

**Seasonal movements and migrations of belugas,
Delphinapterus leucas, along the Nunavik coastlines:
Evidence from harvest statistics, game reports, local
knowledge and scientific studies.**

by

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Prepared for the Department of Fisheries and Oceans Canada
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March 1998

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Abstract

There is direct genetic evidence that two dominant haplotypes of belugas, those of Eastern and Western Hudson Bay, occupy Nunavik waters during the fall and winter. The pattern of summer distribution suggests that as many as 6 possible stocks might exist in the Nunavik and adjacent areas (Ungava Bay, Eastern Hudson Bay, James Bay, Northern Ontario, Western Hudson Bay and North Hudson Bay). These come together in North Eastern Hudson Strait and Northern Ungava Bay during the winter. Belugas from this mixture of stocks are harvested during the spring and early summer on their westward migration and during their return to the east during the autumn. Genetic sampling and harvests during October in the South Western Hudson Strait area show a potential for overharvesting at least one Nunavik stock, that of Eastern Hudson Bay. Specific harvest sites such as Erik Cove, Digges Sound and Cape Smith appear to yield consistent high harvests at this time of the year. While reports from DFO community agents on harvests and sightings of belugas have greatly improved in the last 3 years, scientific studies using VHF tagged belugas and intensive genetic sampling of the October harvests are needed. The detailed information from such studies will allow the fine tuning of the management strategies to protect what appears to be a heavily exploited and possible overharvested Eastern Hudson Bay beluga stock.

Résumé

À ce jour, il y a des preuves génétiques qu'il existe deux haplotypes dominants de marsouins blancs, ceux de l'est de la Baie d'Hudson et de l'ouest de la Baie d'Hudson, qui occupent les eaux de Nunavik durant l'automne et l'hiver. Les mouvements et la distribution estivale suggère qu'il y a possiblement jusqu'à 6 populations qui existent sur le territoire de Nunavik et les régions environnantes (La Baie d'Ungava, l'est de la Baie d'Hudson, la Baie James, le nord de l'Ontario, l'ouest de la Baie d'Hudson et le nord de la Baie d'Hudson). Ces dernières se regroupent dans le nord-est du Détroit d'Hudson et au nord de la Baie d'Ungava durant l'hiver. Les marsouins blancs de ce regroupement de différentes populations sont récoltés durant le printemps et tôt à l'été, lors de leur migration vers l'ouest et, à l'automne, durant leur retour vers l'est. Les

résultats de l'échantillonnage génétique et les récoltes, durant le mois d'octobre dans la région du sud-ouest du Déroit d'Hudson, affichent un potentiel de surexploitation d'au moins une population, soit celle de l'est de la Baie d'Hudson. Des sites spécifiques pour la collecte tels qu'Erik Cove, Digges Sound et Cape Smith semblent produire, de façon régulière, des collectes élevées à ce temps de l'année. Quoique les rapports des agents communautaires du MPO sur les récoltes et les observations visuelles des marsouins blancs se sont beaucoup améliorés depuis les trois dernières années, des études scientifiques utilisant des marsouins blancs marqués avec des émetteurs radios et nombre d'échantillonnages génétiques des récoltes d'octobre sont requis. L'information détaillée, provenant de telles études, permettront de mettre à point les stratégies d'aménagement qui protégeront, ce qui nous semble, une population de marsouins blancs de l'est de la Baie d'Hudson sévèrement exploitée et possiblement sursurcoltée.

Introduction

The Inuit of Nunavik harvest belugas, *Delphinapterus leucas*, from communities along the Ungava Bay, Hudson Strait and Eastern Hudson Bay coastlines. Behavioral, distributional and genetic evidence indicate that at least two, and potentially as many as 6 different beluga stocks, come together during the winter months, in Hudson Strait. During their spring and autumn movements these stocks pass by the coastal hunting communities where they are harvested by the Northern Quebec Inuit. Because of the severely reduced numbers of belugas in Ungava Bay (Smith and Hammill 1986, Kingsley and Doidge *in prep.*) this putative stock has been classified as endangered (Reeves and Mitchell 1989). The Eastern Hudson Bay stock which has been recently estimated to number about 2000 animals (Kingsley and Doidge *in prep.*) has also been classified as threatened and might be endangered by the current harvest levels.

A five year co-management agreement has been reached based on a consensual approach to annual community quotas, but it is felt that more precise information is needed on the level of harvests to which the different stocks are exposed. A combination of increased information on the genetic identity of the harvested animals and detailed information on migration from satellite tagged belugas from the various summer locations, should provide management with the necessary knowledge needed to formulate plans which would prevent overharvesting of any stock threatened by overexploitation (Smith 1997).

This report details the information available on seasonal harvests and sightings of belugas from recent field observations by scientists, community agents and published local knowledge. It also examines game harvests statistics available prior to the first co-management attempts to introduce quotas in 1986 and cites pertinent historical studies dealing with catch statistics and original population estimates. The objectives are to detail the timing of movements of belugas and to identify the location of the most important harvest areas. This will set the stage for future scientific efforts seeking to more precisely delimit the timing and pathways of beluga migrations in Nunavik.

Early Exploitation of Nunavik Stocks

Of interest in the historical accounts of catch history of belugas is the detailing of location of harvests and the depletion of major concentrations of belugas over a very short number of years (Finley *et al.* 1982). In Ungava Bay the Mucralic River estuary saw aggregations of up to 400 whales at a time, as late as the 1950's (George Koneak, Kuujjuaq, to T. G. Smith *pers.com.* 1983). Reeves and Mitchell (1987a) document the removals of belugas from this area during the period from 1860 to 1920.

