Fisheries and Oceans Canada | Pêches et Océans Canada
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Quebec Region
Canadian Science Advisory Secretariat
Science Advisory Report 2011/080

HARVEST ADVICE FOR NUNAVIK BELUGA (*DELPHINAPTERUS LEUCAS*)

G. Kuehl

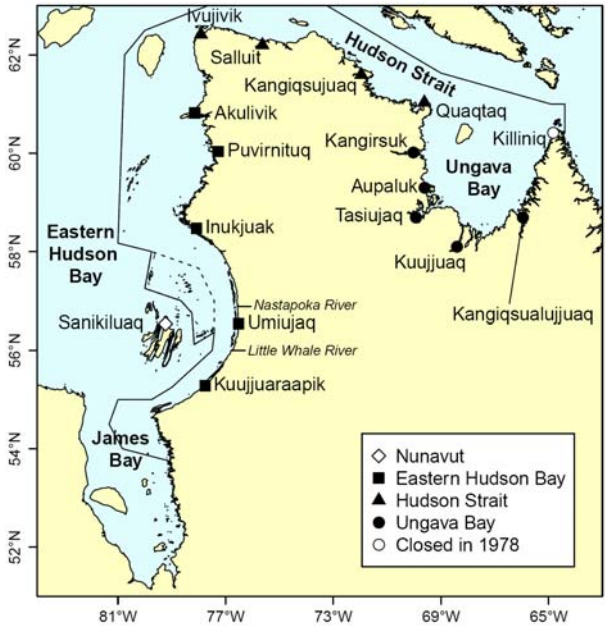

Figure 1. Map of communities in Nunavik and limits of Nunavik Marine Region (solid line) and Equal Use and Occupancy Area (dashed line).

Context

*Beluga whales (*Delphinapterus leucas*) are found in summer along the coasts of Hudson Bay, James Bay and Ungava Bay (Fig. 1). At least three separate summer stocks (previously referred to as populations) have been identified: eastern Hudson Bay (EHB), western Hudson Bay (WHB) and Ungava Bay (UB). The majority of these animals are thought to overwinter in Hudson Strait and the Labrador Sea. In 2004, the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) recommended that the UB and EHB stocks 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 that local group. Current subsistence hunting is directed towards both summering concentrations and migrating whales from a mixture of stocks during spring and fall. High subsistence harvests have limited recovery of the EHB and UB beluga stocks. 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 seasonal and regional allowable takes. In 2006, the Nunavik Inuit Land Claims Agreement (NILCA) was signed, resulting in the establishment of the Nunavik Marine Region Wildlife Board (NMRWB) that has management responsibilities for the co-management of Nunavik beluga. This review provides information necessary for the development of a multi-year beluga management plan for Nunavik with the NMRWB and the Regional Nunavimmi Umajutvijiit Katajuaqatigininga (RNUK) also known as the Nunavik Hunters, Fishermen and Trappers Association, and addresses the specific requests from DFO

Ecosystems and Fisheries Management described below:

a) Determine the maximum number of beluga that can be taken from the EHB stock for different probabilities of stock increase (25%, 50% and 75%) based on the hunting season and location.

b) Determine the maximum number of beluga that can be taken from the UB stock at different probabilities of stock increase (25%, 50% and 75%).

c) Present the scientific rationale for keeping the Mucalic, Nastapoka and Little Whale River estuaries closed and the impact on beluga stocks (EHB and UB).

d) Determine whether the James Bay (JB) beluga are part of the EHB stock, whether these individuals remain in James Bay throughout the year and, if applicable, their migration route.

e) Determine the best allocation scheme for individuals that are taken in the Belcher (east and west shore), King George and Sleeper Islands and the impact on the EHB stock.

SUMMARY

- Nunavik hunters harvest beluga from a mix of several discrete stocks (previously referred to as populations), designated after their specific summering areas: Western Hudson Bay (WHB), Eastern Hudson Bay (EHB), and Ungava Bay (UB).
- The 2011 reported harvest consisted of 32 beluga killed near Sanikiluaq (Belcher Islands), 19 in the eastern Hudson Bay area, 17 in Ungava Bay, 115 in Hudson Strait in the spring and 86 in the fall. Based on proportions derived from genetic analyses, this harvest is equivalent to 55 EHB beluga.
- Population modeling, using catch data and abundance estimates corrected for diving, indicate that the EHB stock has likely declined from ~4,100 whales in 1985 to ~3,000 in 2011. At current harvest levels, the stock has probably remained stable in recent years.
- Removing 49 EHB animals in future harvests has a 50% probability of causing a decline in the stock, while lower harvests would likely allow some recovery. The probability of decline in the absence of harvest is 19%.
- No whales were counted on transect lines during four systematic aerial surveys of Ungava Bay, although there were some off-line observations. According to a Bayesian binomial model, there is a strong probability that there are less than 100 individuals in the UB stock (95% CI 0–94). Any harvest from the UB stock clearly poses a threat to its recovery.
- Based on the combination of genetic and telemetry studies, beluga in James Bay are considered a separate stock. Estimates of the number of JB beluga from aerial surveys flown in 1993, 2001, 2004, 2008 were highly variable and ranged from ~8,200 to ~19,400.
- All available information indicates that the EHB stock is straddling the limits of Nunavut and Nunavik. Although current harvesting by Sanikiluaq hunters is limited to the early summer or late fall, when few EHB animals are taken, changes in their harvesting practices could have an important impact on the EHB beluga stock.
- The Little Whale and Nastapoka river estuaries are places of regular aggregations for large numbers of whales. Satellite telemetry data show that beluga return repeatedly to specific estuaries over the course of the summer.
- Recent genetic analyses indicate that beluga killed in the same hunting event tend to be related. Hunting in estuaries usually leads to the capture of larger numbers of beluga, and is thus more likely to remove several whales from the same family unit. Given the strong

philopatry documented in beluga, estuarine hunts have a higher risk of extirpating animals from estuaries and compromising future recolonization.

