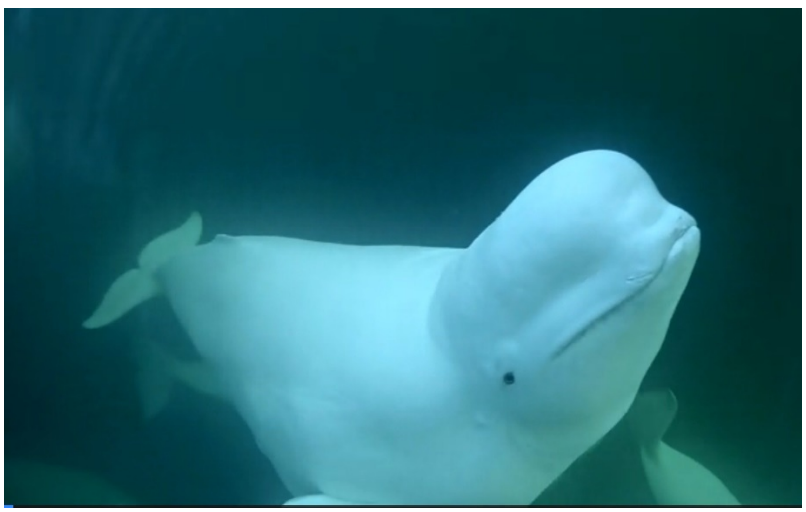
# COSEWIC
# Assessment and Status Report

on the

# Beluga Whale
## *Delphinapterus leucas*

Eastern High Arctic - Baffin Bay population
Cumberland Sound population
Ungava Bay population
Western Hudson Bay population
Eastern Hudson Bay population
James Bay population

**in Canada**



**Eastern High Arctic - Baffin Bay population - SPECIAL CONCERN**
**Cumberland Sound population - ENDANGERED**
**Ungava Bay population - ENDANGERED**
**Western Hudson Bay population - NOT AT RISK**
**Eastern Hudson Bay population - THREATENED**
**James Bay population - NOT AT RISK**
**2020**


**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:

COSEWIC. 2020. COSEWIC assessment and status report on the Beluga Whale *Delphinapterus leucas*, Eastern High Arctic - Baffin Bay population, Cumberland Sound population, Ungava Bay population, Western Hudson Bay population, Eastern Hudson Bay population and James Bay population in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. xxxv + 84 pp. (https://www.canada.ca/en/environment-climate-change/services/species-risk-public-registry.html).

Previous report(s):

COSEWIC 2004. COSEWIC assessment and update status report on the beluga whale *Delphinapterus leucas* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. ix + 70 pp. (www.sararegistry.gc.ca/status/status_e.cfm).

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.

Production note:
COSEWIC would like to acknowledge Randall Reeves (Okapi Wildlife Associates) for writing the status report on Beluga Whale, *Delphinapterus leucas* in Canada, prepared under contract with Environment and Climate Change Canada. This report was overseen and edited by Hal Whitehead, Co-chair of the COSEWIC Marine Mammals Specialist Subcommittee.

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Également disponible en français sous le titre Évaluation et Rapport de situation du COSEPAC sur la Béluga (*Delphinapterus leucas*), population de l’est du Haut-Arctique et de la baie de Baffin, population de la baie Cumberland, population de la baie d’Ungava, population de l’ouest de la baie d’Hudson, population de l’est de la baie d’Hudson and population de la baie James, au Canada.

Cover illustration/photo:
Beluga Whale — @Beluga Bits / explore.org.


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# COSEWIC
# Assessment Summary

**Assessment Summary – November 2020**

**Common name**
Beluga Whale - Eastern High Arctic - Baffin Bay population

**Scientific name**
*Delphinapterus leucas*

**Status**
Special Concern

**Reason for designation**
This population was overexploited in the past, with consequent substantial decline (probably >50%). However, harvests are now likely sustainable and the population appears to have stabilized and may be growing. There is concern that increased vessel traffic facilitated by climate change is changing the nature of the acoustic habitat of this population. The population may fit, or is close to fitting, the criteria for Threatened.

**Occurrence**
Nunavut, Arctic Ocean

**Status history**
Designated Special Concern in April 1992. Status re-examined and confirmed in May 2004 and November 2020.

**Assessment Summary – November 2020**

**Common name**
Beluga Whale - Cumberland Sound population

**Scientific name**
*Delphinapterus leucas*

**Status**
Endangered

**Reason for designation**
This is a small population with a restricted range, heavily reduced by commercial whaling in the past. While whales from this population continue to be harvested for subsistence, recent models suggest that reported removals are not sustainable. There are also concerns related to fishery removals of Greenland Halibut, a prey item for this population 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: the Southeast Baffin Island animals (formerly part of the Southeast Baffin Island-Cumberland Sound population) were included as part of the “Western Hudson Bay population, 2004 designation”. The newly defined “Cumberland Sound population” was designated Threatened in May 2004. Status re-examined and designated Endangered in November 2020.

**Assessment Summary – November 2020**

**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 remains very low and may be extinct. However, it is difficult to definitively conclude that none remain because whales from other populations may visit Ungava Bay during their migration. Unsustainable hunting caused the population decline and it continues in Ungava Bay, posing a threat to any remaining whales.

**Occurrence**
Quebec, Arctic Ocean, Atlantic Ocean

**Status history**
Designated Endangered in April 1988. Status re-examined and confirmed in May 2004 and November 2020.

**Assessment Summary – November 2020**

**Common name**
Beluga Whale - Western Hudson Bay population

**Scientific name**
*Delphinapterus leucas*

**Status**
Not at Risk

**Reason for designation**
There is good evidence that this population is large, robust, and not declining. However, there is concern about the potential effects of current and increasing ocean noise. Harvesting in Nunavut has been increasing but is currently sustainable.

**Occurrence**
Nunavut, Manitoba, Ontario, Quebec, Newfoundland and Labrador, Arctic Ocean, Atlantic Ocean

**Status history**
The species was considered a single unit ("Western Hudson Bay population, original designation") and designated Special Concern in May 2004. Following the Designatable Unit report on Beluga Whale (COSEWIC 2016), a new population structure was proposed and accepted by COSEWIC. Renamed as "Western Hudson Bay population, 2004 designation", in November 2020. Split into two populations in November 2020. The Western Hudson Bay population was designated Not at Risk in November 2020.

**Assessment Summary – November 2020**

**Common name**
Beluga Whale - Eastern Hudson Bay population

**Scientific name**
*Delphinapterus leucas*

**Status**
Threatened

**Reason for designation**
The population has declined substantially (about 50%) since 1974 (i.e. over the last 2 generations). The population is still hunted for subsistence, and is at low numbers (ca. 2,600 mature individuals). While harvests have been reduced and the decline in abundance seems to have been halted, current harvest levels are a concern as the primary factor limiting population growth. Noise from increased vessel traffic, particularly in the overwintering areas of Hudson Strait and the Labrador Sea, related in part to declines in ice cover due to climate change, is also a concern.

**Occurrence**
Nunavut, Quebec, Newfoundland and Labrador, Arctic Ocean, Atlantic Ocean

**Status history**
Designated Threatened in April 1988. Status re-examined and designated Endangered in May 2004. Status re-examined and designated Threatened in November 2020.

**Assessment Summary – November 2020**

**Common name**
Beluga Whale - James Bay population

**Scientific name**
*Delphinapterus leucas*

**Status**
Not at Risk

**Reason for designation**
The population is relatively large and appears robust. Current harvest levels are very small, there is little industrial activity within the range of the population, and there has been no new hydroelectric development in recent years. Animals from this population do not appear to undertake long-distance seasonal movements.

**Occurrence**
Nunavut, Quebec, Ontario

**Status history**
The species was considered a single unit ("Western Hudson Bay population, original designation") and designated Special Concern in May 2004. Following the Designatable Unit report on Beluga Whale (COSEWIC 2016), a new population structure was proposed and accepted by COSEWIC. Renamed as "Western Hudson Bay population, 2004 designation", in November 2020. Split into two populations in November 2020. The James Bay population was designated Not at Risk in November 2020.

# COSEWIC
# Executive Summary

## Beluga Whale
*Delphinapterus leucas*

### Wildlife Species Description and Significance

The Beluga (*Delphinapterus leucas*), also called Beluga Whale or White Whale, is a medium-sized toothed whale. It is the only living member of its genus. The Beluga and its closest relative, the Narwhal (*Monodon monoceros*), are both endemic to high latitudes of the Northern Hemisphere and they are broadly similar in size and body form, with a rounded head, and no dorsal fin. Belugas are born grey and gradually become paler with maturity – adults are completely white. They have a full complement of teeth in both the upper and lower jaws.

### Distribution

The Beluga's distribution is circumpolar in the Arctic and Sub-arctic. Within Canada, seven populations of Belugas have long been recognized, based primarily on disjunct summer distributions and genetic differences: 1) St. Lawrence Estuary (assessed separately; see COSEWIC 2014), 2) Ungava Bay, 3) Eastern Hudson Bay, 4) Western Hudson Bay, 5) Eastern High Arctic–Baffin Bay, 6) Cumberland Sound, and 7) Eastern Beaufort Sea (not assessed here). An eighth population centred in James Bay and southern Hudson Bay has recently been recognized. Several of the Arctic populations overlap during spring and autumn migrations and share common wintering areas.

### Habitat

Belugas are highly mobile and able to exploit a wide range of habitat types seasonally – offshore, coastal, and estuarine waters, with depths from only a few to thousands of metres, free of ice or > 90% ice-covered, clear or turbid. Some populations migrate annually over thousands of kilometres.

### Biology

Female Belugas reach sexual maturity at 6-14 years of age, a few years earlier than males. Mating generally takes place offshore in late winter or spring and females give birth to a single precocial calf following a gestation period of 13-15 months. Lactation may last for two years, suggesting a reproductive cycle of close to 3 years. The lifespan is 45-60 years, possibly longer. Generation length is assumed to be 28.6 years. The diet of Belugas varies by area and season but, species-wide, is extremely diverse, including fish, crustaceans, cephalopods, worms, and some gastropods. The whales forage in the water column and on the bottom, and they are known to dive for prey to depths of at least 800 metres.

## Population Sizes and Trends

The total population of mature Belugas in Canada is estimated to be in the order of 78,000 to 90,000 individuals. There are fewer Belugas in Canada today than there were historically, prior to commercial hunting and the expansion of human presence in much of their range. However, there is no clear evidence of a trend in aggregate (total country-wide) abundance over the past one or two generations. Of the populations assessed here, one (Western Hudson Bay) numbers in the tens of thousands (all ages), two (Eastern High Arctic – Baffin Bay [EHA-BB] and James Bay [JB]) number over 10,000 (all ages), two (Cumberland Sound [CS] and Eastern Hudson Bay [EHB]) number between 1000 and 4000 (all ages), and one (Ungava Bay; UB) is probably functionally extirpated or numbers fewer than 100. Although the EHA-BB and EHB populations are still depleted from overharvesting, they are thought to be stable or slowly increasing. The CS population is suspected to be declining.

## Threats and Limiting Factors

Historical overhunting was responsible for reducing most Beluga populations in Canada. Although commercial hunting is now prohibited and subsistence harvests are monitored and managed under co-management agreements, subsistence harvesting is likely preventing recovery in some areas (e.g. Cumberland Sound, Eastern Hudson Bay). Belugas are disturbed by underwater noise and therefore can be negatively affected by some human activities besides hunting – e.g. icebreaking, boat and ship traffic, seismic surveys, offshore construction, and port development. Rapid climate change, including the reduction in sea ice, is almost certainly affecting Belugas both directly through ecological processes (exposure to novel pathogens, prey availability, competition for prey, increased predation by Killer Whales) and indirectly by giving humans unprecedented access to the Arctic and sub-Arctic, bringing much more noise disturbance, more exposure to chemical contaminants, and greater risk of oil spills. Natural limiting factors such as ice-entrapment and predation by Polar Bears and Killer Whales are affected by climate change but the net impacts on Beluga populations are not always clear.

## Protection, Status and Ranks

The Beluga is not listed under SARA at the species level. The St. Lawrence Estuary (not part of this status report, but was assessed by COSEWIC in November 2014) and Cumberland Sound populations are on SARA Schedule 1 (as Endangered and Threatened, respectively). Other populations with previous COSEWIC assessments but currently no SARA status are: Eastern Hudson Bay, Eastern High Arctic – Baffin Bay, Ungava Bay, Eastern Beaufort Sea, and Western Hudson Bay. The IUCN Red List considers the Beluga as Least Concern globally.

## TECHNICAL SUMMARY – Eastern High Arctic - Baffin Bay population

*Delphinapterus leucas*

Beluga Whale (Eastern High Arctic - Baffin Bay population)

Béluga (Population de l’est du Haut-Arctique et de la baie de Baffin)

Range of occurrence in Canada (province/territory/ocean): Nunavut, Arctic Ocean

**Demographic Information**

| | |
|---|---|
| Generation time<br>Lowry *et al*. (2017) | 28.6 yrs |
| Is there an [observed, inferred, or projected] continuing decline in number of mature individuals? | No, Stable or increasing slowly (inferred) |
| Estimated percent of continuing decline in total number of mature individuals within [5 years or 2 generations] | Stable or increasing slowly |
| [Observed, estimated, inferred, or suspected] percent [reduction or increase] in total number of mature individuals over the last [10 years, or 3 generations]. | Uncertain |
| [Projected or suspected] percent [reduction or increase] in total number of mature individuals over the next [10 years, or 3 generations]. | Uncertain |
| [Observed, estimated, inferred, or suspected] percent [reduction or increase] in total number of mature individuals over any [10 years, or 3 generations] period, over a time period including both the past and the future. | Uncertain |
| Are the causes of the decline a. clearly reversible and b. understood and c. ceased? | Earlier decline:<br>a. Yes<br>b. Yes<br>c. Yes |
| Are there extreme fluctuations in number of mature individuals? | No |

**Extent and Occupancy Information**

| | |
|---|---|
| Estimated extent of occurrence (EOO) | ~250,000 $km^2$ |
| Index of area of occupancy (IAO)<br>(Always report 2x2 grid value).<br>Summer concentration area centred around Somerset Island in Canada, winter concentration areas in North Water and West Greenland | ~49,000 $km^2$ (summer) or 170,000 $km^2$ (winter) |
| Is the population “severely fragmented” i.e., is >50% of its total area of occupancy in habitat patches that are (a) smaller than would be required to support a viable population, and (b) separated from other habitat patches by a distance larger than the species can be expected to disperse? | No |

| | |
|---|---|
| Number of “locations”[*] (use plausible range to reflect uncertainty if appropriate) | Not applicable |
| Is there an [observed, inferred, or projected] decline in extent of occurrence? | No |
| Is there an [observed, inferred, or projected] decline in index of area of occupancy? | No |
| Is there an [observed, inferred, or projected] decline in number of subpopulations? | Not applicable: subpopulation structure unclear |
| Is there an [observed, inferred, or projected] decline in number of “locations”*? | Not applicable |
| Is there an [observed, inferred, or projected] decline in [area, extent and/or quality] of habitat? | Yes, inferred decline in quality due to noise associated with increased vessel traffic through Northwest Passage |
| Are there extreme fluctuations in number of subpopulations? | Not applicable: subpopulation structure unclear |
| Are there extreme fluctuations in number of “locations”∗? | Not applicable |
| Are there extreme fluctuations in extent of occurrence? | No |
| Are there extreme fluctuations in index of area of occupancy? | No |

**Number of Mature Individuals (in each subpopulation)**

| **Subpopulations (give plausible ranges)** | **N Mature Individuals** |
|---|---|
| Eastern High Arctic – Baffin Bay<br>68% of 21,213 (95% 10,985 to 32,619) (based on data from a 1996 survey) | 14,425 (95% CI 7,470-22,181) |
| Total | 14,425 |

**Quantitative Analysis**

| | |
|---|---|
| Is the probability of extinction in the wild at least [20% within 20 years or 5 generations, or 10% within 100 years]? | No such analysis carried out |

**Threats (direct, from highest impact to least, as per IUCN Threats Calculator)**

| |
|---|
| Was a threats calculator completed for this species? Yes<br><br>i. Pollution (9), Excess energy (9.6) – Medium-low impact<br><br>What additional limiting factors are relevant?<br><br>Predation (especially by Killer Whales), ice entrapment, disease |

[*] See Definitions and Abbreviations on COSEWIC web site and IUCN (Feb 2014) for more information on this term

**Rescue Effect (immigration from outside Canada)**

| | |
|---|---|
| Status of outside population(s) most likely to provide immigrants to this population. | Unknown |
| Is immigration known or possible? | Very unlikely |
| Would immigrants be adapted to survive in the distribution area of this population? | Unlikely |
| Is there sufficient habitat for immigrants in the distribution area of this population? | Possibly |
| Are conditions deteriorating in the distribution area of this population? | Uncertain |
| Are conditions for the source (i.e., outside) population deteriorating? | Not relevant |
| Is this population considered to be a sink? | No |
| Is rescue from outside populations likely? | No |

**Data Sensitive Species**

| | |
|---|---|
| Is this a data sensitive species? | No |

**Status History**

| |
|---|
| COSEWIC: Designated Special Concern in April 1992. Status re-examined and confirmed in May 2004 and November 2020. |

**Status and Reasons for Designation:**

| | |
|---|---|
| **Status:**<br>Special Concern | **Alpha-numeric codes:**<br>Not applicable |
| **Reasons for designation:**<br>This population was overexploited in the past, with consequent substantial decline (probably >50%). However, harvests are now likely sustainable and the population appears to have stabilized and may be growing. There is concern that increased vessel traffic facilitated by climate change is changing the nature of the acoustic habitat of this population. The population may fit, or is close to fitting, the criteria for Threatened. | |

**Applicability of Criteria**

| |
|---|
| Criterion A (Decline in Total Number of Mature Individuals):<br>Not applicable. The population may fit Threatened, A1d. The total population in 1933 (3 generations ago) was likely less than 55,000 (mid-19$^{th}$ Century estimate), and the population today is likely greater than 21,000 (21,213 estimated in 1996), but both estimates are very approximate. A2 is not met as unsustainable whaling has ceased. |
| Criterion B (Small Distribution Range and Decline or Fluctuation):<br>Not applicable. |

| |
|---|
| Criterion C (Small and Declining Number of Mature Individuals):<br>Not applicable. |
| Criterion D (Very Small or Restricted Population):<br>Not applicable. |
| Criterion E (Quantitative Analysis):<br>Not applicable. Not done. |

## TECHNICAL SUMMARY – Cumberland Sound population

*Delphinapterus leucas*

Beluga Whale (Cumberland Sound population)

Béluga (Population de la baie Cumberland)

Range of occurrence in Canada (province/territory/ocean): Nunavut, Arctic Ocean (Davis Strait and Baffin Bay)

### Demographic Information

| | |
|---|---|
| Generation time<br>Lowry *et al*. (2017) | 28.6 yrs |
| Is there an [observed, inferred, or projected] continuing decline in number of mature individuals? | Yes (inferred and projected) |
| Estimated percent of continuing decline in total number of mature individuals within [5 years or 2 generations] | Estimated 29.3% decline in next 10 years assuming catch stays at 41 individuals per year (Department of Fisheries and Oceans 2019) |
| Estimated percent reduction in total number of mature individuals over the last 3 generations (Watt *et al.* 2020) | 62% (1960-2019); likely greater decline over 3 generations |
| [Projected or suspected] percent [reduction or increase] in total number of mature individuals over the next [10 years, or 3 generations]. | Projected and suspected reduction, % uncertain |
| [Observed, estimated, inferred, or suspected] percent [reduction or increase] in total number of mature individuals over any [10 years, or 3 generations] period, over a time period including both the past and the future. | Inferred and suspected reduction, % uncertain |
| Are the causes of the decline a. clearly reversible and b. understood and c. ceased? | a. Yes<br>b. Yes<br>c. No |
| Are there extreme fluctuations in number of mature individuals? | No |

### Extent and Occupancy Information

| | |
|---|---|
| Estimated extent of occurrence (EOO) | ~27,000 km² |
| Index of area of occupancy (IAO)<br>(Always report 2x2 grid value). | ~9000 km² |
| Is the population "severely fragmented" i.e., is >50% of its total area of occupancy in habitat patches that are (a) smaller than would be required to support a viable population, and (b) separated from other habitat patches by a distance larger than the species can be expected to disperse? | No |
| Number of "locations"* (use plausible range to reflect uncertainty if appropriate) | Not applicable |

* See Definitions and Abbreviations on COSEWIC web site and IUCN (Feb 2014) for more information on this term

| | |
|---|---|
| Is there an [observed, inferred, or projected] decline in extent of occurrence? | No |
| Is there an [observed, inferred, or projected] decline in index of area of occupancy? | No |
| Is there an [observed, inferred, or projected] decline in number of subpopulations? | Not applicable |
| Is there an [observed, inferred, or projected] decline in number of “locations”*? | Not applicable |
| Is there an [observed, inferred, or projected] decline in [area, extent and/or quality] of habitat? | Inferred (quality) |
| Are there extreme fluctuations in number of subpopulations? | Not applicable |
| Are there extreme fluctuations in number of “locations”? | Not applicable |
| Are there extreme fluctuations in extent of occurrence? | No |
| Are there extreme fluctuations in index of area of occupancy? | No |

**Number of Mature Individuals (in each subpopulation)**

| **Subpopulations (give plausible ranges)** | **N Mature Individuals** |
|---|---|
| 68% of 1090 (95% CI: 617-1864) (modeled estimate for 2018 based on results of 2017 survey; Department of Fisheries and Oceans 2019; Watt *et al.*2020) | 741 (95% CI 420-1268) |
| Total | 741 |

**Quantitative Analysis**

| | |
|---|---|
| Is the probability of extinction in the wild at least [20% within 20 years or 5 generations, or 10% within 100 years]? | No such analysis carried out |

**Threats (direct, from highest impact to least, as per IUCN Threats Calculator)**

Was a threats calculator completed for this species? Yes

i. Biological resource use (5), Fishing and harvesting aquatic resources (5.4) – High impact
ii. Pollution (9), Excess energy (9.6) – Low impact

What additional limiting factors are relevant?
Predation (especially by Killer Whales), ice entrapment, disease

**Rescue Effect (immigration from outside Canada)**

| | |
|---|---|
| Status of outside population(s) most likely to provide immigrants to this population. | Unknown |
| Is immigration known or possible? | Very unlikely |
| Would immigrants be adapted to survive in the distribution area of this population? | Unlikely |
| Is there sufficient habitat for immigrants in the distribution area of this population? | Possibly |
| Are conditions deteriorating in the distribution area of this population? | Uncertain |
| Are conditions for the source (i.e., outside) population deteriorating? | Not relevant |
| Is this population considered to be a sink? | No |
| Is rescue from outside populations likely? | No |

**Data Sensitive Species**

| | |
|---|---|
| Is this a data sensitive species? | No |

**Status History**

COSEWIC: The Southeast Baffin Island-Cumberland Sound population was designated Endangered in April 1990. In May 2004, the structure of the population was redefined: the Southeast Baffin Island animals (formerly part of the Southeast Baffin Island-Cumberland Sound population) were included as part of the “Western Hudson Bay population, 2004 designation”. The newly defined “Cumberland Sound population” was designated Threatened in May 2004. Status re-examined and designated Endangered in November 2020.

**Status and Reasons for Designation:**

| **Status:** | **Alpha-numeric codes:** |
|---|---|
| Endangered | A2bd+4bd; C1+2a(ii) |

**Reasons for designation:**
This is a small population with a restricted range, heavily reduced by commercial whaling in the past. While whales from this population continue to be harvested for subsistence, recent models suggest that reported removals are not sustainable. There are also concerns related to fishery removals of Greenland Halibut, a prey item for this population of Belugas.

**Applicability of Criteria**

Criterion A (Decline in Total Number of Mature Individuals):
Meets Endangered, A2bd, (A2 as the population is still being hunted at what is thought to be unsustainable levels).The total population has declined from an estimated 2,900 to an estimated 1,100 between 1960 and 2019 (62% decline; Watt *et al.* 2020), and it was likely higher in 1933 (three generations ago) than in 1960. Meets A4bd as the decline is projected to continue at least 10 years into the future under the current harvest levels (Department of Fisheries and Oceans 2019).

