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**LOCAL KNOWLEDGE OF BELUGA AND NARWHAL
FROM FOUR COMMUNITIES IN ARCTIC CANADA**

by

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PREFACE

This report was prepared under contract for the Canada/Greenland Joint Commission for the Conservation and Management of Beluga and Narwhal. Scientific Authorities for this contract were Tasha Stephenson and Dan Pike of the Department of Fisheries and Oceans, Iqaluit, NT, Canada, XOA OHO. Translation of this manuscript into Inuktitut was ongoing at the time of publication. The Inuktitut version of the report will be available from the Department of Fisheries and Oceans, Iqaluit, NT, XOA OHO.

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ABSTRACT

Stewart, D.B., A. Akeeagok, R. Amarualik, S. Panipakutsuk, and A. Taqtu. 1995. Local knowledge of beluga and narwhal from four communities in Arctic Canada. Can. Tech. Rep. Fish. Aquat. Sci. 2065: viii + 48 p. + Appendices on disk.

Inuit hunters from the communities of Grise Fiord, Arctic Bay, Igloolik, and Hall Beach were interviewed for their knowledge of the seasonal distribution, biology, and Inuit hunting practices of beluga (Delphinapterus leucas) and narwhal (Monodon monoceros). Survey questionnaires were used to gather information on belugas from a total of 19 hunters, and narwhal from 15 of the 19. This report documents their observations for use in resource co-management, and to provide a basis for further discussions between the hunters and resource managers and researchers. It was prepared for the Canada/Greenland Joint Commission for the Conservation and Management of Beluga and Narwhal. The role and effectiveness of the questionnaire method of gathering local or traditional knowledge is discussed. (Copies in Inuktitut will be available from the Department of Fisheries and Oceans, Iqaluit, NT, XOA OHO)

Key words: Arctic Zone; Northwest Territories; Nunavut; subsistence harvesting; indigenous knowledge; Admiralty Inlet; Jones Sound; Foxe Basin; marine mammals; life history; survey methodology; fishery management.

RÉSUMÉ

Stewart, D.B., A. Akeeagok, R. Amarualik, S. Panipakutsuk, et A. Taqtu. 1995. Local knowledge of beluga and narwhal from four communities in Arctic Canada. Can. Tech. Rep. Fish. Aquat. Sci. 2065: viii + 48 p. + Appendices on disk.

Des chasseurs inuit des collectivités de Grise Fiord, Arctic Bay, Igloolik et Hall Beach ont été interrogés pour connaître la distribution saisonnière et la biologie du béluga (Delphinapterus leucas) et du narval (Monodon monoceros), ainsi que les habitudes de chasse des Inuit en ce qui concerne ces deux mammifères cétacés. Au total, 19 chasseurs ont fourni des renseignements sur le béluga, par voie de questionnaire, et 15 d'entre eux ont également fourni des renseignements sur le narval. Ce rapport, qui documente leurs observations, servira lors de l'aménagement conjoint des ressources et fournira une assise à de plus amples discussions entre les chasseurs, les gestionnaires de ressources et les chercheurs. Il a été préparé pour la Commission mixte Canada/Groënland pour la conservation et la gestion du béluga et du narval. Le rapport présente également une discussion sur le rôle et sur l'efficacité de la méthode du questionnaire pour rassembler des connaissances locales ou traditionnelles (on peut s'en procurer des exemplaires en inuktitut en s'adressant au ministère des Pêches et des Océans, Iqaluit [T.N.-O.], XOA OHO).

Mots-clés: zone de l'Arctique; Territoires du Nord-Ouest; Nunavut; récoltes de subsistance; connaissances autochtones; inlet de l'Amirauté; détroit de Jones; bassin Foxe; mammifères marins; évolution biologique; techniques d'enquête; gestion des pêches.

உதவி

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INTRODUCTION

While evidence based on the patterns of distribution and timing of movements is not conclusive, it strongly suggests that Canada and Greenland share the "Baffin Bay" stocks of beluga (Delphinapterus leucas) and narwhal (Monodon monoceros). In summer, these species are found in large numbers in the eastern Canadian High Arctic. They migrate westward into the area from Baffin Bay via Lancaster Sound as the ice dissipates in the spring, and return eastward via the same route as ice forms in the fall. Most of them are thought to winter in Baffin Bay, but some overwinter in the "Northwater", off the east coast of Devon Island and at the mouths of Jones Sound and Smith Sound (P. Richard, pers. comm.). Belugas and narwhals found off the northwest coast of Greenland in summer may also be part of these stocks, which appear to be separated geographically from those elsewhere.

If Canada and Greenland share the Baffin Bay stocks, then these whales are harvested by hunters from both countries and there is significant risk of overharvesting. To reduce this risk, Canada and Greenland have agreed to share management responsibility for these stocks. To this end, they established the Canada-Greenland Joint Commission for the Conservation and Management of Beluga and Narwhal (CGJC). Its mandate is to make recommendations concerning research and management of the Baffin Bay beluga and narwhal to the Government of Canada and to the Greenland Home Rule Government (Thomsen 1993).

The Government of Canada will pass on the CGJC's recommendations to the Nunavut Wildlife Management Board (NWM Board) (S. Innes, pers. comm.). The NWM Board consists of an equal number of Inuit and Government representatives, plus a chairperson. It was appointed recently to co-manage wildlife in the Nunavut Settlement Area, the waters of which are frequented by the Baffin Bay stocks. A member of the CGJC has also been appointed to the NWM Board.

In making its management recommendations for the Baffin Bay whale stocks, the CGJC seeks to integrate local knowledge with western science. These two bodies of knowledge are valuable and often complementary. The local people can offer the benefit of their qualitative, long-term observations; the scientists their quantitative research and interpretive skills (Gunn et al. 1988; Stewart 1993). In order to make the best

possible management decisions then, it is important to gather and document the local knowledge and to facilitate communications between the two groups.

This is the third study that the CGJC has recommended to gather and document local, or traditional, knowledge of the Baffin Bay belugas and narwhals. The first study was conducted by Remnant and Thomas (1992), who gathered data on the whales' distribution and biology from hunters in the Canadian communities of Broughton Island, Clyde River, Pond Inlet, Arctic Bay, Resolute Bay, and Grise Fiord. The second study was conducted in West and North Greenland by Thomsen (1993), who in addition to gathering data on distribution and biology also gathered information on hunting practices.

These studies have been referred to both as "traditional knowledge studies" and as "local knowledge studies". The Traditional Knowledge Working Group (TKWG 1991) has defined **traditional knowledge** as "knowledge that derives from, or is rooted in the traditional way of life of aboriginal people." It defines **local knowledge** as a body of knowledge that is "specific to a geographical location or period of time and may be closely entwined with traditional knowledge". The latter term is sometimes used to describe the local expression of traditional knowledge. Our study is perhaps best termed a local knowledge study, since it deals with specific geographical areas and a knowledge base that is essentially traditional, but that has been affected to some extent by modern technology and scientific research.

The purpose of this study is to gather and document Inuit hunter's knowledge of belugas and narwhals in the areas of Grise Fiord, Arctic Bay, Igloolik and Hall Beach. Pangnirtung declined to participate in the study due to ongoing discussions with fishery managers on the harvest of belugas and narwhals. Like the earlier works, this is not a comprehensive study of Inuit traditional ecological knowledge in this field. Rather, it is an attempt to learn about particular aspects of the distribution, biology, and hunting of these whales by asking a set of focussed questions. Through this work, we hope to preserve the information and make it available in a form that permits its integration into resource management strategies and scientific research. Hopefully, this process and its product will also facilitate discussions between the hunters and scientists.

A critique of study methods is included in

the discussion, followed by recommendations for future work.

METHODS

Inuit hunters in Grise Fiord, Arctic Bay, Igloolik, and Hall Beach were interviewed during the winter of 1993. These hunters were selected using a reputational sampling method. This involved asking the Hunters and Trappers Association (HTA) in each community to identify which hunters and elders they consider to be most knowledgeable of belugas and/or narwhals in their area. These people were then interviewed in person by a local resident.

The interviewers were also recommended to the study, as respected members of their community with a working knowledge of English and Inuktitut, by their HTA. They used a standardized questionnaire, in English or Inuktitut, to gather information on the distribution, biology and hunting of the whales (Appendix 2). They were trained in the use of this questionnaire by the senior author at a workshop held in Iqaluit on 4-7 November 1993. The completed interviews were sent to him in Winnipeg, where they were compiled and documented.

Pretesting of the questionnaire during the workshop was used to make final revisions and to check the accuracy of the Inuktitut translation. Workshop participants described the questions as clear, understandable, and appropriate.

The questionnaire contained a number of maps to be used for reporting observations. The geographical area covered by the map for each community was based upon earlier work by Freeman (1976). Examples of these maps are included with the questionnaire (Appendix 2). Pencils of different colours were used to differentiate between different types of information. Information from a parent or grandparent was only mapped if it differed from what the hunters had seen.

To avoid any confusion of the information, separate nearly identical questionnaires were prepared for belugas and narwhals. This also enabled the hunters to respond to one questionnaire only, if they chose. As a reminder, there was a beluga or narwhal picture at the top of each page that pertained to that whale (Appendix 2). To assist the interviewers, pictures of some food items that scientists have found in the stomachs of these

whales in this area were also included, as were pictures of foetuses and of whales entrapped in the ice.

Hunters were asked to relate their observations to the six Inuit seasons which are based on environmental conditions and, if possible, also to the calendar. The seasons indicated in text are based on both the general ranges given by the hunters and on their responses to the questionnaire. Seasonal data from an area were not accepted if a hunter indicated that he had not visited the area or seen whales during that season. On occasion the months or seasons in text do not correspond with those listed in a heading due to annual variations. The Inuit seasons are characterized in Appendix 1.

The responses from each community are presented so that individual responses cannot be identified. The completed questionnaires will be stored in Iqaluit by the Department of Fisheries and Oceans. People wishing to study them must obtain permission from the appropriate HTA. The names of people interviewed will be kept separate from the interviews to ensure that the individual responses remain anonymous.

The design for this study was based largely on the previous Canadian work by Remnant and Thomas (1992). Every effort was made to comply with the constructive criticisms of that work offered by resource managers and social scientists (e.g. Roberts 1993; J.T. Strong, pers. comm; G. Williams, pers. comm.). Extensive changes to the questionnaire were deemed necessary despite the difficulties they create for comparisons with the earlier study. Changes were made to other aspects of the methods but they were constrained by the time and resources available for the work. Appendix 1 outlines these changes and the reasons for making them.

RESULTS

This section is organized hierarchically by species, then community, and finally by topic. Information on belugas is summarized first for Grise Fiord, then Arctic Bay, and then Igloolik-Hall Beach. The information on narwhals follows.

The survey responses are reported below and tabulated in Appendix 3. Numbers have been included to provide a record of the responses, not for emphasis. An event seen by a single hunter is just as valid and important as one seen by several.

BELUGA

Grise Fiord

Five active hunters from Grise Fiord were interviewed for information on belugas. Two had lived at Alexander Fiord in the 1950's and early 1960's, and all had lived at the old or new village of Grise Fiord since the late 1950's or early 1960's, with occasional sojourns to Resolute or Iqaluit. They had over 166 years of combined experience hunting belugas in the region. They had been taught to hunt by their fathers (4) or by someone else (1).

Seasonal distribution and movements: The seasonal travels of Grise Fiord hunters and their observations of seasonal beluga distributions and movements are summarized in Figures 1 to 6.

UKIU (January and February) (Fig. 1): During ukiu the hunters had observed belugas moving about the floe edge in eastern Jones Sound, feeding and trying to keep in open water as the ice changes. Several hunters reported seeing them in the pack ice south of Coburg Island during a recent aerial survey.

UPINGOAKSAK (March through mid-May) (Fig. 2): The hunters had travelled more extensively during upingoaksak than during ukiu. During upingoaksak the whales continue to move about the floe edge in eastern Jones Sound, feeding and trying to keep in open water as the ice changes. One hunter, who had travelled up the east coast of Ellesmere Island, indicated that the belugas' use of the area is related to ice, and that they wait in open water until the ice dissipates before moving northward. He did not know the northward extent of their movements but indicated that they were coming from the south and moving northward to at least Talbot Inlet, feeding beneath the landfast ice as they travelled.

UPINGOA (mid-May through early July) (Fig. 3): During upingoa the belugas continue to move and feed along the floe edge in eastern Jones Sound and to move northward east of Ellesmere Island. The latter movements which occur in leads and open water extend northward to at least Cadogan Inlet. The whales also follow leads into the fiords of southern Ellesmere Island if there is open water. During heavy ice years some belugas remain at the Hell's Gate polynya year-round.

AUJA (early July through August) (Fig. 4):

During auja the hunters' marine travels had been limited to Jones Sound. They had observed belugas moving westward into the sound following leads in the ice, and feeding. The animals bypass some of the fiords along the southern coast of Ellesmere Island (e.g. South Cape Fiord and Starnes Fiord) but do enter Grise, Harbour, and Muskox fiords. Belugas had also been observed moving westward in leads along the north coast of Devon Island, and southeastward from Jones Sound through Lady Ann Strait.

UKIAKSAK (September and October) (Fig. 5): During ukiaksak the hunters' marine travels had been limited largely to the fiords of southern Ellesmere Island, but one hunter had crossed Jones Sound to Devon Island and travelled extensively in Baumann Fiord. During this season, there is a general movement of belugas from the fiords of southern Ellesmere Island eastward back towards the winter floe edge, although one hunter indicated that the whales are usually entering the fiords during ukiaksak. The belugas feed and rest as they go, and some stop to feed at the mouth of Grise Fiord in late September.

UKIA (November and December) (Fig. 6): Only one hunter had seen belugas during ukia. They were trapped in the ice near the mouth of Starnes Fiord. This event was reported by Freeman (1968). One hunter reported that fewer whales were seen in the Grise Fiord area in the three years following the ice entrapment event.

Changes in seasonal distribution: Grise Fiord is a relatively new community so local knowledge of whales only extends back about 40 years. Consequently only one hunter had local knowledge from his parents or grandparents. That information did not differ from his own observations.

One hunter observed that there seem to be more whales when the ice breaks up completely and fewer when it does not, but noted that comparison is difficult. Others noted a general decrease in the number of belugas since 1975; over the past 10 years; or in the last 3 years--the latter being attributed to the persistent presence of old ice.

Three hunters indicated that, in their lifetimes, there had been changes in the way belugas use habitat in their area during auja. One observed that the belugas near Grise Fiord are not feeding as much as they did in the past; another that there are fewer whales and they are more

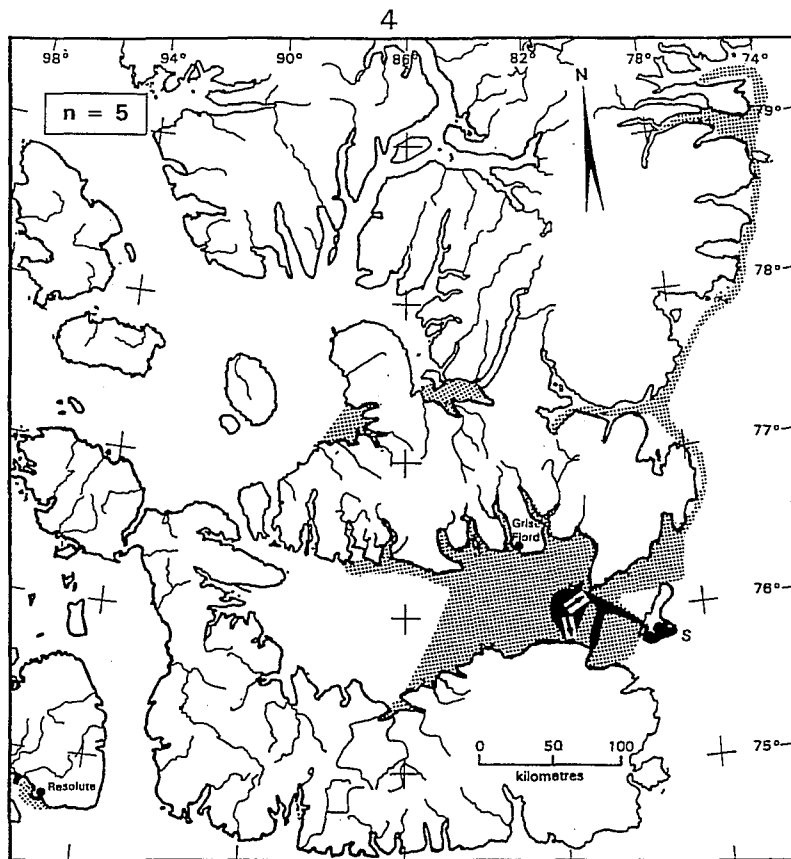


Figure 1.

Areas where hunters from Grise Fiord have travelled (stippled) and observed belugas (solid) during ukiu (January and February). Areas where belugas were observed during aerial surveys are indicated with the letter "s". Directional arrows indicate seasonal movements by the belugas.

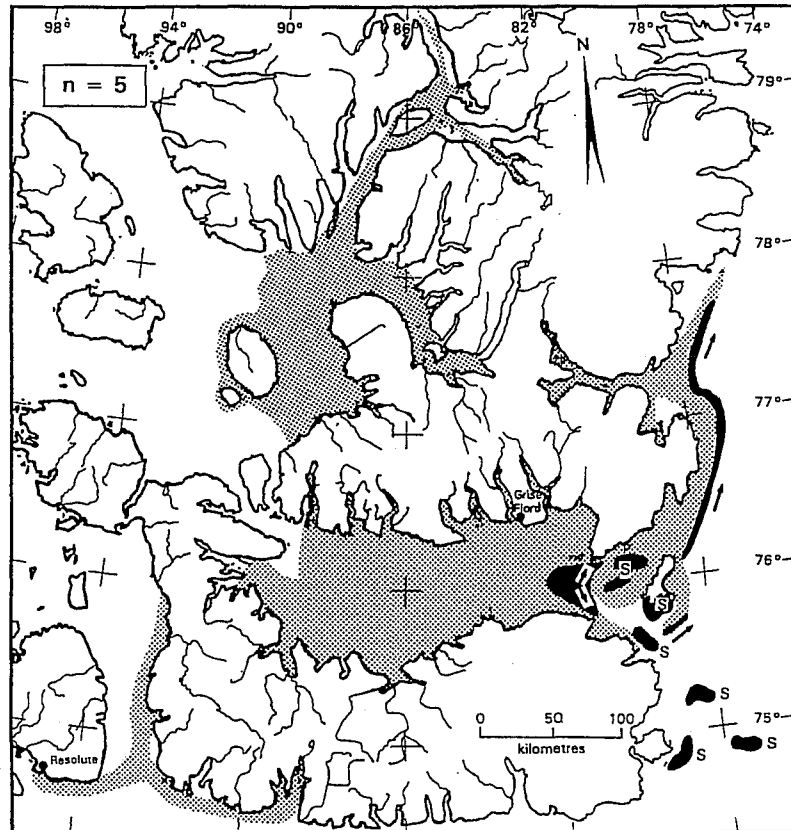


Figure 2.

Areas where hunters from Grise Fiord have travelled (stippled) and observed belugas (solid) during upingoaksak (March through mid-May). Areas where belugas were observed during aerial surveys are indicated with the letter "s". Directional arrows indicate seasonal movements by the belugas.

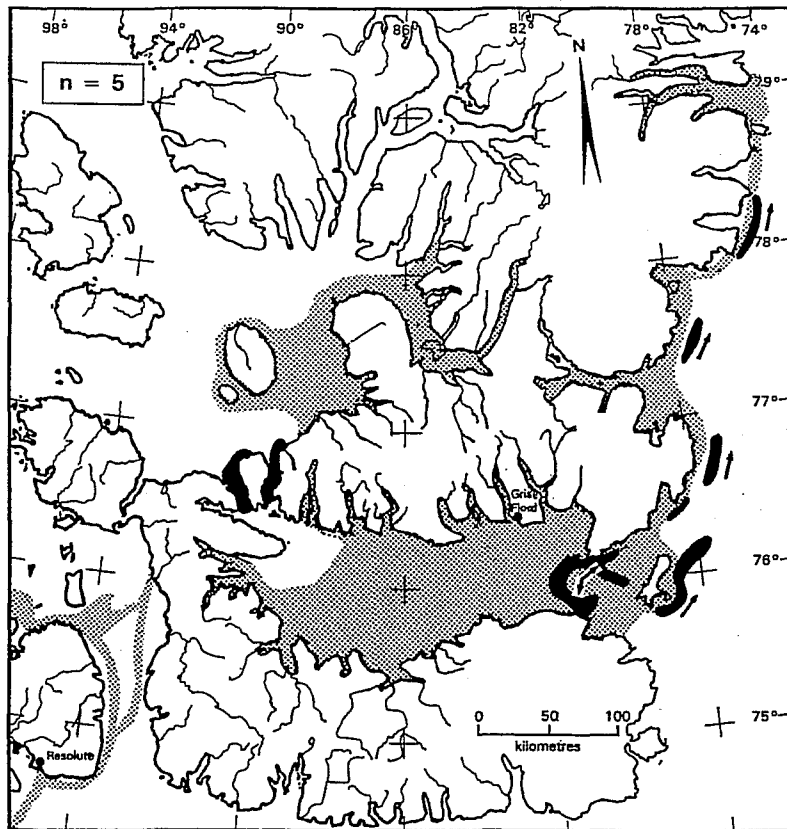


Figure 3. