint Management Committee (FJMC) was established in 1986 and worked with the Inuvialuit to implement the Beaufort Sea Beluga Management Plan in 1996 (FJMC 1998, Harwood and Smith 2002).

SUMMARY OF STATUS REPORT

Current data suggest that the belugas in Canada be divided into seven designatable units, based principally on summer ranges and gene distributions.

Based on recent aerial surveys, the St. Lawrence Estuary population is thought to be stable or at least not measurably declining. Its numbers are thought to be in the order of 1,000 animals. This is considerably higher than when it was assigned the COSEWIC status of Endangered (Campbell 1985) based on a presumed population of 350 which was thought to be declining (Pippard 1985).

The Ungava Bay population has very low numbers, and may no longer exist.

The Eastern Hudson Bay population, which is low in numbers and subject to over-harvesting, is thought to be declining. Models based on conservative population parameters predict its likely disappearance under present harvest levels in less than 20 years. Studies of the genetic identity of the considerable numbers of belugas just south of the Eastern Hudson Bay population, their possible relationship to Eastern Hudson Bay belugas and their contribution to the annual harvests from Eastern Hudson Bay, are essential to evaluating the status of this population.

The Western Hudson Bay population has not been surveyed for over 15 years. It is one of the two largest populations of belugas in Canada. While it ranges over a large geographical area and has major summer concentrations in three large rivers, it has been little studied by geneticists who have sampled from only a few locations. There is hunting throughout the summer range of this population, and it is hunted elsewhere by Nunavut and Nunavik communities during its spring and autumn migrations. The catches are substantial and rising.

Some evidence suggests that the Eastern High Arctic - Baffin Bay population should be split. One part is of a considerable size and appears to remain in Canadian or offshore waters during the winter where it is only harvested at low levels. Another part of the Eastern High Arctic - Baffin Bay population spends the winter in western Greenland waters where it is heavily exploited. It appears to have significantly decreased in numbers over the last decade.

The Cumberland Sound population containing about 1,500 animals is managed under an allowable catch of 41 belugas. It has increased in numbers since 1980 and is now either stable or slightly growing. It appears to have a limited distribution in the Cumberland Sound area throughout the year.

The Eastern Beaufort Sea population is large in comparison to the annual removals by subsistence harvests. Annual monitoring studies do not indicate any significant changes in abundance, distribution or health status.

TECHNICAL SUMMARY: (1) ST. LAWRENCE ESTUARY POPULATION

Delphinapterus leucas

Beluga

béluga

(1) St. Lawrence Estuary population

Range of Occurrence in Canada: Gulf of St. Lawrence, Quebec / Atlantic Ocean

Extent and Area Information	
• <i>Extent of occurrence (EO)(km²)</i>	36,000 km ² (approx.)
• <i>Specify trend in EO</i>	Stable
• <i>Are there extreme fluctuations in EO?</i>	No
<i>Area of occupancy (AO) (km²)</i>	5,000 km ²
• <i>Specify trend in AO</i>	Stable?
• <i>Are there extreme fluctuations in AO?</i>	No
• <i>Number of known or inferred current locations</i>	Not applicable
• <i>Specify trend in #</i>	Not applicable
• <i>Are there extreme fluctuations in number of locations?</i>	No
• <i>Specify trend in area, extent or quality of habitat</i>	Stable
Population Information	
• <i>Generation time (average age of parents in the population)</i>	14 years
• <i>Number of mature individuals</i>	571 (60% \times 952)
• <i>Total population trend:</i>	?
• <i>% decline over the last/next 10 years or 3 generations.</i>	Not applicable
• <i>Are there extreme fluctuations in number of mature individuals?</i>	No
• <i>Is the total population severely fragmented?</i>	No
• <i>Specify trend in number of populations</i>	Not applicable
• <i>Are there extreme fluctuations in number of populations?</i>	Not applicable
Threats (actual or imminent threats to populations or habitats)	
Chemical pollution, loss of habitat, vessel traffic, in-breeding, developing commercial fisheries	
Rescue Effect (immigration from an outside source)	
<i>Status of outside population(s)?</i> Not at Risk to Endangered	
• <i>Is immigration known or possible?</i>	Yes
• <i>Would immigrants be adapted to survive in Canada?</i>	Yes
• <i>Is there sufficient habitat for immigrants in Canada?</i>	Yes
• <i>Is rescue from outside populations likely?</i>	Not very
Quantitative Analysis	Not applicable
Other Status	
COSEWIC: Endangered, April 1997	