Criterion B (Small Distribution Range and Decline or Fluctuation):
Not applicable.

| |
|---|
| Criterion C (Small and Declining Number of Mature Individuals):<br>Meets Endangered, C1: less than 2,500 mature individuals (Watt *et al.* 2020) and projected >20% decline within two generations (29.3% decline estimated in next 10 years, assuming no change in harvest level, which is currently 41 individuals per year; Department of Fisheries and Oceans 2019). Meets Endangered, C2a(ii) with >95% of mature individuals in only one subpopulation. |
| Criterion D (Very Small or Restricted Population):<br>Meets Threatened D1, as less than 1,000 mature individuals. |
| Criterion E (Quantitative Analysis): Not done. |

## TECHNICAL SUMMARY – Ungava Bay population

*Delphinapterus leucas*

Beluga Whale (Ungava Bay population)

Béluga (Population de la baie d'Ungava)

Range of occurrence in Canada (province/territory/ocean): Quebec, Arctic Ocean, Atlantic Ocean

**Demographic Information**

| | |
|---|---|
| Generation time<br>Lowry *et al*. (2017) | 28.6 yrs |
| Is there an [observed, inferred, or projected] continuing decline in number of mature individuals?<br>The population is too small to determine a trend. | Uncertain |
| Estimated percent of continuing decline in total number of mature individuals within [5 years or 2 generations] | Uncertain |
| Suspected percent reduction in total number of mature individuals over the last 3 generations (i.e. since 1932).<br>Judging by observations of 400-500 whales in a single estuary (Mucalic) in 1962 (Reeves and Mitchell 1987c, p. 46) and only 25 (at most) in the same estuary in 1980 (Finley *et al.* 1982), a decline of at least 94-95% over 3 generations is plausible. | 94-95% reduction estimated over last 3 generations |
| [Projected or suspected] percent [reduction or increase] in total number of mature individuals over the next [10 years, or 3 generations]. | Uncertain |
| [Observed, estimated, inferred, or suspected] percent [reduction or increase] in total number of mature individuals over any [10 years, or 3 generations] period, over a time period including both the past and the future.<br>Steep decline in past but future trend uncertain. | Unknown |
| Are the causes of the decline a. clearly reversible and b. understood and c. ceased? | a. No<br>b. Yes, overhunting (although according to NMRWB [2019], "it is possible that noise caused Belugas to abandon some of these areas")<br>c. Probably not (According to NMRWB [2019], "It should at least be pointed out that the causes of decline are greatly reduced...") |
| Are there extreme fluctuations in number of mature individuals? | No |

**Extent and Occupancy Information**

| | |
|---|---|
| Estimated extent of occurrence (EOO) | ~51,000 $km^2$ |
| Index of area of occupancy (IAO)<br>(Always report 2x2 grid value). | ~12,000 $km^2$ |

| | |
|---|---|
| Is the population "severely fragmented" i.e., is >50% of its total area of occupancy in habitat patches that are (a) smaller than would be required to support a viable population, and (b) separated from other habitat patches by a distance larger than the species can be expected to disperse? | a. No<br><br>b. No |
| Number of "locations"* (use plausible range to reflect uncertainty if appropriate) | Not applicable |
| Is there an [observed, inferred, or projected] decline in extent of occurrence? | Uncertain |
| Is there an [observed, inferred, or projected] decline in index of area of occupancy? | Uncertain |
| Is there an [observed, inferred, or projected] decline in number of subpopulations? | Not applicable |
| Is there an [observed, inferred, or projected] decline in number of "locations"*? | Not applicable |
| Is there an [observed, inferred, or projected] decline in [area, extent and/or quality] of habitat? | Inferred (quality) |
| Are there extreme fluctuations in number of subpopulations? | Not applicable |
| Are there extreme fluctuations in number of "locations"∗? | Not applicable |
| Are there extreme fluctuations in extent of occurrence? | No |
| Are there extreme fluctuations in index of area of occupancy? | No |

**Number of Mature Individuals (in each subpopulation)**

| **Subpopulations (give plausible ranges)** | **N Mature Individuals** |
|---|---|
| This range assumes that total population (all ages) is from zero to 32, and if the latter, no more than 20 would be mature. | 0-20 |
| Total | 0-20 |

**Quantitative Analysis**

| | |
|---|---|
| Is the probability of extinction in the wild at least [20% within 20 years or 5 generations, or 10% within 100 years]? | No such analysis carried out |

* See Definitions and Abbreviations on COSEWIC web site and IUCN (Feb 2014) for more information on this term

**Threats (direct, from highest impact to least, as per IUCN Threats Calculator)**

| |
|---|
| Was a threats calculator completed for this species? Yes<br><br>i. Biological resource use (5), Fishing and harvesting aquatic resources (5.4) – Very high impact<br>ii. Pollution (9), Excess energy (9.6) – Medium-low impact<br><br>What additional limiting factors are relevant?<br>Predation (especially by Killer Whales), ice entrapment, disease |

**Rescue Effect (immigration from outside Canada)**

| | |
|---|---|
| Status of outside population(s) most likely to provide immigrants to this population. | Unknown |
| Is immigration known or possible? | Very unlikely |
| Would immigrants be adapted to survive in the distribution area of this population? | Unlikely |
| Is there sufficient habitat for immigrants in the distribution area of this population? | Possibly |
| Are conditions deteriorating in the distribution area of this population? | Uncertain |
| Are conditions for the source (i.e., outside) population deteriorating? | Not relevant |
| Is this population considered to be a sink? | No |
| Is rescue from outside populations likely? | No |

**Data Sensitive Species**

| | |
|---|---|
| Is this a data sensitive species? | No |

**Status History**

| |
|---|
| COSEWIC: Designated Endangered in April 1988. Status re-examined and confirmed in May 2004 and November 2020. |

**Status and Reasons for Designation:**

| **Status:**<br>Endangered | **Alpha-numeric codes:**<br>A2bd; D1 |
|---|---|
| Reasons for designation:<br>All signs indicate that the population residing in Ungava Bay remains very low and may be extinct. However, it is difficult to definitively conclude that none remain because whales from other populations may visit Ungava Bay during their migration. Unsustainable hunting caused the population decline and it continues in Ungava Bay, posing a threat to any remaining whales. | |

**Applicability of Criteria**

| |
|---|
| Criterion A (Decline in Total Number of Mature Individuals):<br>Meets Endangered, A2bd. Since 1933 (three generations ago) several hundred animals have been killed but modelling indicates that there are now likely fewer than 20 mature individuals. Thus, the population has declined by >50% in the last 3 generations. Areas in southern Ungava Bay have been closed to harvesting to protect this population, but some illegal harvests continue to occur. These are likely not sustainable and may be contributing to the lack of recovery of this population. |
| Criterion B (Small Distribution Range and Decline or Fluctuation):<br>Not applicable. |
| Criterion C (Small and Declining Number of Mature Individuals):<br>Not applicable. Not clear that population is still declining. |
| Criterion D (Very Small or Restricted Population):<br>Meets D1 Endangered with less than 250 mature individuals. |
| Criterion E (Quantitative Analysis): Not done. |

## TECHNICAL SUMMARY – Western Hudson Bay population

*Delphinapterus leucas*

Beluga Whale (Western Hudson Bay population)

Béluga (Population de l’ouest de la baie d’Hudson)

Range of occurrence in Canada (province/territory/ocean): Nunavut, Manitoba, Ontario, Quebec, Newfoundland and Labrador, Arctic Ocean, Atlantic Ocean

**Demographic Information**

| | |
|---|---|
| Generation time<br>Lowry *et al*. (2017) | 28.6 yrs |
| Is there an [observed, inferred, or projected] continuing decline in number of mature individuals? | No: probably stable or increasing |
| Estimated percent of continuing decline in total number of mature individuals within [5 years or 2 generations] | Probably stable or increasing |
| [Observed, estimated, inferred, or suspected] percent [reduction or increase] in total number of mature individuals over the last [10 years, or 3 generations]. | Probably stable or increasing |
| [Projected or suspected] percent [reduction or increase] in total number of mature individuals over the next [10 years, or 3 generations]. | Uncertain |
| [Observed, estimated, inferred, or suspected] percent [reduction or increase] in total number of mature individuals over any [10 years, or 3 generations] period, over a time period including both the past and the future. | Uncertain |
| Are the causes of the decline a. clearly reversible and b. understood and c. ceased? | Not applicable |
| Are there extreme fluctuations in number of mature individuals? | No |

**Extent and Occupancy Information**

| | |
|---|---|
| Estimated extent of occurrence (EOO) | ~680,000 $km^2$ |
| Index of area of occupancy (IAO)<br>(Always report 2x2 grid value). | ~51,000 $km^2$ |
| Is the population “severely fragmented” i.e., is >50% of its total area of occupancy in habitat patches that are (a) smaller than would be required to support a viable population, and (b) separated from other habitat patches by a distance larger than the species can be expected to disperse? | a. No<br><br>b. No |
| Number of “locations”* (use plausible range to reflect uncertainty if appropriate) | Not applicable |

* See Definitions and Abbreviations on COSEWIC web site and IUCN (Feb 2014) for more information on this term

| | |
|---|---|
| Is there an [observed, inferred, or projected] decline in extent of occurrence? | No |
| Is there an [observed, inferred, or projected] decline in index of area of occupancy? | No |
| Is there an [observed, inferred, or projected] decline in number of subpopulations? | Not applicable |
| Is there an [observed, inferred, or projected] decline in number of “locations”*? | Not applicable |
| Is there an [observed, inferred, or projected] decline in [area, extent and/or quality] of habitat? | Inferred (quality) |
| Are there extreme fluctuations in number of subpopulations? | Not applicable |
| Are there extreme fluctuations in number of “locations”? | Not applicable |
| Are there extreme fluctuations in extent of occurrence? | No |
| Are there extreme fluctuations in index of area of occupancy? | No |

**Number of Mature Individuals (in each subpopulation)**

| Subpopulations (give plausible ranges) | N Mature Individuals |
|---|---|
| 68% of 54,473 (CV = 0.098, 95% CI = 44,988–65,957) (based on survey in 2015) | 37,042 (30,592-44,851) |
| Total | 37,042 (30,592-44,851) |

**Quantitative Analysis**

| | |
|---|---|
| Is the probability of extinction in the wild at least [20% within 20 years or 5 generations, or 10% within 100 years]? | No such analysis carried out |

**Threats (direct, from highest impact to least, as per IUCN Threats Calculator)**

Was a threats calculator completed for this species? Yes

i. Pollution (9), Excess energy (9.6) – Medium-low impact

What additional limiting factors are relevant?
Predation (especially by Killer Whales), ice entrapment, disease

**Rescue Effect (immigration from outside Canada)**

| | |
|---|---|
| Status of outside population(s) most likely to provide immigrants to this population. | Unknown |
| Is immigration known or possible? | Very unlikely |
| Would immigrants be adapted to survive in the distribution area of this population? | Unlikely |

| | |
|---|---|
| Is there sufficient habitat for immigrants in the distribution area of this population? | Possibly |
| Are conditions deteriorating in the distribution area of this population? | Uncertain |
| Are conditions for the source (i.e., outside) population deteriorating? | Not relevant |
| Is this population considered to be a sink? | No |
| Is rescue from outside populations likely? | No |

**Data Sensitive Species**

| | |
|---|---|
| Is this a data sensitive species? | No |

**Status History**

| |
|---|
| COSEWIC: The species was considered a single unit ("Western Hudson Bay population, original designation") and designated Special Concern in May 2004. Following the Designatable Unit report on Beluga Whale (COSEWIC 2016), a new population structure was proposed and accepted by COSEWIC. Renamed as "Western Hudson Bay population, 2004 designation", in November 2020. Split into two populations in November 2020. The Western Hudson Bay population was designated Not at Risk in November 2020. |

**Status and Reasons for Designation:**

| | |
|---|---|
| **Status:**<br>Not at Risk | **Alpha-numeric codes:**<br>Not applicable |
| **Reasons for designation:**<br>There is good evidence that this population is large, robust, and not declining. However, there is concern about the potential effects of current and increasing ocean noise. Harvesting in Nunavut has been increasing but is currently sustainable. | |

**Applicability of Criteria**

| |
|---|
| Criterion A (Decline in Total Number of Mature Individuals):<br>Not applicable. No evidence for decline over 3 generations. |
| Criterion B (Small Distribution Range and Decline or Fluctuation):<br>Not applicable. |
| Criterion C (Small and Declining Number of Mature Individuals):<br>Not applicable. |
| Criterion D (Very Small or Restricted Population):<br>Not applicable. |
| Criterion E (Quantitative Analysis): Not done. |

# TECHNICAL SUMMARY – Eastern Hudson Bay population

*Delphinapterus leucas*

Beluga Whale (Eastern Hudson Bay population)

Béluga (Population de l'est de la baie d'Hudson)

Range of occurrence in Canada (province/territory/ocean): Nunavut, Quebec, Newfoundland and Labrador, Arctic Ocean, Atlantic Ocean

**Demographic Information**

| | |
|---|---|
| Generation time<br>Lowry *et al*. (2017) | 28.6 yrs |
| Is there an [observed, inferred, or projected] continuing decline in number of mature individuals? | Uncertain |
| Estimated percent of continuing decline in total number of mature individuals within [5 years or 2 generations] | Uncertain |
| Estimated percent reduction in total number of mature individuals over the last 3 generations (i.e. since 1933).<br>Using 1974 as the base year for a density-dependent model, Hammill *et al.* (2017a) estimated a decline in total population from 6,600 (95% CI=4,800-9,300) in 1974 to 3,100 in 2001 and 3,400 (95% CI=2,200-5,000) in 2016, implying a reduction over this portion (42 years) of the last 3 generations (86 years) by approximately 50%. Modelling suggests numbers have been 'stable' since 1985 (Hammill *et al.* 2018b). | ~50% |
| [Projected or suspected] percent [reduction or increase] in total number of mature individuals over the next [10 years, or 3 generations]. | Uncertain |
| [Observed, estimated, inferred, or suspected] percent [reduction or increase] in total number of mature individuals over any [10 years, or 3 generations] period, over a time period including both the past and the future.<br>The population may have declined over the past 3 generations (86 yr, 1933) but modelling suggests numbers have been 'stable' since 1985 (Hammill *et al.* 2018b). | Uncertain |
| Are the causes of the decline a. clearly reversible and b. understood and c. ceased? | a. yes, b. yes, c. yes (current hunting is sustainable) |
| Are there extreme fluctuations in number of mature individuals? | No |

**Extent and Occupancy Information**

| | |
|---|---|
| Estimated extent of occurrence (EOO) | ~221,000 $km^2$ |
| Index of area of occupancy (IAO)<br>(Always report 2x2 grid value). | ~41,000 $km^2$ |

| | |
|---|---|
| Is the population "severely fragmented" i.e., is >50% of its total area of occupancy in habitat patches that are (a) smaller than would be required to support a viable population, and (b) separated from other habitat patches by a distance larger than the species can be expected to disperse? | No |
| Number of "locations"* (use plausible range to reflect uncertainty if appropriate) | Not applicable |
| Is there an [observed, inferred, or projected] decline in extent of occurrence? | Uncertain |
| Is there an [observed, inferred, or projected] decline in index of area of occupancy? | Uncertain |
| Is there an [observed, inferred, or projected] decline in number of subpopulations? | Not applicable |
| Is there an [observed, inferred, or projected] decline in number of "locations"*? | Not applicable |
| Is there an [observed, inferred, or projected] decline in [area, extent and/or quality] of habitat? | inferred (quality) |
| Are there extreme fluctuations in number of subpopulations? | Not applicable |
| Are there extreme fluctuations in number of "locations"*? | Not applicable |
| Are there extreme fluctuations in extent of occurrence? | No |
| Are there extreme fluctuations in index of area of occupancy? | No |

**Number of Mature Individuals (in each subpopulation)**

| **Subpopulations (give plausible ranges)** | **N Mature Individuals** |
|---|---|
| 68% of 2700-4300 (based on 7 surveys between 1985 and 2015) or of 3819 Belugas (CV = 0.43) (based on a 2015 survey) | 1836-2924 or 2597 |
| Total | 1836-2924 or 2597 |

**Quantitative Analysis**

| | |
|---|---|
| Is the probability of extinction in the wild at least [20% within 20 years or 5 generations, or 10% within 100 years]? | No such analysis carried out |

* See Definitions and Abbreviations on COSEWIC web site and IUCN (Feb 2014) for more information on this term

**Threats (direct, from highest impact to least, as per IUCN Threats Calculator)**

| |
|---|
| Was a threats calculator completed for this species? Yes<br><br>i. Biological resource use (5), Fishing and harvesting aquatic resources (5.4) – Medium-low impact<br>ii. Pollution (9), Excess energy (9.6) – Medium-low impact<br><br>What additional limiting factors are relevant?<br>Predation (especially by Killer Whales), ice entrapment, disease |

**Rescue Effect (immigration from outside Canada)**

| | |
|---|---|
| Status of outside population(s) most likely to provide immigrants to this population. | Unknown |
| Is immigration known or possible? | Very unlikely |
| Would immigrants be adapted to survive in the distribution area of this population? | Unlikely |
| Is there sufficient habitat for immigrants in the distribution area of this population? | Possibly |
| Are conditions deteriorating in the distribution area of this population? | Uncertain |
| Are conditions for the source (i.e., outside) population deteriorating? | Not relevant |
| Is this population considered to be a sink? | No |
| Is rescue from outside populations likely? | No |

**Data Sensitive Species**

| | |
|---|---|
| Is this a data sensitive species? | No |

**Status History**

| |
|---|
| COSEWIC: Designated Threatened in April 1988. Status re-examined and designated Endangered in May 2004. Status re-examined and designated Threatened in November 2020. |

**Status and Reasons for Designation:**

| **Status:**<br>Threatened | **Alpha-numeric codes:**<br>A1bd. |
|---|---|
| **Reasons for designation:**<br>The population has declined substantially (about 50%) since 1974 (i.e. over the last 2 generations). The population is still hunted for subsistence, and is at low numbers (ca. 2,600 mature individuals). While harvests have been reduced and the decline in abundance seems to have been halted, current harvest levels are a concern as the primary factor limiting population growth. Noise from increased vessel traffic, particularly in the overwintering areas of Hudson Strait and the Labrador Sea, related in part to declines in ice cover due to climate change, is also a concern. | |

**Applicability of Criteria**

| |
|---|
| Criterion A (Decline in Total Number of Mature Individuals):<br>Meets Threatened, A1bd. There has been a decline of approximately 50% since 1974, only two generations ago, but data are lacking between 1933 (three generations ago) and 1974. Current harvests may be sustainable. |
| Criterion B (Small Distribution Range and Decline or Fluctuation):<br>Not applicable. |
| Criterion C (Small and Declining Number of Mature Individuals):<br>Not applicable, no continuing decline. |
| Criterion D (Very Small or Restricted Population):<br>Not applicable. |
| Criterion E (Quantitative Analysis): Not done. |

## TECHNICAL SUMMARY – James Bay population

*Delphinapterus leucas*

Beluga Whale (James Bay population)

Béluga (Population de la baie James)

Range of occurrence in Canada (province/territory/ocean): Nunavut, Quebec, Ontario

### Demographic Information

| | |
|---|---|
| Generation time<br>Lowry *et al.* (2017) | 28.6 yrs |
| Is there an [observed, inferred, or projected] continuing decline in number of mature individuals? | No |
| Estimated percent of continuing decline in total number of mature individuals within [5 years or 2 generations] | Not applicable |
| [Observed, estimated, inferred, or suspected] percent [reduction or increase] in total number of mature individuals over the last [10 years, or 3 generations].<br>Modelling suggests an increasing trend since 1985 (Hammill *et al.* 2018c), but trends prior to 1985 are uncertain. | Uncertain |
| [Projected or suspected] percent [reduction or increase] in total number of mature individuals over the next [10 years, or 3 generations]. | Uncertain |
| [Observed, estimated, inferred, or suspected] percent [reduction or increase] in total number of mature individuals over any [10 years, or 3 generations] period, over a time period including both the past and the future, but trends prior to 1985 are uncertain.<br>Modeling suggests an increasing trend since 1985 (Hammill *et al.* 2018c). | Uncertain |
| Are the causes of the decline a. clearly reversible and b. understood and c. ceased? | Not applicable |
| Are there extreme fluctuations in number of mature individuals? | No |

### Extent and Occupancy Information

| | |
|---|---|
| Estimated extent of occurrence (EOO)<br>Very rough estimate given paucity of information | >90,000 km$^2$ |
| Index of area of occupancy (IAO)<br>(Always report 2x2 grid value).<br>Very rough estimate given paucity of information | >90,000 km$^2$ |
| Is the population “severely fragmented” i.e., is >50% of its total area of occupancy in habitat patches that are (a) smaller than would be required to support a viable population, and (b) separated from other habitat patches by a distance larger than the species can be expected to disperse? | No |

| | |
|---|---|
| Number of "locations"* (use plausible range to reflect uncertainty if appropriate) | Not applicable |
| Is there an [observed, inferred, or projected] decline in extent of occurrence? | Uncertain |
| Is there an [observed, inferred, or projected] decline in index of area of occupancy? | Uncertain |
| Is there an [observed, inferred, or projected] decline in number of subpopulations? | Not applicable |
| Is there an [observed, inferred, or projected] decline in number of "locations"*? | Not applicable |
| Is there an [observed, inferred, or projected] decline in [area, extent and/or quality] of habitat? | Inferred (quality) |
| Are there extreme fluctuations in number of subpopulations? | Not applicable |
| Are there extreme fluctuations in number of "locations"*? | Not applicable |
| Are there extreme fluctuations in extent of occurrence? | No |
| Are there extreme fluctuations in index of area of occupancy? | No |

**Number of Mature Individuals (in each subpopulation)**

| **Subpopulations (give plausible ranges)** | **N Mature Individuals** |
|---|---|
| 68% of 10,615 (CV=0.25) (based on 2015 survey) | 7218 |
| Total | 7218 |

**Quantitative Analysis**

| | |
|---|---|
| Is the probability of extinction in the wild at least [20% within 20 years or 5 generations, or 10% within 100 years] | No such analysis carried out |

**Threats (direct, from highest impact to least, as per IUCN Threats Calculator)**

Was a threats calculator completed for this species? Yes

i. Pollution (9), Excess energy (9.6) – Low impact

What additional limiting factors are relevant?
Predation (especially by Killer Whales), ice entrapment, disease

**Rescue Effect (immigration from outside Canada)**

| | |
|---|---|
| Status of outside population(s) most likely to provide immigrants to this population. | Unknown |

* See Definitions and Abbreviations on COSEWIC web site and IUCN (Feb 2014) for more information on this term

| | |
|---|---|
| Is immigration known or possible? | Very unlikely |
| Would immigrants be adapted to survive in the distribution area of this population? | Unlikely |
| Is there sufficient habitat for immigrants in the distribution area of this population? | Possibly |
| Are conditions deteriorating in the distribution area of this population? | Uncertain |
| Are conditions for the source (i.e., outside) population deteriorating? | Not relevant |
| Is this population considered to be a sink? | No |
| Is rescue from outside populations likely? | No |

**Data Sensitive Species**

| | |
|---|---|
| Is this a data sensitive species? | No |

**Status History**

COSEWIC: The species was considered a single unit ("Western Hudson Bay population, original designation") and designated Special Concern in May 2004. Following the Designatable Unit report on Beluga Whale (COSEWIC 2016), a new population structure was proposed and accepted by COSEWIC. Renamed as "Western Hudson Bay population, 2004 designation", in November 2020. Split into two populations in November 2020. The James Bay population was designated Not at Risk in November 2020.

**Status and Reasons for Designation:**

| | |
|---|---|
| **Status:**<br>Not at Risk | **Alpha-numeric codes:**<br>Not applicable. |
| **Reasons for designation:**<br>The population is relatively large and appears robust. Current harvest levels are very small, there is little industrial activity within the range of the population, and there has been no new hydroelectric development in recent years. Animals from this population do not appear to undertake long-distance seasonal movements. | |

**Applicability of Criteria**

| |
|---|
| Criterion A (Decline in Total Number of Mature Individuals):<br>Not applicable. No evidence for decline. |
| Criterion B (Small Distribution Range and Decline or Fluctuation):<br>Not applicable. |
| Criterion C (Small and Declining Number of Mature Individuals):<br>Not applicable. |
| Criterion D (Very Small or Restricted Population):<br>Not applicable. |
| Criterion E (Quantitative Analysis):<br>Not applicable. Not done. |

## PREFACE

The Beluga in Canada was most recently assessed in 2004, at which time seven designatable units (DUs) were recognized and included in the update status report (COSEWIC 2004). Since that time, a separate assessment and status report for the St. Lawrence Estuary (SLE) population was published (COSEWIC 2014) and a separate report on designatable units (DUs) was approved and published (COSEWIC 2016). The present report therefore covers all DUs approved by COSEWIC in 2016, other than the St. Lawrence Estuary population which was assessed as Endangered in 2014, and the Eastern Beaufort Sea (EBS) DU which was not assessed in November 2020 following a request from the Inuvialuit Game Council and Fisheries Joint Management Committee that there be a delay due to planned research with an anticipated updated population estimate becoming available in late 2021.

The DU structure proposed in the DU report (COSEWIC 2016) and accepted at the November 2016 COSEWIC meeting is as follows:

- DU1: Eastern Beaufort Sea (EBS)
- DU2: Eastern High Arctic - Baffin Bay (EHA-BB)
- DU3: Cumberland Sound (CS)
- DU4: Ungava Bay (UB)
- DU5: Western Hudson Bay (WHB) (or Western-Northern-Southern Hudson Bay, see Richard 2010)
- DU6: Eastern Hudson Bay (EHB)
- DU7: St. Lawrence Estuary (SLE)
- DU8: James Bay (JB) (or Hudson Bay-James Bay, see Cardinal 2013).

Although a number of caveats related to the potential need for further splitting as well as for recognizing a certain degree of mixing and interbreeding between some DUs were discussed in the DU report (COSEWIC 2016), for the purposes of the present report the DU structure as agreed by COSEWIC has been applied. However, opportunities for mixing have clearly increased in recent decades as climatic conditions have moderated rapidly in high latitudes (O'Corry-Crowe *et al.* 2010). Historically, land masses and heavy sea ice cover, together with strong site fidelity characteristic of the species, limited interchange among Beluga populations across the Arctic and sub-Arctic and this presumably helped to shape the population structure as we have come to regard it. Much of the conventional wisdom concerning DU structure is likely to change with time, and the rate of such change may now be much faster than would have been predicted even 20 years ago.

Besides the information on population structure summarized in the DU report (COSEWIC 2016), considerable new information on other aspects of Beluga biology and conservation status that are relevant to assessment has become available since 2004. Much of that information was collated and reviewed at the Global Review of Monodontids workshop in March 2017 (NAMMCO 2018), which was expected to be followed by published papers in a special issue of *Marine Fisheries Review* (which has yet to materialize). Also, an updated IUCN Red List assessment of the species has been published, with the global listing changed from Near Threatened to Least Concern (Lowry *et al.* 2017).

## 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. Species designated at meetings of the full committee are added to the list. 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 for 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 entities (Canadian Wildlife Service, Parks Canada Agency, Department of Fisheries and Oceans, and the Federal Biodiversity Information Partnership, chaired by the Canadian Museum of Nature), three non-government science members and the co-chairs of the species specialist subcommittees and the Aboriginal Traditional Knowledge subcommittee. The Committee meets to consider status reports on candidate species.

## DEFINITIONS
## (2020)

| | |
|---|---|
| Wildlife Species | A species, subspecies, variety, or geographically or genetically distinct population of animal, plant or other organism, other than a bacterium or virus, that is wild by nature and is either native to Canada or has extended its range into Canada without human intervention and has been present in Canada for at least 50 years. |
| Extinct (X) | A wildlife species that no longer exists. |
| Extirpated (XT) | A wildlife species no longer existing in the wild in Canada, but occurring elsewhere. |
| Endangered (E) | A wildlife species facing imminent extirpation or extinction. |
| Threatened (T) | A wildlife species likely to become endangered if limiting factors are not reversed. |
| Special Concern (SC)* | A wildlife 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 wildlife species that has been evaluated and found to be not at risk of extinction given the current circumstances. |
| Data Deficient (DD)*** | A category that applies when the available information is insufficient (a) to resolve a species' eligibility for assessment or (b) to permit an assessment of the species' risk of extinction. |

* 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. Definition of the (DD) category revised in 2006.

Environment and Climate Change Canada
Canadian Wildlife Service

Environnement et Changement climatique Canada
Service canadien de la faune

Canada

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

# COSEWIC Status Report

on the

# Beluga Whale
*Delphinapterus leucas*

Eastern High Arctic - Baffin Bay population
Cumberland Sound population
Ungava Bay population
Western Hudson Bay population
Eastern Hudson Bay population
James Bay population

**in Canada**

2020

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# WILDLIFE SPECIES DESCRIPTION AND SIGNIFICANCE

## Name and Classification

The Beluga, *Delphinapterus leucas* (Pallas, 1776), derives its English common name from the Russian *belukha*, which means “white.” *Delphinus* is Latin for dolphin and *pteron* (Ancient Greek) means fin or wing, thus *apterus* refers to the lack of a dorsal fin. The other often-used English vernacular names are Beluga Whale and White Whale. Béluga is the common name in French although Marsouin Blanc or Baleine Blanche have also been used, the former primarily in Quebec.

## Morphological Description

Belugas are toothed whales (odontocetes) with a rounded head, broad flippers, and no dorsal fin. The cervical vertebrae are unfused, allowing considerable flexibility of the neck and head (Stewart and Stewart 1989).

Newborn Belugas are dark grey or brown and become lighter with age. Transition to uniformly white occurs at 10-20 years of age. This transition does not always coincide with sexual maturation.

Belugas are about 1.5 m long at birth, and adult lengths range from 2.6 to 4.5 m depending on the population, with adult females being approximately 80% the length of adult males. Differences in body size among the various geographical populations in Canada have long been recognized (Sergeant and Brodie 1969), but the factors responsible for such differences are difficult to determine with certainty. Luque and Ferguson (2010) found a trend of increasing body size with latitude (Belugas in Hudson Bay and Hudson Strait are smaller than those in Cumberland Sound and the Mackenzie Delta; Lesage *et al.* 2014: their Table 1) but acknowledged the possibility that this finding was influenced by hunter selectivity or reduced animal density due to exploitation (assuming a density-dependent response in age and size distribution).

## Population Spatial Structure and Variability

Detailed information on this subject is available in the DU report (COSEWIC 2016).

## Designatable Units (DUs)

Eight designatable units in Canada are recognized, as follows (COSEWIC 2016):

- DU1: Eastern Beaufort Sea (EBS)
- DU2: Eastern High Arctic - Baffin Bay (EHA-BB)
- DU3: Cumberland Sound (CS)

- DU4: Ungava Bay (UB)
- DU5: Western Hudson Bay (WHB) (or Western-Northern-Southern Hudson Bay, see Richard 2010)
- DU6: Eastern Hudson Bay (EHB)
- DU7: St. Lawrence Estuary (SLE)
- DU8: James Bay (JB) (or Hudson Bay – James Bay, see Cardinal 2013).

## Special Significance

The Beluga is the only species of its genus and is one of only two species in the family Monodontidae, the other being the Narwhal (*Monodon monoceros*). Belugas are endemic to Arctic and sub-Arctic latitudes of the northern hemisphere (Stewart and Stewart 1989).