In Hudson Strait, where there was not the same intense commercial effort on belugas made by the Hudson Bay Company and other trading companies, the records of past catches are not as detailed. Nonetheless it is evident that areas such as Ivujivik, Sugluc (Salluit) and Wakeham Bay (Kangiqsujuaq) were all important beluga whale hunting sites. Nuvuk Point and Digges Sound apparently averaged 60 whales a year in the 1950's and 1960's (Evans 1958, Roy 1971) and in some years harvests could be as high as 300 from the Wolstenholme area (Reeves and Mitchell 1987). The peak catches were made in the late September through October in nets, but also quite frequently by driving large numbers of belugas into natural "traps" which were small coves in Digges Sound and on the coasts of islands. Further east, at Salluit, Evans (1958) estimated 50 belugas were taken each year and at Wakeham Bay the annual average was estimated as 80 in the 1950's.

In Eastern Hudson Bay the Great Whale River, Little Whale River and Nastapoka River were all major areas of beluga aggregation during the months of July and August. Both the Great Whale and Little Whale rivers were harvested by catching belugas behind barrier nets used to trap the whales in the rivers.

Over the period 1856 to 1868 a total of 5600 belugas were removed from the Great Whale River in about 10 major netting events. The largest single catch was of 1511 in 1860. The catches drop off drastically after this, and to this day the Great Whale River, situated beside the village of Kuujjuarapik, is infrequently visited by belugas.

The Little Whale River was exploited in a similar way during the period 1854-1868 with 3000+ belugas also caught in 10 netting events; the largest single catch being 743 belugas in 1859. Whales continue to frequent this estuary but now rarely more than 40 belugas are sighted there at one time (DFO Quebec, files, community agents' reports 1995-1997).

The Nastapoka River, which is now closed to hunting during the month of July, is still frequented by belugas and at present shows the largest concentration of belugas during the summer in Eastern Hudson Bay. In the early 1980's Caron and Smith(1990) saw up to 200+ belugas there at a time in July and August. Reports from community agents during July and August (1995-97) mention sightings of 40-60 animals at a time during the hunting season. This estuary was not amendable to being shut off completely by a barrier net and most of the early catches were made by harpooning (Reeves and Mitchell 1987b). This resulted in much lower yields than in the Great Whale and Little Whale rivers.

One other river, possibly the Nowliakpik River, near Inukjuak (Port Harrison), was frequented by belugas and used as a netting site by Inuit (Reeves and Mitchell 1987). Sometime in the 1950's or 1960's a large catch of whales was made there during a drive fishery. Approximately 60 whales were taken in one drive and few whales have been seen there since (Elie Weetaltuk, Inukjuak, to T.G. Smith *pers.com.* 1981).

While the estimation of original population size is fraught with uncertainties, it is evident that the numbers of belugas in Ungava Bay and Eastern Hudson Bay were much greater in the past than they are now (Table 1). What is most striking is that significant areas of summer abundance in river estuaries which were heavily netted or where drive fisheries were conducted, are no longer occupied by large numbers of belugas. Of particular note are the Mucralic River in Ungava Bay and the Great Whale River in Eastern Hudson Bay.

Annual Beluga Harvests

Statistics on total annual harvests of belugas in Nunavik are available from several sources in some detail since 1974 to the present (Table 2). Prior to that date some area economic studies (Evans 1958, Roy 1971) provided fairly accurate estimates of annual harvests from the specific communities in which the investigators worked.

I have examined the harvests from 1974 to 1985 separately from those from 1986 to the present, since it was in 1986 that a co-management approach was put into place, which established village quotas, closed seasons, and closed areas for beluga hunting.

Prior to co-management and establishment of catch limits the highest proportion of the annual catches came from the three villages of Kangiqsujaq, Salluit and Ivujivik in Hudson Strait and Inukjuak in Eastern Hudson Bay (Table 3). After 1985 this changed to include Puvirnituk as the third most important catch. It should be noted that this community did not report catches until 1986. Akulivik, which prior to 1985 harvested only 0.014 of the total take increased its catch to 0.058. Both Puvirnituk and Akulivik might have increased their take of belugas by having acquired large fishing boats, which enabled them to travel north to the Ivujivik hunting area to hunt belugas in late autumn.

Harvest Trends

Only catch statistics prior to the establishment of quotas have been used to examine harvest trends. Not only did the management measures appear to fix catches to the quota level, they changed the location from which communities catch their whales. It is also apparent that in Ungava Bay and communities such as Ivujivik there is some incomplete reporting of the catch.

I have broken out the annual catch for all areas into different groupings in Table 4. In the Ungava Bay communities for the years 1974 to 1985 there is a clear trend toward reduced annual harvests (Figure 1,a). Most of the harvest taken during these years was during the summer months.

Hudson Strait also shows a marked trend toward reduction of catches for the period from 1974 to 1985. This is particularly evident after 1977 (Figure 1,b). Slight increases in the early 80's might be explained by the acquisition of several new fishing boats in the Hudson Strait villages.

In Eastern Hudson Bay a similar decrease in catch is seen during the same period (Figure 1,c). Because of the proximity of the concentration of belugas in the Nastapoka estuary to both Inukjuak and Kuujjuarapik, the trend is not as magnified, but catches from 1981 to 1985 are noticeably lower than earlier in the period.

Ungava Bay had obviously suffered a marked depletion of the beluga population summering in that area. Both the harvest trends and recent aerial surveys (Smith and Hammill, 1986, Kingsley and Doidge *in prep.*) show this very clearly. Since 1986, the total quota of 10 belugas for each Ungava village (5 in and 5 out of the area after August 31) shows no trend whatsoever (Table 4). Location data on the summer kills is poor except for 1996 and 1997, and is of insufficient quantity to identify recent trends in catches within Ungava Bay.

Interpreting trends in catches of belugas from the communities of Ivujivik, Akulivik and Puvirnituk is problematical because of lack of data for both Ivujivik and Puvirnituk prior to 1983 and 1985 respectively. The fact that most of the catches made by all 3 communities are taken from large boats operating in the late autumn in the same hunting area near Ivujivik adds to the confusion and incomplete reporting. Additionally it is evident that Ivujivik deliberately under-reports catches. An example is that the excessive high catch of 118 in 1989 was followed by no reporting in 1990 and years of low or no reports in 1992 and 1993. Recent reports from this village must be viewed with suspicion. In fact it is likely that Ivujivik has continued to harvest as many belugas as it can take in any year, probably averaging about 60 whales (Table 4 for years 1980 to 1988). This corresponds well to the annual harvest estimates given for Ivujivik by Evans (1958) and Roy (1971) for the 1950's and 1960's.

It is also interesting to note that Akulivik took very few belugas prior to about 1990 (Table 4). Increased access to the hunting area near Ivujivik by large boats seem to be the reason for their present higher catches.

Management appears to be functioning in Eastern Hudson Bay (Inukjuak and south) better than in other regions. The establishment of the village of Umiujaq near summer beluga concentrations in the Nastapoka and Richmond Gulf does not seem to have added unreasonably to the overall annual catches from this region. The total quota of 54 appears to be respected in most years.

Seasonal Distribution of the Harvest

Beluga are taken from Nunavik communities primarily between June and November (Appendix 1). A few are taken in some years in May mainly by Ungava Bay villages, but these are not a significant proportion of the annual harvest.

Ungava Bay harvests the majority of the belugas in July and August. Prior to the quotas and complete closure of the Mucralic (Unguniavik) area to hunting, a large part of the Ungava Bay harvest was taken there. Presently the regulations stipulate no hunting in August in Ungava Bay, and the Mucralic is completely protected. While the intention is to oblige Ungava residents to harvest outside Ungava Bay (i.e. at Quaqtac in the fall) the majority of the annual harvest (55%) is taken in July and August and only 18% in October (Table 5). It is unclear from the inconsistent reporting on location of kills how many whales are actually taken within Ungava Bay during the summer closed period.

Hudson Strait communities catch significant numbers of belugas in the early and late part of the season. August and September are the low months indicating that beluga stocks have apparently passed through the area and are occupying their summer ranges. The break up pattern of ice in the spring appears to favor catches at Kangiqsujaq and Salluit more than at Ivujivik, which appears to be occasionally blocked from access to the whales by near-shore ice at this time of year. Quaqtac, at the east end of the Strait, also makes good catches in June. July catches at Quaqtac,

Kangiqsujuaq and Salluit remain high, but drop off in August and September, as do those of Ivujivik. Catches increase significantly in all Hudson Strait communities in October with Ivujivik taking the largest proportion (44%) of the harvest (Table 5). This proportion might in fact be higher since the harvests from Purvirnituaq and Akulivik appear to be largely taken in the Ivujivik area.

In Eastern Hudson Bay the majority of belugas (67%) are taken during July and August (Table 5). A large proportion of those animals are taken in the vicinity of the Nastapoka Estuary and the Richmond Gulf.

Weekly Sightings of Belugas from Community Agents' Reports

It is only since 1995 that sightings appear to have been included in more than a sporadic way as part of the community agents reports. These are based on informal interviews and radio communication with the hunters and are not corroborated in any way by other sources. The main problem in attempting to use these data is the apparent inconsistent effort from one community to the other in gathering this information. Communities such as Inukjuak and Umiujaq appear to report sightings consistently throughout the season as evidenced by strong correlation between harvests and sightings in the months when the harvests are most abundant. Others such as Ivujivik, Akulivik and Purvirnituaq are inconsistent or almost absent in reporting during the months of maximum harvests.

I have grouped several communities together to attempt to gain a general picture of beluga distribution from sightings (Table 6). In Ungava Bay occasional sightings of large pods of belugas are made as early as mid-June. Sightings increase throughout August and drop off in September and October. In November occasional large pods are again seen. The sighting data might be a more reliable indication of the seasonal distribution than the harvests reported for Ungava Bay villages, given that the management rules force the Ungava Inuit to hunt outside of Ungava Bay during the month of August. The large pods seen there in June and November probably reflect the presence of belugas from other stocks occupying the ice free waters during the winter.

The sightings from Kangiqsujaq and Salluit, both situated in mid-Southern Hudson Strait, indicate large numbers of belugas in late June and July and early August, with numbers dropping off drastically after that. This appears a little different than seasonal distribution of harvests from the villages. The sightings of large groups in August, is surprising given that hunt returns have then dropped off significantly. It may well be that belugas are still abundant into August but that open water hunting conditions, which are adversely affected by increasing winds, reduce the number of landed belugas.

Sightings from Ivujivik are obviously not well reported. The traditional higher harvests in October and lack of sightings at this time of year are entirely contradictory. Sightings from Akulivik and Purvirnituk are numerous in October and November. These are also problematical since it appears that most October and November sightings from those communities, are from boats hunting in the south west of Hudson Strait, which also corresponds to their time of maximum harvest. Some location data related to the increased sightings in the last three weeks of September indicate that these are actually made in the areas near Akulivik and Purvirnituk. (Table 6).

Sightings from Inukjuak and Umiujaq begin in early June and peak in mid August. A gradual drop off is seen from then on with occasional large sightings in September. Kuujjuarapik, to the South, first sights belugas in early July and numbers remain steady until the third week of September. These three Hudson Bay communities appear to have better and more consistent reports of sightings, particularly for the years 1996 and 1997.

Discussion

Belugas from Ungava Bay, Eastern Hudson Bay, James Bay and greater Hudson Bay come together in Hudson Strait and Northern Ungava Bay during the winter. To date two haplotypes, one based mainly on samples from the Nastapoka area in Eastern Hudson Bay and another from belugas in Western Hudson Bay, have been identified (Mancuso 1995, Brown 1996). It remains to be confirmed by genetic sampling whether other distinct genetic stocks exist. The summer distribution of belugas suggests that James Bay, possibly Northern Ontario, and Northern Hudson Bay may also be separate stocks.

Fourteen Inuit villages in Nunavut and one in Nunavik, Sanikiluaq, harvest belugas that might belong to the depleted Eastern Hudson Bay stock (Smith and Hammill 1986, Kingsley and Doidge *in prep.*). Early genetic sampling shows that both Western Hudson Bay and Eastern Hudson Bay belugas are taken by Hudson Strait villages during the autumn harvests. There is direct evidence from the genetic samples taken so far, that belugas of the same haplotype travel together (Brown 1996) and that the harvests certainly have the potential of taking large numbers of the same haplotype in single hunts. This is particularly worrisome in such situations as during the hunt at Ivujivik in the autumn, where up to 100+ belugas have been killed on several occasions during single drive fisheries. The same potential probably exists in the spring harvest, although the hunt, which occurs along the ice edges, takes much fewer belugas per hunting event. No genetic samples from the spring harvest are yet available from villages such as Kangiqsujaq or Salluit, which take significant numbers of belugas.

The tagging of belugas in Nunavik (Kingsley and Doidge *in prep.*) and Western Hudson Bay (Weaver and Richard, DFO Winnipeg *pers.com.*1997) has not proven very successful to date. Tagging of belugas early in the season combined with the short average retention time of the tag has resulted in little information being gained on timing or routes of the fall migrations (Smith 1997). Nothing at all has yet been attempted to describe the routes of spring migrations.

Long term tagging programs using satellite linked radio transmitters has yielded very precise information on migration routes in other stocks of Arctic belugas (Martin and Smith 1992, Martin *et al* 1993, Smith and Martin 1994); to the extent that now beluga tagged in one area, can be reliably recaptured sometime later in a distant locality (Smith *et al* unpublished 1997). Tag retention times of up to 126 days are now possible, making it feasible to get information on migration and distribution into the winter months. In the High Arctic stock, over an 8 year period, virtually every bay, stream and inlet used by the belugas have been identified. The routes and timing of migration remain fairly consistent from year to year (Smith and Martin 1994).

The harvest data from Nunavik prior to the establishment of the quotas in 1985 show clear declines of abundance in Ungava Bay from 1977 to 1985. Selected groupings of annual harvests from Hudson Strait and Eastern Hudson Bay also show downward trends in harvests from the late 70's (Figure 1). The decline in Ungava Bay are quite marked from about 1977 indicating that depletion of the stocks had probably reached a critical level at that time. Subsequent summer aerial surveys and ground observations (Smith and Horonowitsch, Mucralic Study 1986 *unpublished data*, Smith and Hammill 1986, Kingsley and Doidge *in prep.*) confirmed that few belugas remained in the former areas of aggregation.

The reduction in harvest yields in Hudson Strait are not as pronounced but also begin around 1976. In Eastern Hudson Bay yields seemed to have remained constant until about 1980, and then dropped almost by half. In both these areas, local acquisition of large boats, allowing Inuit to travel to autumn or summer areas of hunting, might have obscured downward trends in harvest yields.

The seasonal distribution of harvests are really only available for 11 years (1985,87,89, 1990-97). Reliability of the data have increased and now (since 1995) weekly reports from community agents give a good indication of the timing of migration throughout the various Nunavik areas. Ungava Bay villages harvests belugas from June through August, within Ungava Bay itself. Belugas seem to be available to southern Ungava communities sometimes as early as May and sightings of large pods are also occasionally seen that early. In recent years the closed season and protected Unguniavik (Mucralic sanctuary) has reduced the hunt in Ungava Bay and caused the harvest to be shifted to the belugas stocks returning from other areas to winter around Quaqtatq.

In Hudson Strait, Quaqtq is able to hunt belugas from June to November being situated closest to the area where belugas of many stocks overwinter. Harvested belugas from this village probably come from every stock that lives in Nunavik and the adjacent Nunavut area. The highest takes are in June and July when ice is still present, making hunting conditions favorable, and in October when the overwintering stocks have returned.

The middle villages of Hudson Strait, Kangiqsujaq and Salluit, harvest the bulk of their animals in June, July and early August. July is the most productive period when the ice has just left the Southern Hudson Strait coast. Belugas persist in the area into August and it is not clear whether harvests taper off because of fewer whales or increasing bad weather. Winds do pick up at this time, making successful boat hunting along the unsheltered coastline difficult (McLaren and Mansfield 1960).

Ivujivik Inuit take belugas in June and July on the eastward migration, but the harvest is variable because of ice conditions, which sometime causes the whales to stay north, away from the village. It is on the return migration, in the month of October, that the Ivujivingmiut are able to make large catches. Akulivik and Purvirnitug begin taking west moving belugas in September near their communities, then move their hunting effort north towards the Ivujivik area by large boat, where the majority of October killed belugas in Nunavik are taken (0.74).

Several locations are used to kill belugas in drive fisheries. Erik Cove, Digges Sound and Cape Smith are all mentioned in the archival game reports and past area economic studies (Evans 1958, Roy 1971, Reeves and Mitchell 1987). The same locations plus others are repeated in reports from community agents and current harvest statistics. These locations also include netting sites and camping areas where Inuit live during the autumn beluga migration. There appears to be a real dearth of belugas in Hudson Strait from mid June until October. When belugas arrive in the Ivujivik-Digges Island area in October, they then appear to remain in that area for a full month and to use certain areas of the coastline and offshore islands in a regular fashion. Feeding might be involved. This stopover on their migration east might be a regular feature of the fall migration pattern. A similar stopover is made by High Arctic belugas on their fall migration (Smith and Martin 1994) and it appears that feeding is involved.

Research Recommendations

The tagging of belugas in other Arctic regions has proven to yield precise information on timing routes of migration and on traditional molting and feeding areas. Belugas in Nunavik should initially be studied using satellite tags on their migration out of Eastern Hudson Bay. Captures for tagging belugas with VHF transmitters during the summer have been made at the Little Whale River successfully (Kingsley and Doidge *unpublished*) and could also be made at the Nastapoka, probably using the individual hoop-netting technique (Martin and Smith 1994). The advantage of tagging at the Nastapoka is that there is a high likelihood of dealing with a single haplotype (Brown 1996) which typifies the Eastern Hudson Bay stock, the one of present concern to management.

Attachment of the tags is made with 4 nylon pins and by using a pattern of holes which are staggered to resist pulling out for a maximum of time (Smith and St.Aubin *unpublished*). Smaller packages, and careful attention to attachment details has resulted in significantly increased retention time since the first attempts of belugas tagging in 1987 (Smith and Martin 1994).

Captures can effectively be made using set nets in areas where belugas cannot be driven into the shallow water. Because whales are easily drowned, even when nets are tended cautiously, an automatic release mechanism at the offshore anchor should be incorporated into the catch design. We have used acoustically triggered units designed for underwater oceanographic equipment successfully for this purpose. Hoop-netting of individual whales can be accomplished using a single inflatable boat, as long as belugas come into areas of shallow water where the visibility is good. In other areas such as the Mackenzie River or Cook Inlet Alaska, where the water is muddy, the best catching method is to surround belugas with a quickly deployed seine net (T.G. Smith, *pers. observation* 1997).

Should tagging progress well from sites in Eastern Hudson Bay, some follow up effort should be put into captures and tagging in the Ivujivik area in October. This would increase the retention time of tags into the early winter months and shed valuable light on the late fall migration routes and wintering areas. Eventually tags will be put on that will be retained long enough to elucidate spring migratory patterns.

Concurrent with the late summer tagging and follow up of the tagged belugas as they move up into Hudson Strait, a genetic specimen collecting program should be attempted. In some years well over 150 belugas are taken by Purvirnitug, Akulivik and Ivujivik in the small area of South Western Hudson Strait during October. Sampling of this harvest by enlisting the cooperation of hunters has not been at all successful. Comments from community agents indicate that hunters have little interest in doing this work and that the monetary incentives from DFO will not produce results. A more productive approach would be to place DFO biologists or technicians aboard the large boats sailing out of the hunting villages to sample the complete autumn catches of belugas. This will require some negotiating with the communities, but could probably be arranged if sufficient funds are available to pay passage and enlist the cooperation of the boat captains. In the Ivujivik area an independent field party made up of a scientist and local hunter, equipped with camping gear and a freighter canoe, could collect much valuable material in a 1 or 2 year field study. Samples could be obtained from the hunters and by biopsy darting.

There is also the possibility of retrieving important samples from carcasses left on Digges Island and along the coastline near Ivujivik after the October hunt. This could be accomplished using DFO personnel during helicopter patrols. Even though the information about which belugas were taken on particular hunts would be missing, a large amount of important genetic material could be acquired in this way.

In my experience the presence of a scientific field party working out of a community goes a long way towards enlisting cooperation and exchange of ideas between the user groups and managers concerned with the resource. It is apparent from comments by community agents that a much closer relationship between government researchers, managers and the villages of Hudson Strait and North Eastern Hudson Bay is needed to solve what is now perceived as an intractable beluga management problem. This can only be resolved by devoting full attention to the problem and developing a joint research project between the Inuit hunters and the Department of Fisheries and Oceans.

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Acknowledgements

I wish to thank Danielle Baillargeon, DFO Quebec for making the files available to me and Colette Craig, DFO Winnipeg for providing me with the N.W.T. catch statistics.

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TABLE 1

Historical and current population (stock) size estimates of belugas in Northern Quebec and adjacent regions (from Smith 1997).

	Original stock estimates	Current stock estimates*	Sources
Ungava Bay	1000	very low very low	Reeves and Mitchell (1987a) Smith and Hammill (1986) Kingsley <i>et al</i> (<i>in prep.</i>)
Eastern Hudson Bay	7000	968 1096	Reeves and Mitchell (1987b) Smith and Hammill (1986) Kingsley and Doidge (<i>in press</i>)
James Bay	none	790-1970 3394	Smith and Hammill (1986) Kingsley and Doidge (<i>in prep.</i>)
Ontario coast belugas	none	1300	Richard <i>et al</i> (1990)
Western Hudson Bay	none	23000-25000	Richard <i>et al</i> (1990)
* Uncorrected for animals underwater			

TABLE 2

Annual beluga harvest data from all available sources for all Nunavik communities and Sanikiluaq, NWT.
Annual estimates of average takes are given for Kangiqsujaq, Salluit and Ivujivik from Evans (1958) and Roy (1971).

		\bar{x}	\bar{x}																									
	Year	1950's	1960's	1974	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	
Ungava Bay	Kangiqsualujuaq			10	27	20	15	10	37	14	26	12	3	5	3	5	2	1	0	0	7	0	4	11	2	9	7	
	Kuujuaq			41	64	102	30	13	34	31	30	29	14	5	2	10	5	2	8	3	3	4	12	9	10	5	13	
	Tasiujaq			4	9	3	23	-	3	11	5	6	13	4	9	14	4	11	9	3	2	2	7	12	11	6	3	
	Aupaluk			-	-	6	31	4	-	-	4	2	3	2	3	3	1	2	3	5	9	0	3	6	6	8	8	
	Kangirsuk			37	48	44	79	10	4	4	14	9	12	3	7	9	8	7	11	10	12	3	12	10	12	16	16	
Hudson Strait	Quaqtaq			26	36	55	85	39	30	65	28	25	38	46	32	21	21	15	35	18	29	22	32	35	28	23	24	
	Kangiqsujaq	80	?	150	174	98	18	62	74	37	14	21	22	26	32	22	28	28	28	24	39	28	29	34	22	25	25	
	Salluit	50	?	84	159	66	104	36	42	50	57	41	53	29	22	24	20	16	53	17	28	19	37	46	40	32	46	
	Ivujivik	60	60	-	-	-	-	-	-	-	58	126	69	69	35	5	24	19	118	-	31	2	37	-	38	34	21	
E. Hudson Bay	Akulivik			3	7	4	2	7	28	1	3	10	4	4	11	12	12	12	19	9	18	16	16	20	18	15	24	
	Purvirnituaq	30		-	-	-	-	-	-	-	-	-	-	-	-	0	16	23	41	22	50	22	23	23	36	38	33	
	Inukjuak	40		88	106	79	124	62	120	144	26	18	19	58	11	7	11	17	17	11	20	16	13	19	20	22	21	
	Umiujaq			**	**	**	**	**	**	**	**	**	**	**	**	3	15	12	18	12	24	24	19	18	21	19	19	
	Kuujuarapik			28	24	50	55	51	63	75	32	45	46	35	40	10	11	0	8	8	12	16	12	22	14	15	11	
	Sanikiluaq	15		91	2	-	14	6	-	-	6	30	7	28	5	25	28	20*	19*	20*	22*	20*	10	50	30	30		
	Total			562	656	527	580	300	435	432	303	374	303	314	212	170	206	185	389	162	306	194	266	315	308	297	271	
	- No data																											
	** Village did not exist before 1985																											
	* Averages only																											

TABLE 4

Selective groupings of annual beluga harvests from Nunavik communities to identify trends in stock abundance.

		Before quotas ←												→ After quotas											
		1974	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97
Ungava Bay	5 villages	92	148	175	188	37	68	59	79	58	45	19	24												
Hudson Strait	Quaqtaq	26	36	55	85	39	30	65	28	25	38	46	32												
	Kangiqtujuaq	150	174	98	18	62	74	37	14	21	22	26	32												
	Salluit	84	159	66	104	36	42	50	57	41	53	29	22	24	20	16	53	17	28	19	37	46	40	32	46
	Ivujivik								58	126	69	69	35	5	24	19	118	-	31	2	37	-	38	34	21
	Akulivik	3	7	4	2	7	28	1	3	10	4	4	11	12	12	12	19	9	18	16	16	20	18	15	24
	Purvirnituaq													0	16	23	41	22	50	22	23	23	36	38	33
	Total (excluding Quaqtaq)	237	340	168	124	105	144	88	132	198	148	128	100												
Hudson Bay	Inukjuak																								
	Kuujuarapik																								
	Total	116	130	129	179	113	183	219	58	73	65	93	51												

TABLE 5

Total monthly harvests of belugas for Nunavik communities for 11 years (1985,1987,1989,1990-1997).

		May	June	July	August	September	October	November
Ungava Bay	Kangiqualujuaq	18	10	10	7	2	1	9
	Kuujuaq	0	1	31	22	2	11	0
	Tasiujaq	0	2	27	19	0	21	2
	Aupaluk	0	1	24	12	1	22	1
	Kangirsuk	7	29	45	10	11	10	2
Hudson Strait	Quaqtaq	0	59	61	24	22	76	25
	Kangiqualujuaq	0	60	158	46	1	26	13
	Salluit	0	58	161	22	2	72	0
	Ivujivik	0	40	40	4	2	142+*	1
E. Hudson Bay	Akulivik	0	1	24	29	19	79*	0
	Purvirnituk	0	2	70	66	17	111*	25*
	Inukjuak	5	11	76	86	6	1	0
	Umiujaq	2	38	68	37	13	18	7
	Kuujuarapik	0	25	68	32	15	3	1
+ Three of 11 years not reported for Ivujivik								
* Most of these belugas are taken from South Western Hudson Strait								

TABLE 6

Weekly sightings of belugas for various Nunavik communities from DFO community agents' reports.

		June			July				August					September				October				November		
		to 15	to 25	to 29	to 6	to 13	to 20	to 27	to 3	to 10	to 17	to 25	to 31	to 7	to 9	to 21	to 28	to 5	to 12	to 19	to 26	to 2	to 14	to 16
Ungava Bay	5 villages	0	101	21	41	4	4	0	20	24	18	12	114	5	5	17	6	3	0	2	+	63	0	0
Hudson Strait	Quaqtaq	0	0	100	35	0	0	0	2	0	1	5	109	0	1	7	0	0	0	5	4	0	2	0
	Kangiarsujuaq																							
	Salluit	0	0	622+	394	913	30	110	125	324	9	18	15	15	12	1	0	2	2	7+	0	4	0	6
	Ivujivik	0	0	0	10	0	13	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
E. Hudson Bay	Akulivik																							
	Purvirnituaq	39	9	50	0	0	2	0	0	1	0	0	0	0	24	34	29	28	60	0	+	215	20	0
	Inukjuak																							
	Umiujaq	19	132	5+	113	111	13	160	100	208	32	40	14	20	81	12	12	1	1	0	2	1	0	0
	Kuujuarapik	0	0	0	106	20	52	9	57	90	4	10	1	50	12	23	0	6	0	0	0	0	0	0

APPENDIX 1

Monthly catches of belugas from all Nunavik communities for the years 1985, 1987, 1989, 1990-1997.

		85	87	89	90	91	92	93	94	95	96	97	85	87	89	90	91	92	93	94	95	96	97	85	87	89	90	91	92	93	94	95	96	97
Years																																		
Months		May											June											July										
Ungava Bay	Kangiqsualujuaq				10	0	0	0	0	0	6	2	0	-	-	0	0	0	0	10	0	0	0	3	3	1	0	0	0	1	0	2	0	0
	Kuujuaq				0	0	0	0	0	0	0	0	0	-	-	0	0	1	0	0	0	0	0	1	-	2	3	1	0	0	7	4	0	10
	Tasiujaq				0	0	0	0	0	0	0	0	0	-	2	0	0	0	0	0	0	0	0	4	3	3	3	0	1	0	6	2	2	3
	Aupaluk				0	0	0	0	0	0	0	0	0	-	-	0	0	0	0	1	0	0	0	3	1	5	5	0	0	1	5	2	6	1
	Kangirsuk				0	0	0	0	0	0	0	7	1	4	-	0	1	0	5	0	3	5	10	2	-	11	10	5	0	7	6	4	6	5
Hudson Strait	Quaqtaq				0	0	0	0	0	0	0	0	0	-	6	17	12	0	0	18	0	4	2	12	-	-	1	16	0	0	0	15	0	17
	Kangiqsujuaq				0	0	0	0	0	0	0	0	10	-	-	4	14	0	16	6	0	10	0	6	17	26	0	15	15	4	17	20	14	24
	Salluit				0	0	0	0	0	0	0	0	3	3	5	8	0	0	8	0	0	6	25	7	18	9	9	23	3	29	3	36	7	16
	Ivujivik				-	0	0	0	0	0	-	0	10	-	-	-	19	0	11	0	0	-	0	10	-	7	-	0	2	2	0	0	-	19
E. Hudson Bay	Akulivik				0	0	0	0	0	0	0	0	-	-	-	0	0	0	1	0	0	0	0	-	12	7	0	0	0	0	0	0	1	4
	Purvirnituk				0	0	0	0	0	0	0	0	-	-	-	0	0	0	2	0	0	0	0	-	16	17	22	22	0	7	0	0	3	0
	Inukjuak				5	0	0	0	0	0	0	0	0	2	5	0	0	0	1	0	1	2	0	5	9	5	1	12	7	11	3	18	2	3
	Umiujaq				0	0	0	0	0	0	0	2	-	15	4	0	4	0	6	5	0	2	2	-	-	6	10	12	9	9	7	0	10	5
	Kuujuarapik				0	0	0	0	0	0	0	0	4	11	-	1	9	0	0	1	2	0	0	20	-	6	7	2	5	9	7	8	6	4
Sanikiluaq				-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	

APPENDIX 1
(continued)

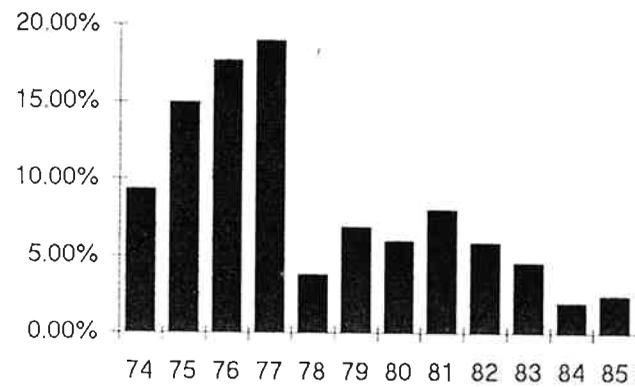
Monthly catches of belugas from all Nunavik communities for the years 1985, 1987, 1989, 1990-1997.

	Years	August												September												October											
		85	87	89	90	91	92	93	94	95	96	97	85	87	89	90	91	92	93	94	95	96	97	85	87	89	90	91	92	93	94	95	96	97			
Ungava Bay	Kangiqsualujuaq	0	-	-	0	1	0	0	1	0	1	4	0	-	-	0	0	0	0	0	0	1	1	0	-	-	0	0	0	1	0	0	0	0			
	Kuujuaq	1	5	-	0	2	0	11	0	0	0	3	0	-	-	0	0	2	0	0	0	0	0	0	-	-	0	0	1	1	1	6	2	0			
	Tasiujaq	5	1	6	0	2	1	2	0	0	2	0	0	-	-	0	0	0	0	0	0	0	0	0	-	-	0	0	0	4	8	9	0	0			
	Aupaluk	0	-	-	0	1	0	2	0	0	2	2	0	-	-	0	1	0	0	0	0	0	0	0	-	-	0	7	0	0	0	4	0	4			
	Kangirsuk	1	2	-	0	6	0	0	1	0	0	1	3	5	-	0	0	0	0	0	0	3	0	-	-	-	0	0	2	2	3	3	0	0			
Hudson Strait	Quaqtaq	-	21	-	0	1	0	0	1	0	0	1	0	-	-	0	0	9	13	0	0	0	0	22	-	9	0	0	11	8	0	13	5	8			
	Kangiqsujuaq	12	11	-	18	0	3	0	1	0	0	1	0	-	-	0	0	0	0	0	0	0	0	2	-	-	2	0	8	2	10	2	0	0			
	Salluit	0	-	-	0	0	13	0	1	0	3	5	0	-	2	0	0	0	0	0	0	0	0	12	-	25	0	5	3	0	42	23	0	0			
	Ivujivik	0	24	-	-	1	0	0	0	0	-	3	0	-	-	-	0	0	2	0	0	-	0	13	-	60	-	10	?	22	0	37	-	0			
E. Hudson Bay	Akulivik	-	-	-	8	10	0	10	1	0	0	0	-	-	5	1	0	0	0	0	7	6	0	-	-	-	0	8	16	1	19	11	2	22			
	Purvirnituaq	-	-	23	0	11	15	1	13	1	2	0	-	-	-	0	0	0	13	1	1	0	2	-	-	24	0	0	7	0	9	26	33	36			
	Inukjuak	6	-	6	5	8	9	1	15	0	18	18	-	-	6	0	0	0	0	0	0	0	0	-	-	-	0	0	0	0	1	0	0	0			
	Umiujaq	-	-	1	2	1	10	3	4	6	6	4	-	-	1	0	1	2	0	1	0	0	8	-	-	-	0	0	2	0	1	15	0	0			
	Kuujuarapik	8	-	-	0	4	5	0	7	4	3	5	-	-	-	0	0	5	1	2	0	5	2	-	-	1	0	0	0	0	2	0	1	0			
Sanikiluaq	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-				

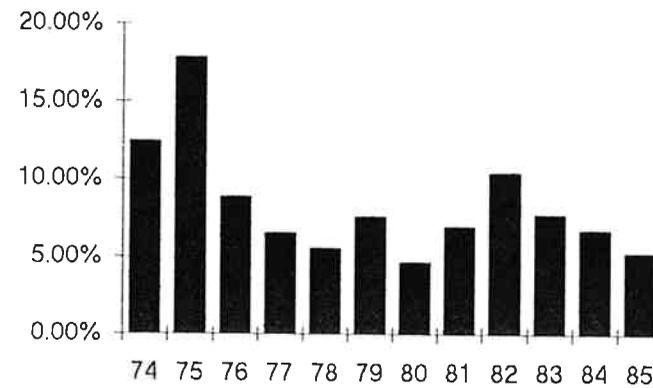
FIGURE 1

Beluga harvests from 1974 to 1985 from selected community groupings for Ungava Bay, Hudson Strait and Eastern Hudson Bay. Annual harvests are shown as a percent of the total harvest for the whole period.

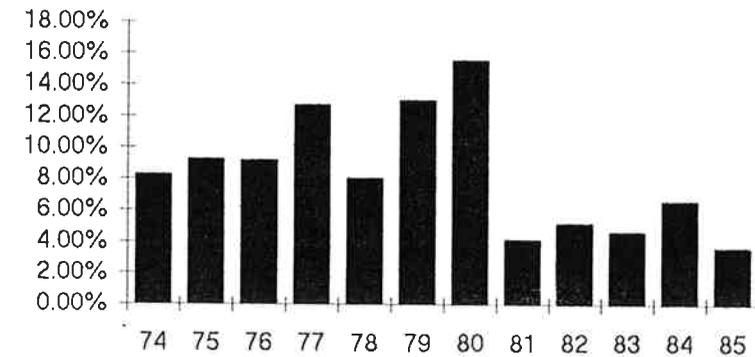
UNGAVA BAY



HUDSON STRAIT



EASTERN HUDSON BAY



	Year	Percentage	Total
Ungava Bay	74	0.093	92
	75	0.149	148
	76	0.176	175
	77	0.190	188
	78	0.037	37
	79	0.069	68
	80	0.059	59
	81	0.080	79
	82	0.058	58
	83	0.045	45
	84	0.019	19
	85	0.024	24
	Total		992

	Year	Percentage	Total
Hudson Strait (Quaqtaq omitted)	74	0.124	237
	75	0.178	340
	76	0.088	168
	77	0.065	124
	78	0.055	105
	79	0.075	144
	80	0.046	88
	81	0.069	132
	82	0.104	198
	83	0.077	147
	84	0.067	128
	85	0.052	100
	Total		1911

	Year	Percentage	Total
Eastern Hudson Bay (Inukjuak and Kuujjuarapik only)	74	0.082	116
	75	0.092	130
	76	0.092	129
	77	0.127	179
	78	0.080	113
	79	0.130	183
	80	0.155	219
	81	0.041	58
	82	0.052	73
	83	0.046	65
	84	0.066	93
	85	0.036	51
	Total		1409