



STOCK ASSESSMENT OF NORTHERN QUEBEC (NUNAVIK) BELUGA (*Delphinapterus leucas*)

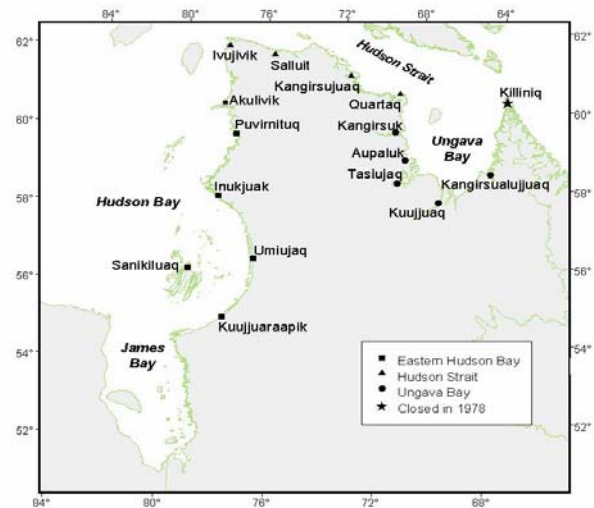


Figure 1. Map of communities in northern Quebec (Nunavik). The community of Killiniq closed in 1978.

Context

Beluga whales are found in summer along the Hudson Bay coast, in James Bay and in Ungava Bay. The majority of these are thought to overwinter in Hudson Strait. At least three separate populations of beluga have been identified (Ungava Bay beluga, eastern Hudson Bay beluga and western Hudson Bay beluga); each population is recognised by the tendency of beluga to home in summer at a particular estuary or group of estuaries. In 1988, the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) classified the Ungava Bay population of beluga as endangered, while the eastern Hudson Bay (EHB) population was identified as threatened (Reeves and Mitchell 1989). In 2004, COSEWIC re-examined Beluga populations in Canada and recommended that the EHB population be re-classified as endangered and maintained its endangered status for the Ungava Bay population.

In addition to the traditional subsistence hunt, commercial hunts in Ungava Bay removed at least 1,340 animals between the 1860's until the early 1900's. The numbers of beluga killed appear to have declined owing to depletion of the population. Commercial hunting at the Little Whale and Great Whale rivers, in eastern Hudson Bay, removed an estimated 7,875 animals between 1854 and 1863. Commercial hunting continued at Great Whale River until at least 1877, but apparently ended owing to depletion of the population. Current subsistence hunting is directed towards both resident populations in summer and also migrating whales from a mixture of populations during spring and fall. High subsistence harvests have limited recovery of the eastern Hudson Bay and Ungava Bay beluga populations.

The beluga hunt in northern Quebec is regulated by a three-year management plan, which allows for annual adjustment of quotas upon availability of new scientific information. Harvesting is regulated through a combination of area closures, controlled season and village quotas.

SUMMARY

- Aerial surveys flown in 2004 provided an abundance estimate (uncorrected for diving animals and including whales counted in the estuaries) of 2,045 (SE=698) in eastern Hudson Bay (EHB) compared to 1,418 (SE=635), 1,314 (SE=489) and 968 (SE=165) in 2001, 1993 and 1985, respectively. In 1985, the same lines were flown, but data were collected following a strip-transect design. When corrected to be comparable with a line-transect design, the 1985 estimate increases to 2,294.
- The same surveys applied to James Bay provided an abundance estimate of 3,998 (SE=1,078) in 2004, compared to 8,262 (SE=1,687), 3,922 (SE=781) and 1,213 (SE=290) whales in 2001, 1993 and 1985, respectively. When corrected to be comparable with a line-transect design, the 1985 estimate increases to 2,256 beluga.
- Ungava Bay was not surveyed in 2004 because four previous surveys have indicated that too few whales are present to provide a population estimate, but numbers are likely less than 200 animals.
- Conditions in 2004 were quite different compared to previous surveys. These include changes in survey altitude, persistent ice, and significant delays due to weather. As a result, the survey of the area took longer to complete, and changes in observers during the survey occurred, all of which may have affected whale counts, and resulting abundance estimates.
- In spite of the uncertainty associated with the interpretation of the available data, the population modeling indicates, that the EHB beluga population, corrected for diving animals, has likely declined from 4,200 (SE=300) whales in 1985 to 3,100 (SE=800) in 2004.
- A multi-year (2001–2003) management plan closed the eastern Hudson Bay arc to harvesting and also closed harvesting in Ungava Bay during the summer months. Harvesting was limited to south of Long Island in southeastern Hudson Bay, in James Bay, and in Hudson Strait. An amendment in 2004, allowed the harvest of 12 beluga in Ungava Bay during the month of July. Total harvest levels in Nunavik waters were limited to 340 animals in 2001 and to 210 beluga in 2002, 2003 and 2004. During the period of the plan, total reported harvests for this region were 395, 198, 216, 168 during 2001, 2002, 2003 and 2004, respectively.
- At the 2004 reported harvest levels, the EHB population could increase very slowly, while a harvest of 60 reported EHB animals would likely allow no change in the population. It is recommended that no harvesting of beluga occurs in Ungava Bay. The eastern Hudson Bay arc should also remain closed to hunting.
- Beluga whales also occur in western Hudson Bay, but population relationships of beluga in the Hudson Bay-James Bay-Ungava Bay complex are poorly understood. More information is needed on the relationship of beluga in James Bay to the other beluga populations in this area.

