



HARVEST ADVICE FOR NUNAVIK BELUGA (*DELPHINAPTERUS LEUCAS*)

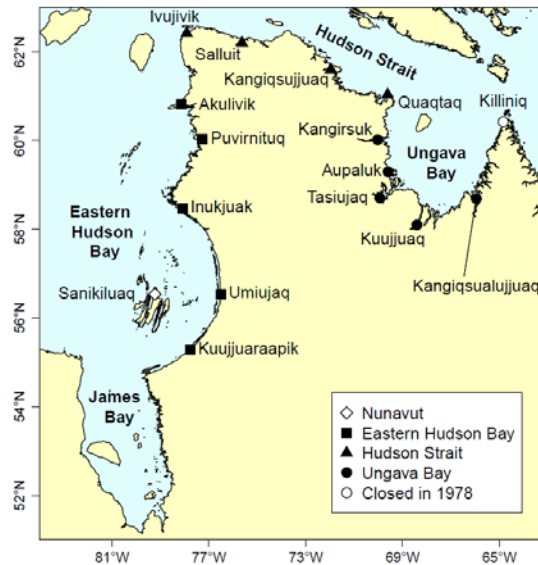


Figure 1. Map of communities in Nunavik.

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Context

Beluga whales (Delphinapterus leucas) are found in summer along the coasts of Hudson, James and Ungava Bays (Fig. 1). The majority of these animals are thought to overwinter in Hudson Strait. At least three separate populations have been identified: Ungava Bay, eastern Hudson Bay and western Hudson Bay. In 2004, the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) recommended that the Ungava Bay (UB) and eastern Hudson Bay (EHB) population be listed as Endangered.

In addition to the subsistence hunt, commercial hunts in Ungava Bay removed at least 1,340 animals between the 1860's and the early 1900's. Commercial hunting in eastern Hudson Bay removed an estimated 7,875 animals between 1854 and 1863, and continued at Great Whale River until at least 1877, apparently ending due to the depletion of the population. Current subsistence hunting is directed towards both summering concentrations and migrating whales from a mixture of populations during spring and fall. High subsistence harvests have limited recovery of the EHB and UB beluga populations.

The beluga hunt is very important from a cultural and subsistence perspective. In northern Quebec, harvesting has been regulated through a combination of area closures, controlled season and regional quotas. In 2006, the Nunavik Inuit Land Claims Agreement (NILCA) was signed, resulting in the establishment of the Nunavik Marine Region Wildlife Board that has management responsibilities for the co-management of Nunavik beluga. A multi-year management plan is to be prepared in 2010 for the 2011 season and beyond.

In 2009, information from aerial surveys, numbers of animal killed, and stock composition of the harvest was incorporated into a population model to inform management efforts. This advisory report updates the model using 2010 harvest statistics and summarizes new information on the age structure of the population. It also addresses a request from DFO-Quebec Fisheries Management for peer-reviewed scientific information on the health of the EHB population in order to determine the maximum harvest of EHB beluga that could occur that would have a 75%, 50%, 25%, and 5% chance of a population decline.

SUMMARY

- Beluga hunted in Nunavik come from separate summering populations. Genetic analyses support the existence of an eastern Hudson Bay stock (EHB) and one or more western Hudson Bay stocks (WHB). There is insufficient genetic information to confirm the stock identity of whales summering in Ungava Bay (UB).
- The 2010 harvest consisted of 45 beluga killed near Sanikiluaq (Belcher Islands), 16 in the eastern Hudson Bay area, 15 in Ungava Bay, 146 in Hudson Strait in the spring and 58 in the fall. Since 2009, it is assumed based on genetic data that all animals killed in EHB, 10% of those killed in the spring and summer in Hudson Strait, and 20% of those killed in Ungava Bay and during the fall in Hudson Strait are EHB beluga. It is also assumed that 12% of beluga killed by Sanikiluaq hunters belong to the EHB stock. Using these proportions, the 2010 harvest is equivalent to 51 EHB beluga.
- Population modeling, using abundance estimates corrected for diving, indicates that the eastern Hudson Bay population has likely declined from 4,120 whales in 1985 to about 3,030 in 2010. At current harvest levels, the population has probably remained stable over the last few years.
- Removing 50 EHB animals in future harvests has a 50% probability of causing a decline in the population, while lower harvests would likely allow some recovery. Limiting the harvest of EHB animals to 10 reduced the probability of decline to 25%. Conversely, a harvest of 100 EHB whales would have a 75% probability of leading to population decline. No harvest scenario could produce a 5% chance of decline, since in the absence of harvest the probability of decline was 18%.
- Analyses on beluga harvested in Hudson Strait, combining age information from teeth and probabilistic information on stock of origin determined from mitochondrial DNA, showed that the age structure of EHB beluga was strongly skewed towards younger individuals and contained less older individuals compared to the non-EHB whales. These results could indicate a disproportional catch of younger EHB animals, significant harvesting pressure on the EHB stock or both. Additional research is needed to better inform management efforts.

