



# POTENTIAL IMPACTS OF AN INCREASED HARVEST OF BELUGA WHALES IN THE NOTTINGHAM AND SALISBURY ISLANDS AREAS

## Context

The subsistence harvest of beluga by Nunavik Inuit is regulated through a combination of area and seasonal closures and a total allowable catch (TAC) as outlined in a management plan developed by DFO in discussions with hunters. In 2004, the LUMAQ working group, which consists of representatives from Makivik Corporation, Kativik Regional Government (KRG), Nunavik Hunters Trappers and Fishermen Association (NHFTA), Nunavut Tungaavik Inc. (NTI), Qikiqtaaluk Wildlife Board (QWB), the Sanikiluaq Hunters and Trappers Association (HTA), the Anguvigak, a regional Hunters, Fishers, and Trappers Association (HFTA), and the Kivalliq Wildlife Board (KWB) was established to set quotas for migratory species in northern Quebec.

Fisheries and Oceans Canada (DFO) is a nonvoting member of the committee. Under the current (2006-08) management plan, quotas were established, but with flexibility to change them if new information became available. After the 2006 hunting season, hunters found quotas too restrictive: some hunters were forced to travel too far from their home hunting area, insufficient beluga were available to some communities, and in some communities the hunt for belugas was closed completely. Therefore, Nunavik hunters expressed a strong desire to re-open the management plan, seeking an increase in the overall quota from 135 to 170 belugas.

The main emphasis of the current management plan is to limit harvesting of Eastern Hudson Bay (EHB) and Ungava Bay beluga whales, to allow these populations to increase. Harvesting strategies have been focused on directing the subsistence hunt towards more abundant beluga populations. To that end, Makivik Corporation proposed a pilot program to harvest 20 belugas in the vicinities of Nottingham Island (*Tutjaat*) and Salisbury Island (*Akulrik*) in October-November 2007 as these animals are more likely to be from the Western Hudson Bay (WHB) population. In June 2007, DFO sent a notice to Nunavik hunters indicating that the Nottingham and Salisbury pilot project would run from September 1 to November 30 with a Total Allowable Catch set at 20 as part of the 2007 Beluga Management Plan.

The Nottingham and Salisbury Islands are Areas of Equal Use and Occupancy within the Nunavut Settlement Area. The NWMB, responding directly to Makivik Corporation's request for a harvest of 20 beluga whales by Nunavik Inuit hunters in this area, has requested DFO Science advice on the impact of the proposed harvest of beluga whales on the WHB population. In May 2007, Fisheries and Aquaculture Management also requested Science advice on whether a harvest of 50 whales from the Nottingham-Salisbury Islands area would have a negative impact on the WHB beluga population. Beluga harvesting in the Nottingham and Salisbury islands area would occur in October-November 2007. In late October, the National Marine Mammal Peer Review Committee (NMMPRC) will review recommendations for total allowable harvest for Nunavut beluga stocks. Since the WHB beluga population is shared between Nunavut and Nunavik, the current request should be considered an interim response until the products of NMMPRC meeting are completed.

## Background

The beluga, *Delphinapterus leucas*, is a medium sized odontocete found throughout northern polar waters. Mitochondrial DNA analyses of skin samples from harvested whales have shown that there are at least three populations in the waters surrounding northern Quebec (De March and Postma 2003). These populations, named for the areas they occupy in summer, are known as the WHB, EHB and Ungava Bay populations. Beluga whales also occur in James Bay, and northwestern Hudson Bay, but the stock relationships of these animals to the other groups in the Hudson Bay complex are uncertain.

Beluga whales along the Ontario and Manitoba coasts of Hudson Bay, known as the WHB population, were last surveyed in 2004 (Richard 2005). Surveys were last flown in EHB in 2004 and in Ungava Bay in 2001 (Gosselin *et al.* 2002; 2005). Stock assessments, corrected for diving animals, have produced population estimates of 3,100 (95% CI=1200-4800) for EHB, and 57,300 (95% CI=37,700-87,100) for WHB. Surveys have also estimated 8,400 (95% CI=6,200-10,600) belugas in James Bay and perhaps 1,000 belugas in northern Hudson Bay (Richard *et al.* 1990; Gosselin *et al.* 2005; Hammill *et al.* 2005; Richard 2005). An estimated 7,000 animals (over 14,000 if corrected for diving) were seen along the Ontario coast of Hudson Bay, but it is not known if this was a separate group of whales, or belugas that had moved eastwards from the Nelson River, between surveys. Aerial surveys of Ungava Bay have not detected any animals while on transect, but simulations suggest that a minimum surface population of 200 beluga whales is required before any animals would be expected to be seen using the current survey design (Hammill *et al.* 2004).