Status and Reasons for Designation

Status: Threatened	Alpha-numeric code: D1
Reasons for Designation: The population was severely reduced by hunting, which continued until 1979. High contaminant loads may have also contributed to the population decline. Aerial surveys since 1973 suggest that the decline has ceased, but do not provide clear evidence of a significant increase in numbers. Levels of many contaminants remain high in beluga tissues. The whales and their habitat are threatened by contaminants, vessel traffic, and industrialization of the St. Lawrence watershed.	

Applicability of Criteria

Criterion A (Declining Total Population): no.

Criterion B (Small Distribution, and Decline or Fluctuation): no

Criterion C (Small Total Population Size and Decline): no

Criterion D (Very Small Population or Restricted Distribution): Threatened D1, less than 1,000 mature individuals.

Criterion E (Quantitative Analysis): not applicable

TECHNICAL SUMMARY: (2) UNGAVA BAY POPULATION

Delphinapterus leucas

Beluga

béluga

(2) Ungava Bay population

Range of Occurrence in Canada: Quebec / Arctic and Atlantic Oceans

Extent and Area Information	
• <i>Extent of occurrence (EO)(km²)</i>	51,000 km ² (approx.)
• <i>Specify trend in EO</i>	Unknown
• <i>Are there extreme fluctuations in EO?</i>	No
• <i>Area of occupancy (AO) (km²)</i>	12,000 km ²
• <i>Specify trend in AO</i>	Unknown
• <i>Are there extreme fluctuations in AO?</i>	No
• <i>Number of known or inferred current locations</i>	Unknown
• <i>Specify trend in #</i>	Unknown
• <i>Are there extreme fluctuations in number of locations?</i>	No
• <i>Specify trend in area, extent or quality of habitat</i>	Stable
Population Information	
• <i>Generation time (average age of parents in the population)</i>	14 years
• <i>Number of mature individuals</i>	Probably less than 30 (60%x50)
• <i>Total population trend:</i>	Decrease over 3 generations, currently unknown
• <i>% decline over the last/next 10 years or 3 generations.</i>	Unknown
• <i>Are there extreme fluctuations in number of mature individuals?</i>	No
• <i>Is the total population severely fragmented?</i>	No
• <i>Specify trend in number of populations</i>	Not applicable
• <i>Are there extreme fluctuations in number of populations?</i>	Not applicable
Threats (actual or imminent threats to populations or habitats)	
Past overexploitation, continuing exploitation, potential hydro-electric development, noise disturbance	
Rescue Effect (immigration from an outside source)	
<i>Status of outside population(s)?</i> Not at Risk to Endangered	
• <i>Is immigration known or possible?</i>	Yes
• <i>Would immigrants be adapted to survive in Canada?</i>	Yes
• <i>Is there sufficient habitat for immigrants in Canada?</i>	Yes
• <i>Is rescue from outside populations likely?</i>	Not very
Quantitative Analysis	Not applicable
Other Status	
COSEWIC: Endangered, April 1988	

Status and Reasons for Designation

Status: Endangered	Alpha-numeric code: A2a; D1
Reasons for Designation: All signs indicate that the population residing in Ungava Bay is very low and may be extirpated. However, it is difficult to definitively conclude that they have been extirpated because beluga from other populations may visit Ungava Bay. Hunting caused the population decline and continues in Ungava Bay, posing a threat to any remaining beluga.	

Applicability of Criteria

Criterion A (Declining Total Population): Endangered A2a.

Criterion B (Small Distribution, and Decline or Fluctuation): not applicable (unknown current range).

Criterion C (Small Total Population Size and Decline): not applicable, because no estimation of trend.

Criterion D (Very Small Population or Restricted Distribution): Endangered D1.

Criterion E (Quantitative Analysis): not applicable.

TECHNICAL SUMMARY: (3) EASTERN HUDSON BAY POPULATION

Delphinapterus leucas

Beluga

béluga

(3) Eastern Hudson Bay population

Range of Occurrence in Canada: Quebec / Nunavut / Arctic and Atlantic Oceans

Extent and Area Information	
• <i>Extent of occurrence (EO)(km²)</i>	221,000 km ² (approx.)
• <i>Specify trend in EO</i>	Stable
• <i>Are there extreme fluctuations in EO?</i>	No
• <i>Area of occupancy (AO) (km²)</i>	41,000 km ²
• <i>Specify trend in AO</i>	Stable
• <i>Are there extreme fluctuations in AO?</i>	No
• <i>Number of known or inferred current locations</i>	Not applicable
• <i>Specify trend in #</i>	Decline (fewer estuarine habitats)
• <i>Are there extreme fluctuations in number of locations?</i>	No
• <i>Specify trend in area, extent or quality of habitat</i>	Stable
Population Information	
• <i>Generation time (average age of parents in the population)</i>	14 years
• <i>Number of mature individuals</i>	1,227 (60% x 2,045)
• <i>Total population trend:</i>	Declining
• <i>% decline over the last/next 10 years or 3 generations.</i>	36% decline 1985-2001 indicates 2.6%/yr or 66% decline over 3 generations
• <i>Are there extreme fluctuations in number of mature individuals?</i>	No
• <i>Is the total population severely fragmented?</i>	No
• <i>Specify trend in number of populations</i>	Not applicable
• <i>Are there extreme fluctuations in number of populations?</i>	Not applicable
Threats (actual or imminent threats to populations or habitats)	
Overexploitation, hydro-electric development of rivers, noise disturbance	
Rescue Effect (immigration from an outside source)	
<i>Status of outside population(s)?</i> Not at Risk to Endangered	
• <i>Is immigration known or possible?</i>	Yes
• <i>Would immigrants be adapted to survive in Canada?</i>	Yes
• <i>Is there sufficient habitat for immigrants in Canada?</i>	Yes
• <i>Is rescue from outside populations likely?</i>	Not very
Quantitative Analysis	
Substantial chance of extirpation 10-15 years (Hammill 2001, Bourdages <i>et al.</i> 2002)	
Other Status	
COSEWIC: Threatened, April 1988	

Status and Reasons for Designation

Status: Endangered	Alpha-numeric code: A2d; C1; E
Reasons for Designation: The population was reduced by at least 50% and continues to decline. Overhunting continues throughout its summer and migratory range. Mathematical models predict that it will likely disappear under present hunting levels in less than 10 to 15 years. Concerns have been expressed about habitat degradation of estuaries by hydroelectric projects, and by small vessel traffic disturbance.	

Applicability of Criteria

Criterion A (Declining Total Population): Endangered A2d.

Criterion B (Small Distribution, and Decline or Fluctuation): no.

Criterion C (Small Total Population Size and Decline): Endangered C1.

Criterion D (Very Small Population or Restricted Distribution): no (nearly D1 Threatened).

Criterion E (Quantitative Analysis): Endangered E, extinction likely under current harvest levels within 20 years.

