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Arctic Region

2023 ABUNDANCE ESTIMATE AND HARVEST ADVICE FOR BELUGA IN CUMBERLAND SOUND



Beluga whales (Delphinapterus leucas)

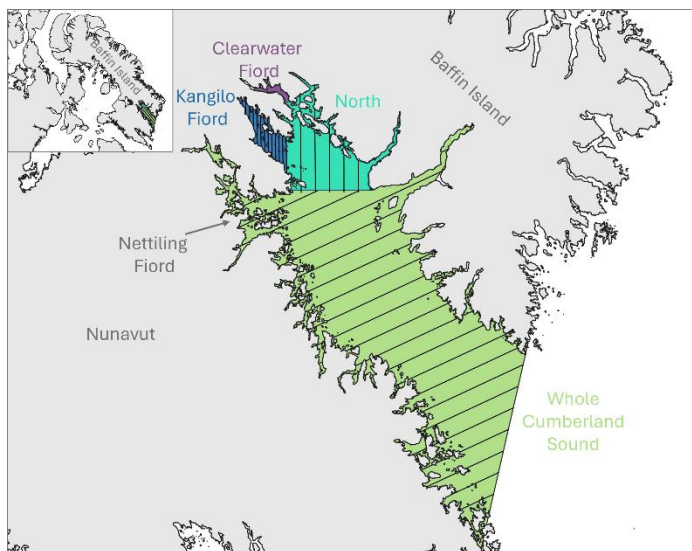


Figure 1. Map indicating transect lines surveyed in the 2023 photographic survey of beluga in Cumberland Sound.

CONTEXT

There are two beluga (*Delphinapterus leucas*) populations that summer in Cumberland Sound (DFO 2022), but aerial surveys are unable to distinguish them. Therefore, co-management partners manage the beluga whales in Cumberland Sound as a single stock. An aerial survey of beluga whales in Cumberland Sound was conducted in August 2023 as part of the High Arctic Cetacean Survey. DFO Fisheries Management has requested an updated population abundance estimate based on the 2023 aerial survey and information on the probability that the abundance of beluga whales summering in Cumberland Sound will decline in 10 years under a range of harvest scenarios.

Fisheries Management requested DFO Science to provide 1) an updated estimate of abundance for beluga whales summering in Cumberland Sound, 2) advice on a sustainable beluga whale harvest level based on the Potential Biological Removal method, and 3) information on the probability that the abundance of beluga whales in Cumberland Sound will decline in 10 years under a range of harvest scenarios (for 0, 5, 10, 15, 25, and 50% probability of decline, and under the existing quota of 41 beluga whales per year).

This Science Advisory Report is from the March 17-20, 2026 regional peer review on the Abundance Estimate From the 2023 High Arctic Cetacean Survey (HACS) and Probability of Population Decline for Beluga Whales (*Delphinapterus leucas*) Summering in Cumberland

Sound. Additional publications from this meeting will be posted on the [Fisheries and Oceans Canada \(DFO\) Science Advisory Schedule](#) as they become available.

SUMMARY

- Beluga in Cumberland Sound (CS) are harvested by hunters from the hamlet of Pangnirtung. Since 2002 the quota has been 41 animals a year. Assessments published in 2016 and 2019 indicated this harvest was not sustainable.
- Two photographic aerial surveys to estimate beluga abundance in CS were flown during August 25 to 29, 2023. The estimated average abundance from the two 2023 surveys was 210 beluga (95% CI 90-500 [rounded to the nearest 10]).
- To determine the trend in population dynamics a model was fit to a series of six survey estimates from 1990-2023 and reported annual harvests from 1960-2025.
- The model estimated a 2026 abundance of 250 beluga (95% CI 1-900). Sustainable harvest advice is based on this modeled abundance.
- The model estimated that harvest levels of 0, 0, 1, 1, 2, and 4 beluga per year would result in a 0, 5, 10, 15, 25, and 50% probability respectively, that abundance of beluga in CS will continue to decline.
- If the current quota of 41 beluga is taken each year, the model estimated a 100% probability of decline in abundance in ten years and possible extirpation of CS beluga.
- The estimated Potential Biological Removal and Total Allowable Landed Catch (TALC) are both 0 using the 2026 modeled estimate of abundance and a recovery factor of 0.1.