Belugas have long been a major nutritional and cultural resource for Indigenous (primarily Inuit) communities in many parts of the Arctic and sub-Arctic (McGhee 1974, Freeman 1976, Brice-Bennett 1977). Human settlement patterns were influenced to some extent by the seasonal availability of Belugas for hunting. For the Inuit in some communities, Belugas are a preferred food item. Their skin, muscles and body organs are extremely nutritious and much sought-after for subsistence, the skin in particular (called maktaaq). The extensive traditional ecological knowledge on Belugas testifies to the importance of these whales in the lives of Inuit, especially in the Hudson Bay region of Canada (Breton-Honeyman *et al.* 2016a). During the early colonial period in Quebec and Canada, Belugas were also of significant commercial importance as a source of oil and hides (Reeves and Mitchell 1987a, 1987b, 1987c; Stewart 2018). The last factory for Beluga products – in Churchill, Manitoba – was dependent on a rail link supplying minced, frozen carcasses to Mink (*Mustela vison*) ranches in the Prairie provinces. This factory became defunct in the 1960s and was briefly followed by a sport hunt that was banned in 1973 (Sergeant and Brodie 1975).

The Beluga population that inhabits the St. Lawrence Estuary (SLE) is an Arctic relict that originates from an eastern refugium that persisted during the Wisconsin Ice Age. With the historical reduction in the SLE population by hunting and the ongoing threats to the remaining population from industrialization, these Belugas, in particular, have come to symbolize marine conservation efforts in Canada. The SLE Belugas, along with the Belugas in the Churchill River Estuary of Western Hudson Bay (WHB), have for many decades featured as major attractions in the nature tourism industry.

Belugas were among the first cetaceans to be brought into captivity. While western Hudson Bay was a principal source of captive Belugas for several decades, in recent times most of them (including most of those currently held at Marineland of Niagara) came from Russia or were born in captivity (Fisher and Reeves 2005).

# DISTRIBUTION

## Global Range

The global range of Belugas is circumpolar in the Arctic and sub-Arctic (NAMMCO 2018; Figure 1). Their total distribution is close to continuous in northern waters of Russia, the United States (western and northern Alaska), Canada, Greenland (western), and Norway (Svalbard), with notable gaps off northern and eastern Greenland and possibly certain parts of the central North American Arctic and the central Russian Arctic. Some populations undertake long migrations that appear to be driven principally by seasonal changes in ice cover as well as prey availability; others may undertake relatively short migratory movements to avoid ice entrapment but are essentially resident to well-defined areas (e.g. Cumberland Sound, St. Lawrence Estuary, Cook Inlet, Svalbard; Figure 1).

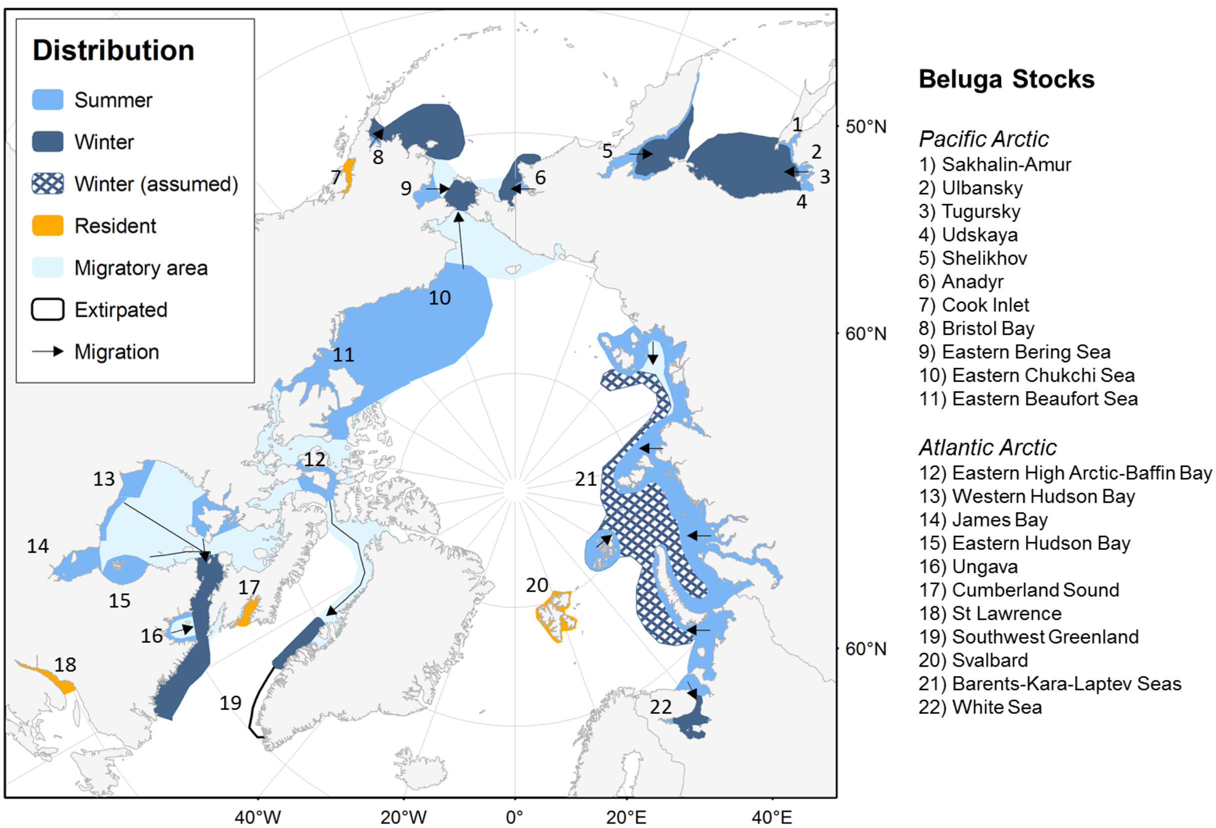


Figure 1. Global range of Belugas showing currently recognized stock boundaries and some indication of movements. Source: NAMMCO (2018).

Belugas have been extirpated (functionally if not literally) from a few portions of their historical range, including Kotzebue Sound (Alaska), some estuaries in Canada (in southern Ungava Bay, eastern Hudson Bay, and the lower St. Lawrence Estuary) and a southern portion of the west coast of Greenland (NAMMCO 2018).

## Canadian Range

Belugas have an extensive distribution in northern Canada (Figure 2). Longitudinally, they occur from the Beaufort Sea eastward to Baffin Bay, with a gap in the central Arctic that may be closing now that the Northwest Passage is often open in summer when Belugas congregate in Amundsen Gulf and Viscount Melville Sound to the west (Richard *et al.* 2001a) and in Peel Sound and Barrow Strait to the east (Richard *et al.* 2001b) (Figures 3a and 3b). Latitudinally, the Canadian range extends from the High Arctic (to at least 78 degrees North; Richard *et al.* 2001a, 2001b) southward to James Bay and the St. Lawrence Estuary (around 47-48 degrees North) (NAMMCO 2018). Roughly half of the world distribution (and two thirds of the total world abundance) of the species is in Canada, especially if one considers the “shared” stocks that migrate seasonally westward into Alaskan and Russian waters and eastward and southward into waters off West Greenland (Figure 1).

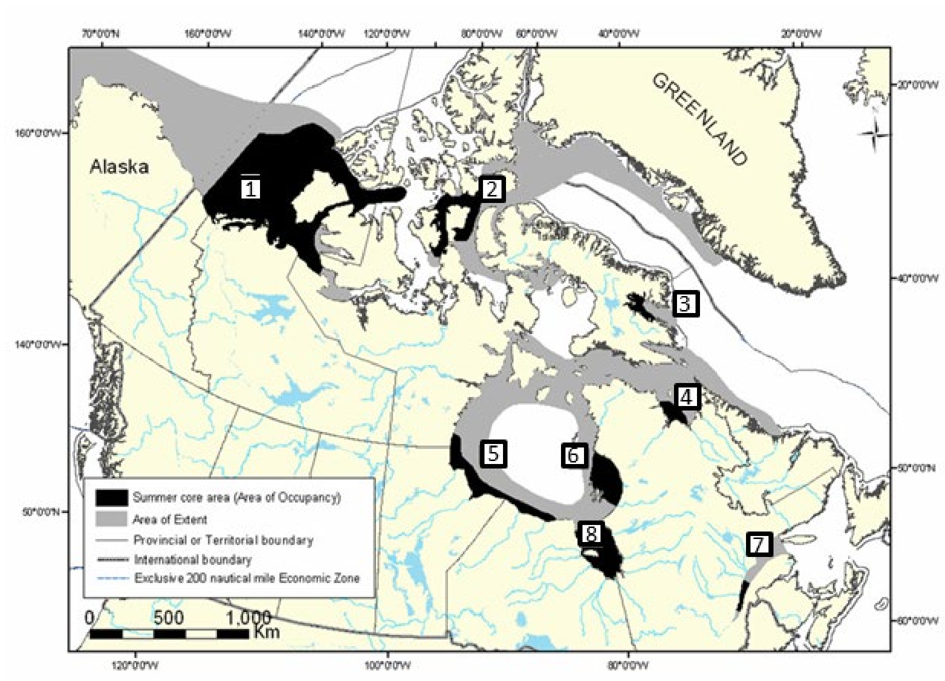


Figure 2. Distribution of Belugas in Canada and designatable units currently recognized: (DU1) Eastern Beaufort Sea; (DU2) Eastern High Arctic-Baffin Bay; (DU3) Cumberland Sound; (DU4) Ungava Bay; (DU5) Western Hudson Bay; (DU6) Eastern Hudson Bay; (DU7) St. Lawrence Estuary; and (DU8) James Bay. Source: COSEWIC (2016). Note: The western boundary of DU1 is somewhat arbitrary, and unrealistically precise.

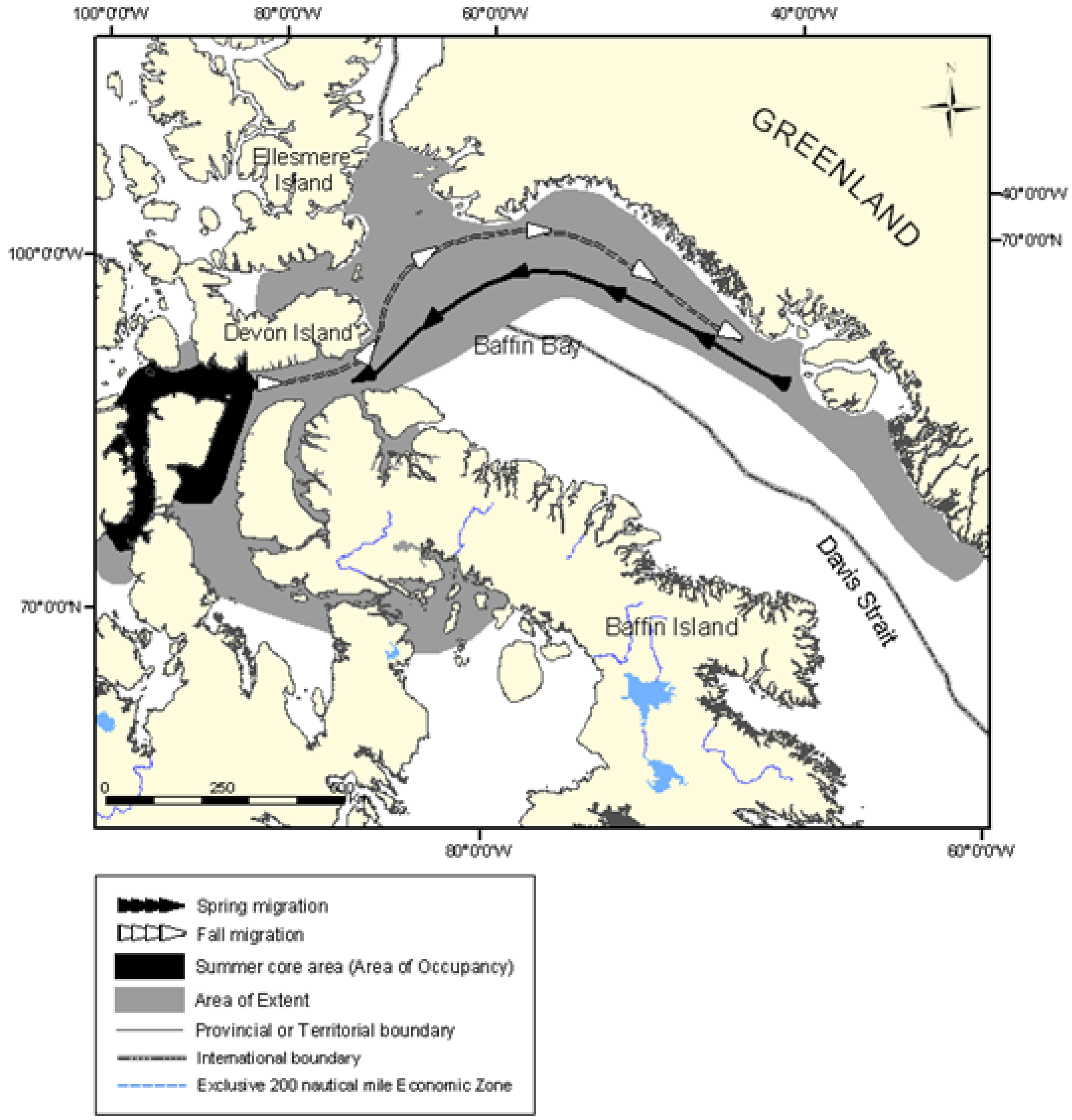


Figure 3a. Approximate total distribution of Eastern High Arctic – Baffin Bay Belugas (DU2) showing the assumed migratory routes and core summering area around Somerset Island. This figure was included in COSEWIC (2004) with the notation that it had been modified from Department of Fisheries and Oceans (2002). Barrow Strait is the summering area (black-shaded) extending from southeastern Devon Island westward; Peel Sound is the continuation of that same summering area extending southward from western Barrow Strait.

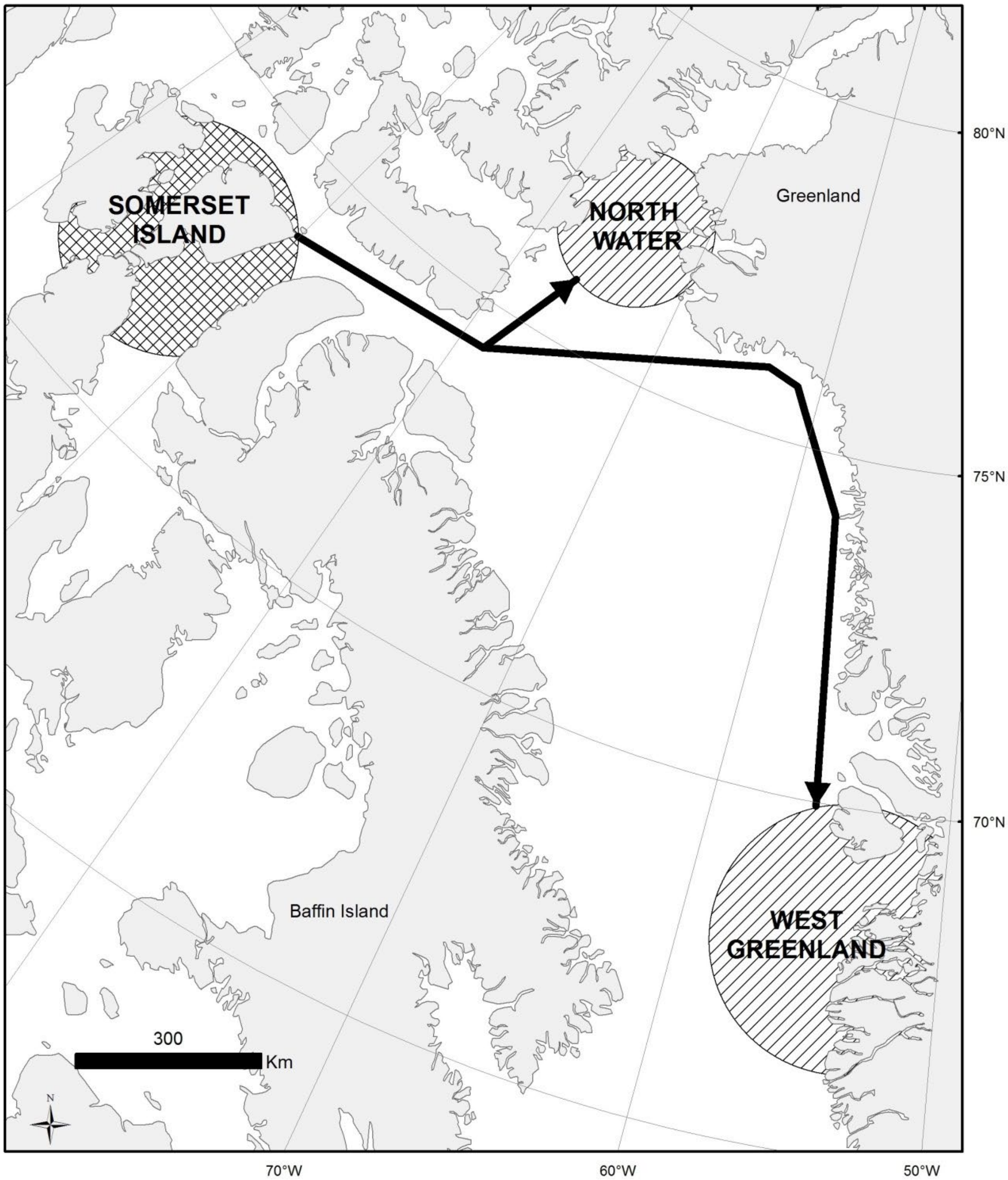


Figure 3b. General distribution of Eastern High Arctic – Baffin Bay Belugas (DU2), showing approximate summering grounds (double-hatched area) around Somerset Island in Canada, the two main wintering grounds (hatched areas) in the North Water and along the West Greenland coast, and the migratory route used in the spring and autumn. Reprinted from Ferguson and Hansen (2018).

Details concerning seasonal movements as well as range expansions or contractions are given in the respective sections on each DU in this report. In general, the only major changes in the distribution of Belugas in Canada over the last three generations (close to a century) are along the south shore of Ungava Bay where they have been greatly depleted and perhaps functionally extirpated from estuaries since the 1960s (Hammill *et al.* 2018a), in eastern Hudson Bay where the same has happened in the Great Whale and Nastapoka estuaries (Reeves and Mitchell 1989; Hammill *et al.* 2004; Turgeon *et al.* 2012), and in the Manicouagan Bank area of the St. Lawrence Estuary where Belugas have become largely absent since the 1960s, apparently as a result of intensive hunting as well as the environmental effects of dams in major rivers along the north shore (Sergeant and Brodie 1975; Sergeant and Hoek 1988; COSEWIC 2014). The importance of such local extirpations was conveyed in COSEWIC (2014) as follows: "A recent study analyzing genetic variation at 13 microsatellite loci indicates that Belugas maintain associations with close relatives during migration, a behaviour which could facilitate learning of migration routes (Colbeck *et al.* 2013). This cultural conservatism may impede recolonization of extirpated summering areas and limit dispersal between stocks that use different migration routes (Colbeck *et al.* 2013)." This statement is supported by the findings of O'Corry-Crowe *et al.* (2018).

## Extent of Occurrence and Area of Occupancy

Rough estimates of EOO and IAO are given below for each of the six DUs based on maps prepared for NAMMCO (2018).

<u>DU2: Eastern High Arctic – Baffin Bay Population</u>

The EOO for this DU is approximately 250,000 $km^2$ (COSEWIC 2004, 2016). The IAO, when considered to consist of only the main summer concentration areas around Somerset Island in Canada, is about 49,000 $km^2$ (COSEWIC 2016); if it were considered to consist of the two main wintering areas, combined, it would be much larger – probably in the order of 170,000 $km^2$ (see Figures 3a and 3b).

DU3: Cumberland Sound Population

The EOO for this DU was estimated as 27,000 km$^2$ and its IAO as 9,000 km$^2$ (COSEWIC 2004, 2016; see Figure 4).

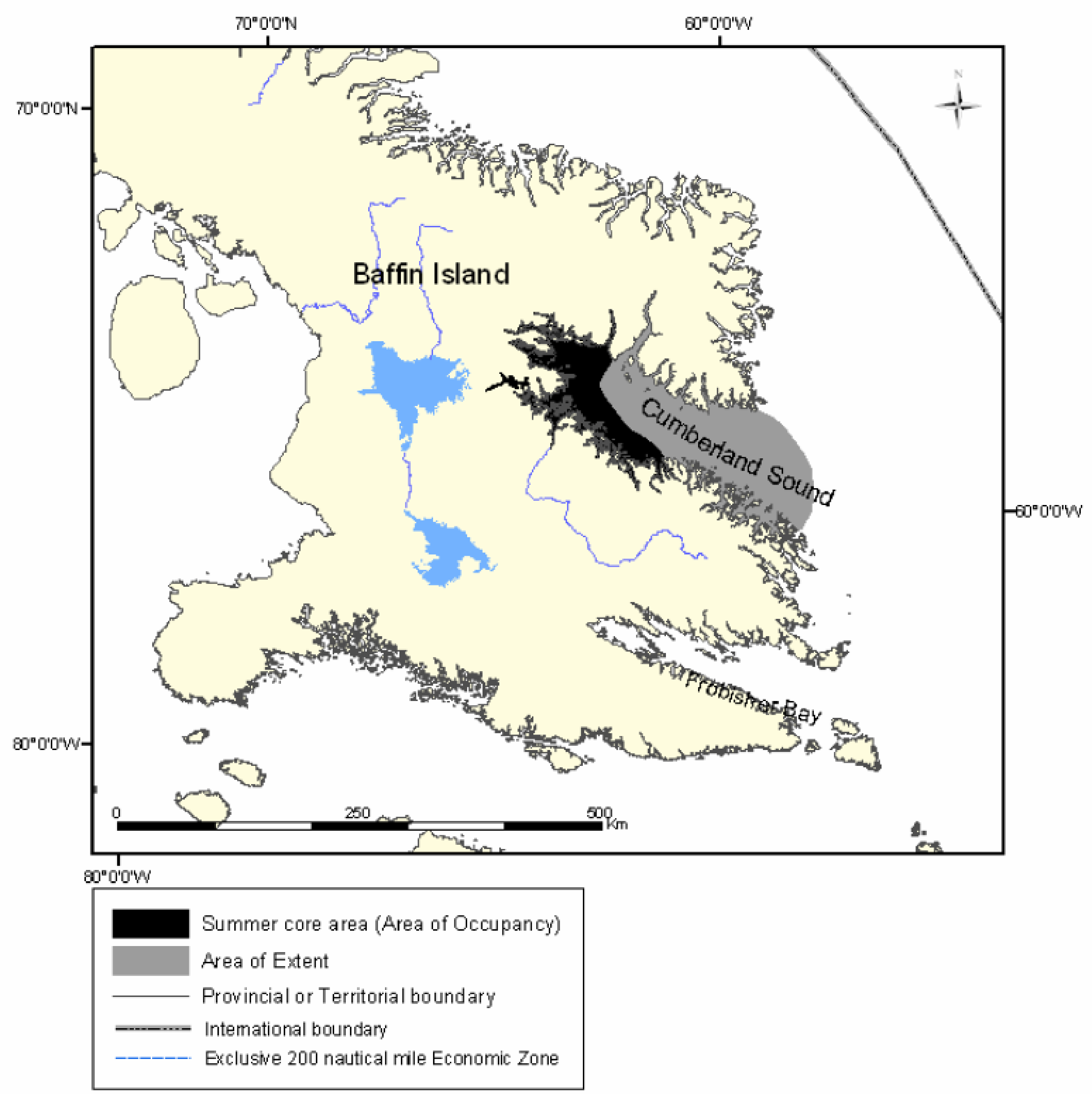


Figure 4. Approximate range of Cumberland Sound Belugas (DU3) (from COSEWIC 2004). The summer core-use area (shaded black) is limited to the western part of the sound (mainly Clearwater Fiord).

DU4: Ungava Bay Population

The EOO for this DU was crudely estimated as ~51,000 km$^2$ and the IAO as 12,000 km$^2$ (COSEWIC 2004, 2016; see Figure 5).

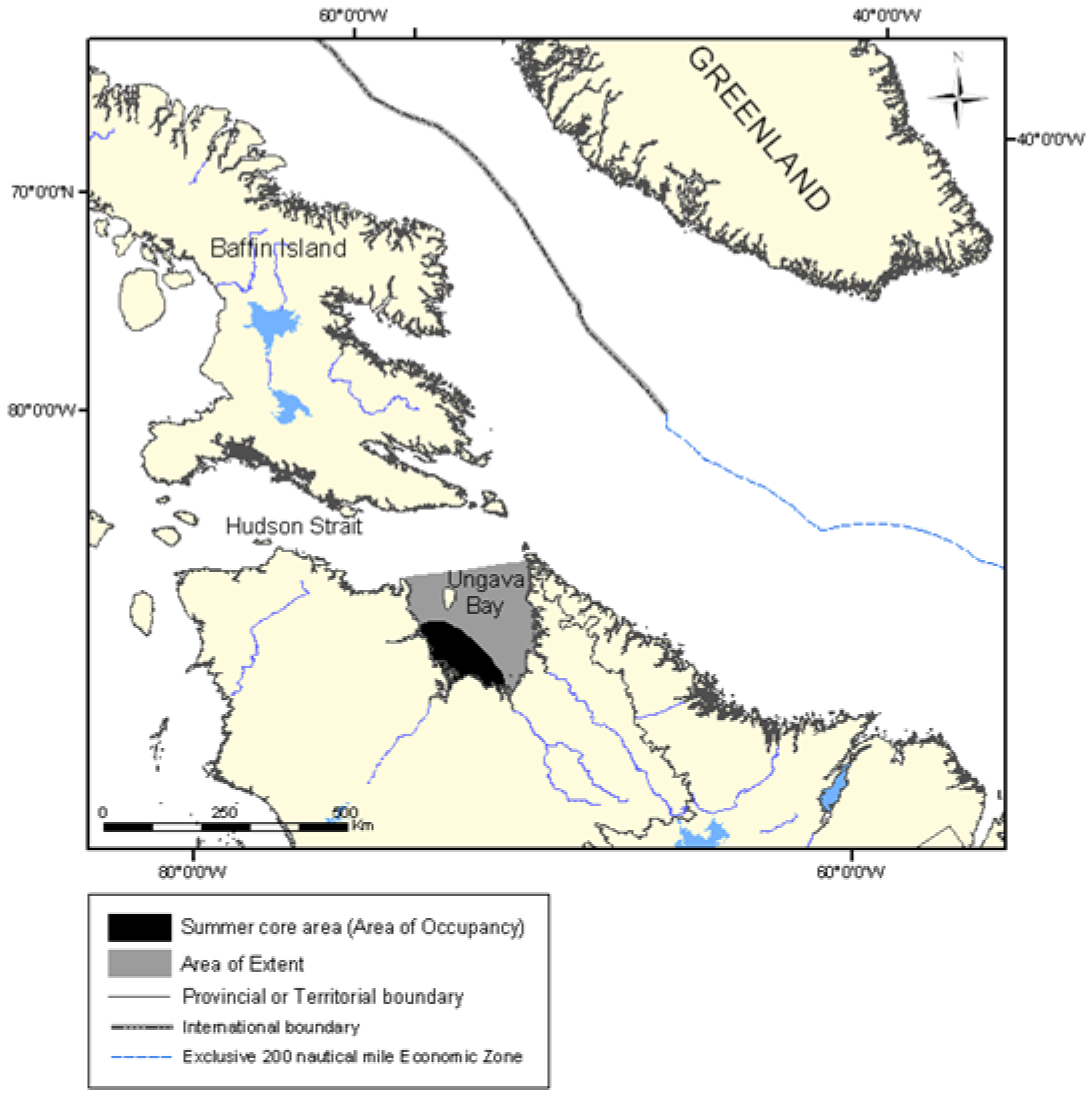


Figure 5. Approximate range of Ungava Bay Belugas (DU4) (from COSEWIC 2004). The summer core-use area (shaded black) is limited to the southern part of the sound (mainly in estuaries).