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. Beluga lack a dorsal fin, which is believed to be an adaptation to inhabiting ice covered waters. Mating is thought to occur during winter or early spring. Calves are born after a 14 month gestation and lactation lasts roughly 18 months. Beluga calves spend 2-3 years with their mother, during which time, they perform several seasonal migrations. It has been suggested that this extended parent-offspring association could provide the opportunity for learning migration routes. The calving interval is 3 years. At birth, the calves are brown or dark bluish in colour. The skin becomes lighter in colour as they mature, gradually turning to grey and then to white. Sexual maturity might fall between 8 and 14 years of age, and longevity may be 60+ years.

Across their entire range, beluga whales are known to visit estuaries and river mouths during summer, 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. In Nunavik, some of these estuaries are places of regular aggregations for large numbers of whales. Satellite telemetry data from the Little Whale and Nastapoka rivers show that beluga exhibit fidelity to these sites during summer as they undertake regular trips to and from estuaries, sometimes hundreds of kilometres away, over the course of the summer (Fig.2).

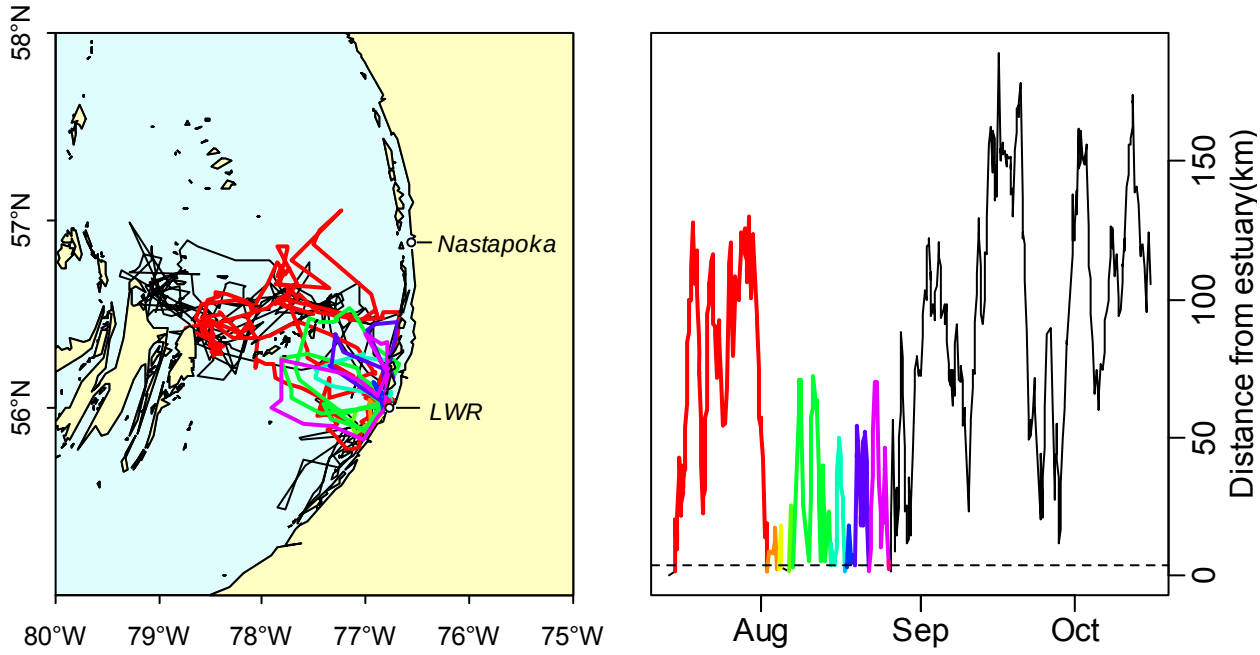

Figure 2. Left: Movements of a beluga whale equipped with satellite transmitters in Little Whale River (LWR) for the period July 14 – October 15, 2004. Each colour corresponds to a trip starting and ending at the LWR estuary. Right: Distance from LWR estuary over the same time period. Each colour corresponds to one of the trips identified in the left hand side panel.

The Harvest

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 total allowable takes (TAT) 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.

Estuaries have traditionally provided good harvesting opportunities for subsistence hunters because large numbers of animals are aggregated in relatively confined spaces. For this reason, several estuaries were chosen by the Hudson Bay Company (HBC) to establish hunting camps and trading posts and large numbers of animals were removed. Analysis of harvest data (1980-2001) indicates that beluga were more likely to be captured in greater numbers in estuaries than elsewhere outside of estuaries (Fig. 3).