BACKGROUND

Species Biology

Beluga whales have a circumpolar distribution. They are medium-sized toothed whales with an adult length of 350 cm and weigh up to 500–600 kg. Mating is thought to occur in March- April, with calving occurring in mid-summer. Calves are born after a 14 month gestation and lactation lasts roughly 18 months. The calving interval is 3 years. At birth, the calves have been described as being brown or dark bluish in colour. As they mature, the skin becomes lighter in colour gradually turning to grey and then to white. In the EHB population, 57% of the light grey animals may be sexually mature. Sexual maturity might fall between 8 and 14 years of age, and longevity may be 60+ years. Beluga lack a dorsal fin, which is believed to be an adaptation to inhabiting ice covered waters. They are often associated with estuaries, which has led to the view that they are a shallow water species. However, aerial surveys and satellite telemetry indicate substantial movements offshore and diving to depths of over 600 m.

The Hunt

Harvest statistics are available since 1974. These statistics represent minimum estimates only, since not all villages provided catch data in all years, and information on the number of animals struck and lost is incomplete. During the 12 year period 1974–1985, a total of 5,402 whales (average=450 whales/yr) was reported to have been taken by Nunavik communities. The introduction of quotas in 1986 reduced annual harvests to an average 258 beluga/yr during 1986–2001 (range: 162–385 beluga/yr), and to an average 175 beluga/yr after 2001 (range: 125–216 beluga/yr). Historically the highest reported harvests have been from Hudson Strait and this has continued with 69–92% of the total annual landings in this area since 2005.

ASSESSMENT

Stock structure

Beluga hunted in Nunavik come from separate summering populations. Genetic analyses support the existence of an eastern Hudson Bay stock and one or more western Hudson Bay stocks. There is insufficient genetic information to confirm the stock identity of whales summering in Ungava Bay.

The harvest consists of animals taken from different stocks. The 2010 harvest consisted of 45 beluga killed near Sanikiluaq (Belcher Islands, Nunavut), 16 in the eastern Hudson Bay area, 15 in Ungava Bay, 146 in Hudson Strait in the spring and 58 in the fall. Since 2009, it is assumed based on genetic data that all animals killed in EHB, 10% of those killed in the spring and summer in Hudson Strait, and 20% of those killed in Ungava Bay and during the fall in Hudson Strait are EHB beluga. It is also assumed that 12% of beluga killed by Sanikiluaq hunters belong to the EHB stock. Using these proportions, the 2010 harvest is equivalent to 51 EHB beluga.

Abundance

Visual systematic transect aerial surveys to evaluate beluga abundance were flown in 1985, 1993, 2001, 2004 and 2008 in James Bay, EHB and Ungava Bay. Ungava Bay was not surveyed in 2004. The survey estimates in both James Bay and EHB have varied widely, with no discernible trend and are characterized by wide confidence intervals (Fig.2).

A population model incorporating updated information on harvest statistics and stock composition was fitted to aerial survey estimates using Bayesian methods. It resulted in a 1985 population estimate of 4,118 animals with a 95% Credible Interval (CI) of 2,219–8765). The lowest abundance point was estimated at 2,977 (95% CI 1,970–4,674) for the year 2001. The model estimated a population in 2010 of 3,034 individuals (95% CI 1,390–6,181). At current harvest levels, the population has probably remained stable over the last few years (Fig.1). The estimated intrinsic rate of population increase of 2.7% (i.e., the population production before harvesting) is within the range expected for other cetaceans with similar life histories. Struck and loss was estimated by the model at 56% but this estimate may also include other biases in catch estimation (see below Sources of uncertainty).