DU5: Western Hudson Bay Population

The EOO for this DU was estimated as 770,000 km² and the IAO as 51,000 km² (COSEWIC 2004, 2016; see Figure 6) but the EOO calculation included James Bay, which has since been determined to be a separate DU (COSEWIC 2016). It can be inferred from the estimated EOO of the James Bay DU that the adjusted EOO for Western Hudson Bay after removing James Bay would be about 680,000 km².

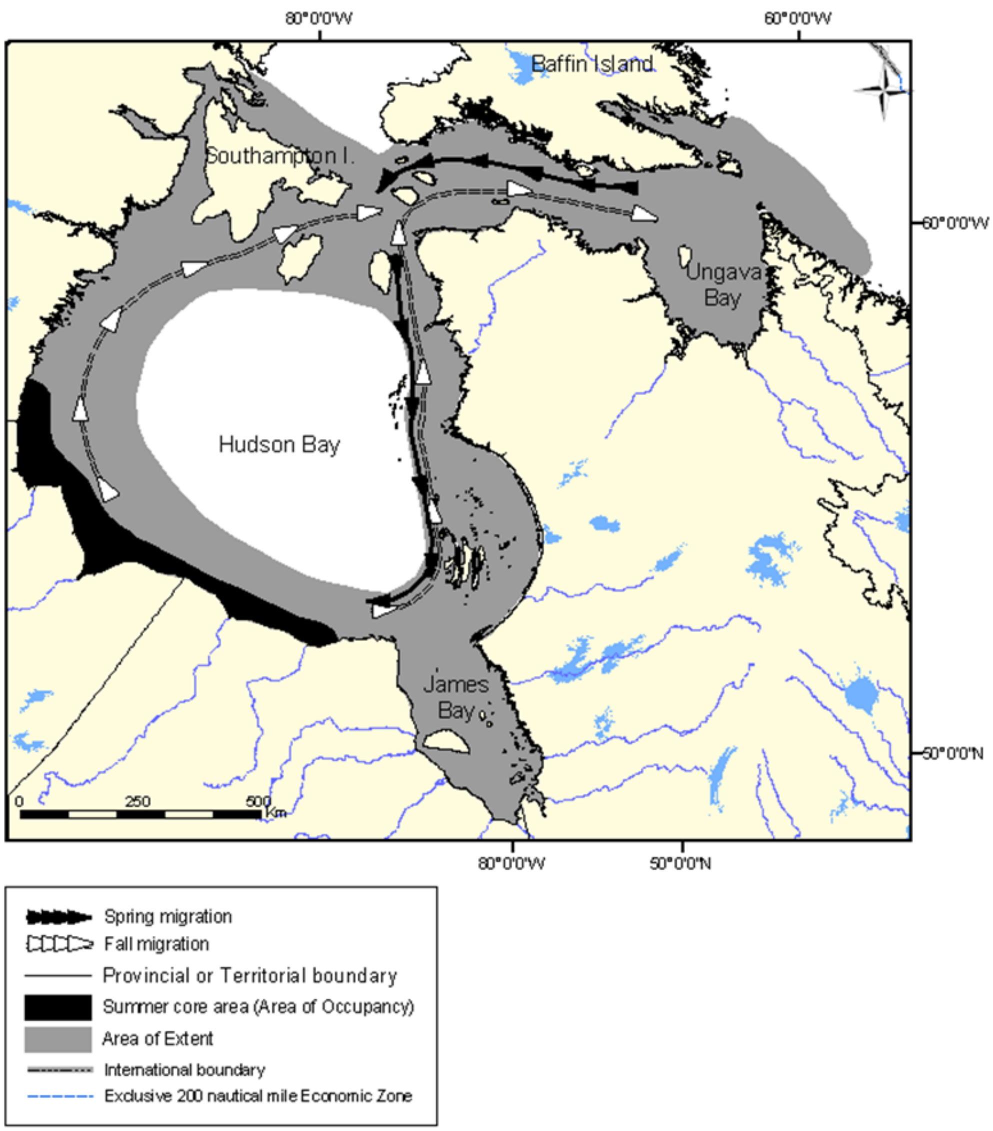


Figure 6. Approximate total distribution of Western Hudson Bay Belugas (DU5) showing the assumed migratory routes and core summering area. This figure was included in COSEWIC (2004) with the notation that it had been modified from Department of Fisheries and Oceans (2002). It should be noted that tagged Belugas have crossed the centre of Hudson Bay during migration (Smith *et al.* 2007).

DU6: Eastern Hudson Bay Population

The EOO for this DU was estimated as 221,000 km² and the IAO as 41,000 km² in 2004 (COSEWIC 2004, 2016; see Figure 7).

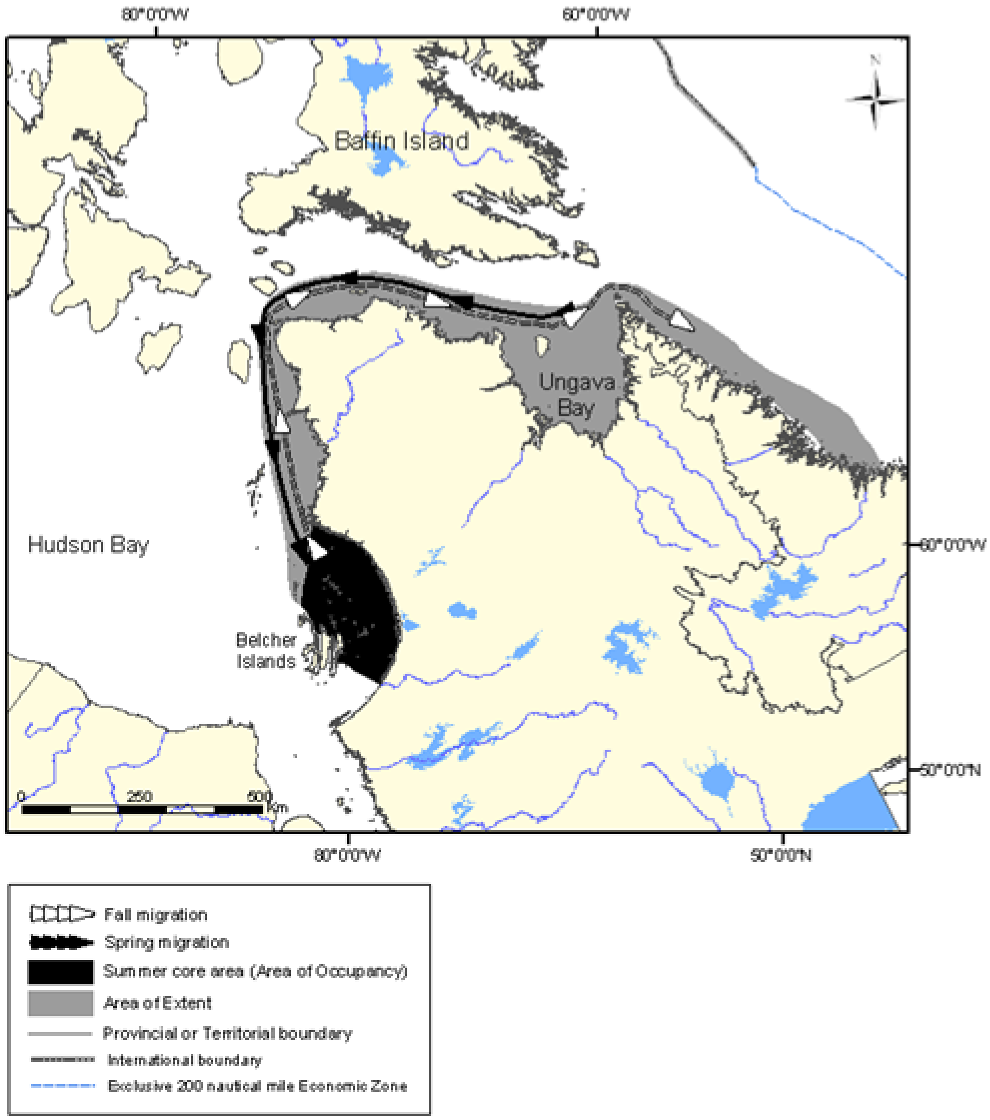


Figure 7. Approximate total distribution of Eastern Hudson Bay Belugas (DU6) showing the core area of their occurrence in summer (dark shading) and extent of occurrence in other seasons. This figure was included in COSEWIC (2004) with the notation that it had been modified from Department of Fisheries and Oceans (2002).

DU8: James Bay Population

As a recently recognized and still poorly known DU, there is considerable uncertainty about how to calculate EOO and IAO for James Bay. The Beluga population is believed to be resident in the bay all the year round (COSEWIC 2016; see Figure 8). Present knowledge of animal movements, habitat use, and relative density is inadequate to distinguish between the EOO and IAO, therefore these metrics are provisionally considered equal. The total surface area of James Bay is > 90,000 km$^2$.

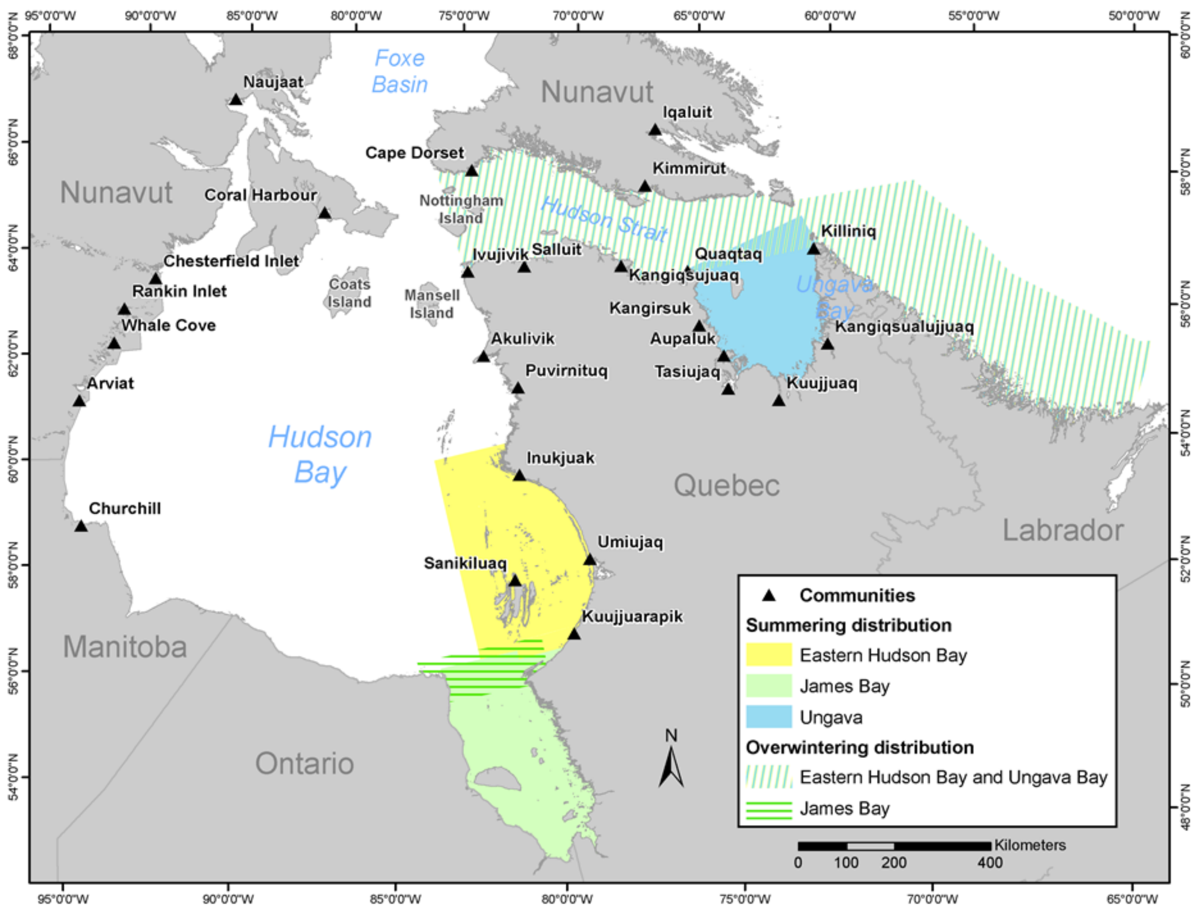


Figure 8. Summering aggregation and overwintering areas of Eastern Hudson Bay Belugas (DU6), James Bay Belugas (DU8), and Ungava Bay Belugas (DU4). Reprinted from Hammill *et al.* (2018b).

## Search Effort

Maritime human communities, particularly those engaged in hunting and fishing, were well aware of the coastal and estuarine habitat used by Belugas in northern and eastern Canada long before European and other explorers arrived. Foreign whalers, sealers, and traders benefited from this local knowledge and, in addition, made their own observations of Belugas in remote offshore regions. In the mid-20th century, scientists relied on hunting statistics (initially collected by the Royal Canadian Mounted Police) to make inferences about Beluga distribution and movements. Beginning in the 1960s, primitive static tags were used to track the movements and study the stock relations of Belugas in western Hudson Bay (Sergeant and Brodie 1969). More recently, since the 1990s, satellite-linked telemetry has transformed understanding of Beluga distribution, movements, and behaviour in much of the species' range (Reeves and St. Aubin 2001). It is now reasonable to conclude that although much remains to be learned about how Belugas use their habitat as well as many other aspects of their behaviour and ecology, the entire range of the species in Canada is well-known. The scale of effort to document the animals' distribution and movements is not uniform – visual and even acoustic survey effort has been strongly biased toward the late spring, summer and early autumn months when conditions for observation tend to be better. Nevertheless, the accumulated knowledge from Inuit (e.g. Stewart *et al.* 1995; Kilabuk 1998; Doidge *et al.* 2002; Cardinal 2013), early explorers, commercial whalers, and in recent years scientific teams (including satellite tracking and passive acoustic monitoring) spans all seasons and makes it very unlikely that any area where, or time when, these animals occur regularly would have been overlooked. A possible exception is in Smith Sound (Kane Basin) where Belugas occur in summer but have not been surveyed (Ferguson 2019).

It is important to emphasize that the species' range may be changing in response to climate-driven environmental factors in northern latitudes (O'Corry-Crowe 2008; O'Corry-Crowe *et al.* 2010) although as discussed in other sections (Canadian Range under DISTRIBUTION; Habitat Trends under HABITAT), these whales' behavioural (cultural) conservatism may limit, or at least slow, their ability to relocate with changing environmental conditions (see Colbeck *et al.* 2013; Smith *et al.* 2017; O'Corry-Crowe *et al.* 2018).

# HABITAT

## Habitat Requirements

Because Belugas are highly mobile and are able to tolerate a broad range of environmental conditions for at least short periods, it may be more appropriate to refer to their habitat *preferences* rather than habitat *requirements*. The types of habitat that they appear to prefer vary seasonally, and there are also significant differences in habitat preferences between males and females (Barber *et al.* 2001). In the summer, Belugas occur in both coastal and offshore waters but much of their summer distribution is centred on estuaries (Sergeant 1973; Sergeant and Brodie 1975; Smith and Martin 1994; Smith *et al.* 1985; NAMMCO 2018). The adaptive significance of this proclivity to aggregate in estuarine habitat is not entirely clear and may vary from one population to another (COSEWIC 2004; Smith *et al.* 2017). At least two factors may serve to drive or reinforce the habit, one being the opportunity to feed intensively on concentrations of anadromous prey (Frost and Lowry 1990) and the other being the promotion of epidermal moult by immersion in relatively warm, fresh water (St. Aubin *et al.* 1990). The hypothesis that Belugas prefer estuaries because of a thermal advantage for neonatal calves, based initially on observations in western Hudson Bay (Sergeant 1973), has been largely discredited.

Neonates are regularly observed in cold meltwater estuaries and young calves in pack ice and coastal areas devoid of freshwater input (Frost and Lowry 1990; Smith *et al.* 2017). Also, the comparatively thick skin of Beluga calves apparently provides an adequate "thermal buffer" to compensate for the relative thinness of their blubber (Doidge 1990a). Narwhal calves, which are approximately the same size and structure as Belugas (their close relatives), are born offshore, and this helps undermine the idea that Belugas need to be born in warm water. The extent to which Belugas use the shallow, braided conditions of many estuaries for protection from Killer Whales (*Orcinus orca*) is somewhat controversial, with some authors regarding predator avoidance as a potentially significant determinant of habitat selection (Smith *et al.* 2017) and others viewing it as less significant than prey distribution and moulting (Frost and Lowry 1990).

Besides their estuarine habit, Belugas are known for their frequently close association with pack ice, although they are generally less pagophilic (ice-loving) than Narwhals. The formation and melting of sea ice and its movement, which is driven by wind and currents, appear to have helped to shape the movement phenology of Belugas. Most populations overwinter in polynyas and areas where the ice cover is sufficiently broken to allow reliable access to the air. A detailed study of habitat selection in regard to bathymetry and ice concentrations in the Canadian Arctic concluded that Belugas "select particular classes of sea ice concentration and water depth, presumably because both relate to factors such as prey distribution, predation, weather, moulting, and the rearing of young" (Barber *et al.* 2001). A recent biotelemetric study of Belugas off northern Alaska concluded that habitat selection is driven primarily by affiliation with bathymetric features rather than extent of ice cover (Hauser *et al.* 2017, 2018). However, sea ice clearly influences the whales' access to foraging habitat and thereby at least indirectly influences habitat selection. Less extensive or less prolonged sea ice cover may enable the whales to spend more time in prime foraging habitat and may also, albeit indirectly, enhance secondary production in the water column and concentrate Beluga prey (Hauser *et al.* 2018; p 797). The strength of these effects in determining habitat suitability likely differs among Beluga populations, but it is probably reasonable to consider both factors (bathymetry and sea ice) as important, and possibly synergistic.

It should be emphasized that the ranging patterns of males and females can differ significantly, with females spending longer periods in coastal and estuarine waters and in areas of lighter ice concentrations (Barber *et al.* 2001; Hauser *et al.* 2017). Also, there can be major year-to-year differences in movements and habitat use (Richard *et al.* 2001a).

## Habitat Trends

The habitat of Belugas in certain parts of their range in Canada has been significantly altered by human activities, many of which are considered further under THREATS AND LIMITING FACTORS. Changes in the St. Lawrence River system, which is probably the most severely degraded part of the range, were summarized in COSEWIC (2014).

In Canada north of the St. Lawrence system, the habitat of Belugas has been altered most fundamentally in the mouths of two major river systems that were dammed to produce electricity, specifically the La Grande (from 1974) flowing into James Bay and the Churchill-Nelson flowing into western Hudson Bay (from the late 1950s). Regarding the potential impacts of dams on Belugas, the Global Review of Monodontids (NAMMCO 2018) concluded: "The altered flow regime downstream of dams can influence seasonal temperature and salinity in estuaries and make them less suitable for belugas, and change distribution and abundance of prey species. Dams interrupt the flow of sand and silt down rivers which over time can result in changes to the substrate and distribution of shallow areas which belugas occupy. Freshwater releases in late fall or winter can affect the timing of freeze-up, making … the sea ice less labile, and thereby may increase the risk of ice entrapment."

However, a clear understanding of how the alterations to hydrological and sedimentary processes caused by damming and diversion have affected Beluga habitat, and in turn affected the distribution, movements, health, and population dynamics of the whale populations, is lacking despite considerable speculation. Local people in Waskaganish, QC, have reported that partial diversion of the Rupert River in James Bay (to support the Eastmain and La Grande Complex hydroelectric projects; see Environmental and Social Impact Review Committee 2020) "has lowered the water level to the point where the beluga can no longer travel upriver to feed in the summer" and that they make "fewer observations of beluga now in the river during the summer" (Blackned 2019). One study comparing Beluga movements and habitat associations with differing annual flow patterns in the Nelson estuary, as influenced by electricity-generating activity in recent years, and with aerial survey observations from the 1940s to 1960s, was not conclusive concerning long-term impacts of the dams and diversions constructed throughout the Churchill-Nelson system (Smith *et al.* 2017). The timing of the annual shift in the whales' distribution away from the estuary (early August) appeared not to have changed since the 1940s-1960s "despite environmental changes including later freeze-up and warming ocean temperatures" (Smith *et al.* 2017). Citing Laidre *et al.* (2008), Smith *et al.* (2017) suggested, "Matrilineal behavior learning may have 'locked' these belugas [in the Nelson estuary] into traditional habitat use and consequently may constrain their behavioural plasticity to environmental change."

COSEWIC is not aware of any new hydroelectric development projects planned or ongoing in recent years for the James Bay and Eastern Hudson Bay DUs.

Human activities, other than damming, that have altered Beluga habitat in Canada include oil and gas exploration and development in the Mackenzie Delta (seismic surveys, offshore drilling, artificial island construction), ice-breaking (Finley *et al.* 1990; Erbe and Farmer 2000), and shipping (e.g. in western Hudson Bay; Pirotta *et al.* 2018) as well as "everyday" boating activities by local people, which frequently involve directed or opportunistic hunting (e.g. Caron and Smith 1990). It has been suggested that noise from the increasing use of outboards for hunting, and not necessarily the direct effects of harvest mortality, has contributed to declines of Belugas in some areas (NMRWB 2019). The potential impacts of commercial fishing on Beluga prey and as a source of disturbance and risk of entanglement have not been investigated in most areas of Canada, but the expansion of commercial fisheries into parts of the sub-Arctic and Arctic as the climate changes is a concern.

Climate change has significantly changed, and will continue to change, Beluga habitat in numerous ways, but the net effects have yet to be well characterized (see Climate Change under THREATS AND LIMITING FACTORS).

## BIOLOGY

The large scale and long history of Beluga hunting in coastal communities across northern Canada has been accompanied by extensive scientific sampling (of carcasses) and research on the species' biology and life history. Much of the following information was taken from previous COSEWIC status reports (COSEWIC 2004, 2014) and the COSEWIC DU report (COSEWIC 2016).

A long-running controversy over whether one or two growth layer groups (GLGs) are laid down annually in the dentin of Beluga teeth has confounded estimates of animal age and in turn estimates of age-related life history parameters (Stewart *et al.* 2006, Campana and Stewart 2014, Stewart and Stewart 2014, Lockyer *et al.* 2018). In fact, the most recent COSEWIC Beluga status reports (2004 (species as a whole) and 2014 (St. Lawrence Estuary population)) used different rates – 2 GLGs/yr and 1 GLG/yr, respectively. Recent studies of the incremental lines that represent daily pulses of dentin mineralization in Beluga teeth added to the weight of evidence of annual deposition (1 GLG/yr) (Vos *et al.* 2019; Waugh *et al.* 2018). The life history parameters given here are based on one GLG in Beluga teeth corresponding to one year of age.

### Life Cycle and Reproduction

Maximum longevity for the species is said to be about 100 years, as reported by Harwood *et al.* (2002) for the Beluga population in the Mackenzie River Estuary. However, there is concern that the exceptional ages reported for both sexes in the EBS population are biased high due to the way different readers interpret and count the GLGs (Luque and Ferguson 2010). Lifespans (apparently meaning maximum age of sampled individuals) reported in the literature range from about 45 to 60 years (Hobbs *et al.* 2015, their Table 2). There is good evidence for menopause, in the sense of significant post-reproductive lifespans for females, in Belugas (Ellis *et al.* 2018). Reproductive senescence in females may begin at approximately 35-40 years of age (Ellis *et al.* 2018; Hobbs *et al.* 2015).

Sexual maturation (evidence of ovarian activity in females and mature testes in males) is usually reached at a somewhat earlier age in females than males, i.e., 6-14 years in females and 14-22 years in males (COSEWIC 2016).

The timing of mating and calving varies among Beluga populations, although in general, mating apparently takes place mostly offshore in late winter or spring. Females give birth to a single calf in summer (between June-September) following a gestation period of 12.8-14 months (COSEWIC 2016) or 14-15 months (COSEWIC 2014). Lactation may last for as long as two years although ingestion of solid food supplements the diet in the second year of life. Lactation may partially overlap the following gestation period, suggesting a 3-year reproductive cycle (Matthews and Ferguson 2015).

Generation length has been estimated in a number of studies in different ways. Most recently, for the 2019 Red List assessment of Cook Inlet (Alaska) Belugas, Lowry *et al.* (2017) used life history parameters from Hobbs *et al.* (2015) to estimate generation length as 28.6 years, and this is the estimate used in this report. It is important to emphasize that values given for generation length in some, mostly older, publications (e.g. COSEWIC 2004) may not be valid for COSEWIC purposes not only because they refer to growing populations (i.e. they are not "pre-disturbance"), but also because they were based on age-related parameters assuming 2 GLGs/yr. This estimate of generation length, 28.6 years, may have been calculated with overly high estimates of adult survivorship and a failure to account for female reproductive senescence (see Ellis *et al.* 2018). Possibly more realistic estimates of birth rates and adult survival rates (compiled in Table 2 of Hobbs *et al.* 2015) suggest generation time of belugas is more likely between 20 and 23 years. However, assuming generation lengths anywhere within the 20-30 year range would not affect the status assessment of any Beluga DUs in this report.

## Physiology and Adaptability

Belugas have a relatively thick dermis (5-12 mm) and a thick (up to 15 cm) hypodermis (the layer of fatty and fibrous connective tissue immediately below the dermis) (Stewart and Stewart 1989; O'Corry-Crowe 2018). These features have sometimes been cited, along with the lack of a dorsal fin and the relatively small head, tail, and flippers, as adaptations to the cold and often partially ice-covered environments that these animals inhabit (Sergeant and Brodie 1969; O'Corry-Crowe 2018). The extent of their reliance on blubber fat to withstand periods of lower food intake is uncertain, but Belugas apparently feed throughout the year and take up to two years to wean their calves. On an annual basis, Belugas require access to lipid-rich food to maintain their large blubber mass.

Studies based on Traditional Ecological Knowledge (TEK) consistently demonstrate strong seasonality in blubber thickness and 'condition'. However, the pattern of differences is not the same everywhere. For example, expert Beluga hunters and Elders in various Nunavik communities noted that Belugas are fattest in the late winter and early spring (when they tend to float after death) and thinnest during the autumn (when carcasses tend to sink) (Breton-Honeyman *et al.* 2016b), whereas Belugas harvested by the Inuvialuit in the eastern Beaufort Sea are thinnest when they arrive in June after migrating from the Bering Sea and fattest in late July and August when their blubber can be 10-15 cm thick (Ostertag *et al.* 2018). According to Doidge (1990b), Belugas in some parts of their range have their lowest body fat content when they arrive in their estuarine summer habitat. In the St. Lawrence Estuary, hunters observed that Belugas were thinnest in the winter

(November-March) and accumulated most of their fat in May-June, reportedly gaining 13-15 cm in blubber thickness in less than 10 days in one area, and remaining fat during the summer (Vladykov 1944 pp 76-77). The hunters also reported wide interannual variation in blubber thickness, with Beluga carcasses floating in one year and sinking during the same period in another year (Vladykov 1944 p 77).

Although most of their range is north of around 50ºN and therefore in relatively cold waters, Belugas occupy varied habitat in terms of water temperature, salinity, and depth. Estuarine occupation for at least a portion of each year is often mentioned as a species characteristic, but just as some populations are migratory and others are not, it seems that some populations do not use estuarine habitat as regularly or for the same purposes as others. Some populations definitely spend considerable periods in estuaries where the water is brackish, relatively warm (to 10º or 12ºC in summer), and only a few metres deep (Sergeant 1973; Martin *et al.* 2001). The Belugas in Cumberland Sound visit the Ranger River estuary (Millut Bay), which is fed by glacial meltwater and is said by local Inuit to be colder than seawater (Richard 2019). As discussed above (Habitat Requirements), the physiological benefit of promoting and sustaining epidermal moult may cause at least some components of most or all populations to spend a certain amount of time in estuaries or bays. The duration of an individual's residency in an estuary may vary considerably.