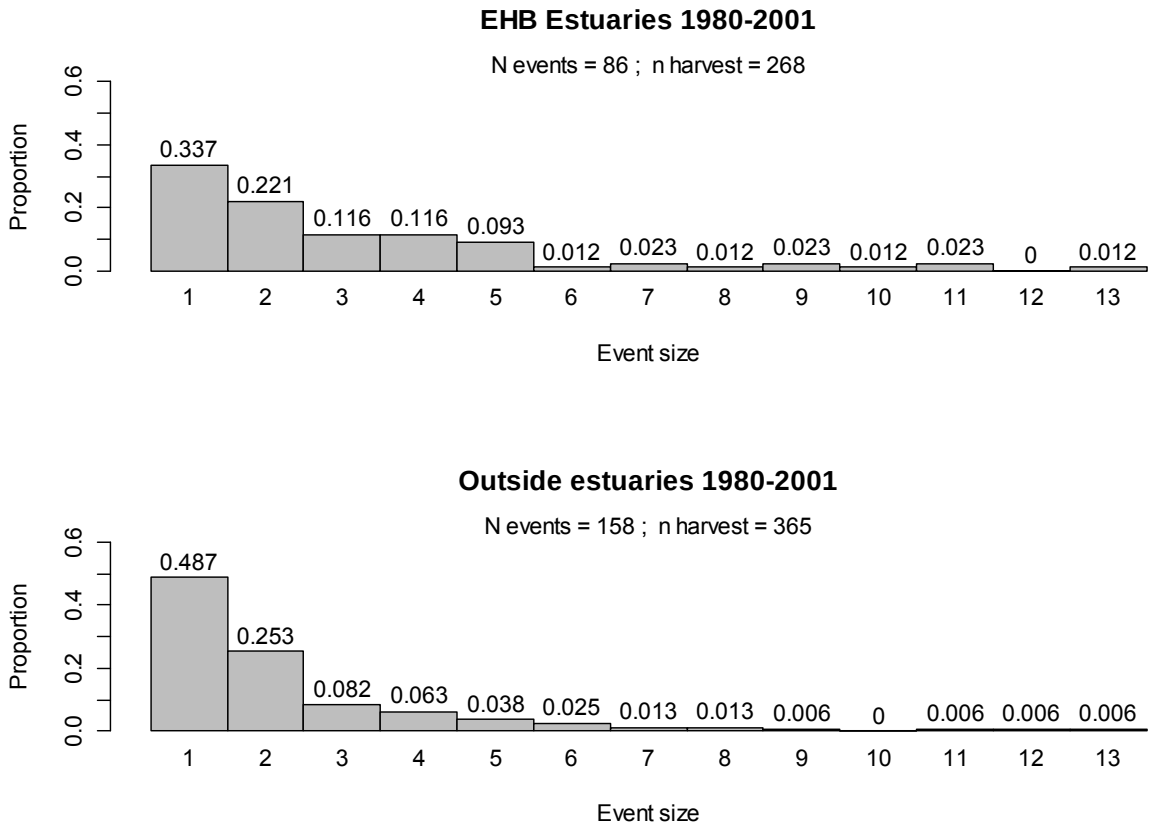

Figure 3. Size of hunting events in eastern Hudson Bay estuaries (top), and outside of estuaries (bottom) in the eastern Hudson Bay arc and Hudson Strait for the period 1980-2001.

Commercial harvests by the HBC probably initiated the depletion of beluga stocks in eastern Hudson Bay and Ungava Bay, whereas high subsistence harvests have likely limited the

opportunity for stocks to recover. In the 1980's, low estimates of beluga abundance in eastern Hudson Bay and Ungava Bay resulted in limits being placed on harvesting through a combination of TAT and seasonal and regional closures, including the creation of a permanent sanctuary in southern Ungava Bay at the Whale, Mucalic, Tuctuc and Tunulic rivers (1986), and seasonal closures at the Nastapoka (1990) and Little Whale (1995) rivers in eastern Hudson Bay. Harvesting in the eastern Hudson Bay was closed from 2001 to 2006, and the Nastapoka River (NR) and Little Whale River (LWR) estuaries have remained close since harvesting resumed in the eastern Hudson Bay area in 2007. The Ungava Bay was entirely closed to hunting during four years (2002−2003, 2005−2006), and the Mucalic has remained a sanctuary since 1986.

ASSESSMENT

Stock structure

Evidence that beluga return every year to the same aggregation areas have come from photo-identification, genetic and contaminant research. Telemetry studies in Nunavut and Nunavik have supported the concept that Nunavik hunters harvest beluga from a mix of several discrete stocks, designated after their specific summering areas: western Hudson Bay (WHB), eastern Hudson Bay (EHB), and Ungava Bay (UB). In the winter, these stocks are found in Hudson Strait, Ungava Bay, the Labrador Sea and southwest Davis Strait where their distributions are largely unknown but are believed to overlap. In spring and fall, each stock migrates to and from their specific summering grounds.

Eastern Hudson Bay (EHB)

Although some individuals are observed from land in late May, most EHB beluga arrive in eastern Hudson Bay around June-July. Their spring migration route has not been documented but genetic analyses suggest that about 10% of the whales harvested by southern Hudson Strait communities in the spring belong to the EHB stock. Satellite telemetry indicates that whales from the Little Whale and Nastapoka rivers leave the eastern Hudson Bay arc between early-October and mid-November and migrate along the southern Hudson Strait shore to Ungava Bay and the Labrador Sea. Their proportion in the fall harvest in Hudson Strait is estimated at 20%.

Ungava Bay (UB)

Beluga were historically abundant in Ungava Bay. Although the major summer concentrations of beluga formerly found in southern Ungava Bay are no longer observed, continued sightings and occasional harvesting suggest either that the stock persists at some low level or that the area is frequented by whales from neighbouring stocks. However, there is insufficient genetic information to confirm the stock identity of whales summering in Ungava Bay.

The proportions of EHB beluga in harvest samples from the five communities in Ungava Bay as well as Quaqtaq have been estimated by genetic analyses at 4% ± 5% in spring, 6% ± 9% in summer, and 28% ± 9% in the fall. The high proportion of EHB beluga in the fall is consistent with satellite telemetry data showing that EHB beluga migrate through Ungava Bay during their fall migration, arriving in October or November, and spending a few weeks to a few months in the bay.