DESCRIPTION OF THE ISSUE

The three year management plan that regulates harvesting of beluga in this area expires prior to the 2005 hunting season. A recovery plan is currently in preparation for both beluga populations to address their potential listing under the Species At Risk Act (SARA). In 2004, new aerial surveys were conducted and new information was obtained on the numbers of animal harvested and the stock composition of the harvest. This information was incorporated into a population model and resulted in an update on the current status of the population to be used in the development of a new management plan and also to guide the completion of recovery plans for those populations.

Species Biology

Beluga whales have a circumpolar distribution. They are a medium-sized toothed whale 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. The calves are born after a 14 month gestation and lactation lasts for roughly 18 months. The calving interval is one calf every 3 years. At birth, the calves have been described by different authors 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. Female belugas are sexually mature between 4 and 7 years of age assuming two growth layer groups (GLGs) in teeth per year. In the EHB population, 57% of the light grey animals may be sexually mature. Beluga have a lifespan of about 30 years, but maximum lifespan is difficult to determine owing to wearing of the teeth.

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.

Reported catches declined beginning in 1978 in Ungava Bay, Hudson Strait and Hudson Bay villages. A management plan to reduce harvesting was introduced in 1986, and reported catches declined to a total of 2,327 (average =233/yr) beluga during the period 1986-95.

In 1996, a 5-year management plan was introduced. This plan limited harvesting to 240 animals per year for the Nunavik region. A quota of 90 animals was allocated to villages along the eastern Hudson Bay coast (18 per village), 100 animals to the four villages in Hudson Strait (25 per village) and 50 animals to communities in Ungava Bay (10 per village). Hunters were to direct harvesting away from young animals or females with calves and towards large males. Hunters in Ungava Bay were encouraged to take animals outside of the bay. Total harvests during that period were 1,424 animals for an average of 282

whales per year (Table 1). Prior to 1996, hunters in EHB took most of their animals near their community or from the Nastapoka, Little Whale rivers and Richmond Gulf.

Under the 2001 management plan, a global quota of 125 animals was allocated to the EHB communities, 120 belugas for the Hudson Strait communities, and 125 beluga for the Ungava Bay communities. In EHB communities, only 30 animals were to be harvested in the EHB arc, 30 animals were allowed to be taken from James Bay, and the remaining 65 animals were to be taken from Hudson Strait. The Ungava Bay communities were to harvest their animals outside of Ungava Bay.

During 2001, the quota was exceeded in all areas with a total harvest of 395 animals reported taken. This total included 140 animals harvested by EHB villages, 164 belugas taken by Hudson Strait communities and 91 whales reported taken by Ungava Bay communities. Some of the harvest by the Ungava Bay communities occurred inside the Bay. Taking into account that 21% of the Hudson Strait harvest and 13% of the Ungava Bay harvest consisted of EHB animals, 140 animals were removed from the EHB beluga population.

Table 1. Minimum beluga harvest statistics for Nunavik villages from 2000-2004.