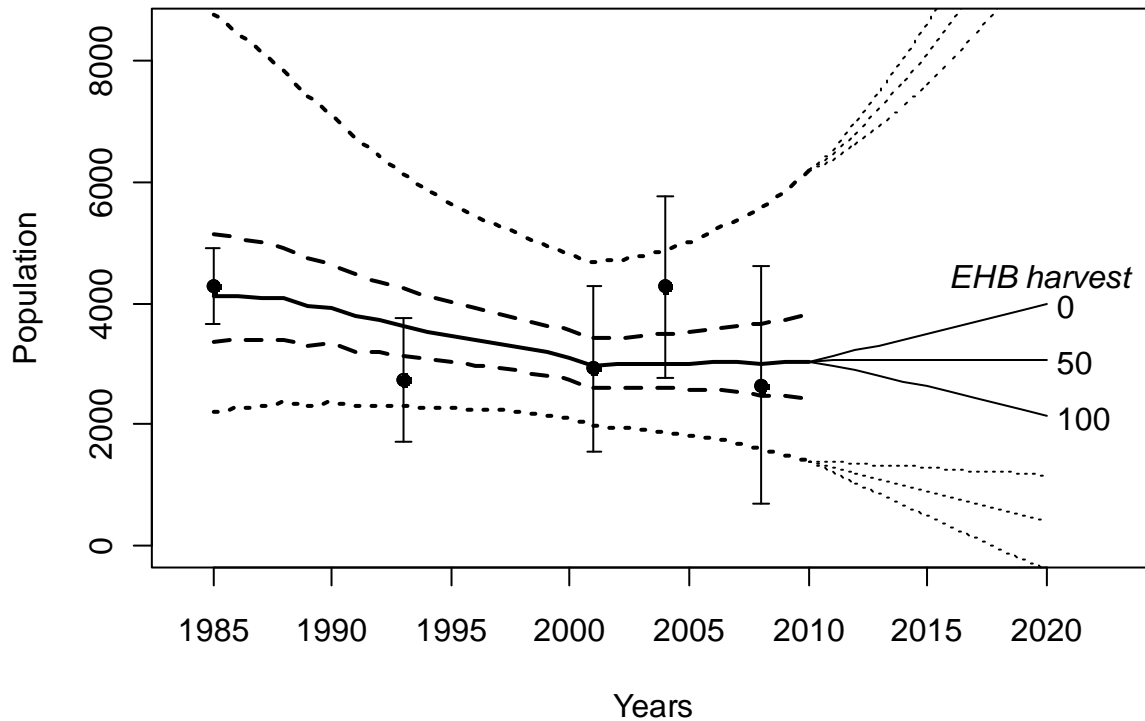


Figure 2. Eastern Hudson Bay beluga. Model estimates of population abundance (thick lines). Solid line: median estimates. Dashed lines: 25% and 75% quartiles. Dotted lines: 2.5% and 97.5% quartiles (= 95% Bayesian Credible Interval). The model was fitted to aerial survey estimates corrected for animals at the surface (closed circles, \pm SE). The thin lines represent future modeled population trajectories (and corresponding CI limits) at three harvest levels.

Under the current management plan, overall harvest rates have declined and the model suggests that the rate of decline in the EHB population has also slowed or stopped. Removing 50 EHB animals in future harvests would have a 50% probability of causing a decline in the population (Fig. 3). Limiting the harvest of EHB animals to 10 reduced this probability to 25%. Conversely, a harvest of 100 EHB whales would have a 75% probability of leading to population decline. No harvest scenario could produce a 5% probability of decline, since in the absence of harvest the probability of decline was 18%.

Age structure

Harvest statistics suggest significant reductions in age of EHB beluga in recent years but hunt closures in eastern Hudson Bay have limited our ability to monitor recent changes in the population age structure. However, most current harvesting is taking place in Hudson Strait, a migration route for both EHB and WHB beluga populations. Thus, we combined age information from teeth with probabilistic information on stock of origin determined from mitochondrial DNA analysis to compare the age distribution of EHB beluga vs. other stocks harvested in the Hudson Strait for the years 2000-2009. The age structure of EHB beluga was strongly skewed towards younger individuals and contained fewer older individuals than the non-EHB harvest in Hudson Strait (Fig. 4). In particular, the proportion of animals under 10 years of age was two times higher in the EHB catch (22%) than in the non-EHB catch (11%). The mean age of EHB beluga was 4.5 years lower than that of non-EHB whales (EHB mean = 16.8, sd = 8.2; non-EHB mean = 21.3, sd = 9.6).