James Bay (JB)

Most beluga whales migrate long distances between wintering and summering locations. However, in some areas animals may remain as resident populations year-round. Information from traditional knowledge and satellite telemetry show that some beluga whales remain in James Bay for the winter and thus may be part of a distinct summer stock and breeding population (Fig. 4). Genetic analyses of whales sampled in James Bay confirmed that beluga in James Bay form a distinct stock from other management stocks in Hudson Bay.

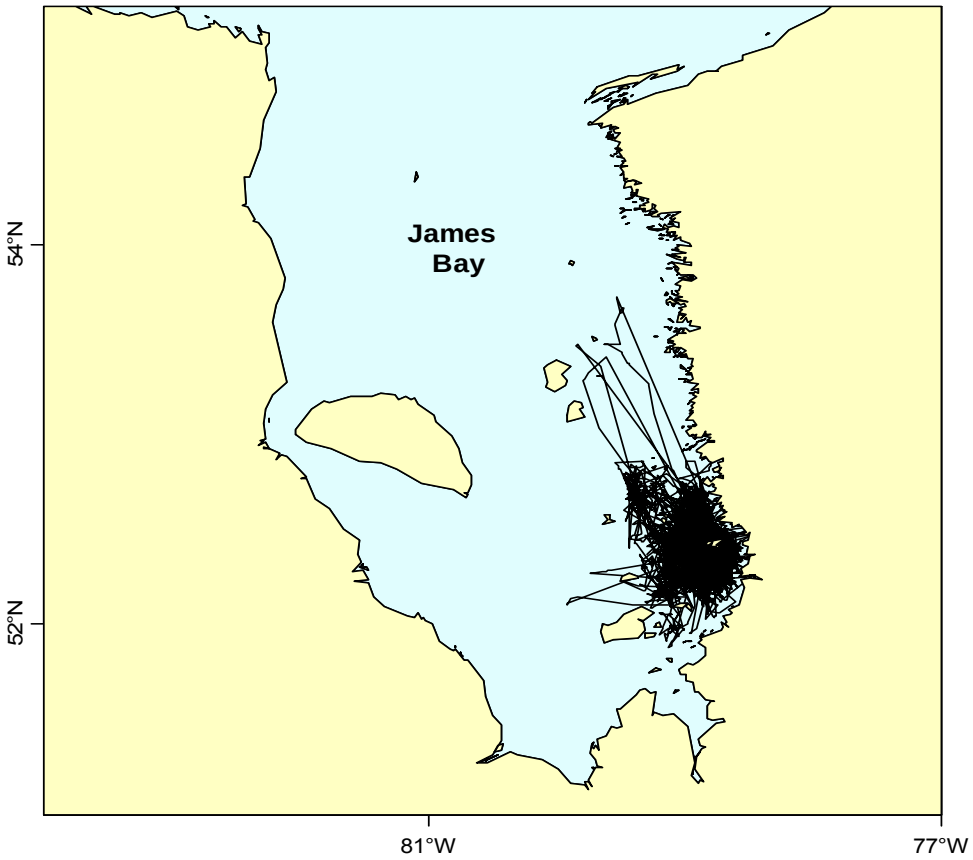

Figure 4. Movement tracks of 14 beluga whales equipped with satellite transmitters over the months August to February.

Belcher, Sleeper and King George Islands

Beluga whales are harvested mostly during spring and fall around the Belcher, Sleeper and King George Islands, which lie in the centre of the arc of eastern Hudson Bay. Their relationship to other summer stocks remains unclear. Observations from summer aerial surveys have shown that the distribution of beluga between the Belcher Islands and the eastern shore of Hudson Bay is continuous. Satellite telemetry confirmed that EHB beluga from the Little Whale and Nastapoka rivers use offshore areas in eastern Hudson Bay that extend into both the Nunavut Settlement Area and the Equal Use and Occupancy Area as defined in the Nunavut Final Agreement, including the Belcher Islands (Fig. 5). Genetic analyses have shown that beluga harvested near Sanikiluaq (Belcher Islands, Nunavut) are of mixed origin. Haplotype composition of samples from animals harvested during spring/early summer indicates that EHB animals represent about 12% of the Sanikiluaq harvest. King George and Sleeper Islands have

too few samples for genetics to make any definitive conclusions on the proportion of EHB whales in the hunt.

The specific haplotype assemblage observed in the Sanikiluaq harvest suggests that a distinct group of individuals may frequent this area and form a summer stock, not only different from EHB, but also from WHB. Traditional knowledge from Sanikiluaq reports the occurrence of numerous polynya north and south of the Belcher Islands, as well as occasional hunting of beluga in December-January, indicating that animals may overwinter in the area.