YEAR	2000	2001	2002	2003	2004
Kuujuarapik	8	15	3	13	15
Umiujaq	19	17	5	5	5
Inujjuaq	35	25	5	1 ^a	0
Puvirnituk	29	50	16	10 ^b	19
Akulivik	12	33	16	1	16
E. Hudson Bay total	103	140	45	30	55
Ivujivik	36	13	41	52	22
Salluit	28	57	21	18	21
Kangirsujuaq	26	34	16	15	14
Quartaq	26	60	34	34	15
Hudson Strait total	116	164	112	119	72
Kangirsuk	12	24	11	17	17
Aupaluk	8	7	3	10	7
Tasiujaq	13	23	9	8	2
Kuujjuaq	7	20	14	27	8
Kangirsualujjuaq	11	17	4	5	4
Ungava Bay total	51	91	41	67	38
Nunavik total	270	395	198	216	165

^a An additional 3 belugas were harvested in Nunavut.

^b An additional 2 belugas were harvested in Nunavut

ASSESSMENT

Resource Status

Belugas in the waters adjoining northern Quebec were originally separated into different populations based on the summer distribution of animals. Beluga that summer in Ungava Bay, along the eastern Hudson Bay coast, and the western Hudson Bay coast have been recognized as separate populations. Genetic analyses have supported the principal of eastern and western Hudson Bay beluga belonging to two separate stocks, while samples have yet to be obtained and analysed from beluga that summer in Ungava Bay and James Bay.

Two genetic techniques have been used to delineate beluga populations. Individuals and populations were characterized with a mitochondrial DNA (mtDNA) d-loop sequence of 324 base pairs that described maternally inherited “haplotypes” and also with 15 nuclear microsatellite loci in which alleles at each locus are inherited from both parents.

The molecular genetics results support the hypothesis that most beluga hunted in EHB and Sanikiluaq are animals belonging to two different populations. Beluga from the Nastapoka River (1984–1985) and from the EHB arc (1990s) have high proportions of two haplotypes (H7 & H18), which are uncommon in other areas. Beluga hunted near Sanikiluaq (1993–1997) are different from EHB beluga and may represent a different population, which also differs from other western Hudson Bay populations that have been examined. Genetic results from both EHB and Sanikiluaq (Belcher Islands) were consistent over the years that beluga were sampled.

Approximately 12% of beluga hunted from Sanikiluaq have EHB haplotypes, and 10% of beluga hunted in the EHB arc have genotypes that resemble western populations. Beluga hunted in Hudson Strait villages have a high genetic diversity, confirming that several populations are hunted there. It is estimated that 21% of the Hudson Strait villages harvest and 13% of the Ungava Bay harvest comprise EHB animals.

Visual systematic transect aerial surveys to evaluate beluga abundance in James Bay, EHB and Ungava Bay were completed in 1985, 1993, 2001 and 2004. All surveys have been flown along the same transect lines to ease comparisons between years.

In James Bay, the 1985 survey produced an estimated population of 1,213 (SE=290) animals (not corrected for diving animals and including whales counted in the estuaries). When corrected to be comparable to the line-transect surveys flown in 1993 and 2001, the 1,213 estimate is revised upward to 2,256 beluga. Estimates of 3,922 beluga (SE=781), 8,262 beluga (SE=1,687) and 3,998 (SE=1,078) were obtained from the 1993, 2001 and 2004 surveys, respectively. The changes observed in the estimated number of animals present in James Bay are too great to be accounted for by population growth alone. However, the movement of whales between James Bay and the Ontario coast of Hudson Bay could be sufficient to account for some of the observed changes. In 2004, there was considerable ice in the study area. This made it more difficult to count animals and, as a result of ice, some animals may have changed their distribution.

In EHB, the 1985 aerial survey estimate was 968 animals (SE=165) (not corrected for diving animals and including whales counted in the estuaries). When corrected to be comparable

to the line-transect surveys flown in 1993 and 2001, the estimate is revised upward to 2,294 beluga. Surveys flown in 1993, 2001 and 2004 resulted in estimates of 1,314 (SE=489), 1,418 (SE=635) and 2,045 (SE=698) beluga, respectively. Numbers of animals seen in Ungava Bay during surveys flown in 1985, 1993 and 2001 were too few to provide an estimate for this area (Smith and Hammill 1986). This area was not surveyed in 2004.