INTRODUCTION

An aerial survey of beluga whales in Cumberland Sound was conducted in August 2023 with expanded coverage to the south west of Cumberland Sound based on advice of the Pangnirtung Hunters and Trappers. With the addition of the 2023 abundance estimate and updated harvest statistics, a population model with aerial survey (1982-2023) and reported harvest data (1951-2025) was assessed. Here we present the results from the 2023 aerial survey and an updated population model with resulting sustainable harvest recommendations.

ASSESSMENT

2023 Survey

Photographic aerial surveys were conducted from August 25-29, 2023 (Figure 1). Survey abundance estimates were adjusted for diving animals that are not visible at the surface, known as availability bias. Availability bias was estimated using data from three female beluga whales equipped with satellite tags in Clearwater Fiord in July of 2006 ($n = 1$) and August 2007 ($n = 2$). The proportion of time belugas spent within 0-1 and 0-2 m of the surface resulted in an instantaneous availability bias of 4.46 (CV 0.20) and 2.06 (CV 0.20), respectively. The 0-1 and 0-2 m adjustment factors were applied to belugas in murky and clear water, respectively.

Whales were only detected in Clearwater Fiord. A weighted average of the two surveys in Clearwater Fiord resulted in an estimated abundance of 210 (95% CI 90-500 [rounded to the nearest 10]) belugas and was used as input into the population model (Table 1).

Table 1. Total population abundance estimates from photographic surveys flown August 25-29, 2023. The average of the Clearwater Fiord surveys was weighted by the variance.

Strata	Date Flown	Estimate	CV (%)	95% CI
Clearwater Fiord	25-Aug	316	20.0	-
Clearwater Fiord	27-Aug	177	20.0	-
North	25-Aug	0	-	-
North	28-Aug	0	-	-
Kangilo Fiord	25-Aug	0	-	-
Kangilo Fiord	27-28 Aug	0	-	-
Whole Cumberland Sound	25-26-29-Aug	0	-	-
Weighted Average	-	210	47.0	158-280

Population Model

The population model fit to six aerial surveys and reported annual harvests estimated a 2023 population of 350 beluga (95% CI 100-950 [rounded to the nearest ten]), and a 2026 population of 250 beluga (95% CI 1-900). The model estimated that the abundance of beluga in Cumberland Sound has been declining.

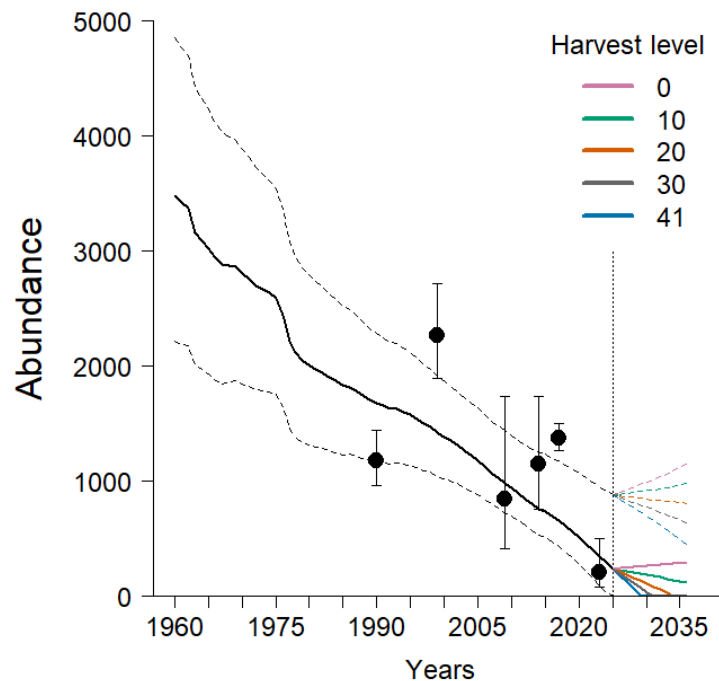


Figure 2. Estimated changes in abundance of beluga in CS beluga determined after fitting a population model to abundance estimates from six aerial surveys flown between 1990–2023. The solid line indicates the median estimate and dotted lines represent the 95% Credibility Intervals. Beyond 2025 indicates future population projections at harvests of 0-41 beluga whales annually.

The model predicted probabilities of decline associated with a given annual landed catch for beluga in Cumberland Sound in ten years (Table 2), assuming animals are taken in proportion to the population sex and age structure. The current annual quota is 41 which is estimated to result in a 100% probability of decline in beluga whales in Cumberland Sound in ten years and lead to possible extirpation.