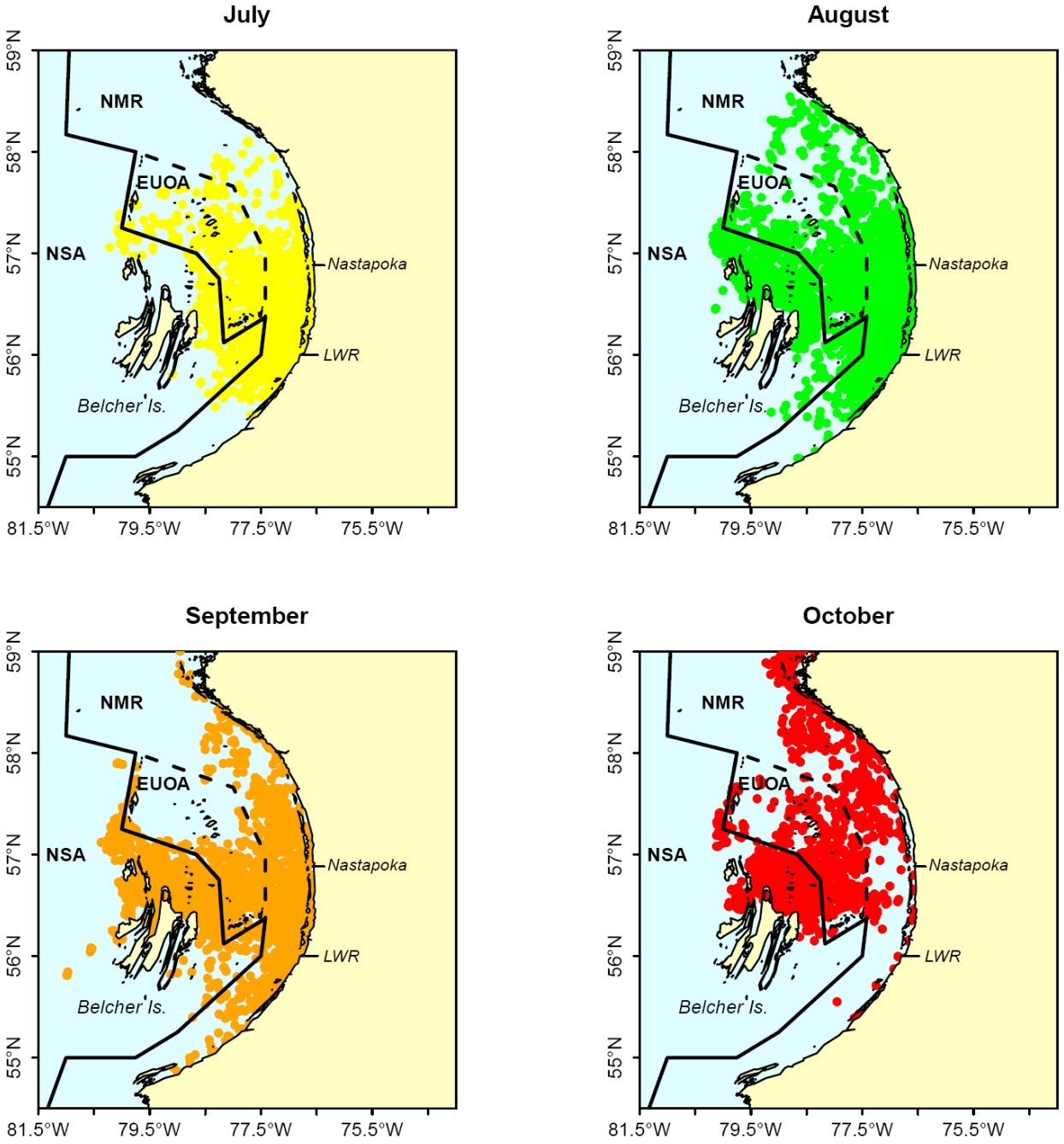

Figure 5. Locations of 34 beluga whales equipped with satellite transmitters in the Little Whale River (LWR, N = 30) and the Nastapoka River (N = 4). NMR: Nunavik Marine Region; EUOA: Equal Use and Occupancy Area; NSA: Nunavut Settlement Area.

Abundance and impact of harvest levels

Visual systematic transect aerial surveys to evaluate beluga abundance were flown in James Bay and eastern Hudson Bay in 1985, 1993, 2001, 2004 and 2008. Ungava Bay was surveyed in the same years, with the exception of 2004.

Eastern Hudson Bay (EHB)

Abundance estimates of the EHB stock from aerial surveys have varied widely and are characterized by wide confidence intervals (Fig. 6). A population model incorporating updated information on harvest statistics and stock composition was fitted to aerial survey estimates using Bayesian methods. The 2011 harvest was assumed to consist of 45 beluga killed near Sanikiluaq, 19 in the eastern Hudson Bay area, 16 in Ungava Bay, 108 in Hudson Strait in the spring and 74 in the fall. Using the proportions outlined above, the 2011 harvest was equivalent to 53 EHB beluga.

The model estimated an EHB beluga abundance in 2011 of 3,030 individuals with a 95% Credible Interval (CI) of 1,256–6535. The 1985 abundance estimate was 4,121 animals (95% CI 2,225–8,857). The lowest abundance point was estimated at 2,981 (95% CI 1,963–4,681) for the year 2001. At current harvest levels, the stock has probably remained stable over the last few years (Fig. 6). The estimated intrinsic rate of increase of 2.6% (i.e., stock 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).