The apparent increase in survey estimates between 2001 and 2004 cannot be accounted for by population growth. Beluga tend to have a clumped distribution. At low population numbers, detection or failure to detect groups of whales has a significant impact on the final abundance estimates. Survey conditions in 2004 also differed from the 2001 survey. In 2004, persistent ice may have altered the distribution of whales in the James Bay and southern Hudson Bay area. Extensive fog resulted in the survey taking about one week longer to complete than normal, which could have resulted in the movement of significant numbers of animals between areas. This also resulted in observer changes, which had an unknown impact on whale detection. The survey was also flown at a lower altitude with the expectation of improving whale detection, but owing to poor weather, calibration tests to compare whale detection at 457.2 m (1985, 1993 and 2001 survey altitude) with whale detection at 304.8 m (2004 survey) could not be completed.

The number of beluga counted from the air must be adjusted to account for animals that were diving below the surface. This is done by multiplying the actual counts by a correction factor to determine the true population size. The survey platform, animal behaviour, and water turbidity will affect this correction factor. Studies of eastern Hudson Bay beluga using satellite-linked-time-depth recorders indicate that 54–59% of individuals are near the surface and available to counting during surveys. A second estimate of 48% was calculated from a helicopter hovering over diving animals in the St Lawrence Estuary. The primary analyses were completed using the second (48%) correction factor which is more suitable, as it was specifically developed with aerial surveys in mind, and water conditions (clarity) in the St Lawrence are similar to EHB. This factor, which results in multiplying the aerial survey estimates by 2.09, provides the highest estimate of population size. The impact of using smaller correction factors is that the total population size would be smaller, and reported current harvest levels would cause the population to decline more quickly than predicted.

Information on abundance from the aerial surveys, factors to correct aerial survey estimates for animals under the water, harvest data and the proportion of EHB animals in the harvest were combined to predict changes in the population since 1985 (Figure 2). A Pella-Thomlinson model incorporating density dependence, estimates of 12,472 animals for a pristine population size, variability in rates of increase, reported harvests, and variability in harvest composition was used to fit changes in population size to the corrected aerial survey estimates for eastern Hudson Bay, by adjusting initial population size and estimates of struck and loss rates. Fitting the population model to the adjusted aerial survey data indicates that beluga in eastern Hudson Bay have likely declined from an estimated population of 4,200 (SE=300) animals in 1985 to 3,100 (SE=800) in 2004.

A comparison of the age frequency distributions of beluga harvested in eastern Hudson Bay between the 1980s and the 1990s indicates a statistically significant change in the age composition of the harvest. During 1980–1987, the median age of beluga taken by the Nunavik villages in eastern Hudson Bay was 13.0 years (N=120), which is much older than the median age of 8.5 years (N=119) for animals harvested during 1993–2004. A characteristic of beluga is an increase in wear of the teeth as the animals become older. This leads to an underestimate of the true age among older animals. During the 1980s,

42% of the teeth from harvested animals were worn. This proportion declined to 31% of the teeth from animals harvested during 1993–2004.

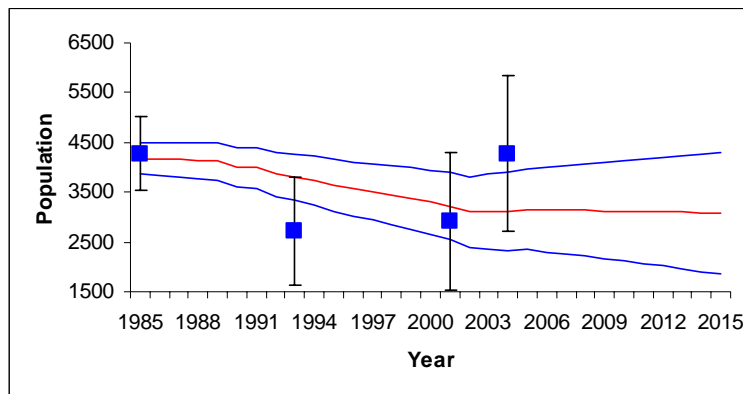


Figure 2. Aerial survey estimates (Mean \pm SE, corrected for diving animals and including whales counted in the estuaries) and modelled changes in abundance of EHB beluga from the population model. If reported harvests do not exceed 61 EHB beluga, then the population will not change or may increase slightly.