TECHNICAL SUMMARY: (4) WESTERN HUDSON BAY POPULATION

Delphinapterus leucas

Beluga

béluga

(4) Western Hudson Bay population

Range of Occurrence in Canada: Manitoba / Nunavut / Ontario / Arctic and Atlantic Oceans

Extent and Area Information	
• <i>Extent of occurrence (EO)(km²)</i>	770,000 km ² (approx.)
• <i>Specify trend in EO</i>	Stable
• <i>Are there extreme fluctuations in EO?</i>	No
• <i>Area of occupancy (AO) (km²)</i>	51,000 km ²
• <i>Specify trend in AO</i>	Stable
• <i>Are there extreme fluctuations in AO?</i>	No
• <i>Number of known or inferred current locations</i>	Not applicable
• <i>Specify trend in #</i>	Not applicable
• <i>Are there extreme fluctuations in number of locations?</i>	No
• <i>Specify trend in area, extent or quality of habitat</i>	Stable
Population Information	
• <i>Generation time (average age of parents in the population)</i>	14 years
• <i>Number of mature individuals</i>	>30,000 (60% \times 30,000)
• <i>Total population trend:</i>	Unknown
• <i>% decline over the last/next 10 years or 3 generations.</i>	Not applicable
• <i>Are there extreme fluctuations in number of mature individuals?</i>	No
• <i>Is the total population severely fragmented?</i>	No
• <i>Specify trend in number of populations</i>	Not applicable
• <i>Are there extreme fluctuations in number of populations?</i>	Not applicable
Threats (actual or imminent threats to populations or habitats)	
Possibly more than one population subjected to seasonal harvesting, including during spring and autumn migrations	
Rescue Effect (immigration from an outside source)	
<i>Status of outside population(s)?</i> Not at Risk to Endangered	
• <i>Is immigration known or possible?</i>	Yes
• <i>Would immigrants be adapted to survive in Canada?</i>	Yes
• <i>Is there sufficient habitat for immigrants in Canada?</i>	Yes
• <i>Is rescue from outside populations likely?</i>	Not very
Quantitative Analysis	
Not applicable	
Other Status	
COSEWIC: Not at Risk, April 1993.	

Status and Reasons for Designation

Status: Special Concern	Alpha-numeric code: Not applicable
Reasons for Designation: The population appears to be relatively abundant, although it has not been surveyed for 15 years and may consist of more than one population. The population is subject to substantial removals by hunting in parts of its range, and is potentially threatened by shipping and hydroelectric dams.	

Applicability of Criteria

Criterion A (Declining Total Population): no

Criterion B (Small Distribution, and Decline or Fluctuation): no

Criterion C (Small Total Population Size and Decline): no

Criterion D (Very Small Population or Restricted Distribution): no

Criterion E (Quantitative Analysis): not applicable.

TECHNICAL SUMMARY: (5) EASTERN HIGH ARCTIC – BAFFIN BAY POPULATION

Delphinapterus leucas

Beluga

béluga

(5) Eastern High Arctic – Baffin Bay population

Range of Occurrence in Canada: Nunavut / Arctic Ocean

Extent and Area Information	
• <i>Extent of occurrence (EO)(km²)</i>	250,000 km ² (approx.)
• <i>Specify trend in EO</i>	Stable
• <i>Are there extreme fluctuations in EO?</i>	No
• <i>Area of occupancy (AO) (km²)</i>	49,000 km ²
• <i>Specify trend in AO</i>	Stable
• <i>Are there extreme fluctuations in AO?</i>	No
• <i>Number of known or inferred current locations</i>	Not applicable
• <i>Specify trend in #</i>	Not applicable
• <i>Are there extreme fluctuations in number of locations?</i>	No
• <i>Specify trend in area, extent or quality of habitat</i>	Stable
Population Information	
• <i>Generation time (average age of parents in the population)</i>	14 years
• <i>Number of mature individuals</i>	12,729 (60% \times 21,213)
• <i>Total population trend:</i>	Decline?
• <i>% decline over the last/next 10 years or 3 generations.</i>	Unknown
• <i>Are there extreme fluctuations in number of mature individuals?</i>	No
• <i>Is the total population severely fragmented?</i>	No
• <i>Specify trend in number of populations</i>	Not applicable
• <i>Are there extreme fluctuations in number of populations?</i>	Not applicable
Threats (actual or imminent threats to populations or habitats)	
Overharvesting off West Greenland	
Rescue Effect (immigration from an outside source)	
<i>Status of outside population(s)?</i> Not at Risk to Endangered	
• <i>Is immigration known or possible?</i>	Yes
• <i>Would immigrants be adapted to survive in Canada?</i>	Yes
• <i>Is there sufficient habitat for immigrants in Canada?</i>	Yes
• <i>Is rescue from outside populations likely?</i>	Not very
Quantitative Analysis	Not applicable
Other Status	
COSEWIC: Special Concern, April 1992	