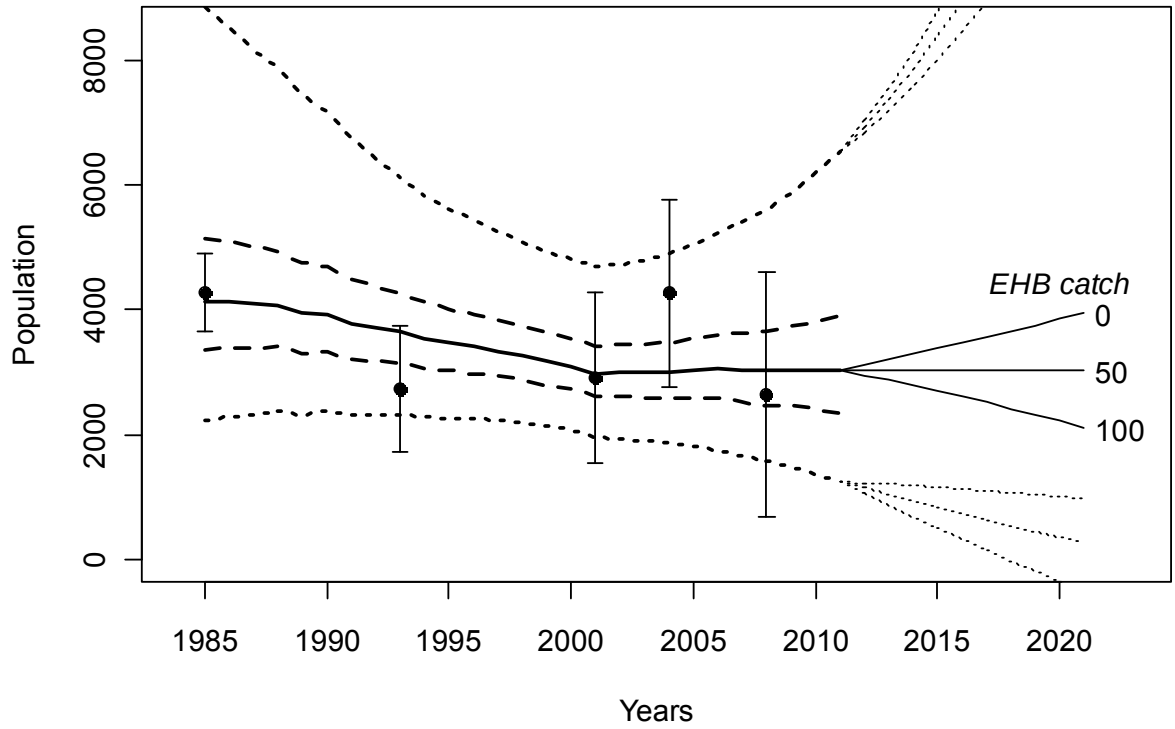

Figure 6. Eastern Hudson Bay beluga. Model estimates of stock abundance (thick lines). Solid line: median estimates. Dashed lines: 25% and 75% quartiles. Dotted lines: 2.5% and 97.5% quantiles (= 95% Bayesian Credible Interval). The model was fitted to aerial survey estimates corrected for animals at the surface (closed circles, ±SE). The thin lines represent future modeled stock trajectories (and corresponding CI limits) at three harvest levels.

The removal of 49 EHB beluga per year in future harvests would have a 50% probability of causing a decline in the stock (Fig. 7). Limiting the harvest of EHB animals to 10 would reduce this probability to 25%. Conversely, a harvest of 103 EHB whales would have a 75% probability of leading to a decline. In the absence of harvest, the probability of decline is estimated to be 19%.

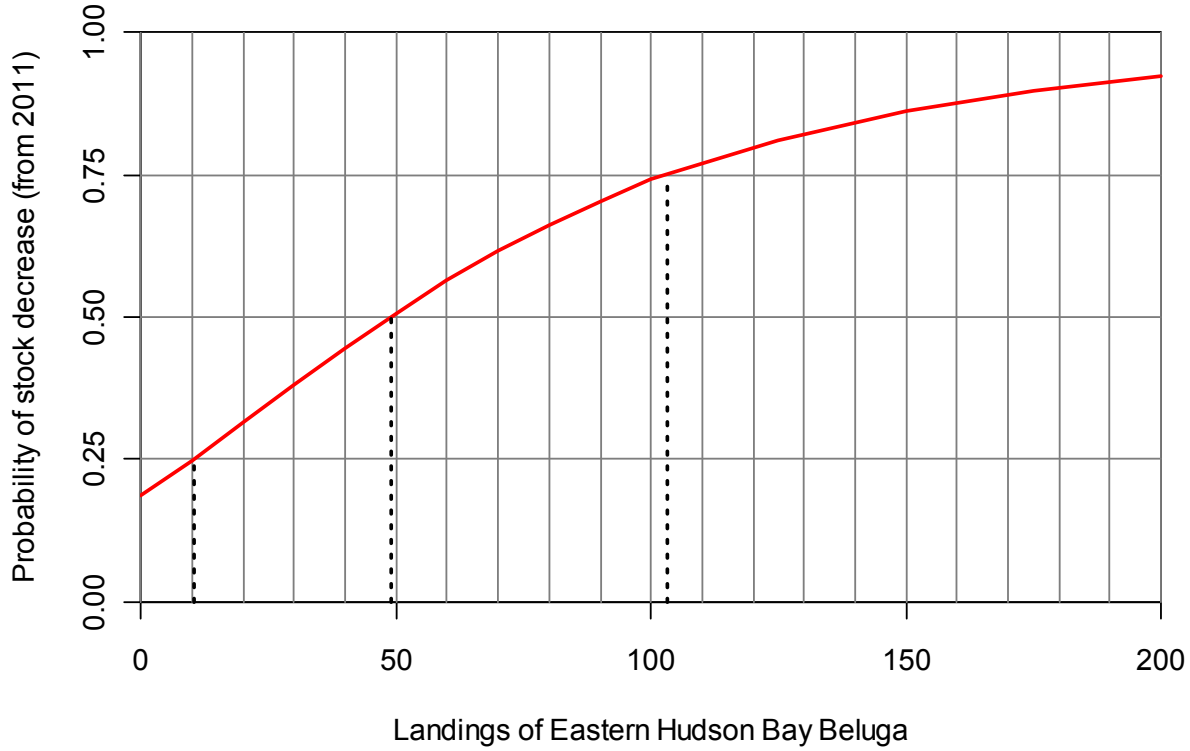

Figure 7. Eastern Hudson Bay beluga. Probability of stock decrease (from the 2011 abundance estimate) at different harvest levels estimated by a Bayesian stock-production model assuming stochastic stock dynamics. Dashed lines: harvest levels corresponding to 25%, 50% and 75% probability of decrease.