Sources of uncertainty

Available data on exploitation and abundance of this stock is neither unbiased nor sufficiently comprehensive to yield precise estimates. Owing to the combination of the small size, non-uniform distribution of animals, their mobility and the large area that must be flown, the estimates are very sensitive to the detection or failure to detect animals during the survey. There is a lack of data on vital rates, which limits opportunities to model the dynamics of this population. Abundance estimates for this population are limited to four aerial surveys, flown in 1985, 1993, 2001 and 2004. These surveys used the same transect lines, but different survey techniques. A correction factor was applied to the 1985 surveys to allow for comparison with the 1993, 2001 and 2004 data. Another correction factor was applied to the aerial survey data to correct for animals that were diving when the survey plane passed overhead. Estimates of total population size are very sensitive to the size and variability associated with this factor, but only limited work has been done to develop such correction factors.

Beluga harvested in the community of Sanikiluaq 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. However, 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, seasonal changes in harvesting practices by Sanikiluaq hunters could have an important impact on the EHB beluga population. 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. Initial

estimates from genetic analyses indicate that about 21% of the beluga harvested by northeastern Hudson Bay and Hudson Strait communities may be from the EHB population, but these are based on small sample sizes. More information on the population composition of the harvest is needed from the Hudson Strait communities in order to assess the impact of these hunts on the EHB population.

The maximum rate of increase is not known for northern Quebec beluga. It may be between 2–4% based on studies of other species of small whales. Such uncertainty has a bearing on our predictions about future population trends.

Harvest statistics have been gathered since the 1970's. However, there is considerable uncertainty about non-reporting of harvests and on the number of animals that are struck and lost. Levels of non-reporting may have been particularly high between 1985 and 1995. Currently, it is not possible to assess the degree of non-reporting of struck whales. Furthermore, although few animals harvested in estuaries may be lost due to a tradition of first harpooning animals, harvests from the Hudson Strait area occur in more open water, where animals are not always harpooned first. Struck and loss data for beluga are limited, but for narwhal in some areas, the number of animals struck and lost may approach 50%.

ADDITIONAL STAKEHOLDER PERSPECTIVES

The Inuit in northern Quebec consider Beluga 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. However, 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.

Beluga in northern Quebec were managed under a five year management plan. This plan was considered by resource users to be too long and unwieldy. In response, a multi-year plan of three years outlining management and science objectives was agreed upon, with quotas to be established annually upon presentation of new scientific information. This plan was extended by one year because no new information had been obtained concerning beluga abundance in 2003, when the current plan actually ended.

CONCLUSIONS AND ADVICE

Lingering ice and poor weather conditions complicated efforts to evaluate EHB beluga abundance in 2004. Although the 2004 aerial survey point estimate for the EHB beluga population was much higher than the 2001 survey estimate, the large standard error indicates that the differences are not significant. Fitting a population model to the aerial survey data indicates that the EHB population has declined since the 1980's, but reported harvests in recent years have also declined. At current reported harvest levels, the population may have stabilized under the current management plan.

Replacement yield is a harvest that would result in no net change in population size over a short time e.g., 5 years. Current information indicates that the population could sustain a reported harvest of 61 EHB beluga. However, harvest levels should be reduced further if the population is to be allowed to recover. Continued closure of hunting in the eastern Hudson Bay arc, and particularly at the Little Whale and Nastapoka River estuaries, is recommended.

The abundance of beluga in Ungava Bay is too low to obtain an estimate using the current survey design, but they likely number less than 200 animals. It is recommended that no harvesting of beluga occurs in Ungava Bay.

However, if current overharvesting is to be reduced, management measures will need the support of the harvesters along with appropriate enforcement.

OTHER CONSIDERATIONS

There is a need for additional information on the abundance and population structure of beluga in Ungava Bay, along the Hudson Bay coast and in James Bay. A regular population monitoring program would reduce the need to rely on accurate harvest data to monitor changes in population abundance. A biological sampling program aimed at understanding the population composition of the Nunavik harvest should be maintained and it is recommended that seized animals in Ungava Bay be sampled whenever possible to determine stock composition of animals from this area. Efforts should be expanded to improve the documentation of harvesting and struck and loss estimates in the Hudson Strait area.

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