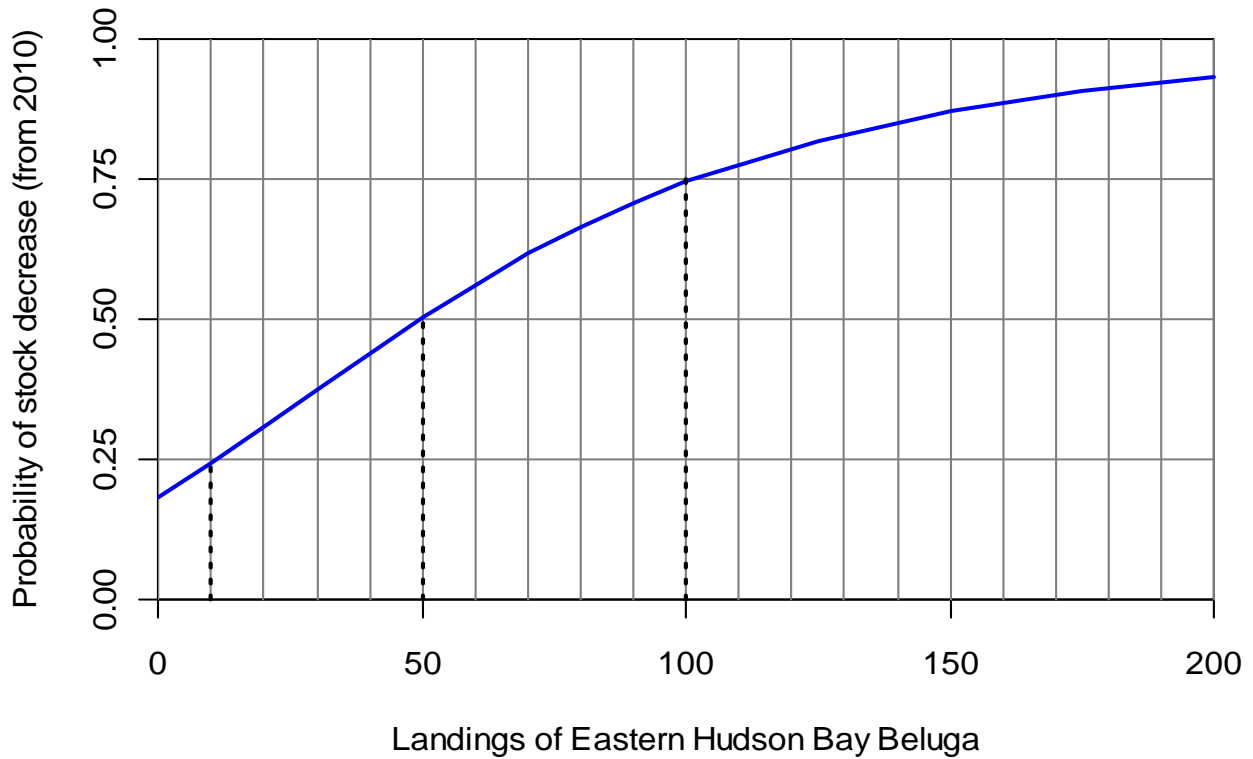


Figure 3. Eastern Hudson Bay beluga. Probability of stock decrease (from the 2010 population estimate) at different harvest levels estimated by a Bayesian stock-production model assuming stochastic stock dynamics.