Ungava Bay (UB)

No whales were counted on transect lines during four systematic aerial surveys of Ungava Bay flown in 1985, 1993, 2001, and 2008, although there were some off-line observations. Based on the 1993 survey, an imprecise upper 90% confidence limit of 150 individuals was proposed. This number, however, was not corrected for availability and did not include the results of previous and subsequent surveys. A Bayesian approach was used to provide probabilistic statements about the impact of different harvest levels, using all four surveys with zero-counts. Using the mean group size observed during surveys and the correction factors for animals underwater, the mean estimate of the current stock size was 32 individuals (95% CI 0–94). With this estimate, the Potential Biological Removal was 0.16 individuals. Assuming an annual growth rate of 2.6%, the harvest levels for which there was a 25%, 50% and 75% probability of stock increase were 0.95, 0.63, and 0.32 respectively (Fig. 8).

James Bay (JB)

Estimates of the number of JB beluga from aerial surveys flown in 1993, 2001, 2004, 2008 were highly variable and ranged from 3,922 (95%CI 2,645–5,816) to 9,292 (95%CI 2,828–30,530). These abundance indices were not corrected for diving animals nor for perception bias and

therefore represent the number of animals detected at the surface. With the correction factor for diving animals, the abundance estimates range from 8,205 to 19,439 beluga.

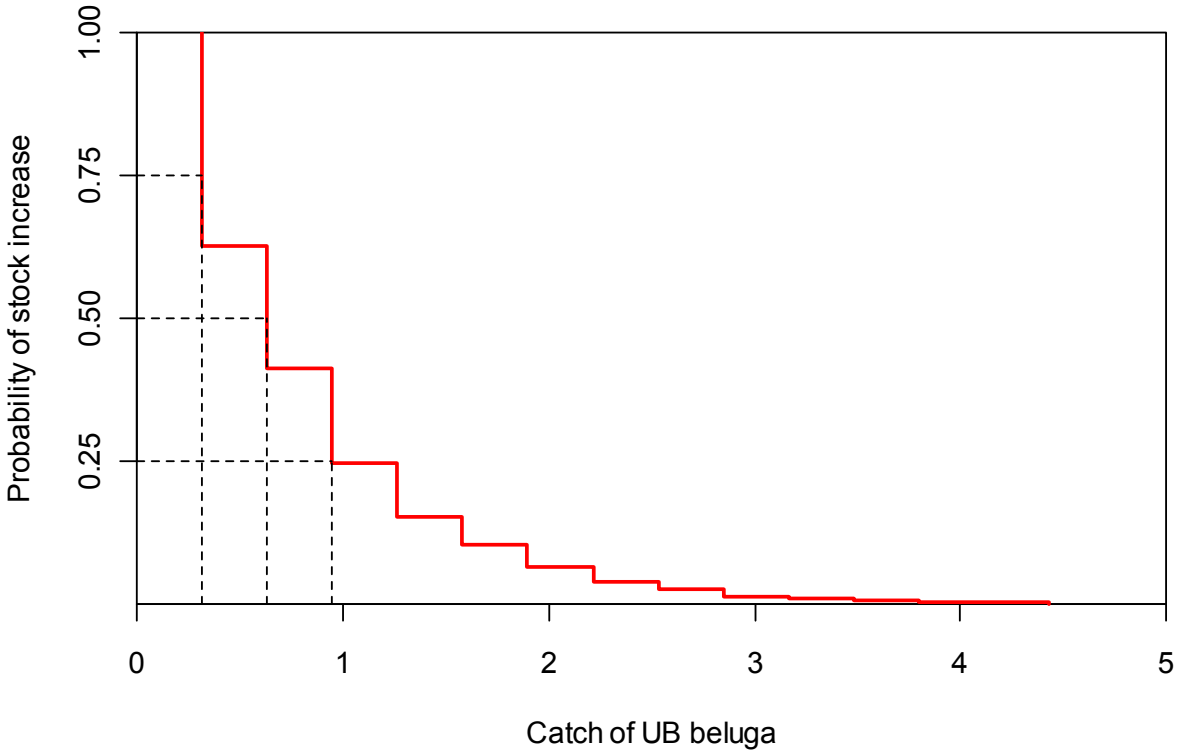

Figure 8. Probability of stock increase as a function of UB beluga harvest per year (not including struck-and-lost whales), assuming a mean group size of 5.6, a correction factor of 2.092 and a growth rate of 2.6%. Dashed lines indicate values corresponding to 75%, 50% and 25% probabilities of stock increase.

Sources of uncertainty

Abundance estimates for these summer stocks 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 stock. 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 abundance 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 stock size, but the coefficients of variation remain quite high (~40%).

Communities north of the eastern Hudson Bay arc and in Hudson Strait are hunting beluga from both the small EHB stock and the large WHB stock. Results from the genetic analyses indicate that about 10% of the animals harvested in Hudson Strait prior to 1 September belong to the EHB stock, 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. Errors in these proportions would affect the overall number of EHB animals removed.

Harvest statistics have been gathered since the 1970's. The reported number of animals struck but not recovered is typically very small (~0–1 per community). Modeling suggests that this figure is probably closer to 50% of the catch. However, this value is sensitive to model assumptions and also encompasses animals killed but not reported as well as 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 2.6% which is within the range of values accepted for beluga. However, for such a small stock relative to estimated pristine levels, a much higher rate approaching a maximum of around 4-5% would be expected. The continued harvest of 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 beluga whales in eastern Hudson Bay are currently considered to be ‘endangered’ by COSEWIC. The current size of the EHB summer stock is estimated at around 3,000 (rounded to the nearest 100) individuals (95%CI 1,300–6,500). The efforts put in place over the last decade have succeeded in reducing overall harvest levels and at current reported harvest levels, the stock numbers may have stabilized. However, there is also little indication of substantial growth.