Status and Reasons for Designation

Status: Special Concern	Alpha-numeric code: Not applicable
<p>Reasons for Designation: The population overwinters in Baffin Bay and west Greenland and may consist of two distinct populations. It is heavily hunted in west Greenland. However, most of the population winters in Baffin Bay and the High Arctic where it is not hunted. Hunting pressure in Canadian waters is low in summer.</p>	
<p>Applicability of Criteria</p>	
<p>Criterion A (Declining Total Population): might qualify for Threatened A2d or A3d as inferred from recent estimate of High Arctic summering population (21,213 animals), and catches, mainly off west Greenland (650-941 per year) in winter. The part of the population off West Greenland declined about 50% between 1981-1994, roughly one generation, suggesting an approximate 7/8 decline over three generations; as the West Greenland wintering animals number about 15% of the current population, this suggests a decline of $[1-1/(0.85+8 \times 0.15)] \times 100 = 51\%$ decline over three generations. Alternatively, the catch (roughly 795.5 off west Greenland and <100 in Canada, plus struck and lost animals) constitutes about 4.2% of the population per year (895.5/21,213), an excess of 1.2% over the median postulated maximum potential rate of increase (3% per year). A decline of 1.2%/year over 42 years (3 generations) is 40%. Both of these calculations make questionable assumptions (about the effects of past and future catches respectively).</p>	
<p>Criterion B (Small Distribution, and Decline or Fluctuation): no</p>	
<p>Criterion C (Small Total Population Size and Decline): no</p>	
<p>Criterion D (Very Small Population or Restricted Distribution): no</p>	
<p>Criterion E (Quantitative Analysis): no</p>	

TECHNICAL SUMMARY: (6) CUMBERLAND SOUND POPULATION

Delphinapterus leucas

Beluga

béluga

(6) Cumberland Sound population

Range of Occurrence in Canada: Nunavut / Arctic Ocean

Extent and Area Information	
• <i>Extent of occurrence (EO)(km²)</i>	27,000 km ² (approx.)
• <i>Specify trend in EO</i>	Stable
• <i>Are there extreme fluctuations in EO?</i>	No
• <i>Area of occupancy (AO) (km²)</i>	9,000 km ²
• <i>Specify trend in AO</i>	Stable
• <i>Are there extreme fluctuations in AO?</i>	No
• <i>Number of known or inferred current locations</i>	Not applicable
• <i>Specify trend in #</i>	Not applicable
• <i>Are there extreme fluctuations in number of locations?</i>	No
• <i>Specify trend in area, extent or quality of habitat</i>	Stable
Population Information	
• <i>Generation time (average age of parents in the population)</i>	14 years
• <i>Number of mature individuals</i>	928 (60% \times 1,547)
• <i>Total population trend:</i>	Stable
• <i>% decline over the last/next 10 years or 3 generations.</i>	
• <i>Are there extreme fluctuations in number of mature individuals?</i>	No
• <i>Is the total population severely fragmented?</i>	No
• <i>Specify trend in number of populations</i>	Not applicable
• <i>Are there extreme fluctuations in number of populations?</i>	Not applicable
Threats (actual or imminent threats to populations or habitats)	
Overexploitation, noise disturbance	
Rescue Effect (immigration from an outside source)	
<i>Status of outside population(s)?</i> Not at Risk to Endangered	
• <i>Is immigration known or possible?</i>	Yes
• <i>Would immigrants be adapted to survive in Canada?</i>	Yes
• <i>Is there sufficient habitat for immigrants in Canada?</i>	Yes
• <i>Is rescue from outside populations likely?</i>	Not very
Quantitative Analysis	
Model exists but does not predict extinction at current harvest levels	
Other Status	
COSEWIC: Endangered, April 1990.	

Status and Reasons for Designation

Status: Threatened	Alpha-numeric code: D1
Reasons for Designation: Numbers of belugas using Cumberland Sound have declined by about 1500 individuals between the 1920s and present. The population decline is believed to have been caused by hunting by the Hudson Bay Company into the 1940s and by the Inuit until 1979. Hunting has been regulated since the 1980s. Current quotas (41 in 2003) appear to be sustainable. Concerns have been raised about increased small vessel traffic and the associated noise of outboard motors, as well as fishery removals of Greenland halibut, a food of belugas.	

Applicability of Criteria

Criterion A (Declining Total Population): no decline since 1960.

Criterion B (Small Distribution, and Decline or Fluctuation): no.

Criterion C (Small Total Population Size and Decline): no.

Criterion D (Very Small Population or Restricted Distribution): Threatened under D1, less than 1,000 mature individuals.

Criterion E (Quantitative Analysis): Model exists but does not predict extinction at current harvest levels.

TECHNICAL SUMMARY: (7) EASTERN BEAUFORT SEA POPULATION

Delphinapterus leucas

Beluga

béluga

(7) Eastern Beaufort Sea population

Range of Occurrence in Canada: NT / Arctic Ocean

Extent and Area Information	
• <i>Extent of occurrence (EO)(km²)</i>	591,000 km ² (approx.)
• <i>Specify trend in EO</i>	Stable
• <i>Are there extreme fluctuations in EO?</i>	No
• <i>Area of occupancy (AO) (km²)</i>	445,000 km ²
• <i>Specify trend in AO</i>	Stable
• <i>Are there extreme fluctuations in AO?</i>	No
• <i>Number of known or inferred current locations</i>	Not applicable
• <i>Specify trend in #</i>	Not applicable
• <i>Are there extreme fluctuations in number of locations?</i>	No
• <i>Specify trend in area, extent or quality of habitat</i>	Stable
Population Information	
• <i>Generation time (average age of parents in the population)</i>	14 years
• <i>Number of mature individuals</i>	≥~23,555 (60%×39,258)
• <i>Total population trend:</i>	Unknown
• <i>% decline over the last/next 10 years or 3 generations.</i>	Not applicable
• <i>Are there extreme fluctuations in number of mature individuals?</i>	No
• <i>Is the total population severely fragmented?</i>	No
• <i>Specify trend in number of populations</i>	Not applicable
• <i>Are there extreme fluctuations in number of populations?</i>	Not applicable
Threats (actual or imminent threats to populations or habitats)	
Offshore oil and gas exploration and exploitation	
Rescue Effect (immigration from an outside source)	
<i>Status of outside population(s)?</i> Not at Risk to Endangered	
• <i>Is immigration known or possible?</i>	Yes
• <i>Would immigrants be adapted to survive in Canada?</i>	Yes
• <i>Is there sufficient habitat for immigrants in Canada?</i>	Yes
• <i>Is rescue from outside populations likely?</i>	Not very
Quantitative Analysis	None
Other Status	
COSEWIC: Not at Risk, April 1985.	

Status and Reasons for Designation

Status: Not at Risk	Alpha-numeric code: Not applicable
Reasons for Designation: This population is currently large and hunted at sustainable levels under an international agreement.	

Applicability of Criteria

Criterion A (Declining Total Population): no.

Criterion B (Small Distribution, and Decline or Fluctuation): no.

Criterion C (Small Total Population Size and Decline): no.

Criterion D (Very Small Population or Restricted Distribution): no.

Criterion E (Quantitative Analysis): not applicable.

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