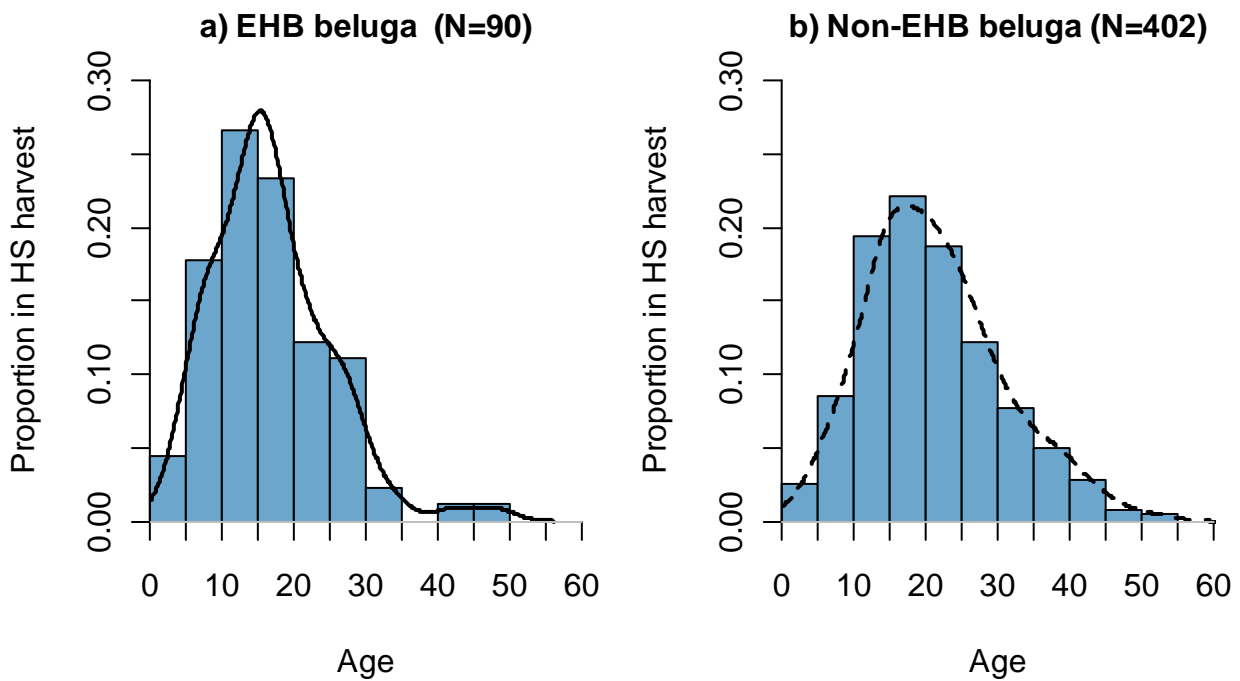


Figure 4. Age structure of beluga harvested in Hudson Strait (2000-2009) assigned to a) Eastern Hudson Bay and b) other stocks. Bars show proportion of each 5-year age class in harvest. Lines show smoothed density estimates. Stock identity was assessed from probabilistic analyses based on mtDNA data.

Such differences may be due to differential migration timing between EHB and WHB beluga, coupled with potential segregation among age classes, making groups of younger EHB animals prone to disproportional catch. This phenomenon would be accentuated if females with calves and juveniles migrate closer to shore during travel (as observed in the Beaufort Sea). These differences could also reflect the impacts of significant harvesting pressure on the EHB herd, which could have resulted in few adults surviving in the population. Moreover, changes in life history traits (e.g., lowering age of first reproduction, reducing birth intervals and increasing pregnancy rate) may explain the higher proportion of juveniles. These changes can have detrimental effects, e.g., female reproducing at a younger age could experience higher calf mortality, especially if there are few experienced females left in their group.

Though present data do not enable us to distinguish among these interpretations, these are clear signs of stock depletion and emphasize the need for further research.

Sources of uncertainty

Abundance estimates for this population are limited to five aerial surveys, flown in 1985, 1993, 2001, 2004 and 2008. There is also a lack of data on vital rates, which limits opportunities to model the dynamics of this population. More frequent surveys would reduce some of the uncertainty, as would increased participation in the sampling program and improvements in field observations of actual struck-and-loss rates.

There is uncertainty associated with the aerial survey estimates, which results from the very clumped distribution of whales. Other factors include the variability in surfacing behaviour of the whales; aerial survey estimates were corrected for animals that were diving when the survey plane passed overhead but estimates of population size are very sensitive to this correction factor which is based on limited data. Fitting a population model to the data helped to reduce some of the uncertainty around the estimates of current population size, but the coefficients of variation remain quite high (~40%).