The total impact of harvesting on the EHB summer stock 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. Removing 49 EHB animals in future harvests would have a 50% probability of causing a decline in the stock. Limiting the harvest of EHB animals to 10 would reduce this probability to 25%. Conversely, a harvest of 103 EHB whales would have a 75% probability of leading to stock decline. Setting catches at levels of around 50 EHB whales per year is not precautionary.

Management of EHB beluga relies on understanding relationships with neighboring stocks. It is thus important to further clarify the status of beluga observed in James Bay and around the Belcher Islands. Based on the combination of genetic and telemetry studies, beluga in James Bay are considered a separate stock.

Data from satellite telemetry studies indicate that from August to October, a large proportion of the EHB stock moves offshore near Sanikiluaq. Several genetic analyses have confirmed that whales frequenting the Belcher Islands area likely represent a variable mixture of stocks, including a significant proportion of EHB whales during summer. All available information indicates that the EHB stock is straddling the limits of Nunavut and Nunavik. 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 a non-negligible impact on the EHB beluga stock. The Sanikiluaq Hunters and Trappers Organization has passed a motion stating that they will not harvest beluga whales during the summer months (i.e., July 15 – September 30).

The current management scheme regarding Sanikiluaq harvest does not take into account the possibility of a distinct stock around the Belcher Islands. This situation would pose an additional challenge for the monitoring of the EHB stock, for which information comes mostly from aerial surveys. Since it is not possible to distinguish between stocks of beluga from the air, there is a risk that whales from a putative Belcher stock would be counted during censuses of the EHB stock, thereby inflating abundance estimation for the latter stock. The magnitude of the bias would depend on the actual size of the Belcher stock and its seasonal distribution.

Our results indicate that any harvest from the UB stock poses a threat to its recovery. There was a Total Allowable Take of 10 beluga in Ungava Bay in 2011, but 17 beluga were taken there during the summer period. The 2011 hunt was open from June 24 to August 31 to minimize the amount of EHB beluga killed. However, hunting in Ungava Bay in the summer probably increases the probability of taking UB beluga.

The strong philopatry of discrete stocks makes them vulnerable to overexploitation. At finer scale, dependence on a few specific estuaries makes beluga particularly vulnerable to the loss of critical habitat and has led to the disappearance of beluga from several estuaries in eastern Hudson Bay and Ungava Bay. The closure of estuaries was aimed at limiting overharvesting and protecting a critical habitat where beluga could fulfill important biological needs. The two estuaries in eastern Hudson Bay that were closed to hunting are the only rivers where beluga have been sighted regularly from coastal aerial surveys over the last 25 years. Other estuaries now appear vacant, either following avoidance of disturbed sites or depletion of local groups.

Recolonization of abandoned areas may also have been hindered by the loss of knowledge of these locations among remaining animals. Extended associations between offspring and parents in long distance migratory animals can allow direct learning of migratory routes. Recent genetic analyses indicate that beluga killed on the same day at the same summering sites were more likely to be close kin or even have parent-offspring associations. Since more individuals are harvested in each hunting event inside estuaries, it is thus more likely that several whales from the same social group may be captured. This could impact the learning of migration routes from adults to young and thus patterns of site fidelity to summer sites. In turn, this could impede the recolonization of extirpated summering areas, and limit the dispersal between stocks using different migration routes.

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 stock 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.

SOURCES OF INFORMATION

This Science Advisory Report is from the Fisheries and Oceans Canada, Canadian Science Advisory Secretariat, National Marine Mammal Peer-Review Committee advisory meeting of October 17-21, 2011. Additional publications from this process will be posted as they become available on the DFO Science Advisory Schedule at http://www.dfo-mpo.gc.ca/csas-sccs/index-eng.htm.

Doniol-Valcroze, T., Hammill, M.O. and Lesage, V. 2012. Information on abundance and harvest of eastern Hudson Bay beluga (*Delphinapterus leucas*). DFO Can. Sci. Advis. Sec. Res. Doc. 2011/119. iv + 17 p.

Doniol-Valcroze, T. and Hammill, M.O. 2012. Harvest advice for beluga in the Belcher, King George, and Sleeper Islands in relation to the eastern Hudson Bay stock. DFO Can. Sci. Advis. Sec. Res. Doc. 2011/125. iv + 8 p.

Doniol-Valcroze, T. and Hammill, M.O. 2012. Information on abundance and harvest of Ungava Bay beluga. DFO Can. Sci. Advis. Sec. Res. Doc. 2011/126. iv + 12 p.

Doniol-Valcroze, T, Lesage, V. and Hammill, M.O. 2012. Management implications of closure of estuaries to hunting of beluga in Nunavik. DFO Can. Sci. Advis. Sec. Res. Doc. 2011/130. iv + 16 p.

Gosselin, J-F. Lesage, V. et Hammill, MO. 2009. Abundance indices of beluga in James Bay, eastern Hudson Bay and Ungava Bay in 2008. DFO Can. Sci. Advis. Sec. Res. Doc. 2009/006. iv + 25 p.

Lesage, V. Baillargeon, D., Turgeon, S. and Doidge, DW. 2009. Harvest statistics for beluga in Nunavik, 2005–2008. DFO Can. Sci. Advis. Sec. Res. Doc. 2009/007. iv + 25 p.

Turgeon, J. Duchesne, P. Postma, L. D. and Hammill, M. O. 2009. Spatiotemporal distribution of beluga stocks (*Delphinapterus leucas*) in and around Hudson Bay: Genetic mixture analysis based on mtDNA haplotypes. DFO Can. Sci. Advis. Sec. Res. Doc. 2009/011. iv + 14 p.

FOR MORE INFORMATION

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