In 2004, the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) reassessed belugas in Canadian waters (COSEWIC 2004) and designated the EHB and Ungava Bay populations as “Endangered” due to low and/or declining numbers and identified threats. COSEWIC designated the WHB population as “Special Concern” owing to an absence of recent abundance information for this population and identified threats. Since then, the WHB population has been surveyed again with no detectable change in the observed population size (Richard 2005). In August 2006, the decision was made not to add the beluga whale populations to Schedule 1 of the *Species At Risk Act* (SARA) at this time, to allow additional time to further engage the Nunavut Wildlife Management Board in the listing decision.

## Analysis and responses

### Methods

Harvest data were obtained from Nunavut and Hudson Strait communities in Nunavik (Table 1). The impact of removals from the WHB population was evaluated using two approaches. The first approach used the Potential Biological Removal (PBR) model initially developed in the United States (Wade 1998) and applied in Canada to the management of Atlantic seals under what is known as ‘Data Poor’ situations (Hammill and Stenson 2007), and which has been adopted by the ICES/NAFO joint working group on harp and hooded seals. PBR is an extremely conservative approach that produces a single threshold value. If removals are below the threshold, then the population is likely to increase or maintain itself above what is known as the optimum sustainable population level (Wade 1998).

The PBR is estimated as,

$$\text{PBR} = 0.5 \cdot R_{\text{Max}} \cdot F \cdot N_{\text{Min}}$$

where  $R_{\text{Max}}$  is the maximum rate of increase for the population,  $F$  is a recovery factor with values between 0.1 and 1 depending on population status (0.1 for endangered populations; 1 for populations not at risk), and  $N_{\text{Min}}$  is the estimated population size using the 20th percentile of the log-normal distribution (Wade 1998).  $R_{\text{Max}}$  is set at a default of 0.04 for cetaceans (Wade 1998).

The impact of harvesting was also examined using an exponential growth model:

$$N_{t+1} = (N_t \cdot \lambda) - H_t$$

Where,  $N_t$  is the population size at time  $t$ ,  $\lambda$  is the rate of increase, and  $H_t$  is the reported harvest.

The uncertainty associated with growth model inputs were addressed by assuming that  $N_t$  for WHB beluga could be modelled using a lognormal distribution (mean= 57,300; SE=12,400, rounded to the nearest 100), and that  $\lambda$  followed a uniform distribution ranging from 1.01 to 1.04. Current harvest data were obtained from Nunavut and Nunavik and were included as a lognormal function from the average of the last 5 years of data. Reported harvests were corrected for beluga struck and lost by assuming the data followed a normal distribution with a mean of 1.28 (SD=.15) as used in the DFO Science review for Northern Hudson Bay narwhal. The projections examined the probability of the WHB beluga population declining over the next 10 years, as a result of Nunavik's request to harvest belugas in the vicinity of Nottingham and Salisbury Islands.

## **Results**

The 2006 harvest data were incomplete. Using the 2000 to 2005 data, an average of 598 (SE=109) animals have been reported harvested from the WHB population. Taking into account belugas that are struck and lost (S&L), an average of 765 (SE=101) animals were removed from the WHB population during that period.

Using the PBR approach and a recovery factor ( $F$ ) of 1, the recommended maximum removal from the WHB beluga population is 955 animals. If the belugas from the Ontario coast reported by Richard (2005) form a distinct group that over-winters in Hudson Strait along with James Bay and northern Hudson Bay animals, there could be as many as 80,700 animals in this region. Assuming a coefficient of variation of 0.25, the maximum PBR would then increase to 1,312 beluga whales. Using the current abundance estimate for WHB beluga populations, the PBR is at least 190 more than the estimated current removal of 765 animals.

Using the exponential growth model and a conservative abundance estimate of 57,300 (SE 12400) WHB belugas, there is only a 0.005 risk that the population could decline by 10% or more by 2017 under the currently reported harvest level (Fig. 1). Increasing the current harvest by 100 animals, i.e. to a total of 698 belugas, results in a 2% risk that the WHB beluga population could decline by 10% or more (Fig.1).

Previous requests to harvest beluga in the Nottingham and Salisbury islands area have raised concerns about the potential removal of migrating EHB whales. Satellite tracking of EHB

belugas (N=27) indicates that these animals are largely coastal during the fall migration; they follow the eastern Hudson Bay coast north and around Cape Wolstenholme into Hudson Strait (Fig. 2). Telemetry data from 12 beluga whales tagged in the Nelson River area in summer indicates that many of these animals pass near the Nunavik and the Nottingham and Salisbury islands area. We conclude that animals caught near Nottingham and Salisbury islands are more likely to be animals that summer in WHB (Fig. 2, 3).

## Conclusions

There is little risk of a significant population decline if as many as an additional 100 beluga whales were harvested from the WHB population. Additional information is needed concerning the stock structure of beluga whales occurring in the Hudson Bay complex as well as improved information about belugas struck and lost. In view of the increasing interest in harvesting beluga whales, the management of WHB and EHB beluga populations would benefit from a joint management approach between Nunavik and Nunavut to ensure sustainability of the hunt for all Inuit.

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## Sources of information

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](http://www.sararegistry.gc.ca/status/status_e.cfm)).

de March, B.G.E. and L.D. Postma. 2003. Molecular genetic stock discrimination of belugas (*Delphinapterus leucas*) hunted in eastern Hudson Bay, northern Quebec, Hudson Strait and Sanikiluaq (Belcher Islands), Canada and comparison to adjacent populations. Arctic 56:111-124.

Gosselin, J.-F., V. Lesage, M.O. Hammill and H. Bourdages. 2002. Population indices of beluga in James Bay, eastern Hudson Bay, and Ungava Bay, in 2001. DFO Can. Sci. Advis. Sec. Res. Doc. 2002/042. Available at [http://www.dfo-mpo.gc.ca/csas/Csas/publications/ResDocs-DocRech/2002/2002\\_042\\_e.htm](http://www.dfo-mpo.gc.ca/csas/Csas/publications/ResDocs-DocRech/2002/2002_042_e.htm).

- Gosselin, J.-F. 2005. Population indices of beluga in James Bay, eastern Hudson Bay, and Ungava Bay, in 2004. DFO Can. Sci. Advis. Sec. Res. Doc. 2005/011. Available at [http://www.dfo-mpo.gc.ca/csas/Csas/Publications/ResDocs-DocRech/2005/2005\\_011\\_e.htm](http://www.dfo-mpo.gc.ca/csas/Csas/Publications/ResDocs-DocRech/2005/2005_011_e.htm).
- Hammill, M.O., V. Lesage, J.-F. Gosselin, H. Bourdages, B. G.E. de March and M.C.S. Kingsley. 2004. Changes in abundance of northern Quebec (Nunavik) beluga. Arctic 57:183-195.
- Hammill, M.O., V. Lesage, and J.-F. Gosselin. 2005. Abundance of eastern Hudson Bay Belugas. DFO Can. Sci. Advis. Sec. Res. Doc. 2005/010. Available at [http://www.dfo-mpo.gc.ca/csas/Csas/Publications/ResDocs-DocRech/2005/2005\\_010\\_E.htm](http://www.dfo-mpo.gc.ca/csas/Csas/Publications/ResDocs-DocRech/2005/2005_010_E.htm).
- Hammill, M.O. and G.B. Stenson. 2007. Application of the Precautionary Approach and Conservation Reference Points to the management of Atlantic seals. ICES Journal of Marine Science, 64: 702–706.
- Richard, P.R 2005. An estimate of the Western Hudson Bay beluga population size in 2004. DFO Can. Sci. Advis. Sec. Res. Doc.. 2005/017. Available at [http://www.dfo-mpo.gc.ca/csas/csas/publications/resdocs-docrech/2005/2005\\_017\\_e.htm](http://www.dfo-mpo.gc.ca/csas/csas/publications/resdocs-docrech/2005/2005_017_e.htm).
- Richard, P.R., J.R. Orr and D.G. Barber. 1990. The distribution and abundance of belugas, *Delphinapterus leucas*, in eastern Canadian subarctic waters: a review and update. p. 23-38. In: T.G. Smith, D.J. St.Aubin and J.R. Geraci [eds.] Advances in research on the beluga whale, *Delphinapterus leucas*. Can. Bull. Aquat. Sci. 224.
- Wade, P.R. 1998. Calculating limits to the allowable human-caused mortality of cetaceans and pinnipeds. Marine Mammal Science 14: 1-37.

## Appendices

Table 1. Reported harvests of WHB belugas between 2000 and 2006 from Nunavut and Nunavik communities. Harvests in the hamlets of Arviat, Cape Dorset, Kimmirut and Repulse Bay are preliminary estimates for 2006. Hudson Strait harvests are the reported numbers of WHB beluga whales harvested after excluding the estimated number of eastern Hudson Bay whales taken (i.e., 21% of the total Hudson Strait beluga harvest). The Hudson Strait harvests include reported removals from the villages of Puvirnituaq, Akulivik, Ivujivik, Salluit, Kangiqsujaq, Quaqtuaq, Kangirsuk, Aupaluk, Tasiujaq, and Kuujuaq.

Community	2000	2001	2002	2003	2004	2005	2006	Average/ 2000-2005	Average/ all years
Arviat	100	100	115	300	100	100	45	136	123
Baker lake							2		2
Cape Dorset	28	13	0	7	nr	21	30	14	17
Chesterfield In.	1	25	18	20	7	no data	3	14	12
Coral Harbour	38	25	20	20	3	data	nr	21	21
Hall Beach	5	8	0	15	12	2	0	7	6
Igloolik	4	16	0	23	nr	15	27	12	14
Kimmirut	27	16	38	20	20	7	25	21	22
Rankin Inlet	45	35	130	25	30	100	60	61	61
Repulse Bay	10	10	18	5	0	3	50	8	14
Sanikiluaq	23	0	15	80	94	49	22	44	40
Iqaluit	22	45	35	28	27	50	64	35	39
Whale Cove	20	40	60	25	nr	40	10	37	33
<b>Nunavut total</b>	<b>323</b>	<b>333</b>	<b>449</b>	<b>568</b>	<b>293</b>	<b>387</b>	<b>338</b>	<b>392</b>	<b>384</b>
<b>Nunavik Total (10 communities)</b>	<b>288</b>	<b>194</b>	<b>227</b>	<b>200</b>	<b>186</b>	<b>137</b>	<b>118</b>	<b>205</b>	<b>193</b>
<b>Total</b>	<b>611</b>	<b>527</b>	<b>676</b>	<b>768</b>	<b>479</b>	<b>524</b>	<b>456</b>	<b>598</b>	<b>577</b>

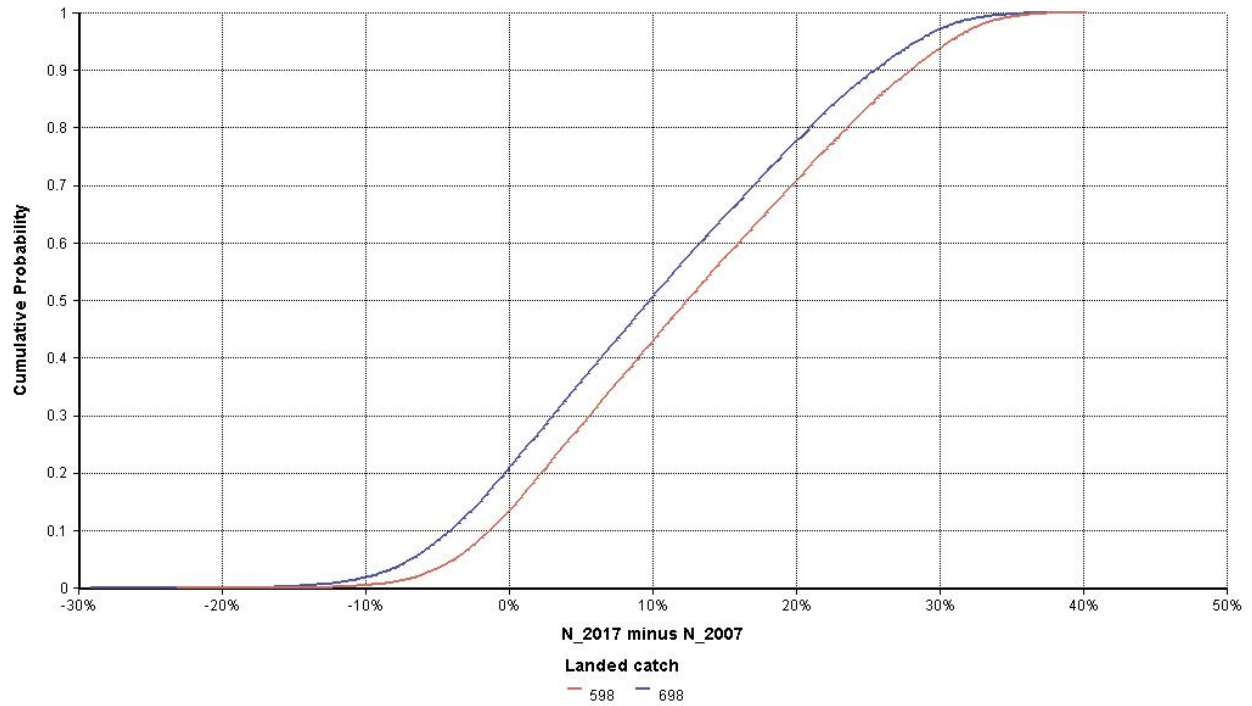


Figure 1. Estimated cumulative probability of population change for the WHB beluga under current harvest conditions (red line) and by increasing the number of reported removals by 100 animals (blue line).

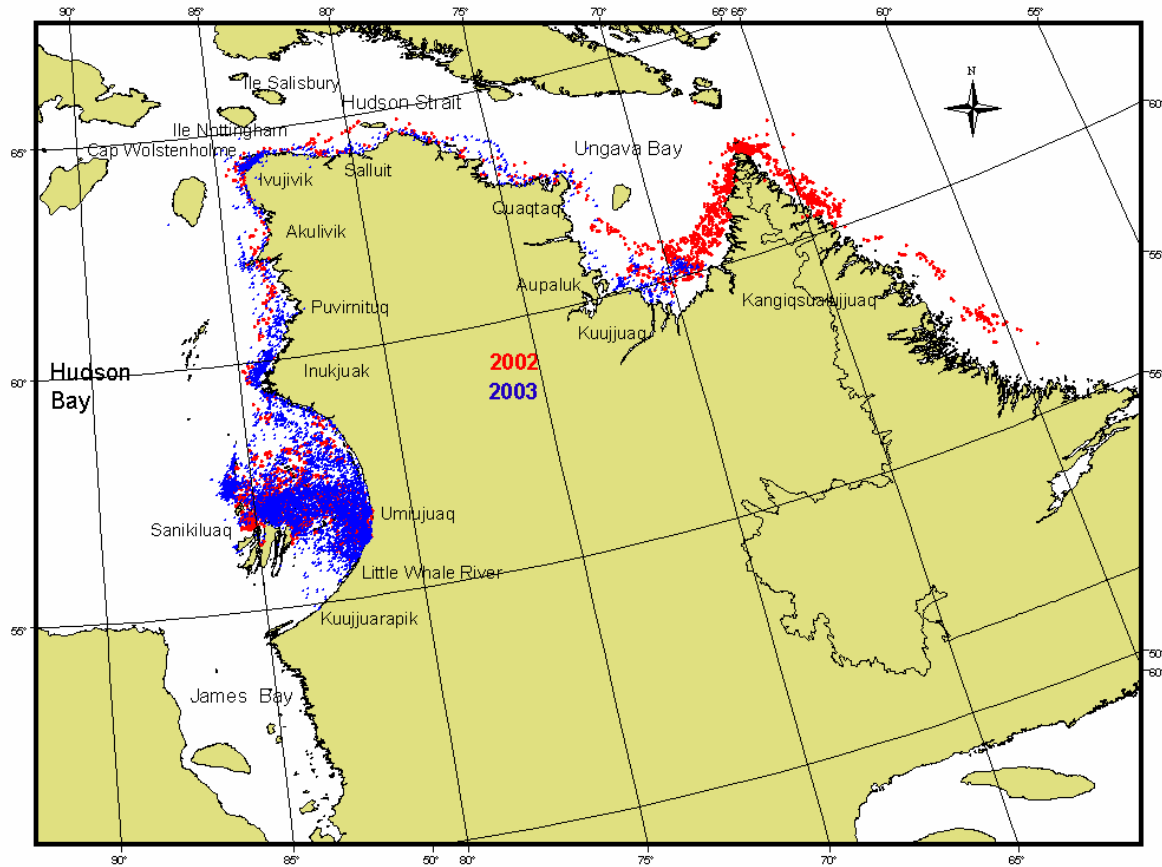


Figure 2. Positions obtained from EHB beluga whales equipped with satellite transmitters to monitor seasonal movements in 2002 and 2003.



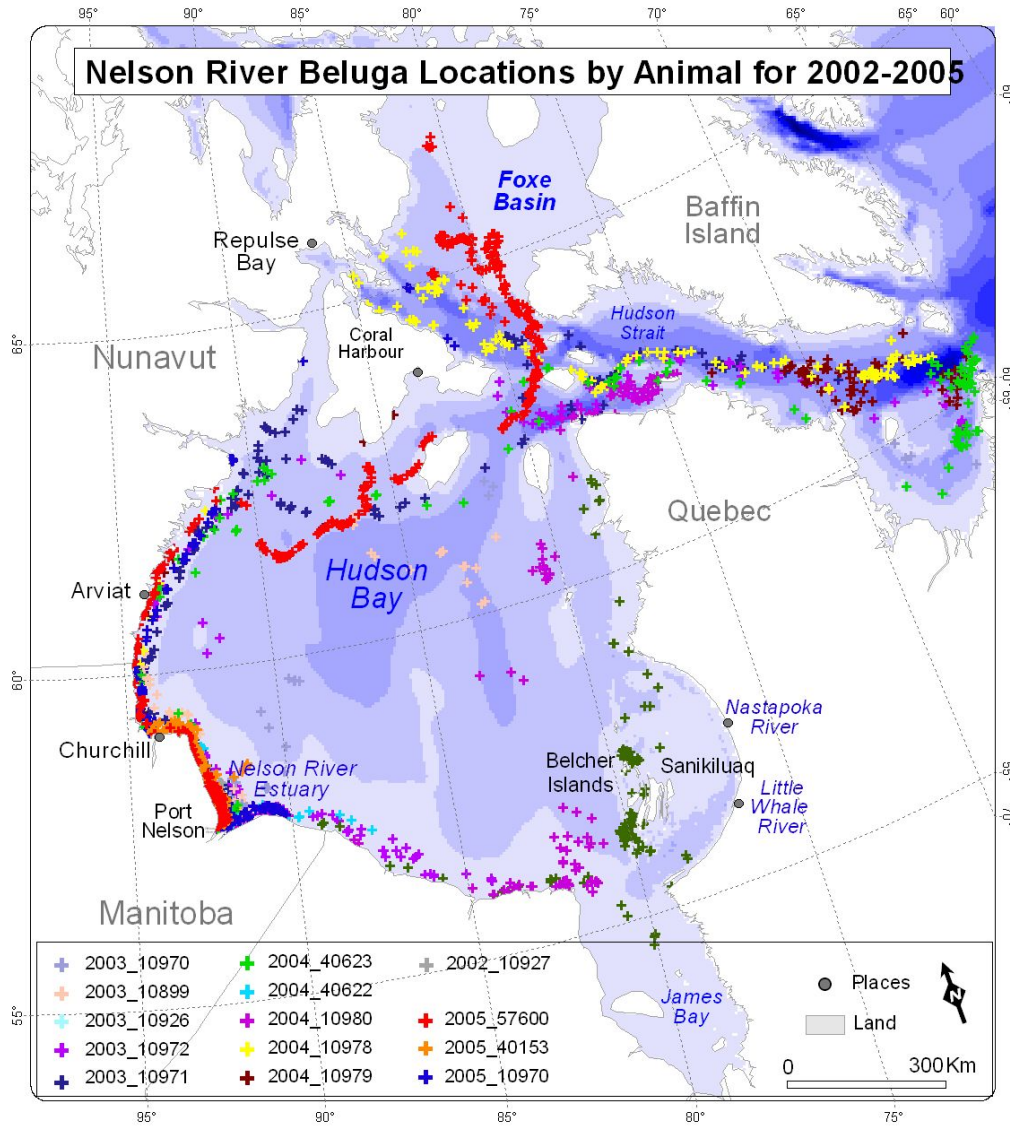


Figure 3. Positions of WHB beluga whales equipped with satellite transmitters to monitor seasonal movements in 2003-2005.

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