Beluga harvested in the community of Sanikiluaq (Nunavut) are of mixed origin. However, it is not possible using aerial survey techniques to determine the proportion of animals in the offshore regions that belong to the EHB population or the western Hudson Bay population. Haplotype composition of samples from animals harvested during spring/early summer indicates that EHB animals represent about 12% of the Sanikiluaq harvest. At current harvest levels, Sanikiluaq probably removes 3–4 EHB beluga from the population annually. Satellite telemetry indicates that from mid-July to late September, a large proportion of the EHB population moves offshore near Sanikiluaq. Although current harvesting is limited to the early summer or winter, and the genetic data support that few EHB animals are taken at those times, seasonal changes in harvesting practices by Sanikiluaq hunters could have an important impact on the EHB beluga population. The Sanikiluaq Hunters and Trappers Organization has passed a bylaw stating that they will not harvest beluga whales during the summer months (i.e., July 15 – September 30).

Communities north of the eastern Hudson Bay arc and in Hudson Strait are hunting beluga from both the small EHB population and the large western Hudson Bay population. Results from the genetic analyses indicate that about 10% of the animals harvested in Hudson Strait prior to 1 September belong to the EHB population, whereas approximately 20% of the animals harvested after 1 September belong to the EHB stock. We are uncertain as to the full extent of the variability in these proportions which would affect the overall number of EHB animals removed.

Harvest statistics have been gathered since the 1970's. These statistics include a column for animals struck but not recovered. Typically this column has a value in the weekly statistic reports of 0 or 1. However, modeling suggests that this figure is probably closer to 60% of the catch. This value represents both animals struck and lost and animals killed but not reported. It also represents errors in the classification of animals to the EHB stock.

The maximum rate of increase is not known for northern Quebec beluga. The model fitted to the survey and catch data estimated a rate of increase of 2.7% which is within the range of values accepted for beluga. However, for such a small population relative to estimated pristine levels, a rate approaching the maximum would be expected. The continued harvest on females with calves may be having some impact on recovery, but this is highly uncertain.

ADDITIONAL STAKEHOLDER PERSPECTIVES

The Inuit in northern Quebec consider beluga whales as an important food resource. There is community concern regarding contaminants and disease agents that could affect the health of beluga or their human consumers. Other global issues of concerns include climate change and the resultant changes in sea ice, which might affect whale movements, their foods and hunter access to whales. Community consultations raised concerns about the increase in numbers of both small boats and large ships, and how increasing noise might disturb beluga, particularly in nearshore areas.

A wide range of concerns have been expressed about beluga whale abundance. Some people have difficulty understanding and accepting survey estimates, since they have seen large numbers of whales in areas where only small numbers of whales have been seen during the survey period. Several people expressed concern that they were seeing fewer animals than in the past. It is not clear whether changes in sightings are a result of a reduction in beluga abundance, or animals having moved elsewhere. Some communities in EHB have also expressed that there are fewer whales today than during previous years due to high harvest levels. However, other communities particularly in Hudson Strait feel very strongly that beluga are abundant.

Moreover, some hunters disagree with the scientific view that female beluga whales have a calf every three years on average, believing instead that beluga females have a calf every year.

CONCLUSIONS AND ADVICE

The current population size is around 3,030 animals (95% CI 1,390–6,181) and is likely stable. Removing 50 EHB animals in future harvests would have a 50% probability of causing a decline in the population. Limiting the harvest of EHB animals to 10 reduced this probability to 25%. Conversely, a harvest of 100 EHB whales would have a 75% probability of leading to population decline.

The efforts put in place over the last decade have succeeded in reducing overall harvest levels and at current reported harvest levels, the population may have stabilized under the current management plan. However, there is also little indication of substantial population growth. Increased participation in the sampling program and improvements in estimates of struck-and-loss are needed.

The beluga whales in eastern Hudson Bay are currently considered to be 'endangered' by COSEWIC. It is advised to limit the harvesting of EHB animals to allow them to recover. The total impact of harvesting on the EHB beluga whale population will be affected by the actual number of animals killed in the eastern Hudson Bay arc area and the proportion of animals taken during spring/summer vs. fall in Hudson Strait. Setting catches at levels of around 50 EHB whales per year is not precautionary.

OTHER CONSIDERATIONS

Beluga in northern Quebec are co-managed with the Nunavik Marine Region Wildlife Board (NMRWB) under a multi-year management plan. While the NMRWB has management responsibilities as outlined in the Nunavik Inuit Land Claims Agreement, DFO retains ultimate responsibility for the management of all marine species.

COSEWIC has identified this population as endangered, but no decision has been made by the Government of Canada pending the establishment of a consultation framework with the Nunavik Marine Region Wildlife Board for SARA issues.

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