The Belugas in at least some populations also spend long periods hundreds of kilometres offshore in waters at least 3000 m deep, and they regularly occur in areas that are more than 90% ice-covered (Suydam *et al.* 2001). Time-depth recording devices on free-ranging Belugas in the Canadian Arctic (specifically animals in DU2) showed that they regularly forage at depths of hundreds of metres (Martin *et al.* 1998; Watt *et al.* 2016), with exceptional dives to greater than 800 m (Heide-Jørgensen *et al.* 1998; Richard *et al.* 2001b). On deep foraging dives, Belugas have been said to "treat most of the water column merely as dead space separating resources of oxygen and nutrition" (Martin *et al.* 1998). Dive duration is often 8-15 minutes.

Despite the wide range of habitat types and conditions that Belugas are clearly capable of dealing with, their capacity for adapting to disturbance or over-exploitation in estuaries appears limited. Many authors have speculated on, and provided various types of evidence for, Belugas having strong philopatric behaviour (Caron and Smith 1990; Smith *et al.* 1994; O'Corry-Crowe *et al.* 2018). Their strong fidelity to summering areas and estuaries may limit their ability to recolonize areas where they have been extirpated or severely depleted, such as the Mucalic River in Ungava Bay and the Great Whale and Nastapoka rivers in eastern Hudson Bay (e.g. COSEWIC 2014) (however, "a large number" of Belugas reportedly were seen in the Nastapoka estuary in August 2019 according to NMRWB 2019). The long generation length of Belugas means that monitoring over long periods, perhaps centuries, would be needed to observe recolonization, and there is evidence of new populations forming in the genomic history of the species.

Belugas are acoustically sophisticated, producing a large repertoire of sounds that are broadly described as whistles and pulsed calls, typically in the frequency range of 0.1 to 12 kHz (Sjare and Smith 1986; Castellote and Fossa 2006; Chmelnitsky and Ferguson 2012; Vergara and Mikus 2019). Around 50 different call types have been characterized – clicks, groans, whistles, buzzes, trills, roars, etc. Their acoustic behaviour clearly reflects a strong reliance on sound for communication, navigation, and prey capture (O'Corry-Crowe 2018).

## Dispersal and Migration

Regardless of their philopatry or site fidelity, and apparently limited ability to recolonize rapidly, Belugas have a broad distribution across the Arctic and sub-Arctic and also inhabit several cold temperate regions. They have persisted in most of their Canadian range and have been severely depleted (and possibly extirpated) in only a few areas (see Canadian Range under DISTRIBUTION). Their dispersal over such a wide area, including in a variety of habitat conditions, testifies to the species' adaptability. The occasional "wandering" by individuals, and sometimes by small groups of Belugas, into areas outside what is considered their "normal" range, indicates the potential for some degree of dispersal and possibly for eventual colonization of new areas (Reeves and Katona 1980; Brown Gladden *et al.* 1999).

In most populations, the whales start to move out of estuaries and begin to exhibit migratory behaviour in the late summer or early autumn (Sergeant 1973; Smith *et al.* 2007). During this time some individuals in some populations (e.g. EHA-BB, EBS) make long-distance excursions to deep water offshore where they spend several weeks diving intensively to the bottom and presumably foraging (Smith and Martin 1994; Richard *et al.* 2001a), then proceed to migrate. Belugas often overwinter in open water close to the sea ice and away from coastal regions, in polynyas, or in loose pack ice near the sea ice edges (Jonkel 1969; Finley and Renaud 1980; McDonald *et al.* 1997; Lewis *et al.* 2009; Heide-Jørgensen *et al.* 2010). In the spring they are often seen migrating along the floe edge on traditional migration routes to summer aggregation areas (Cardinal 2013).

An important recent study (O'Corry-Crowe *et al.* 2018) that combined satellite telemetry findings with genetic analyses of 1,647 individual Belugas sampled over more than two decades, and encompassing all major coastal summering aggregations in the Pacific Ocean, reached the following key conclusions: (1) evolutionary divergence was found among whales in the Gulf of Alaska, the Bering, Chukchi, and Beaufort Seas, and the Okhotsk Sea; (2) likely demographic independence and in many cases limited gene flow was found among summering groups within regions; (3) few immigrants were identified within summering aggregations; (4) migrating groups were linked to specific summering areas; (5) some migratory corridors were used by whales from multiple subpopulations; and (6) dispersal was male-biased. Overall, the authors surmised that "migratory culture and kinship," as evidenced by "widespread natal philopatry to summering aggregation and entire migratory circuits," help to maintain the demographic independence of Beluga "stocks" even when they overlap in time and space.

## Interspecific Interactions

### Prey

As opportunistic foragers, Belugas are known to prey on a wide variety of fishes and invertebrates across their circumpolar range (Kleinenberg *et al.* 1964; Laidre *et al.* 2008; Quakenbush *et al.* 2015; Breton-Honeyman *et al.* 2016b), but the diet varies from area to area as well as seasonally and to some extent by age and sex. Composition of the diet reportedly differs within the Nunavik region, with cottids, gadids, salmonids (e.g. *Salvelinus spp.*, *Coregonus* spp.) and crustaceans (mainly shrimps and crabs) most commonly reported (Breton-Honeyman *et al.* 2016b). Inuit of Baffin Island (Arctic Bay, Pangnirtung and Iqaluit) report that Belugas prey on both Arctic Cod (*Boreogadus saida*) and Greenland Halibut (Turbot) (*Reinhardtius hippoglossoides*) along the floe edge in spring (Stewart *et al.* 1995; Kilabuk 1998). Many of the Beluga populations in the Canadian Arctic rely heavily on Arctic Cod whereas those in Hudson Bay tend to be more reliant on Capelin (*Mallotus villosus*) (Kelley *et al.* 2010). Breton-Honeyman *et al.* (2016b) suggested that Capelin have become more frequent and abundant in the Hudson Bay during recent decades due to climate warming. This trend is also occurring in Cumberland Sound where Capelin have increased and Arctic Cod have decreased since the early 2000s, and there is ample indirect evidence (stable isotope and fatty acid analyses, diving behaviour presumably related to foraging) that Belugas there are consuming more Capelin and less Arctic Cod, reflecting climate-driven changes in the foodweb (Marcoux *et al.* 2012; Watt *et al.* 2016; Yurkowski *et al.* 2017).

### Predators

Significant interactions of Belugas with other species (apart from their prey species) primarily involve predators and competitors. Killer Whales and Polar Bears (*Ursus maritimus*) are the only non-human predators of Belugas (e.g. Stewart *et al.* 1995; Shelden *et al.* 2003; COSEWIC 2004). Like other prey species, Belugas move very close to shore and into shallow water when Killer Whales are present (Ferguson *et al.* 2012). The reduction of sea ice in high latitudes has enabled Killer Whales to expand their range into areas where they were scarce or absent a few decades ago (e.g. much of Hudson Bay; Higdon and Ferguson 2009). This has meant that Belugas are exposed to the threat of predation in more of their range and for longer periods of the year than in the past. One Inuk hunter in Igloolik suggested to Ferguson *et al.* (2012) that Belugas were arriving later in the season in response to the presence of Killer Whales (no explanation was provided as to why this would be the case). The Eastern Beaufort Sea is an exception to the general increase in Killer Whale occurrence in the Canadian North. Inuit informants reported that Killer Whales were still rarely seen there (at least through the early 2010s), and most of the occasional observations were in the Mackenzie Delta (Higdon *et al.* 2013).

Polar Bears have long been known to catch and consume Belugas that are ice-entrapped (or at least ice-constrained) (Freeman 1973; Mitchell and Reeves 1981; Lowry *et al.* 1987; Heide-Jørgensen *et al.* 2002). Quantitative fatty acid signature analysis indicated that Belugas are “important prey” of Polar Bears (15-19% of diet composition) in the Canadian High Arctic (Baffin Bay, Lancaster Sound, Gulf of Boothia) (Galicia *et al.* 2015). Smith and Sjare (1990) observed a bear killing two young Belugas in deep water of Cunningham Inlet by pouncing on them from an ice pan. On other occasions Smith and Sjare (1990) saw Belugas interacting with Polar Bears in a manner reminiscent of mobbing by passerines on raptors. Those authors also observed bears in Cunningham Inlet preying on Belugas and Narwhals that had become stranded in tidal pools (also see Heyland and Hey 1976). Claw marks on Belugas in the High Arctic are observed fairly often by local Inuit (Stewart *et al.* 1995). In recent years, tour operators in estuaries in western Hudson Bay have filmed Polar Bears hunting and catching Belugas by positioning themselves on exposed rocks during low tide states and waiting to ambush the whales as they move inshore with the flood tide. These observations tend to support the suggestion by Smith and Sjare (1990) that individual bears have learned to be whale-hunting specialists.

Competitors

As opportunists that are capable of preying on a very broad range of organisms, Belugas should, in principle, be capable of adapting to competition by prey-switching. The diet of Belugas overlaps extensively those of other marine mammals and seabirds, e.g. with regard to Arctic Cod (Welch *et al.* 1993) and benthic invertebrates (Quakenbush *et al.* 2015). There is speculation that resource competition helps explain the broad-scale movement strategies of Belugas. For example, satellite-tracking data on Belugas led Citta *et al.* (2017) to conclude, “… if the risk of killer whale predation is limited to the marginal ice edge, predator avoidance does not explain why some beluga winter ranges are far north of the ice edge. Hence, while predation [specifically by Killer Whales] may explain why winter ranges are north of the ice edge, other factors such as ice conditions, food resources, or competition are likely more important within the ice.”

None of the Above

Noteworthy interactions with other species that don’t fit any of the above descriptors involve Narwhals and Walruses (*Odobenus rosmarus*). Narwhals are sometimes seen in close proximity to Belugas and there is evidence of occasional aggressive interaction (a tusk tip was found lodged in the melon of a large male Beluga killed by hunters in Kugmallit Bay near Tuktoyaktuk; Orr and Harwood 1998) as well as interbreeding (Heide-Jørgensen and Reeves 1993; Skovrind *et al.* 2019). The previous status report (COSEWIC 2004) referred to a suggestion by Inuvialuit of the Mackenzie Delta that Belugas are frightened of Walruses and that a ‘wound’ observed on a Beluga might have been caused by a Walrus tusk.

# POPULATION SIZES AND TRENDS

## Overall Canadian Population

Sampling Effort and Methods

The most common method used to estimate Beluga numbers in Canada is aerial line transect or strip sampling, involving either visual counts (usually by at least two observers, one on either side of the aircraft), vertical photographs from a constant known altitude, or a combination of these. As a rule, aerial surveys of Belugas in Canada take place in the summer or autumn. The Eastern High Arctic – Baffin Bay DU is an exception insofar as it has been surveyed repeatedly off West Greenland where some of the population overwinters, and occasionally and partially in the North Water where most of the population is believed to overwinter (Heide-Jørgensen *et al.* 2003, 2016, 2017).

Survey frequency and sampling intensity are strongly influenced by the high cost as well as by concerns regarding human safety and the challenges of sea state, weather, and seasonal differences in day length and ice cover.

Whales counted at or near the surface as the aircraft flies along a transect or strips are an unknown fraction of the number actually present. This is because (i) some whales are below the surface and out of visual (or photographic) range as the aircraft passes overhead (availability bias) and (ii) others, though "available," are not detected by the observers (perception bias). Therefore, a crucial aspect of abundance estimation is "correcting" the numbers observed and recorded (or photographed) to account for missed whales. Various approaches have been taken to accomplish this, e.g. modelling data on dive cycles obtained from either direct visual observations or tagging studies with mark-recapture distance analyses and analyses of effects of turbidity (Kingsley *et al.* 2001; Kingsley and Gauthier 2002; Heide-Jørgensen *et al.* 2001, 2017; Matthews *et al.* 2017). When reviewing published abundance estimates of Belugas, close attention needs to be given to whether and how they have been corrected for availability and perception bias. The degree of availability bias can vary greatly depending on depth and turbidity. Inuit in areas formerly used by Belugas in southern Ungava Bay, for example, report that the animals there can disappear "incredibly easily, even when observed from the air" (NMRWB 2019).

Abundance

Each of the eight DUs constitutes a population according to the COSEWIC definition. The total number of individuals, all ages, for the species in Canada can be estimated as the sum of the central, or point, estimates of those populations, following the information in Table 2 of NAMMCO (2018), which comes to 131,450 individuals. The population estimates vary widely in terms of their accuracy and precision, whether they are modelled or derived from survey data, and how they have (or have not) been "corrected" for availability and perception bias. According to Taylor *et al.* (2007), the proportion of mature individuals in a Beluga population at equilibrium is 68%; and for a growing population, 59%. Therefore, it is reasonable to infer that there are presently on the order of 80,000 to 90,000 mature Belugas in Canada.

No attempt has been made to identify subpopulations of Belugas in Canada although it is recognized that some populations, such as those in the eastern Beaufort Sea in summer and the eastern High Arctic – Baffin Bay in winter (Figure 3b), have more than one geographically distinct, high-density aggregation area.

Fluctuations and Trends

Cetacean populations are not prone to fluctuate according to the meaning of the term in the COSEWIC context, therefore only trends are considered in this report.

No judgment on trends in overall (total) Beluga numbers in Canada was reported in the previous COSEWIC assessments or in the 2017 Global Review of Monodontids (NAMMCO 2018). However, some of the subpopulations in Canada have been greatly reduced from historical levels, primarily as a direct result of over-exploitation, and these declines were summarized in COSEWIC (2004). Since the 1970s, deliberate killing of Belugas for commercial and sport purposes in Canada has been illegal, hunting for domestic use as food has been managed in some jurisdictions under land-claims agreements, and efforts have been made to limit disturbance by tourism and ship traffic more generally in the St. Lawrence and Churchill estuaries (see Protection, Status and Ranks, below). Possibly in part as a result of those measures, the total population of Belugas in Canada, across all DUs, appears not to have changed much over the last 40-50 years. In any event, there is no evidence to suggest a strong recent or ongoing trend of increase or decrease in the aggregate population.

Rescue Effect

There is very little chance that the nearest Beluga population in the North Atlantic, which is centred at Svalbard (Norway) and for which there is no estimate of abundance, could rescue any of the Canadian DUs being considered in this report, and there are no other realistic potential sources of rescue.

## DU2: Eastern High Arctic – Baffin Bay (EHA-BB) Population

Abundance

Abundance estimates for this population can be a challenge to interpret because they have been derived from surveys of different areas (Canadian Eastern Arctic vs North and West Greenland) at different times of the year (summer vs winter). A Bayesian analysis using recent aerial survey data from the Canadian Arctic (Innes *et al.* 2002) and West Greenland (Heide-Jørgensen and Acquarone 2002), together with information on the catch history going back to the 1860s (Reeves and Mitchell 1987b, Heide-Jørgensen and Rosing-Asvid 2002), resulted in 1861 estimates of 39,790 (19,812–78,588) for the Baffin Bay [= West Greenland] wintering stock and 15,966 (5,053–30,748) for the North Water wintering stock (Innes and Stewart 2002). Combining these estimates implies a total abundance for the EHA-BB population of about 55,000 whales in the middle of the 19$^{th}$ century (Ferguson and Hansen 2018).

The first and only systematic survey of the summering grounds in 1996 resulted in an estimate of 21,213 Belugas of all ages (95% CI 10,985 to 32,619; Innes *et al.* 2002). This estimate was corrected for availability and perception bias and included direct counts of whales congregated in estuaries. Separate recent abundance estimates for portions of this population have been generated from aerial surveys of the West Greenland wintering ground. The most recent such estimate, fully corrected for availability and perception bias, was 9,072 whales (CV= 0.32; 95% CI 4895-16,815) in 2012 (Heide-Jørgensen *et al.* 2016). As explained by Ferguson and Hansen (2018 p 92), "The stock of belugas that winters in West Greenland is part of the larger aggregation that is found in the summer in inlets and bays along Somerset Island in northern Canada. Only a portion of the whales from Somerset Island move to West Greenland for the winter whilst the other portion winters in the North Water area in northern Baffin Bay (Heide-Jørgensen *et al.*, 2003)." No complete estimate of Belugas overwintering in the North Water is available but Heide-Jørgensen *et al.* (2016) estimated that there were 2,324 animals (95 % CI 968–5575) (corrected for availability bias) present in the eastern part of this large polynya in April 2014.

Fluctuations and Trends

The EHA-BB population was seriously overexploited in West Greenland and declined considerably – possibly by as much as 50% – over the period 1981-1994 (Innes and Stewart 2002). It was assessed as Special Concern in 2004 (COSEWIC 2004). Since that time, there has been less hunting pressure in Greenland, and the Global Assessment concluded that the stock off West Greenland was increasing (NAMMCO 2018, p 68, table 2). The same assessment document, however, noted (p 21), "Although the population trajectory can be interpreted as suggesting an increasing population, the stock as a whole [i.e. the EHA-BB population, DU2] is still considered depleted." Overall, it seems likely that the population is stable or increasing slowly.

## DU3: Cumberland Sound (CS) Population

Abundance

The first comprehensive surveys of this population were conducted between 1990 and 2009 (Richard 2013). A survey using essentially the same methods and design was carried out in August 2014 (Marcoux *et al.* 2016). It consisted of visual aerial line transect coverage of a western stratum and a northern stratum in the main body of the sound, combined with complete photographic coverage of Clearwater Fiord where Belugas congregate in the summer. The resulting 2014 estimate (corrected for availability bias) was 1,151 whales of all ages (CV=0.21) (Marcoux *et al.* 2016). Most earlier surveys had limited coverage and were considered negatively biased even after correcting for availability bias (Matthews 2018). Another aerial survey was conducted in summer 2017 and it provided the basis for a modelled estimate of 1,090 (95% CI: 617-1864) Belugas (Department of Fisheries and Oceans 2019; Watt *et al.* 2020).

Fluctuations and Trends

Large-scale removals by commercial whalers and traders from the late 1860s through the 1940s left this population severely depleted (Mitchell and Reeves 1981), and overhunting by local Inuit continued through the 1970s (Kemper 1980) after which time management measures were implemented (COSEWIC 2004). In 2004 COSEWIC considered the population "stable" and downlisted it from Endangered to Threatened. However, a modelling analysis of the nine abundance surveys since 1980, fitting all of the data to the four most recent surveys and harvest statistics, suggested a declining trend (Marcoux and Hammill 2016). The total population has declined from an estimated 2,900 to an estimated 1,100 between 1960 to 2019 (Department of Fisheries and Oceans 2019; Watt *et al.* 2020), and was likely higher in 1933 (three generations ago) than in 1960. Projections assuming a stable catch of 41 Belugas per year indicated that this DU's abundance would fall about by about 29% between 2018 and 2028 (Department of Fisheries and Oceans 2019; Fig. 2). The Global Review accepted this result (NAMMCO 2018, p 26) and concluded that the CS population was "small in both numbers and range [and] believed to be declining." Recent harvest levels were considered unsustainable. Therefore, it appears that the long-term declining trend of this population has continued to the present, and, if harvest levels are not reduced, will decline into the future.

## DU4: Ungava Bay (UB) Population

Abundance

Historical catches and observations at river mouths in southern Ungava Bay indicated that Belugas were present in considerable numbers until at least the 1880s (Finley *et al.* 1982; Reeves and Mitchell 1987c). Although the methodology and data used were not presented, Department of Fisheries and Oceans (2005) estimated that there were 1,900 Belugas in this population in the 1880s.

The first systematic surveys were flown in 1982 and additional surveys took place at intervals through 2008, resulting in no on-transect or within-strip observations of Belugas (Hammill *et al.* 2004, 2018a). Small groups continued to be seen and reported by land-based observers through 1993 (Doidge *et al.* 1994) and an Inuit knowledge study in 2019 found that Belugas "are definitely still seen in the southern Ungava Bay estuary" during July-September (NMRWB 2019). A Bayesian analysis that used on- and off-transect data from surveys and applied a correction factor for availability bias produced an estimate of 32 individuals (95% CI 0–94) in 2011 (Doniol-Valcroze and Hammill 2012). No more recent estimate is available (Hammill *et al.* 2018a).

Fluctuations and Trends

All sources indicate a major decline in this population (Hammill *et al.* 2004). Reeves and Mitchell (1989) inferred from direct counts and catch statistics that only a few hundred Belugas continued to congregate annually in the Mucalic (= Marralik) River mouth in the 1960s-1970s. With continued hunting pressure through the 1980s (Reeves and Mitchell 1989), the UB population was very nearly extirpated. Despite a total allowable take of ten whales per year in the 2011-2013 management plan, 17 Belugas were landed by hunters in southern Ungava Bay in the summer of 2011 (Doniol-Valcroze and Hammill 2012). According to the Inuit knowledge study (NMRWB 2019), small groups of Belugas were “often sighted” by a study participant who had flown over the area every summer (late July and August) since the 1980s, and “numbers have not appeared to change over that time.”

## DU5: Western Hudson Bay (WHB) Population

Abundance

The first, very crude estimate of 5,000-10,000 Belugas in western Hudson Bay was based on aerial counts in 1965 centred on estuaries between 56º-61ºN (Sergeant 1973); the same estimate was later characterized as “near 10,000 animals” (Sergeant and Brodie 1975). In 1987, Richard *et al.* (1990) carried out strip census and photographic aerial surveys of the entire coast of western Hudson Bay and estimated total abundance (uncorrected) as 23,000 (95% CI 11,000-56,500). Richard (2005) carried out the first comprehensive survey of this population in 2004. The most recent (and presumably best) bias-corrected estimate of 54,473 (CV = 0.098, 95% CI = 44,988– 65,957) was obtained from a combined visual and photographic aerial survey in 2015 (Matthews *et al.* 2017). It is noteworthy that the 2015 surveys did not cover the coast of Ontario, where ~14,800 Belugas were estimated during the 2004 survey (Richard 2005), therefore the total abundance of the WHB population may be even higher than estimated in 2015 although some, most, or all of the Belugas along the Ontario coast could be part of the James Bay population (see later). At the same time, it should be noted that Belugas, presumably belonging to the WHB population, have not been counted or surveyed in northwestern Hudson Bay where they are present (and hunted from Arviat) in August, which is when the above-cited 2015 aerial survey was conducted (Ferguson 2019).

Fluctuations and Trends

From 1977 to 2015, 503 Belugas (range 252-784, including struck and lost; Hammill *et al.* 2017a) were removed annually from the WHB population by hunting communities around Hudson Bay and Hudson Strait (including Sanikiluaq). Matthews and Ferguson (2018) concluded that this has been sustainable given that the survey data since 2004, indicates an essentially stable WHB population.

## DU6: Eastern Hudson Bay (EHB) Population

Abundance

Seven range-wide systematic aerial surveys of this population were conducted between 1985 and 2015 (Hammill *et al.* 2018b). The point estimates of abundance from all of these surveys (corrected for availability but not perception bias, and adjusted to incorporate counts of whales in estuaries) were between around 2700 and 4300 Belugas (Hammill *et al.* 2018b). The 1985 estimate was 4282 Belugas (CV=0.13) and the 2015 estimate was 3819 (CV = 0.43) (Gosselin *et al.* 2017).

Fluctuations and Trends

A density-dependent model fitted to the seven abundance estimates (1985-2015) and the available harvest data (1974-2016) indicated that the population continued to decline even after catch limits were introduced in the 1980s, apparently because catches remained excessive, with an estimated decline in total population from 6,600 (95% CI=4,800-9,300) in 1974 to 3,100 in 2001 and 3,400 (95% CI=2,200-5,000) in 2016, implying a reduction of approximately 50% over two generations (Hammill *et al.* 2017a, 2018b). However, abundance estimates may include whales from other DUs (primarily WHB and JB) which have had larger and more stable populations, thus leading to an overestimate of the size and an underestimate of the depletion for EHB. Harvest levels between 1933 (3 generations ago) and 1974 may not have allowed much, if any, population recovery from commercial hunts (Hammill *et al.* 2018b). Since the early 2000s, hunting effort has been directed toward these other DUs to reduce the taking of EHB whales, and the population may have stabilized (Hammill *et al.* 2018b). Modelling suggests numbers have been approximately stable since 1985 (Hammill *et al.* 2018b). Better information is needed on the stock affiliations of whales present in the region at the times of the surveys (NAMMCO 2018).

## DU8: James Bay (JB) Population

Abundance

A series of seven systematic aerial surveys of James Bay from 1985 through 2015 confirmed that this is a relatively large population, probably consisting of at least 10,000 Belugas (Hammill *et al.* 2018c). The estimate from the 2015 survey (corrected for availability bias) was 10,615 (CV=0.25) (Gosselin *et al.* 2017). There is uncertainty concerning whether the Belugas observed along the Ontario coast belong to this population or the WHB population.

Fluctuations and Trends

Modelling that incorporated all available data on both abundance and harvest suggested an increasing trend since 1985, but the question of whether there is an influx of animals in some years, possibly from the Ontario coast, is a confounding factor (Hammill *et al.* 2018c). Trends prior to 1985 are uncertain. In any event, there is no indication of any decline in the James Bay population.

# THREATS AND LIMITING FACTORS

## Threats - General

Belugas are vulnerable to the cumulative effects of various threats, which are described here for Belugas in general in Canada (in no particular order). Following this general section, separate Threats subsections are given for each of the six DUs for which a Threats Calculator was completed.

Overhunting

Intensive commercial exploitation substantially reduced abundance of some Beluga populations (e.g. those in Cumberland Sound, Ungava Bay, and eastern Hudson Bay), usually with continued hunting for local subsistence and inter-settlement trade in muktuk; there is some ambiguity in how “commercial” is defined with respect to Beluga hunting. Regardless, large-scale commercial hunting had ceased by the 1960s or 1970s (Sergeant and Brodie 1975; Kemper 1980; Reeves and Mitchell 1989). Belugas were apparently extirpated from some areas where they were once common (Reeves and Mitchell 1987a, 1987c, 1989; Hammill *et al.* 2004). The impacts of severe reductions are long-lasting and can be irreversible simply due to the effects of demographic and environmental stochasticity and possibly also the disruptive effects on behaviour and social structure (Wade *et al.* 2012). As explained under PROTECTION, STATUS AND RANKS (below), current co-management arrangements in most areas are thought to be adequate for preventing further declines caused by non-commercial overhunting. However, even though the mandate of co-management boards may include “restoration” or “revitalization” of depleted populations, defining and meeting recovery objectives for such populations, given the need to balance protection with Aboriginal harvesting rights, remains a major challenge (Hammill *et al.* 2017b).

Noise Disturbance

The importance of underwater noise as a threat to cetaceans has become increasingly evident as research has progressed and as the spatial scale of such noise has widened and its intensity has grown. The Beluga’s exceptional acoustic complexity (see Vergara and Mikus 2019 and contained references) makes anthropogenic underwater noise an important consideration for conservation management.

Inuit hunters in many areas have long been aware that Belugas respond to the noise of the relatively small, powered vessels and snowmobiles that are used for transportation and hunting in maritime communities throughout northern Canada (Kilabuk 1998). This disturbance can have both short-term and long-term effects on the whales' behaviour and distribution. Inuit in Cumberland Sound have reported that Belugas are thinner than in the past and they attribute this to the increased energy spent to avoid boat traffic (Kilabuk 1998).

A resident of Tuktoyaktuk noted at the Global Review workshop in 2017 (NAMMCO 2018) that the Inuvialuit are concerned about the rapidly increasing ship traffic into and through the Northwest Passage (for tourism, cargo, research, etc.). They worry that such traffic can force Belugas into narrow passages where they are at increased risk of ice entrapment. Controlled experiments in the St. Lawrence Seaway found that the vocal behaviour of Belugas, and presumably the efficiency of their communication, was affected by both the low-frequency noise of a ferry that moved slowly and regularly on a predictable path and the higher-frequency noise from a small outboard motorboat moving rapidly and erratically through the study area (Lesage *et al.* 1999). The potential for vessel noise to mask Beluga communication sounds depends on numerous factors including the behavioural and environmental context as well as vessel characteristics (Pine *et al.* 2018). In general, Belugas' reactions to vessels "range from great tolerance to extreme sensitivity, apparently depending on whale activities and experience, habitat, boat type, and boat behaviour" (Richardson *et al.* 1995 p 255).

There is no evidence that Belugas are frequently struck by vessels, likely because of their highly accurate auditory system and their ability to evade vessels that are on a predictable trajectory. This can mean, however, that they are easily displaced from habitat that is critical to them for one reason or another (NAMMCO 2018).

Belugas in the Canadian High Arctic exhibited a strong avoidance reaction to an approaching icebreaker at distances of 35-50 km and their acoustic behaviour ("presumed alarm vocalizations") suggested that they were aware of the icebreaker when it was 80 km away. The whales deserted the area as the icebreaker passed through and did not return for nearly two days (Finley *et al.* 1990). Pod integrity, surfacing and diving behaviour, and call types also changed. It was assumed at the time (1982-1984) that the whales in this region were naïve to this acoustic source. Observations of Belugas in the same area in 1986 generally confirmed a high degree of responsiveness to icebreaker noise (Cosens and Dueck 1993). A modelling study of the "zones of impact" for Belugas around a Canadian Coast Guard icebreaker in the Beaufort Sea suggested that it would be audible at distances of 35-78 km, affect behaviour at slightly smaller distances, mask communication signals at 14-71 km, and temporarily damage hearing at 1-4 km if exposed for 20 min or longer (Erbe and Farmer 2000).

The very loud underwater noise from seismic surveys is widespread in high latitudes, including parts of the range of Belugas (Moore *et al.* 2012; Kyhn *et al.* 2019). Studies in the eastern Beaufort Sea found Beluga densities to be lower than expected within 20 km of an operating seismic vessel and higher than expected 20-30 km away from it, suggesting a strong aversive reaction (Miller *et al.* 2005). Again, it was assumed that the whales in that area were naïve to seismic airgun noise.

In a detailed analysis of the soundscape during four concurrent marine seismic surveys in eastern Baffin Bay in 2012, Kyhn *et al.* (2019) reached a number of important conclusions regarding the potential for impacts of seismic survey noise on Belugas even though, in this instance, Narwhals were of much greater concern than Belugas given the timing and location of the surveys. They concluded that "noticeable energy at higher frequencies all the way to ranges of about 14km from the source … impl[ies] that high-frequency species, such as toothed whales [including Belugas], may react at these distances – much beyond the line of sight." They further concluded that even though mitigation measures such as deploying marine mammal observers on seismic vessels and enforcing safety zones around the airgun array can mitigate the threat of physiological damage to hearing, they do little or nothing to reduce masking or behavioural effects which are "likely to occur far away from the ship, orders of magnitude beyond visual range of the observers."

<u>Climate Change</u>

Climate change likely has been affecting and will continue to affect the behaviour and ecology of Belugas. Determining the net effects of climate change, however, in terms of both direction and scale as well as causal mechanisms, will continue to be a challenge. A circumpolar analysis that attempted to compare the "sensitivity" of all Arctic marine mammals to "climate-induced habitat change" ranked the Beluga as "moderately sensitive" (Laidre *et al.* 2008).

The reduction of sea ice in Cumberland Sound (DU3) has been associated with increased availability of Capelin and decreased availability of Arctic Cod as prey (Watt *et al.* 2016). There is clear evidence that this has caused a change in the consumption patterns of CS Belugas (Marcoux *et al.* 2012; Watt *et al.* 2016), but how such a change has affected or might ultimately affect the whale population is uncertain. The distribution of Belugas that overwinter in Disko Bay (Greenland; DU2) has undergone a dramatic change in recent decades: the whales have expanded their distribution westward "as new areas on the banks off West Greenland open up earlier in spring with reduced sea-ice coverage or early annual ice recession" (Heide-Jørgensen *et al.* 2010). Changes in Beluga phenology in response to changes in the timing of autumn freeze-up appear to differ across populations. For example, the timing of migration of Eastern Beaufort Sea Belugas (DU1) was found to be unrelated to freeze-up timing and remained the same between an "early" period (1993–2002) and a "late" period (2004–2012), whereas over the same timeframe the nearby Eastern Chukchi Sea population delayed initiation of its westward migration out of the western Beaufort and eastern Chukchi seas by 2-4+ weeks (Hauser *et al.* 2016). Analyzing the same data set, Hauser *et al.* (2018) found that as ice conditions changed between the “early” period of heavy ice cover and the “late” period with less ice, the Eastern Chukchi Sea Belugas engaged in longer, deeper dives, presumably foraging. This could be interpreted as negative – in the absence of ice cover the whales are forced to expend more energy to find prey, or positive – the lack of ice cover gives them access to “new” (i.e. previously inaccessible due to ice cover) foraging habitat.

Many of the effects of climate change are bound to be less direct and related to changes in human activity. Climate change is allowing the scale of certain activities, notably shipping (Halliday *et al.* 2017; McWhinnie *et al.* 2018), oil and gas development, other mining, tourism, and commercial fishing, to increase in areas previously covered with heavy ice (Reeves *et al.* 2014). These developments all have the potential to affect Belugas, bringing greater risk of entanglements and oil spills, more exposure to noise, more competition for prey, and alterations in pathogen transmission. A few of the changes brought by climate change could be beneficial to Belugas in some respects although it is not clear whether the apparent benefits will prove to be long-term and whether they will be sufficient to offset the negative effects of climate change. For example, hunters in Disko Bay (West Greenland) now have more difficulty catching Belugas because the animals’ distribution has shifted farther offshore because of reduced sea ice along the coast (Heide-Jørgensen *et al.* 2010). This appears to have contributed to a substantial decline in removals by hunting. Heide-Jørgensen *et al.* (2010) also noted the absence of large-scale ice entrapments of Belugas in Disko Bay since 1990 and suggested that this could also be explained by the reduction of sea ice there. Fewer entrapments would mean less “natural” mortality (e.g. suffocation, predation by Polar Bears) as well as fewer opportunistic removals by hunters (see Heide-Jørgensen *et al.* 2002).

Another indirect effect of the loss of sea ice due to climate change is that less ice coverage makes Belugas more accessible to Killer Whales.

<u>Industrial Development</u>

Offshore oil and gas development is a major cause for concern in many areas inhabited by Belugas (Gavrilchuk and Lesage 2014). It not only brings the risk of oil leaks and spills from accidents during drilling, extraction, and transport (via pipelines or tankers), but also introduces both episodic loud underwater noise (seismic surveys, pile driving, dynamic positioning of ships) and chronic continuous noise (drilling, ship traffic) to the surrounding environment. As stated in the 2017 Global Assessment report (NAMMCO 2018): “Besides shipping (for supply and export) and seismic surveys, offshore oil and gas development normally requires construction or upgrading of infrastructure (e.g. platforms, drilling rigs, pipelines, sometimes artificial islands). This becomes a nearly constant localized source of underwater noise for years or decades. The rigs themselves are a constant source of noise. Port development involves dredging, pile-driving, as well as support shipping.”

The Mary River Iron Mine on northern Baffin Island has been the subject of much concern because of its likely impacts on marine mammals, including Belugas (Stewart *et al.* 2012; Department of Fisheries and Oceans 2014). The ranges and/or migration routes of

Eastern High Arctic – Baffin Bay (DU2), Western Hudson Bay (DU5), and Eastern Hudson Bay (DU6) Belugas all appear to overlap with the port of Milne and the yet-to-be-built port at Steensby, and the shipping lanes associated with these ports. Ice-breaking is already happening on shoulder seasons associated with the Milne port. DFO science advice on the Baffinland Mary River Project Phase 2 proposal to increase shipping from 6mT to 12mT annually is available at http://www.dfo-mpo.gc.ca/csas-sccs/Publications/ScR-RS/2019/2019_015-eng.html (February 2019), http://www.dfo-mpo.gc.ca/csas-sccs/Publications/ScR-RS/2019/2019_031-eng.html (July 2019), and http://www.dfo-mpo.gc.ca/csas-sccs/Publications/ScR-RS/2019/2019_038-eng.html (September 2019). Other relevant technical documents are available on the Nunavut Impact Review Board's website at https://www.nirb.ca/application?strP=r.

Another project of concern is the Oceanic Iron Ore Corporation's mine near Aupaluk (Cape Hopes Advance) in southwestern Ungava Bay (NAMMCO 2018). This project will involve port construction (projected for 2019-2021) and year-round shipping (with ice-breaking), probably mainly to markets in Asia (http://oceanicironore.com/_resources/presentations/17_04_2017_Oceanic_Iron_Ore_Investor_Presentation_APR.pdf; Ferguson 2019).

Chemical Pollution

Pollution from urban centres, industry, agriculture, mines, and military operations is pervasive in the world's oceans. Pollutants enter the habitat of Belugas and their prey through riverine discharge, ocean currents, and atmospheric transport as well as from local point sources such as sewage outfalls and factory or mine discharges.

The relatively high burdens of contaminants in SLE (DU7) Belugas, especially organochlorine, organotin, organobromine, and perfluorinated compounds used in industry, agriculture, and consumer products, have been a major concern for many decades (COSEWIC 2016). Their tissues have significantly higher concentrations of most contaminants than those of Belugas in other Canadian populations (Department of Fisheries and Oceans 2012, p 51). Organochlorine concentrations in EBS (DU1) Belugas have been monitored for several decades and declines since the 1970s, post-regulation, have been documented for most of these compounds (Noël *et al.* 2018). Broadly similar patterns throughout the Arctic have been documented for some other industrial pollutants (Rigét *et al.* 2019). However, there is concern that climate change will lead to the "re-introduction" of various legacy contaminants into Arctic aquatic food webs as it affects contaminant cycling, deposition, and processing (Noël *et al.* 2018).

Mercury and other heavy metal levels in Beluga tissues have been monitored extensively in many parts of the Canadian Arctic and sub-Arctic, and, as is true of the other contaminants mentioned above, levels of mercury and lead in northern Belugas tend to be several times lower than those in St. Lawrence animals (Department of Fisheries and Oceans 2012 p 58). According to R.E.A. Stewart (2019), mercury levels are generally higher in Belugas that frequent peat-drainage estuaries than in those that frequent alpine-fed estuaries, and the influence of climate change on exposure to heavy metals may vary across DUs. A recent review concluded that concentrations of methylmercury (MeHg) in beluga cerebellum are sufficiently high to have the potential to cause significant neurochemical changes, “but probably not high enough to cause overt MeHg neurotoxicity” (Scheuhammer *et al.* 2015). There is some evidence to suggest that selenium, which also accumulates in Beluga tissues, at least partially protects them from methylmercury neurotoxicity (Lemes *et al.* 2011; Ostertag *et al.* 2014; Scheuhammer *et al.* 2015).

Ingestion of plastic debris and microplastics is a growing concern for many marine organisms, including cetaceans (Guzzetti *et al.* 2018).

Fisheries

Belugas are generally not considered to be as susceptible to entanglement in fishing gear (“bycatch”) as are many cetaceans, possibly in part because of their exceptionally acute echolocation capabilities as well as their ability to swim backwards (enabling them to wriggle free of large-mesh netting) (NAMMCO 2018). It is worth noting, however, that very little monitoring of bycatch occurs in the remote areas they inhabit. Also, in some areas with subsistence hunting, whales caught in fishing gear might be reported as catch (“opportunistic harvest”) rather than as by-catch (NAMMCO 2018). It is also worth noting that Belugas were historically, and still are in some places, deliberately caught with nets.

Although competition with fisheries is a concern, there is little evidence to determine if, or how, it affects Belugas. The recent COSEWIC assessment of the St. Lawrence Estuary Beluga population (COSEWIC 2014) contended that fisheries “can cause decreased abundance, quality and availability of Beluga prey as well as ecosystem-wide changes,” noting that changes in the population dynamics of the St. Lawrence population had coincided with “the collapse of some overexploited fish stocks.” However, Plourde *et al.* (2014), one of the sources cited to support the contention that overfishing was responsible for the collapse of prey stocks (e.g. Atlantic Herring, *Clupea harengus*), emphasized the potential role of physical and other biological factors in an apparent regime shift that made the estuarine ecosystem less favourable to Belugas beginning around 1998 (worsening after 2009). Competition with fisheries for Greenland Halibut and shrimp in Baffin Bay, Davis Strait, and Hudson Strait is a significant concern for Narwhals (NAMMCO 2018), and might also be for Belugas to the extent that they prey on these organisms, especially during the winter (Watt *et al.* 2016). The NMRWB and its co-management partners are concerned about the bycatch of Arctic Cod (important prey of Belugas) in the shrimp fishery (NMRWB 2019).

## Threats, by DU, According to Threats Calculator

In this section the threats are categorized following the IUCN-CMP (International Union for Conservation of Nature – Conservation Measures Partnership) unified threats classification system. For each DU, they are listed in order of decreasing severity of impact (greatest to least), ending with those for which scope or severity is unknown.

DU2 (Eastern High Arctic – Baffin Bay)

- 9. Pollution, 9.6. Excess energy. See Threats – General. Noise Disturbance. Medium-low impact.

- All other threats judged to have Negligible or Unknown impact.

DU3 (Cumberland Sound)

- 5. Biological resource use, 5.4. Fishing & harvesting aquatic resources. See Threats – General. Overhunting. High impact.

- 9. Pollution, 9.6. Excess energy. See Threats – General. Noise Disturbance. Low impact.

- All other threats judged to have Negligible or Unknown impact.

DU4 (Ungava Bay)

- 5. Biological resource use, 5.4. Fishing & harvesting aquatic resources. See Threats – General. Overhunting. Very high impact.

- 9. Pollution, 9.6. Excess energy. See Threats – General. Noise Disturbance. Medium-low impact.

- All other threats judged to have Negligible or Unknown impact.

DU5 (Western Hudson Bay)

- 9. Pollution, 9.6. Excess energy. See Threats – General. Noise Disturbance. Medium-low impact.

- All other threats judged to have Negligible or Unknown impact.

DU6 (Eastern Hudson Bay)

- 5. Biological resource use, 5.4. Fishing & harvesting aquatic resources. See Threats – General. Overhunting. Medium-low impact.

- 9. Pollution, 9.6. Excess energy. See Threats – General. Noise Disturbance. Medium-low impact.

- All other threats judged to have Negligible or Unknown impact.

DU7 (St. Lawrence Estuary)

- Assessed separately (COSEWIC 2014).

DU8 (James Bay)

- 9. Pollution, 9.6. Excess energy. See Threats – General. Noise Disturbance. Low impact.

- All other threats judged to have Negligible or Unknown impact.

## Limiting Factors

Predation, an obvious limiting factor, is discussed above under BIOLOGY: Interspecific Interactions and again under THREATS: Climate Change.

Ice Entrapment

Ice entrapment affects Beluga populations (Siegstad and Heide-Jørgensen 1994; Stewart *et al.* 1995) and occurs relatively frequently in some areas, such as the network of narrow, relatively deep "lakes" (*Imaryuk* or Husky Lakes) that link Liverpool Bay to the Beaufort Sea near Tuktoyaktuk (Postma *et al.* 2018), and Disko Bay, West Greenland (Siegstad and Heide-Jørgensen 1994; Heide-Jørgensen *et al.* 2002). The frequently large scale of entrapment-caused mortality experienced by the Eastern High Arctic – Baffin Bay population (DU2) (between 1970 and 1990 close to 3000 Belugas died in 9 ice-entrapments in Disko Bay alone) is of particular concern (Siegstad and Heide-Jørgensen 1994) although, as noted above, the incidence of entrapments in Disko Bay may be declining as sea ice recedes (Heide-Jørgensen *et al.* 2010).

Disease

Belugas, like all other marine mammals, are exposed to a number of diseases that may influence individual and population health (Gulland and Hall 2005). There are many ways in which climate change is expected to affect disease exposure and transmission in high latitudes where Belugas, until recently, were relatively unaffected by pathogens (Burek *et al.* 2008).

There is a high prevalence of *Toxoplasma gondii*, an intracellular protozoan parasite known to infect warm-blooded vertebrates with sometimes fatal consequences, in St. Lawrence Belugas (Iqbal *et al.* 2018). Serological screening has revealed exposure to morbillivirus, *Toxoplasma*, and *Brucella* spp. in Belugas from the Sea of Okhotsk (Alekseev *et al.* 2009) and *Brucella* antibodies reportedly have also been found in Beaufort Sea Belugas (COSEWIC 2004).

Harmful Algal Blooms

Algal toxins are a concern and both saxitoxin and domoic acid have been documented in the tissues of Belugas in Alaska where, however, prevalence is not exceptionally high compared to other marine mammals (Lefebvre *et al.* 2016). Several Belugas died during a multispecies mass mortality event in the St. Lawrence Estuary in summer 2008 that was linked to an intense bloom of the toxic dinoflagellate *Alexandrium tamarense* (Starr *et al.* 2017). While toxic algal blooms occur naturally, there is increasing evidence that human actions (including those that have enhanced ocean warming) have increased the spatial extent, frequency, and severity of these events (Van Dolah 2000; McCabe *et al.* 2016).

## Number of Locations

There is no clear way to designate geographically or ecologically distinct areas in which a single threatening event could rapidly affect all individuals present. Therefore, the concept of location was not applied to any DU in this report.

# PROTECTION, STATUS AND RANKS

## Legal Protection and Status

Overall Framework in Canada

The first legal protection of Belugas came from regulations under the *Fisheries Act* in 1949 which required a licence to hunt in certain areas (not including the High Arctic or St. Lawrence Estuary) (Kemper 1980; see Reeves and Mitchell 1989, their Table 2). Inuit and RCMP officers were exempt on the condition that products of the hunt were used only for domestic purposes (including both human food and dog food). In 1962 the Beluga regulations were revised to allow and encourage sport hunting (under quota) in the Mackenzie Delta and Whale Cove, and later also at Churchill (Kemper 1980). In 1966 additional changes in the regulations made it legal for non-Native residents of remote areas to hunt Belugas for subsistence while preventing all subsistence users, Native and non-Native alike, from selling or bartering whale products to outside communities (Kemper 1980).

In more recent years, owing in large part to land-claims agreements and ensuing co-management arrangements, the legal and regulatory process has shifted to stock-by-stock limits on harvest levels, area closures to hunting, and other measures set out through local or regional bodies. Three main land-claims agreements are relevant to Beluga co-management in Canada – the Inuvialuit Final Agreement of 1984 (as amended) (relevant to DU1), the Nunavut Land Claim Agreement of 1993 (relevant primarily to DUs 2, 3, and 5), and the Nunavik Inuit Land Claims Agreement of 2006 (relevant primarily to DUs 4, 6, and 8). Supported co-management frameworks arising from land claim agreements are an important tool for Inuit peoples and federal, provincial and territorial governments, working together to achieve long-term Beluga recovery and protect Inuit harvesting rights.

Multilateral Commitments

Canada was a charter signatory to the 1946 International Convention for the Regulation of Whaling and participated regularly in the work of the International Whaling Commission (IWC) through 1981, but withdrew its membership in 1982 and no longer participates officially in that body's stock assessment or other work related to Belugas (see International Whaling Commission 1993; 2000).

Canada is a signatory to the 1973 Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). The Beluga is listed in CITES Appendix II, which includes "species not necessarily threatened with extinction, but in which trade must be controlled in order to avoid utilization incompatible with their survival" (CITES homepage). For export or re-export of Appendix II specimens, an export permit or re-export certificate issued by the national management authority is required, and an export permit may be issued "only if the specimen was legally obtained and if the export will not be detrimental to the survival of the species."

The bilateral Canada-Greenland Joint Commission on Beluga and Narwhal was established in 1991 under terms of a Memorandum of Understanding between the Department of Fisheries and Oceans (DFO) and the Ministry of Fisheries and Hunting of the Greenland Home Rule Government (Richard and Pike 1993). This commission meets biennially to review reports of its three working groups (Scientific, Traditional Knowledge, and User to User) and issues recommendations to authorities in both countries.

Although Canada is not a member of the regional North Atlantic Marine Mammal Commission (NAMMCO), Canadian government and non-government scientists as well as representatives of subsistence hunting communities participate regularly in NAMMCO's Beluga stock assessments and other relevant work (see https://nammco.no/). The various NAMMCO working groups coordinate closely, as appropriate, with those of the Canada-Greenland Joint Commission.

COSEWIC Status, by DU

The St. Lawrence Estuary (not part of this status report but assessed by COSEWIC November 2014) and Cumberland Sound populations are on SARA Schedule 1 (as Endangered and Threatened, respectively). Other Beluga populations with previous COSEWIC assessments but no SARA status are: Eastern Hudson Bay, Eastern High Arctic – Baffin Bay, Ungava Bay, Eastern Beaufort Sea (not part of this status report), and Western Hudson Bay.

Current Management Policies, by DU

The various measures in place for each DU (other than the SLE DU) are summarized separately below:

*Eastern High Arctic – Baffin Bay DU*

Management for this population is complicated because it is hunted over a wide area and during much of the year – by 12 Nunavut communities in Canada and 12 municipalities in West Greenland (Ferguson and Hansen 2018). No catch limits apply to the hunting in Canada but winter hunting in Greenland is subject to a quota based on scientific advice from the Joint Commission (see Multilateral Commitments). This is the only Beluga population that is considered a "shared stock" with Greenland and is, as a consequence, jointly assessed and at least partially managed within the remit of the Joint Commission.

*Cumberland Sound DU*

This population was subject to intensive commercial and subsistence hunting historically, and it is one of the few Beluga populations that are currently believed to be declining and overharvested (NAMMCO 2018). Although CS Belugas are hunted almost entirely by hunters from Pangnirtung and outpost camps along the shores of the sound, the population has been the focus of management concern for many decades, and numerous efforts have been made to limit the hunting pressure (e.g. Kemper 1980; Brodie *et al.* 1981; Richard and Pike 1993). The previous COSEWIC report stated, "A recovery strategy for this population is being developed by Fisheries and Oceans Canada in collaboration with the Pangnirtung HTA [hunters and trappers association], Qikiqtaaluk Wildlife Board, Nunavut Wildlife Management Board and Nunavut Tunngavik Inc…" and it was noted that the annual allowable catch was 41 Belugas landed (COSEWIC 2004). The annual catch limit of 41 Belugas landed has not changed even though all analyses indicate that greatly reduced removal levels would be needed to achieve the stated DFO management objective of seeing the population increase to 5,000 by 2091, with an interim target of 1,235 within the next 10 years (Marcoux and Hammill 2016; Department of Fisheries and Oceans 2016; Matthews 2018). Without better abundance and harvest data, Hammill *et al.* (2017b) were unable to produce a "precautionary reference level" for application to CS Beluga hunt management.

*Ungava Bay DU*

In 1986 a system of quotas was implemented in Ungava Bay, and the Mucalic River estuary was closed to hunting (Lesage *et al.* 2001). The most recent official document on "harvest advice" for Ungava Bay Belugas simply stated that no survey could be conducted in 2011 because of inclement weather and that previous assessments concluded that "any harvest' from this population posed a threat to its recovery (Department of Fisheries and Oceans 2013). The advice document also noted that 10 Belugas had been taken during the summer and two during the fall in Ungava Bay in 2012, and that summer hunting minimizes the number of Eastern Hudson Bay Belugas that are killed in Ungava Bay but increases the probability that whales from the Ungava Bay DU will be killed.

*Western Hudson Bay DU*

There are no specific management or co-management arrangements for this population because the combined annual removals by communities throughout its extensive range in Hudson Bay, Hudson Strait, and Ungava Bay are considered sustainable (Hammill *et al.* 2017a; Department of Fisheries and Oceans 2018). Under the Nunavut Land Claims Agreement, there is no right to limit harvesting by Inuit unless there is a demonstrated conservation issue (Richard 2019).

*Eastern Hudson Bay DU*

In the 1980s, limits were placed on harvesting through a combination of Total Allowable Take (TAT) and seasonal closures of the Nastapoka and Little Whale rivers (Hammill *et al.* 2018b; Department of Fisheries and Oceans 2018). Harvesting was closed in the EHB area from 2001 to 2006, and closures of the Nastapoka and Little Whale River estuaries have remained in place since harvesting resumed in 2007 (Hammill *et al.* 2018b; Department of Fisheries and Oceans 2018). Harvest levels are set by the Nunavik Marine Region Wildlife Management Board based on 3-year plans with specified management objectives. The objective of the 2015-2017 plan was to maintain a constant population (Hammill *et al.* 2018b).

There is no TAT for the Nunavut village of Sanikiluaq on the Belcher Islands where some EHB Belugas are hunted. However, harvesting by Sanikiluaq is limited by a local agreement to not harvest between 15 July and 30 September, the period when EHB Belugas are most likely to be present (Hammill *et al.* 2018b; Department of Fisheries and Oceans 2018).

*James Bay DU*

Catch information is collected and reported to DFO on a weekly basis. Beluga hunting in James Bay is not subject to any limits and is conducted mainly by hunters from the eastern Hudson Bay coast who were encouraged to redirect their effort away from EHB Belugas and instead take James Bay Belugas. Hunting removals from the James Bay population have remained very small in relation to the level that is thought to be sustainable (Hammill *et al.* 2018c).

## Non-Legal Status and Ranks

NatureServe considers the species as a whole secure (G5) but several populations in Canada are recognized as being at risk. The IUCN Red List considers the Beluga as Least Concern globally (Lowry *et al.* 2017); one population (Cook Inlet, Alaska) is red-listed separately and assessed as Critically Endangered (Lowry *et al.* 2019).

## Habitat Protection and Ownership

Apart from the protections afforded to the Beluga's Critical Habitat in the St. Lawrence Estuary, there is little legal protection of the species' habitat in Canada. The Tarium Niryutait Marine Protected Area in the Mackenzie Delta was designated in 2010 (Canada's first Arctic MPA) and it is designed and managed with the explicit objective "To conserve and protect beluga whales and other marine species (anadromous fish, waterfowl and seabirds), their habitats and their supporting ecosystem" (http://www.dfo-mpo.gc.ca/oceans/mpa-zpm/tarium-niryutait/index-eng.html). A second MPA, Anguniaqvia niqiqyuam, was established, also in the Mackenzie Delta and also to benefit Belugas, in 2016 (Loseto *et al.* 2018).

In 2019, Tallurutiup Imanga National Marine Conservation Area (NMCA) was established in Lancaster Sound by agreement between the Government of Canada (Parks Canada and Fisheries and Oceans Canada) and the Qikiqtani Inuit Association (QIA). The 108,000 km$^2$ NMCA is Canada's largest marine protected area. An interim management plan (IMP), including zoning framework, is currently in preparation by Canada, Nunavut and the QIA, and will incorporate Inuit harvest rights. Input will be sought from communities, stakeholders and the public as part of the IMP development process.

Discussions concerning the designation of an MPA in the Churchill River Estuary, in part to protect Beluga summering habitat, have been underway since early 2018 (https://www.cbc.ca/news/canada/manitoba/oceans-north-beluga-report-1.4627945).

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## BIOGRAPHICAL SUMMARY OF REPORT WRITER

Randall Reeves is a former co-chair of the COSEWIC Marine Mammals Specialist Sub-committee. He currently chairs the IUCN Species Survival Commission's Cetacean Specialist Group and the U.S. Marine Mammal Commission's Committee of Scientific Advisors. Of particular relevance to this report, he helped organize, conduct, and report on the recent Global Review of Monodontids and co-authored the 2017 Red List assessment of *Delphinapterus leucas*.

## COLLECTIONS EXAMINED

None.

# APPENDIX1. THREATS CALCULATORS FOR BELUGA

## Appendix 1a. Eastern High Arctic - Baffin Bay Beluga Threats Calculator.

| | | | | |
|---|---|---|---|---|
| **Species or Ecosystem Scientific Name** | Eastern High Arctic - Baffin Bay Population of Beluga, *Delphinapterus leucas* | | | |
| **Element ID** | | | **Elcode** | |
| **Date (Ctrl + ";" for today's date):** | 29/01/2020 | | | |
| **Assessor(s):** | Randall Reeves (writer), Hal Whitehead (Co-chair), Dwayne Lepitzki (facilitator), Karen Timm (Secretariat), Christina Davy, Ashley Kling, Kyle Ritchie, Mark Basterfield, Mike Hammill, Rob Stewart, Kim Parsons, John Ford, Colleen Arnison, Matthew Webb, Veronique Lesage, Marianne Marcoux, Arnaud Mosnier, Hayley Roberts, Aurelie Chagnon-Lafortune | | | |
| **References:** | draft calculator prepared by RR, reviewed by HW; 6-month provisional COSEWIC status report; ; telecon 29 Jan 2020 | | | |
| **Overall Threat Impact Calculation Help:** | | **Level 1 Threat Impact Counts** | | |
| | **Threat Impact** | | **high range** | **low range** |
| | A | Very High | 0 | 0 |
| | B | High | 0 | 0 |
| | C | Medium | 1 | 0 |
| | D | Low | 0 | 1 |
| **Calculated Overall Threat Impact:** | | | Medium | Low |
| **Assigned Overall Threat Impact:** | | | **CD = Medium - Low** | |
| **Impact Adjustment Reasons:** | | | | |
| **Overall Threat Comments** | | | Generation time 28.6 years therefore time period for scoring severity and timing is 85.8 years into the future. | |

| **Threat** | | **Impact (calculated)** | | **Scope (next 10 Yrs)** | **Severity (10 Yrs or 3 Gen.)** | **Timing** | **Comments** |
|---|---|---|---|---|---|---|---|
| 1 | Residential & commercial development | | | | | | |
| 1.1 | Housing & urban areas | | | | | | |
| 1.2 | Commercial & industrial areas | | | | | | Potential for military base to be developed in northern waters (e.g., Resolute Bay). Ship port development at some sites possible. |
| 1.3 | Tourism & recreation areas | | | | | | There is tourism centred on summer congregation areas (e.g. Cunningham Inlet) where some disturbance is possible, and cruise ship traffic through Lancaster Sound and other parts of the High Arctic archipelago could cause disturbance. Tour boats are considered in 6.1. |
| 2 | Agriculture & aquaculture | | | | | | |
| 2.1 | Annual & perennial non-timber crops | | | | | | |

| Threat | | Impact (calculated) | | Scope (next 10 Yrs) | Severity (10 Yrs or 3 Gen.) | Timing | Comments |
|---|---|---|---|---|---|---|---|
| 2.2 | Wood & pulp plantations | | | | | | |
| 2.3 | Livestock farming & ranching | | | | | | |
| 2.4 | Marine & freshwater aquaculture | | | | | | No aquaculture in species range at present. |
| 3 | Energy production & mining | | Negligible | Large (31-70%) | Negligible (<1%) | Moderate (Possibly in the short term, < 10 yrs/3 gen) | |
| 3.1 | Oil & gas drilling | | Negligible | Large (31-70%) | Negligible (<1%) | Moderate (Possibly in the short term, < 10 yrs/3 gen) | This activity brings multiple types of threat which are dealt with in other categories -- primarily oil contamination of the whales (Pollution 9.2) and their prey (direct mortality of Belugas 9.2, prey reduction 7.3), and noise associated with seismic surveys, construction of offshore structures (platforms, etc.), drilling noise, and vessel traffic. There is also some risk of ship strikes by vessels involved in these operations (including tanker transport) (Shipping Lanes 4.3). It is unclear how much of this activity is ongoing or likely to occur during the next 10 years in the range of this population (especially West Greenland, where these animals pass through and overwinter). However the population may travel to and overwinter in two different areas so scope and impact uncertain. |
| 3.2 | Mining & quarrying | | | | | | The Mary River iron ore mine on N Baffin Island is of great concern with regard to Narwhals but not so much Belugas. There is however ongoing concern about the noise (9.6) and ship strike risk (4.3) to Belugas as they migrate through Lancaster Sound to and from their summering areas. The noise disturbance as well as the physical changes in ice conditions caused by icebreaking operations (4.3) to enable marine traffic to and from the mine are additional concerns. Mining itself is not a threat but shipping of products may be. Not scored. |
| 3.3 | Renewable energy | | | | | | |
| 4 | Transportation & service corridors | | Negligible | Pervasive (71-100%) | Negligible (<1%) | High (Continuing) | |
| 4.1 | Roads & railroads | | | | | | |
| 4.2 | Utility & service lines | | | | | | |

| Threat | | Impact (calculated) | Scope (next 10 Yrs) | Severity (10 Yrs or 3 Gen.) | Timing | Comments |
|---|---|---|---|---|---|---|
| 4.3 | Shipping lanes | Negligible | Pervasive (71-100%) | Negligible (<1%) | High (Continuing) | Marine traffic (commercial, tourist, military, and research) through the Northwest Passage is increasing in both volume and areal extent and this trend is certain to continue. The noise and risks of ship strikes (assessed here) and oil spills (9.3) may affect this Beluga population during migration and possibly in areas important for feeding. |
| 4.4 | Flight paths | | | | | |
| 5 | Biological resource use | Negligible | Pervasive (71-100%) | Negligible (<1%) | High (Continuing) | |
| 5.1 | Hunting & collecting terrestrial animals | | | | | |
| 5.2 | Gathering terrestrial plants | | | | | |
| 5.3 | Logging & wood harvesting | | | | | |
| 5.4 | Fishing & harvesting aquatic resources | Negligible | Pervasive (71-100%) | Negligible (<1%) | High (Continuing) | This population is hunted in both Canada and West Greenland. The pervasive Scope is due to the fact that most individuals, and possibly the entire population, are susceptible to being targeted in one or more parts of the annual range. The scoring of Severity as negligible is due to the fact that levels of harvesting removals in Canada are small and those in Greenland are currently regarded as sustainable. Also, the population is relatively large and harvest levels are monitored, with regular assessment by NAMMCO and Canadian authorities. |
| 6 | Human intrusions & disturbance | Negligible | Pervasive (71-100%) | Negligible (<1%) | High (Continuing) | |
| 6.1 | Recreational activities | Negligible | Pervasive (71-100%) | Negligible (<1%) | High (Continuing) | Increasing tourism, but currently low impact |
| 6.2 | War, civil unrest & military exercises | Negligible | Unknown | Negligible (<1%) | High (Continuing) | |
| 6.3 | Work & other activities | Negligible | Pervasive (71-100%) | Negligible (<1%) | High (Continuing) | As noted in the status report, “everyday” boating activities by local people frequently involves directed or opportunistic hunting and "the noise from increasing use of outboards for hunting, and not necessarily the hunting per se, has contributed to declines of Belugas in some areas (NMRWB 2019)." Also see 9.6. Navy craft activity within the population's range in summer months. |
| 7 | Natural system modifications | Unknown | Unknown | Unknown | Unknown | |
| 7.1 | Fire & fire suppression | | | | | |
| 7.2 | Dams & water management/use | | | | | |

| Threat | | Impact (calculated) | | Scope (next 10 Yrs) | Severity (10 Yrs or 3 Gen.) | Timing | Comments |
|---|---|---|---|---|---|---|---|
| 7.3 | Other ecosystem modifications | | Unknown | Unknown | Unknown | Unknown | There is concern about potential by-catch of Arctic Cod in a developing Canadian shrimp fishery, but impacts are not well known (likely not impacting this particular population). Killer Whale (as a top predator) range expansion into areas inhabited by this population was discussed. |
| 8 | Invasive & other problematic species & genes | | | | | | Pathogens stated in Tech. Summary |
| 8.1 | Invasive non-native/alien species/diseases | | | | | | |
| 8.2 | Problematic native species/diseases | | | | | | Pressure of predation by Killer Whales is almost certainly affecting this population in both Canada and Greenland, and that pressure is increasing. |
| 8.3 | Introduced genetic material | | | | | | |
| 8.4 | Problematic species/diseases of unknown origin | | | | | | |
| 8.5 | Viral/prion-induced diseases | | | | | | |
| 8.6 | Diseases of unknown cause | | | | | | |
| 9 | Pollution | CD | Medium - Low | Pervasive (71-100%) | Moderate - Slight (1-30%) | High (Continuing) | |
| 9.1 | Domestic & urban waste water | | Negligible | Negligible (<1%) | Unknown | High (Continuing) | Potential local sources for contamination, but little information available. |
| 9.2 | Industrial & military effluents | | Unknown | Small (1-10%) | Unknown | High (Continuing) | Oil spills from pipelines, ships, port storage facilities, ship ballast. |
| 9.3 | Agricultural & forestry effluents | | | | | | |
| 9.4 | Garbage & solid waste | | Unknown | Pervasive (71-100%) | Unknown | High (Continuing) | Garbage dumps in communities, and disposal from ships. |
| 9.5 | Air-borne pollutants | | Unknown | Pervasive (71-100%) | Unknown | High (Continuing) | An issue for all Arctic mammals, of unknown consequence for Belugas. |
| 9.6 | Excess energy | CD | Medium - Low | Pervasive (71-100%) | Moderate - Slight (1-30%) | High (Continuing) | Belugas are critically dependent on sound for communication and echolocation (to navigate and find/capture food). This means that sound energy introduced by human activities can have significant impacts on their behavior and capabilities to carry out necessary life functions. There is evidence of very strong responsiveness to noise associated with icebreaking activity. Also see 6.3. |
| 10 | Geological events | | | | | | |
| 10.1 | Volcanoes | | | | | | |

| Threat | | Impact (calculated) | | Scope (next 10 Yrs) | Severity (10 Yrs or 3 Gen.) | Timing | Comments |
|---|---|---|---|---|---|---|---|
| 10.2 | Earthquakes/tsunamis | | | | | | |
| 10.3 | Avalanches/landslides | | | | | | |
| 11 | Climate change & severe weather | | Unknown | Pervasive (71-100%) | Unknown | High (Continuing) | |
| 11.1 | Habitat shifting & alteration | | Unknown | Pervasive (71-100%) | Unknown | High (Continuing) | Climate change is strongly affecting the habitat of Belugas throughout their range by changing ice conditions and increasing water temperatures, which in turn almost certainly affects the availability (locations, quantities, etc.) and possibly types of prey as well as the animals' vulnerability to predation. There is, as yet, no indication that the population might be 'benefiting' from access to previously unavailable feeding habitat or other types of habitat, or that changed environmental conditions are making these belugas less vulnerable to hunting. |
| 11.2 | Droughts | | | | | | |
| 11.3 | Temperature extremes | | | | | | |
| 11.4 | Storms & flooding | | | | | | |
| 11.5 | Other impacts | | | | | | |
| Classification of Threats adopted from IUCN-CMP, Salafsky *et al*. (2008). | | | | | | | |

# Appendix 1b. Cumberland Sound Beluga Threats Calculator.

| | | | | |
|---|---|---|---|---|
| **Species or Ecosystem Scientific Name** | Cumberland Sound Population of Beluga, *Delphinapterus leucas* | | | |
| **Element ID** | | | **Elcode** | |
| **Date:** | 29/01/2020 | | | |
| **Assessor(s):** | Randall Reeves (writer), Hal Whitehead (Co-chair), Dwayne Lepitzki (facilitator), Karen Timm (Secretariat), Christina Davy, Ashley Kling, Kyle Ritchie, Mark Basterfield, Mike Hammill, Rob Stewart, Kim Parsons, John Ford, Colleen Arnison, Matthew Webb, Veronique Lesage, Marianne Marcoux, Arnaud Mosnier, Hayley Roberts, Aurelie Chagnon-Lafortune | | | |
| **References:** | draft calculator prepared by RR, reviewed by HW; 6-month provisional COSEWIC status report; telecon 29 Jan 2020 | | | |
| **Overall Threat Impact Calculation Help:** | | | **Level 1 Threat Impact Counts** | |
| | **Threat Impact** | | **high range** | **low range** |
| | A | Very High | 0 | 0 |
| | B | High | 1 | 1 |
| | C | Medium | 0 | 0 |
| | D | Low | 1 | 1 |
| **Calculated Overall Threat Impact:** | | | High | High |
| **Assigned Overall Threat Impact:** | | | **B = High** | |
| **Impact Adjustment Reasons:** | | | | |
| **Overall Threat Comments** | | | Generation time 28.6 years therefore time period for scoring severity and timing is 85.8 years into the future. This population is on a negative trajectory due to overharvest. | |

| Threat | | Impact (calculated) | | Scope (next 10 Yrs) | Severity (10 Yrs or 3 Gen.) | Timing | Comments |
|---|---|---|---|---|---|---|---|
| 1 | Residential & commercial development | | | | | | |
| 1.1 | Housing & urban areas | | | | | | |
| 1.2 | Commercial & industrial areas | | | | | | |
| 1.3 | Tourism & recreation areas | | | | | | |
| 2 | Agriculture & aquaculture | | | | | | |
| 2.1 | Annual & perennial non-timber crops | | | | | | |
| 2.2 | Wood & pulp plantations | | | | | | |
| 2.3 | Livestock farming & ranching | | | | | | |
| 2.4 | Marine & freshwater aquaculture | | | | | | |

| Threat | | Impact (calculated) | | Scope (next 10 Yrs) | Severity (10 Yrs or 3 Gen.) | Timing | Comments |
|---|---|---|---|---|---|---|---|
| 3 | Energy production & mining | | | | | | |
| 3.1 | Oil & gas drilling | | | | | | |
| 3.2 | Mining & quarrying | | | | | | |
| 3.3 | Renewable energy | | | | | | |
| 4 | Transportation & service corridors | | Negligible | Pervasive (71-100%) | Negligible (<1%) | High (Continuing) | |
| 4.1 | Roads & railroads | | | | | | |
| 4.2 | Utility & service lines | | | | | | |
| 4.3 | Shipping lanes | | Negligible | Pervasive (71-100%) | Negligible (<1%) | High (Continuing) | Some local shipping |
| 4.4 | Flight paths | | | | | | |
| 5 | Biological resource use | B | High | Pervasive (71-100%) | Serious (31-70%) | High (Continuing) | |
| 5.1 | Hunting & collecting terrestrial animals | | | | | | |
| 5.2 | Gathering terrestrial plants | | | | | | |
| 5.3 | Logging & wood harvesting | | | | | | |
| 5.4 | Fishing & harvesting aquatic resources | B | High | Pervasive (71-100%) | Serious (31-70%) | High (Continuing) | This population has long been, and still is, hunted unsustainably. The pervasive Scope is due to the fact that most individuals, and possibly the entire population, are susceptible to being targeted throughout the population's range. The scoring of Severity as serious is due to the fact that levels of harvesting removals in Canada, thought to be unsustainable, are likely depleting the population such that in the next 3 generations the extent of decline should not be as great as 70% but it could be > 30% unless strong measures are taken, quickly, to reduce hunting pressure. Competition with fisheries is covered in 7.3. |
| 6 | Human intrusions & disturbance | | Negligible | Pervasive (71-100%) | Negligible (<1%) | High (Continuing) | |
| 6.1 | Recreational activities | | Negligible | Pervasive (71-100%) | Negligible (<1%) | High (Continuing) | |
| 6.2 | War, civil unrest & military exercises | | | | | | |
| 6.3 | Work & other activities | | Negligible | Pervasive (71-100%) | Negligible (<1%) | High (Continuing) | As noted in the status report, “everyday” boating activities by local people frequently involves directed or opportunistic hunting and "the noise from increasing use of outboards for hunting, and not necessarily the hunting per se, has contributed to declines of Belugas in some areas (NMRWB 2019)." Also see 9.6. |

| Threat | | Impact (calculated) | | Scope (next 10 Yrs) | Severity (10 Yrs or 3 Gen.) | Timing | Comments |
|---|---|---|---|---|---|---|---|
| 7 | Natural system modifications | | Negligible | Pervasive (71-100%) | Negligible (<1%) | High (Continuing) | |
| 7.1 | Fire & fire suppression | | | | | | |
| 7.2 | Dams & water management/use | | | | | | |
| 7.3 | Other ecosystem modifications | | Negligible | Pervasive (71-100%) | Negligible (<1%) | High (Continuing) | Potential reduction of prey by fisheries for turbot and shrimp (directly or through by-catch). Killer Whale (as a top predator) range expansion into this area was discussed. |
| 8 | Invasive & other problematic species & genes | | | | | | |
| 8.1 | Invasive non-native/alien species/diseases | | | | | | |
| 8.2 | Problematic native species/diseases | | | | | | |
| 8.3 | Introduced genetic material | | | | | | |
| 8.4 | Problematic species/diseases of unknown origin | | | | | | |
| 8.5 | Viral/prion-induced diseases | | | | | | |
| 8.6 | Diseases of unknown cause | | | | | | |
| 9 | Pollution | D | Low | Pervasive (71-100%) | Slight (1-10%) | High (Continuing) | |
| 9.1 | Domestic & urban waste water | | Negligible | Negligible (<1%) | Unknown | High (Continuing) | Whales currently spend little time near communities. |
| 9.2 | Industrial & military effluents | | Unknown | Small (1-10%) | Unknown | High (Continuing) | Ballast water was discussed but not likely of great impact. |
| 9.3 | Agricultural & forestry effluents | | | | | | |
| 9.4 | Garbage & solid waste | | Unknown | Pervasive (71-100%) | Unknown | High (Continuing) | |
| 9.5 | Air-borne pollutants | | Unknown | Pervasive (71-100%) | Unknown | High (Continuing) | |
| 9.6 | Excess energy | D | Low | Pervasive (71-100%) | Slight (1-10%) | High (Continuing) | Belugas are critically dependent on sound for communication and echolocation (to navigate and find/capture food). This means that sound energy introduced by human activities can have significant impacts on their behaviour and capabilities to carry out necessary life functions. The Severity score is not particularly high because it is assumed that vessel activity is comparatively light in much of Cumberland Sound during most of the year and there is no icebreaking activity. |
| 10 | Geological events | | | | | | |

| Threat | | Impact (calculated) | | Scope (next 10 Yrs) | Severity (10 Yrs or 3 Gen.) | Timing | Comments |
|---|---|---|---|---|---|---|---|
| 10.1 | Volcanoes | | | | | | |
| 10.2 | Earthquakes/tsunamis | | | | | | |
| 10.3 | Avalanches/landslides | | | | | | |
| 11 | Climate change & severe weather | | Unknown | Pervasive (71-100%) | Unknown | High (Continuing) | |
| 11.1 | Habitat shifting & alteration | | Unknown | Pervasive (71-100%) | Unknown | High (Continuing) | Climate change is strongly affecting the habitat of Belugas throughout their range by changing ice conditions and increasing water temperatures, which in turn almost certainly affects the availability (locations, quantities, etc.) and possibly types of prey as well as the animals' vulnerability to predation. There is, as yet, no indication that the population might be 'benefiting' from access to previously unavailable feeding or other types of suitable habitat, or that changed environmental conditions are making these Belugas less vulnerable to hunting. |
| 11.2 | Droughts | | | | | | |
| 11.3 | Temperature extremes | | | | | | |
| 11.4 | Storms & flooding | | | | | | |
| 11.5 | Other impacts | | | | | | |
| Classification of Threats adopted from IUCN-CMP, Salafsky *et al.* (2008). | | | | | | | |

# Appendix 1c. Ungava Bay Beluga Threats Calculator.

| | | | | |
|---|---|---|---|---|
| **Species or Ecosystem Scientific Name** | Ungava Bay Population of Beluga, *Delphinapterus leucas* | | | |
| **Element ID** | | | **Elcode** | |
| **Date:** | 29/01/2020 | | | |
| **Assessor(s):** | Randall Reeves (writer), Hal Whitehead (Co-chair), Dwayne Lepitzki (facilitator), Karen Timm (Secretariat), Christina Davy, Ashley Kling, Kyle Ritchie, Mark Basterfield, Mike Hammill, Rob Stewart, Kim Parsons, John Ford, Colleen Arnison, Matthew Webb, Veronique Lesage, Marianne Marcoux, Arnaud Mosnier, Hayley Roberts, Aurelie Chagnon-Lafortune | | | |
| **References:** | draft calculator prepared by RR, reviewed by HW; 6-month provisional COSEWIC status report; telecon 29 Jan 2020 | | | |
| | **Overall Threat Impact Calculation Help:** | | **Level 1 Threat Impact Counts** | |
| | **Threat Impact** | | **high range** | **low range** |
| | A | Very High | 1 | 1 |
| | B | High | 0 | 0 |
| | C | Medium | 1 | 0 |
| | D | Low | 0 | 1 |
| | **Calculated Overall Threat Impact:** | | Very High | Very High |
| | **Assigned Overall Threat Impact:** | | **A = Very High** | |
| | **Impact Adjustment Reasons:** | | | |
| | **Overall Threat Comments** | | Generation time 28.6 years therefore time period for scoring severity and timing is 85.8 years into the future. The last records for this population may go back to the 1960s. Its status may soon be approaching the Extinct category; however, it would be difficult to prove one way or the other because it is not yet possible to distinguish the animals of the original DU from individuals of other populations that may migrate into and out of the range. More biopsies may be available in coming years and these could be used to make informative comparisons. | |

| **Threat** | | **Impact (calculated)** | | **Scope (next 10 Yrs)** | **Severity (10 Yrs or 3 Gen.)** | **Timing** | **Comments** |
|---|---|---|---|---|---|---|---|
| 1 | Residential & commercial development | | | | | | |
| 1.1 | Housing & urban areas | | | | | | |
| 1.2 | Commercial & industrial areas | | | | | | |
| 1.3 | Tourism & recreation areas | | | | | | |
| 2 | Agriculture & aquaculture | | | | | | |
| 2.1 | Annual & perennial non-timber crops | | | | | | |
| 2.2 | Wood & pulp plantations | | | | | | |
| 2.3 | Livestock farming & ranching | | | | | | |

| Threat | | Impact (calculated) | | Scope (next 10 Yrs) | Severity (10 Yrs or 3 Gen.) | Timing | Comments |
|---|---|---|---|---|---|---|---|
| 2.4 | Marine & freshwater aquaculture | | | | | | |
| 3 | Energy production & mining | | | | | | |
| 3.1 | Oil & gas drilling | | | | | | |
| 3.2 | Mining & quarrying | | | | | | |
| 3.3 | Renewable energy | | | | | | |
| 4 | Transportation & service corridors | | Negligible | Pervasive (71-100%) | Negligible (<1%) | High (Continuing) | |
| 4.1 | Roads & railroads | | | | | | |
| 4.2 | Utility & service lines | | | | | | |
| 4.3 | Shipping lanes | | Negligible | Pervasive (71-100%) | Negligible (<1%) | High (Continuing) | Some local shipping, mostly supply boats to communities. |
| 4.4 | Flight paths | | | | | | |
| 5 | Biological resource use | A | Very High | Pervasive (71-100%) | Extreme (71-100%) | High (Continuing) | |
| 5.1 | Hunting & collecting terrestrial animals | | | | | | |
| 5.2 | Gathering terrestrial plants | | | | | | |
| 5.3 | Logging & wood harvesting | | | | | | |
| 5.4 | Fishing & harvesting aquatic resources | A | Very High | Pervasive (71-100%) | Extreme (71-100%) | High (Continuing) | If this population is strictly defined as consisting of descendants of the animals that congregated in southern Ungava Bay estuaries in large numbers within the last century, any mortality from hunting could lead to extinction. There are reports of Belugas still being harvested. Any mortality will undoubtedly have a negative impact on this small population. |
| 6 | Human intrusions & disturbance | | Negligible | Pervasive (71-100%) | Negligible (<1%) | High (Continuing) | |
| 6.1 | Recreational activities | | Negligible | Pervasive (71-100%) | Negligible (<1%) | High (Continuing) | Since restriction of Beluga harvest was imposed by DFO, reports indicate much lower human activity in the areas once occupied by this population. |
| 6.2 | War, civil unrest & military exercises | | | | | | |
| 6.3 | Work & other activities | | Negligible | Pervasive (71-100%) | Negligible (<1%) | High (Continuing) | As noted in the status report, “everyday” boating activities by local people frequently involves directed or opportunistic hunting and "the noise from increasing use of outboards for hunting, and not necessarily the hunting per se, has contributed to declines of Belugas in some areas (NMRWB 2019)." |

| Threat | | Impact (calculated) | | Scope (next 10 Yrs) | Severity (10 Yrs or 3 Gen.) | Timing | Comments |
|---|---|---|---|---|---|---|---|
| 7 | Natural system modifications | | Negligible | Restricted (11-30%) | Negligible (<1%) | High (Continuing) | |
| 7.1 | Fire & fire suppression | | | | | | |
| 7.2 | Dams & water management/use | | | | | | |
| 7.3 | Other ecosystem modifications | | Negligible | Restricted (11-30%) | Negligible (<1%) | High (Continuing) | A developing shrimp fishery with bycatch of Arctic Cod is located in the outer (northern) reaches of the bay and this may affect the prey of this population of Belugas. |
| 8 | Invasive & other problematic species & genes | | | | | | |
| 8.1 | Invasive non-native/alien species/diseases | | | | | | |
| 8.2 | Problematic native species/diseases | | | | | | |
| 8.3 | Introduced genetic material | | | | | | |
| 8.4 | Problematic species/diseases of unknown origin | | | | | | |
| 8.5 | Viral/prion-induced diseases | | | | | | |
| 8.6 | Diseases of unknown cause | | | | | | |
| 9 | Pollution | CD | Medium - Low | Pervasive (71-100%) | Moderate - Slight (1-30%) | High (Continuing) | |
| 9.1 | Domestic & urban waste water | | Negligible | Negligible (<1%) | Unknown | High (Continuing) | |
| 9.2 | Industrial & military effluents | | Unknown | Small (1-10%) | Unknown | High (Continuing) | Status report: The planned Oceanic Iron Ore Corporation's mine near Aupaluk (Cape Hopes Advance) in southwestern Ungava Bay is of concern. "This project will involve port construction (projected for 2019-2021) and year-round shipping (with icebreaking)..." |
| 9.3 | Agricultural & forestry effluents | | | | | | |
| 9.4 | Garbage & solid waste | | Unknown | Pervasive (71-100%) | Unknown | High (Continuing) | |
| 9.5 | Air-borne pollutants | | Unknown | Pervasive (71-100%) | Unknown | High (Continuing) | |

| Threat | | Impact (calculated) | | Scope (next 10 Yrs) | Severity (10 Yrs or 3 Gen.) | Timing | Comments |
|---|---|---|---|---|---|---|---|
| 9.6 | Excess energy | CD | Medium - Low | Pervasive (71-100%) | Moderate - Slight (1-30%) | High (Continuing) | Belugas are critically dependent on sound for communication and echolocation (to navigate and find/capture food). This means that sound energy introduced by human activities can have significant impacts on their behaviour and capabilities to carry out necessary life functions. It is possible that the disturbance caused by small vessel traffic in the estuaries makes them much less habitable for Belugas, thereby preventing or at least discouraging reoccupation. The noise associated with industrial activities near Aupaluk could also have some effect. |
| 10 | Geological events | | | | | | |
| 10.1 | Volcanoes | | | | | | |
| 10.2 | Earthquakes/tsunamis | | | | | | |
| 10.3 | Avalanches/landslides | | | | | | |
| 11 | Climate change & severe weather | | Unknown | Pervasive (71-100%) | Unknown | High (Continuing) | |
| 11.1 | Habitat shifting & alteration | | Unknown | Pervasive (71-100%) | Unknown | High (Continuing) | Climate change is strongly affecting the habitat of belugas throughout their range by changing ice conditions and increasing water temperatures, which in turn almost certainly affects the availability (locations, quantities, etc.) and possibly types of prey as well as the animals' vulnerability to predation. There is, as yet, no indication that the population might be 'benefiting' from access to previously unavailable feeding or other types of suitable habitat, or that changed environmental conditions are making these Belugas less vulnerable to hunting. |
| 11.2 | Droughts | | | | | | |
| 11.3 | Temperature extremes | | | | | | |
| 11.4 | Storms & flooding | | | | | | |
| 11.5 | Other impacts | | | | | | |

Classification of Threats adopted from IUCN-CMP, Salafsky *et al.* (2008).

# Appendix 1d. Western Hudson Bay Beluga Threats Calculator.

| | | | | |
|---|---|---|---|---|
| **Species or Ecosystem Scientific Name** | Western Hudson Bay Population of Beluga, *Delphinapterus leucas* | | | |
| **Element ID** | | | **Elcode** | |
| **Date:** | 29/01/2020 | | | |
| **Assessor(s):** | Randall Reeves (writer), Hal Whitehead (Co-chair), Dwayne Lepitzki (facilitator), Karen Timm (Secretariat), Christina Davy, Ashley Kling, Kyle Ritchie, Mark Basterfield, Mike Hammill, Rob Stewart, Kim Parsons, John Ford, Colleen Arnison, Matthew Webb, Veronique Lesage, Marianne Marcoux, Arnaud Mosnier, Hayley Roberts, Aurelie Chagnon-Lafortune | | | |
| **References:** | draft calculator prepared by RR, reviewed by HW; 6-month provisional COSEWIC status report; telecon 29 Jan 2020 | | | |
| | **Overall Threat Impact Calculation Help:** | | **Level 1 Threat Impact Counts** | |
| | **Threat Impact** | | **high range** | **low range** |
| | A | Very High | 0 | 0 |
| | B | High | 0 | 0 |
| | C | Medium | 1 | 0 |
| | D | Low | 0 | 1 |
| | **Calculated Overall Threat Impact:** | | Medium | Low |
| | **Assigned Overall Threat Impact:** | | **CD = Medium - Low** | |
| | **Impact Adjustment Reasons:** | | | |
| | **Overall Threat Comments** | | Generation time 28.6 years therefore time period for scoring severity and timing is 85.8 years into the future. Note that this DU is more towards the Low end of the overall threat impact range when compared to the Eastern Hudson Bay DU. | |

| **Threat** | | **Impact (calculated)** | | **Scope (next 10 Yrs)** | **Severity (10 Yrs or 3 Gen.)** | **Timing** | **Comments** |
|---|---|---|---|---|---|---|---|
| 1 | Residential & commercial development | | | | | | |
| 1.1 | Housing & urban areas | | | | | | An inflow pipe to draw water into Churchill town site is planned. |
| 1.2 | Commercial & industrial areas | | | | | | Potential expansion of Churchill Harbour, and others. |
| 1.3 | Tourism & recreation areas | | | | | | A Marine Observatory is planned for Churchill; there may be a boat launch. |
| 2 | Agriculture & aquaculture | | | | | | |
| 2.1 | Annual & perennial non-timber crops | | | | | | |
| 2.2 | Wood & pulp plantations | | | | | | |
| 2.3 | Livestock farming & ranching | | | | | | |
| 2.4 | Marine & freshwater aquaculture | | | | | | |

| Threat | | Impact (calculated) | | Scope (next 10 Yrs) | Severity (10 Yrs or 3 Gen.) | Timing | Comments |
|---|---|---|---|---|---|---|---|
| 3 | Energy production & mining | | | | | | |
| 3.1 | Oil & gas drilling | | | | | | |
| 3.2 | Mining & quarrying | | | | | | |
| 3.3 | Renewable energy | | | | | | See 7.2 (hydro power) |
| 4 | Transportation & service corridors | | Negligible | Pervasive (71-100%) | Negligible (<1%) | High (Continuing) | |
| 4.1 | Roads & railroads | | | | | | |
| 4.2 | Utility & service lines | | | | | | |
| 4.3 | Shipping lanes | | Negligible | Pervasive (71-100%) | Negligible (<1%) | High (Continuing) | Ship traffic into and out of the port of Churchill represents a risk of disturbance to the whales while congregated in the estuary. Concern is especially high because of the concentrated nature of the whales' occurrence and the vulnerability of mother-calf pairs. With the rapid changes in climate, traffic in these whales' estuarine habitat is likely to continue increasing. Less ice in Hudson Strait may mean more ship traffic there in winter when belugas from this population are also there. The noise (9.6) and risks of ship strikes (assessed here) and oil spills (9.3) may affect this beluga population within and near the estuaries (Churchill, Seal, Nelson etc.), during migration and possibly in areas important for feeding. |
| 4.4 | Flight paths | | | | | | |
| 5 | Biological resource use | | Negligible | Pervasive (71-100%) | Negligible (<1%) | High (Continuing) | |
| 5.1 | Hunting & collecting terrestrial animals | | | | | | |
| 5.2 | Gathering terrestrial plants | | | | | | |
| 5.3 | Logging & wood harvesting | | | | | | |
| 5.4 | Fishing & harvesting aquatic resources | | Negligible | Pervasive (71-100%) | Negligible (<1%) | High (Continuing) | This population is subject to hunting at sustainable levels. However, there is concern that as management efforts are made to shift hunting pressure away from Eastern Hudson Bay animals, this will increase the hunting pressure on Western Hudson Bay Belugas. |
| 6 | Human intrusions & disturbance | | Negligible | Pervasive (71-100%) | Negligible (<1%) | High (Continuing) | |
| 6.1 | Recreational activities | | Negligible | Pervasive (71-100%) | Negligible (<1%) | High (Continuing) | This refers specifically to tourism centred on summer congregation areas (e.g. Churchill River Estuary) where some disturbance is possible, and to cruise ship traffic in Hudson Strait and western Hudson Bay that could cause disturbance. |
| 6.2 | War, civil unrest & military exercises | | | | | | Little military activity in area. |

| Threat | | Impact (calculated) | | Scope (next 10 Yrs) | Severity (10 Yrs or 3 Gen.) | Timing | Comments |
|---|---|---|---|---|---|---|---|
| 6.3 | Work & other activities | | Negligible | Pervasive (71-100%) | Negligible (<1%) | High (Continuing) | As noted in the status report, “everyday” boating activities by local people frequently involve directed or opportunistic hunting and "the noise from increasing use of outboards for hunting, and not necessarily the hunting per se, has contributed to declines of Belugas in some areas (NMRWB 2019)." Also see 9.6. |
| 7 | Natural system modifications | | Negligible | Pervasive (71-100%) | Negligible (<1%) | High (Continuing) | |
| 7.1 | Fire & fire suppression | | | | | | |
| 7.2 | Dams & water management/use | | Negligible | Pervasive (71-100%) | Negligible (<1%) | High (Continuing) | Water management (for navigation and hydroelectric development) in the Churchill and Nelson River basins could have downstream effects on estuarine conditions and this could reduce the suitability of these important estuaries for Belugas. There is no conclusive evidence of impact to date so this must be viewed as a potential future problem for this population. No other water management projects under way. |
| 7.3 | Other ecosystem modifications | | Negligible | Restricted (11-30%) | Negligible (<1%) | High (Continuing) | There is concern about by-catch of Arctic Cod (an important prey) in a developing Canadian shrimp fishery, but impacts (if any) are not well known. |
| 8 | Invasive & other problematic species & genes | | | | | | |
| 8.1 | Invasive non-native/alien species/diseases | | | | | | |
| 8.2 | Problematic native species/diseases | | | | | | |
| 8.3 | Introduced genetic material | | | | | | |
| 8.4 | Problematic species/diseases of unknown origin | | | | | | |
| 8.5 | Viral/prion-induced diseases | | | | | | |
| 8.6 | Diseases of unknown cause | | | | | | |
| 9 | Pollution | CD | Medium - Low | Pervasive (71-100%) | Moderate - Slight (1-30%) | High (Continuing) | This population passes by many small communities so exposures may be higher for it than for other populations. |
| 9.1 | Domestic & urban waste water | | Unknown | Small (1-10%) | Unknown | High (Continuing) | Potential local sources of contamination, but little information available (applies more strongly here than in High Arctic). |
| 9.2 | Industrial & military effluents | | Unknown | Small (1-10%) | Unknown | High (Continuing) | Potential local sources for contamination, but little information available. |
| 9.3 | Agricultural & forestry effluents | | | | | | |
| 9.4 | Garbage & solid waste | | Unknown | Pervasive (71-100%) | Unknown | High (Continuing) | Garbage dumps in communities, and disposal from ships. |

| Threat | | Impact (calculated) | | Scope (next 10 Yrs) | Severity (10 Yrs or 3 Gen.) | Timing | Comments |
|---|---|---|---|---|---|---|---|
| 9.5 | Air-borne pollutants | | Unknown | Pervasive (71-100%) | Unknown | High (Continuing) | An issue for all Arctic mammals, of unknown consequence for Belugas. |
| 9.6 | Excess energy | CD | Medium - Low | Pervasive (71-100%) | Moderate - Slight (1-30%) | High (Continuing) | Belugas are critically dependent on sound for communication and echolocation (to navigate and find/capture food). This means that sound energy introduced by human activities can have significant impacts on their behaviour and capabilities to carry out necessary life functions. There is evidence of very strong responsiveness to noise associated with icebreaking activity. |
| 10 | Geological events | | | | | | |
| 10.1 | Volcanoes | | | | | | |
| 10.2 | Earthquakes/tsunamis | | | | | | |
| 10.3 | Avalanches/landslides | | | | | | |
| 11 | Climate change & severe weather | | Unknown | Pervasive (71-100%) | Unknown | High (Continuing) | |
| 11.1 | Habitat shifting & alteration | | Unknown | Pervasive (71-100%) | Unknown | High (Continuing) | Climate change is strongly affecting the habitat of Belugas throughout their range by changing ice conditions and increasing water temperatures, which in turn almost certainly affects the availability (locations, quantities, etc.) and possibly types of prey as well as the animals' vulnerability to predation. There is, as yet, no indication that this population might be 'benefiting' from access to previously unavailable feeding or other types of suitable habitat, or that changed environmental conditions are making these Belugas less vulnerable to hunting. |
| 11.2 | Droughts | | | | | | |
| 11.3 | Temperature extremes | | | | | | |
| 11.4 | Storms & flooding | | | | | | |
| 11.5 | Other impacts | | | | | | |

Classification of Threats adopted from IUCN-CMP, Salafsky *et al*. (2008).

# Appendix 1e. Eastern Hudson Bay Beluga Threats Calculator.

| | | | | |
|---|---|---|---|---|
| **Species or Ecosystem Scientific Name** | Eastern Hudson Bay Population of Beluga, *Delphinapterus leucas* | | | |
| **Element ID** | | | **Elcode** | |
| **Date:** | 29/01/2020 | | | |
| **Assessor(s):** | Randall Reeves (writer), Hal Whitehead (Co-chair), Dwayne Lepitzki (facilitator), Karen Timm (Secretariat), Christina Davy, Ashley Kling, Kyle Ritchie, Mark Basterfield, Mike Hammill, Rob Stewart, Kim Parsons, John Ford, Colleen Arnison, Matthew Webb, Veronique Lesage, Marianne Marcoux, Arnaud Mosnier, Hayley Roberts, Aurelie Chagnon-Lafortune | | | |
| **References:** | draft calculator prepared by RR, reviewed by HW; 6-month provisional COSEWIC status report; telecon 29 Jan 2020 | | | |
| | **Overall Threat Impact Calculation Help:** | | **Level 1 Threat Impact Counts** | |
| | **Threat Impact** | | **high range** | **low range** |
| | A | Very High | 0 | 0 |
| | B | High | 0 | 0 |
| | C | Medium | 2 | 0 |
| | D | Low | 0 | 2 |
| | **Calculated Overall Threat Impact:** | | Medium | Low |
| | **Assigned Overall Threat Impact:** | | **CD = Medium - Low** | |
| | **Impact Adjustment Reasons:** | | | |
| | **Overall Threat Comments** | | Generation time 28.6 years therefore time period for scoring severity and timing is 85.8 years into the future. Note that due to population size, this DU is more towards the Medium end of the overall threat impact range compared to, for example, the Western Hudson Bay DU. | |

| **Threat** | | **Impact (calculated)** | | **Scope (next 10 Yrs)** | **Severity (10 Yrs or 3 Gen.)** | **Timing** | **Comments** |
|---|---|---|---|---|---|---|---|
| 1 | Residential & commercial development | | | | | | |
| 1.1 | Housing & urban areas | | | | | | |
| 1.2 | Commercial & industrial areas | | | | | | |
| 1.3 | Tourism & recreation areas | | | | | | |
| 2 | Agriculture & aquaculture | | | | | | |
| 2.1 | Annual & perennial non-timber crops | | | | | | |
| 2.2 | Wood & pulp plantations | | | | | | |
| 2.3 | Livestock farming & ranching | | | | | | |

| Threat | | Impact (calculated) | | Scope (next 10 Yrs) | Severity (10 Yrs or 3 Gen.) | Timing | Comments |
|---|---|---|---|---|---|---|---|
| 2.4 | Marine & freshwater aquaculture | | | | | | |
| 3 | Energy production & mining | | | | | | |
| 3.1 | Oil & gas drilling | | | | | | |
| 3.2 | Mining & quarrying | | | | | | |
| 3.3 | Renewable energy | | | | | | See 7.2 (hydro power) |
| 4 | Transportation & service corridors | | Negligible | Pervasive (71-100%) | Negligible (<1%) | High (Continuing) | |
| 4.1 | Roads & railroads | | | | | | |
| 4.2 | Utility & service lines | | | | | | |
| 4.3 | Shipping lanes | | Negligible | Pervasive (71-100%) | Negligible (<1%) | High (Continuing) | Ship traffic in Hudson Strait and the Labrador Sea where much or most of this population overwinters is a concern mainly because of noise disturbance. See 9.6. |
| 4.4 | Flight paths | | | | | | |
| 5 | Biological resource use | CD | Medium - Low | Pervasive (71-100%) | Moderate - Slight (1-30%) | High (Continuing) | |
| 5.1 | Hunting & collecting terrestrial animals | | | | | | |
| 5.2 | Gathering terrestrial plants | | | | | | |
| 5.3 | Logging & wood harvesting | | | | | | |
| 5.4 | Fishing & harvesting aquatic resources | CD | Medium - Low | Pervasive (71-100%) | Moderate - Slight (1-30%) | High (Continuing) | This population has declined by nearly 50% over the past 2 generations, largely or entirely because of overhunting. Removals by hunting have been reduced but not necessarily sufficiently to allow recovery (and the removal rate may still be unsustainable). Overhunting remains a threat although hunting pressure has been reduced over the past 10 years and the population appears to be stabilizing. |
| 6 | Human intrusions & disturbance | | Negligible | Pervasive (71-100%) | Negligible (<1%) | High (Continuing) | |
| 6.1 | Recreational activities | | Negligible | Pervasive (71-100%) | Negligible (<1%) | High (Continuing) | Low levels of tourism and recreation. |
| 6.2 | War, civil unrest & military exercises | | | | | | |
| 6.3 | Work & other activities | | Negligible | Pervasive (71-100%) | Negligible (<1%) | High (Continuing) | As noted in the status report, “everyday” boating activities by local people frequently involves directed or opportunistic hunting and "the noise from increasing use of outboards for hunting, and not necessarily the hunting per se, has contributed to declines of Belugas in some areas (NMRWB 2019)." Also see 9.6. |
| 7 | Natural system modifications | | Negligible | Pervasive (71-100%) | Negligible (<1%) | High (Continuing) | |
| 7.1 | Fire & fire suppression | | | | | | |

| Threat | | Impact (calculated) | | Scope (next 10 Yrs) | Severity (10 Yrs or 3 Gen.) | Timing | Comments |
|---|---|---|---|---|---|---|---|
| 7.2 | Dams & water management/use | | Negligible | Pervasive (71-100%) | Negligible (<1%) | High (Continuing) | Water management (hydroelectric development) in rivers in south-eastern Hudson Bay could have had, and could continue to have, downstream effects on estuarine conditions and this could have reduced (or could eventually reduce) the suitability of these important estuaries for Belugas. There is no conclusive evidence of impact to date. |
| 7.3 | Other ecosystem modifications | | Negligible | Restricted (11-30%) | Negligible (<1%) | High (Continuing) | There is concern about potential by-catch of Arctic Cod in a developing Canadian shrimp fishery, but impacts are not well known. |
| 8 | Invasive & other problematic species & genes | | | | | | Pathogens stated in Tech. Summary |
| 8.1 | Invasive non-native/alien species/diseases | | | | | | |
| 8.2 | Problematic native species/diseases | | | | | | Pressure of predation by Killer Whales may be affecting this population, and that pressure is likely to increase. |
| 8.3 | Introduced genetic material | | | | | | |
| 8.4 | Problematic species/diseases of unknown origin | | | | | | |
| 8.5 | Viral/prion-induced diseases | | | | | | |
| 8.6 | Diseases of unknown cause | | | | | | |
| 9 | Pollution | CD | Medium - Low | Pervasive (71-100%) | Moderate - Slight (1-30%) | High (Continuing) | This population passes by many small communities so exposures may be higher for it than for other populations |
| 9.1 | Domestic & urban waste water | | Unknown | Small (1-10%) | Unknown | High (Continuing) | Potential local sources of contamination, but little information available. |
| 9.2 | Industrial & military effluents | | Unknown | Small (1-10%) | Unknown | High (Continuing) | Potential local sources of contamination, but little information available. |
| 9.3 | Agricultural & forestry effluents | | | | | | |
| 9.4 | Garbage & solid waste | | Unknown | Pervasive (71-100%) | Unknown | High (Continuing) | Garbage dumps in communities, and disposal from ships. |
| 9.5 | Air-borne pollutants | | Unknown | Pervasive (71-100%) | Unknown | High (Continuing) | An issue for all Arctic mammals, of unknown consequence for Belugas. |
| 9.6 | Excess energy | CD | Medium - Low | Pervasive (71-100%) | Moderate - Slight (1-30%) | High (Continuing) | Belugas are critically dependent on sound for communication and echolocation (to navigate and find/capture food). This means that sound energy introduced by human activities can have significant impacts on their behaviour and capabilities to carry out necessary life functions. There is evidence of very strong responsiveness to noise associated with icebreaking activity. See 6.3. |
| 10 | Geological events | | | | | | |
| 10.1 | Volcanoes | | | | | | |

| Threat | | Impact (calculated) | | Scope (next 10 Yrs) | Severity (10 Yrs or 3 Gen.) | Timing | Comments |
|---|---|---|---|---|---|---|---|
| 10.2 | Earthquakes/tsunamis | | | | | | |
| 10.3 | Avalanches/landslides | | | | | | |
| 11 | Climate change & severe weather | | Unknown | Pervasive (71-100%) | Unknown | High (Continuing) | |
| 11.1 | Habitat shifting & alteration | | Unknown | Pervasive (71-100%) | Unknown | High (Continuing) | Climate change is strongly affecting the habitat of belugas throughout their range by changing ice conditions and increasing water temperatures, which in turn almost certainly affect the availability (locations, quantities, etc.) and possibly types of prey as well as the animals' vulnerability to predation. There is, as yet, no indication that the population might be 'benefiting' from access to previously unavailable feeding or other types of suitable habitat, or that changed environmental conditions are making these Belugas less vulnerable to hunting. |
| 11.2 | Droughts | | | | | | |
| 11.3 | Temperature extremes | | | | | | |
| 11.4 | Storms & flooding | | | | | | |
| 11.5 | Other impacts | | | | | | |

Classification of Threats adopted from IUCN-CMP, Salafsky *et al.* (2008).

## Appendix 1f. James Bay Beluga Threats Calculator.

| | | | | |
|---|---|---|---|---|
| **Species or Ecosystem Scientific Name** | James Bay Population of Beluga, *Delphinapterus leucas* | | | |
| **Element ID** | | | **Elcode** | |
| **Date:** | 29/01/2020 | | | |
| **Assessor(s):** | Randall Reeves (writer), Hal Whitehead (Co-chair), Dwayne Lepitzki (facilitator), Karen Timm (Secretariat), Christina Davy, Ashley Kling, Kyle Ritchie, Mark Basterfield, Mike Hammill, Rob Stewart, Kim Parsons, John Ford, Colleen Arnison, Matthew Webb, Veronique Lesage, Marianne Marcoux, Arnaud Mosnier, Hayley Roberts, Aurelie Chagnon-Lafortune | | | |
| **References:** | draft calculator prepared by RR, reviewed by HW; 6-month provisional COSEWIC status report; telecon 29 Jan 2020 | | | |
| **Overall Threat Impact Calculation Help:** | | | **Level 1 Threat Impact Counts** | |
| | **Threat Impact** | | **high range** | **low range** |
| | A | Very High | 0 | 0 |
| | B | High | 0 | 0 |
| | C | Medium | 0 | 0 |
| | D | Low | 1 | 1 |
| **Calculated Overall Threat Impact:** | | | Low | Low |
| **Assigned Overall Threat Impact:** | | | **D = Low** | |
| **Impact Adjustment Reasons:** | | | | |
| **Overall Threat Comments** | | | Generation time 28.6 years therefore time period for scoring severity and timing is 85.8 years into the future. Note that this area is shallow and strongly influenced by fresh water. Climate change could have unforeseen but significant impacts here. | |

| **Threat** | | **Impact (calculated)** | | **Scope (next 10 Yrs)** | **Severity (10 Yrs or 3 Gen.)** | **Timing** | **Comments** |
|---|---|---|---|---|---|---|---|
| 1 | Residential & commercial development | | | | | | |
| 1.1 | Housing & urban areas | | | | | | |
| 1.2 | Commercial & industrial areas | | | | | | |
| 1.3 | Tourism & recreation areas | | | | | | |
| 2 | Agriculture & aquaculture | | | | | | |
| 2.1 | Annual & perennial non-timber crops | | | | | | |
| 2.2 | Wood & pulp plantations | | | | | | |
| 2.3 | Livestock farming & ranching | | | | | | |
| 2.4 | Marine & freshwater aquaculture | | | | | | |
| 3 | Energy production & mining | | | | | | |
| 3.1 | Oil & gas drilling | | | | | | |

| Threat | | Impact (calculated) | Scope (next 10 Yrs) | Severity (10 Yrs or 3 Gen.) | Timing | Comments |
|---|---|---|---|---|---|---|
| 3.2 | Mining & quarrying | | | | | |
| 3.3 | Renewable energy | | | | | See 7.2 (hydro power) |
| 4 | Transportation & service corridors | | | | | |
| 4.1 | Roads & railroads | | | | | |
| 4.2 | Utility & service lines | | | | | |
| 4.3 | Shipping lanes | Negligible | Pervasive (71-100%) | Negligible (<1%) | High (Continuing) | Supply ships visit communities. A diamond mine on the west side of the bay may no longer be in production (and so not generating shipping). |
| 4.4 | Flight paths | | | | | |
| 5 | Biological resource use | Negligible | Large (31-70%) | Negligible (<1%) | High (Continuing) | |
| 5.1 | Hunting & collecting terrestrial animals | | | | | |
| 5.2 | Gathering terrestrial plants | | | | | |
| 5.3 | Logging & wood harvesting | | | | | |
| 5.4 | Fishing & harvesting aquatic resources | Negligible | Large (31-70%) | Negligible (<1%) | High (Continuing) | This population is large and subject to limited hunting pressure. Removals are thought to be sustainable. |
| 6 | Human intrusions & disturbance | Negligible | Large (31-70%) | Negligible (<1%) | High (Continuing) | |
| 6.1 | Recreational activities | Negligible | Large (31-70%) | Negligible (<1%) | High (Continuing) | Low levels of recreation and little impact. |
| 6.2 | War, civil unrest & military exercises | | | | | |
| 6.3 | Work & other activities | Negligible | Large (31-70%) | Negligible (<1%) | High (Continuing) | As noted in the status report, “everyday” boating activities by local people frequently involves directed or opportunistic hunting and "the noise from increasing use of outboards for hunting, and not necessarily the hunting per se, has contributed to declines of Belugas in some areas (NMRWB 2019)." Also see 9.6. |
| 7 | Natural system modifications | Negligible | Pervasive (71-100%) | Negligible (<1%) | High (Continuing) | |
| 7.1 | Fire & fire suppression | | | | | |
| 7.2 | Dams & water management/use | Negligible | Pervasive (71-100%) | Negligible (<1%) | High (Continuing) | Water management (hydroelectric development) in rivers in south-eastern Hudson Bay and James Bay could have had, and could continue to have, downstream effects on estuarine conditions and this could have reduced (or could eventually reduce) the suitability of these important estuaries for Belugas. There is no conclusive evidence of impact to date. |
| 7.3 | Other ecosystem modifications | | | | | |

| Threat | | Impact (calculated) | | Scope (next 10 Yrs) | Severity (10 Yrs or 3 Gen.) | Timing | Comments |
|---|---|---|---|---|---|---|---|
| 8 | Invasive & other problematic species & genes | | | | | | |
| 8.1 | Invasive non-native/alien species/diseases | | | | | | |
| 8.2 | Problematic native species/diseases | | | | | | |
| 8.3 | Introduced genetic material | | | | | | |
| 8.4 | Problematic species/diseases of unknown origin | | | | | | |
| 8.5 | Viral/prion-induced diseases | | | | | | |
| 8.6 | Diseases of unknown cause | | | | | | |
| 9 | Pollution | D | Low | Pervasive (71-100%) | Slight (1-10%) | High (Continuing) | |
| 9.1 | Domestic & urban waste water | | Negligible | Negligible (<1%) | Unknown | High (Continuing) | |
| 9.2 | Industrial & military effluents | | Unknown | Small (1-10%) | Unknown | High (Continuing) | |
| 9.3 | Agricultural & forestry effluents | | | | | | |
| 9.4 | Garbage & solid waste | | Unknown | Pervasive (71-100%) | Unknown | High (Continuing) | |
| 9.5 | Air-borne pollutants | | Unknown | Pervasive (71-100%) | Unknown | High (Continuing) | |
| 9.6 | Excess energy | D | Low | Pervasive (71-100%) | Slight (1-10%) | High (Continuing) | Belugas are critically dependent on sound for communication and echolocation (to navigate and find/capture food). This means that sound energy introduced by human activities can have significant impacts on their behaviour and capabilities to carry out necessary life functions. There is evidence of very strong responsiveness to noise associated with icebreaking activity. See 6.3. James Bay seems to be an area with comparatively little anthropogenic noise. |
| 10 | Geological events | | | | | | |
| 10.1 | Volcanoes | | | | | | |
| 10.2 | Earthquakes/tsunamis | | | | | | |
| 10.3 | Avalanches/landslides | | | | | | |
| 11 | Climate change & severe weather | | Unknown | Pervasive (71-100%) | Unknown | High (Continuing) | |

| Threat | | Impact (calculated) | | Scope (next 10 Yrs) | Severity (10 Yrs or 3 Gen.) | Timing | Comments |
|---|---|---|---|---|---|---|---|
| 11.1 | Habitat shifting & alteration | | Unknown | Pervasive (71-100%) | Unknown | High (Continuing) | Climate change is strongly affecting the habitat of belugas throughout their range by changing ice conditions and increasing water temperatures, which in turn almost certainly affects the availability (locations, quantities, etc.) and possibly types of prey as well as the animals' vulnerability to predation. There is, as yet, no indication that the population might be 'benefiting' from access to previously unavailable feeding or other types of suitable habitat, or that changed environmental conditions are making these Belugas less vulnerable to hunting. |
| 11.2 | Droughts | | | | | | |
| 11.3 | Temperature extremes | | | | | | |
| 11.4 | Storms & flooding | | | | | | |
| 11.5 | Other impacts | | | | | | |

Classification of Threats adopted from IUCN-CMP, Salafsky *et al.* (2008).