Table 2. Percent probability (P) of decline in beluga abundance in Cumberland Sound in 10 yrs under different annual landed catches.

P (%)	Landed Catch
0	0
5	0
10	1
15	1
20	1
25	2
30	2
40	3
50	4
60	5
70	6
80	8
90	14
95	35
100	41

Potential Biological Removal (PBR)

The model provides a more robust estimate of the current abundance than a point estimate from a survey; therefore, we calculated PBR based on the modelled 2026 estimate of abundance rather than using the 2023 aerial survey estimate.

Based on the 2026 model estimate of N_{Min} (104), using a recovery factor of 0.1 following guidelines for an endangered population (DFO 2025), and the default maximum growth rate (4% per year), PBR and TALC were both 0.

Sources of Uncertainty

The Pangnirtung Hunters and Trappers noted that abundance and distribution of marine mammals in Cumberland Sound was unusual in 2023 both during and after the survey was completed. The factors responsible for this are unknown and inter-annual variability in environmental factors can influence whale distribution and behaviour.

The availability bias correction factors used to adjust the survey estimates for animals that are not visible are the best values currently available for beluga in CS; however, they are derived from only three female beluga tagged in 2006–2007. These factors have been applied to the entire time series of aerial survey estimates. Additional beluga of both sexes and varying age classes, preferably tagged spatially and temporally to coincide with the survey, would result in a better understanding of beluga behaviour. A large sample of tagged whales would also improve our understanding of diving behaviour in different environmental conditions and habitats.

There is uncertainty in the model estimates. The model assumes animals are taken in proportion to the population's sex and age structure, but more information on the harvested animals is needed to test this assertion.

The current model only includes harvest history back to 1960. Future work is required to develop a model that includes the history of commercial whaling, especially if an understanding of carrying capacity is needed (e.g., for development of a limit reference point).

In addition to the Cumberland Sound beluga (CSB) population, beluga genetically most similar to Western Hudson Bay (WHB) are known to occur in summer in CS. Whether they are migrants or residents is unknown. Additional samples from these whales in CS (through harvest or non-lethal methods) would help with assessing their temporal and spatial distribution. The two populations cannot be distinguished visually during surveys, and consequently the population model describes the dynamics of beluga summering in CS.

Killer whales have been regularly sighted in Cumberland Sound during the summer and the impact they have on beluga in Cumberland Sound is currently unknown.

Very small populations of toothed-whales are known to have difficulty recovering, even in the absence of harvest. There may be many factors that inhibit their recovery and these cumulative impacts are not well understood.

CONCLUSIONS AND ADVICE

Both the survey and modelled abundance estimates suggest this population is depleted. The model estimated that harvest levels of 0, 0, 1, 1, 2, 4, and 41 beluga per year would result in a 0, 5, 10, 15, 25, 50, and 100% probability of decline, respectively, in beluga abundance in ten years. A PBR and TALC of 0 were calculated from the modelled 2026 abundance.

LIST OF MEETING PARTICIPANTS

Name	Organization/Affiliation
David Yurkowski (Chair)	DFO – Science, Arctic Region
Steve Ferguson	DFO – Science, Arctic Region
Marianne Marcoux	DFO – Science, Arctic Region
Cortney Watt	DFO – Science, Arctic Region
Justine Hudson	DFO – Science, Arctic Region
Caroline Sauve	DFO – Science, Quebec Region
Elise Keppel	DFO – Science, Pacific Region
Brooke Biddlecombe	University of Alberta
Jason Harasimo ¹	Nunavut Wildlife Management Board
Rod Hobbs	(Retired from NAMMCO and NOAA, Alaska Fisheries Center National Marine Fisheries)

¹ Erratum October 2026: Recognition of the meeting participation by Jason Harasimo.

Name	Organization/Affiliation
Bill Koski	(Retired from LGL Limited – Environmental Research Associates)
David Lee	Nunavut Tunngavik Incorporated
Patt Hall	DFO – Fisheries Management, Arctic Region
Michelle Wetton-Salo	DFO – Fisheries Management, Arctic Region
Richard DiRocco	DFO – Fisheries Management, Arctic Region
Kaytlin Cooper	DFO – Species at Risk, Arctic Region
David Boguski	CSAS – Arctic Region
Melanie Toyne	CSAS – Arctic Region

SOURCES OF INFORMATION

DFO. 2025. Revised Atlantic Seal Management Strategy. DFO Can. Sci. Advis. Sec. Sci. Advis. Rep. 2025/005.

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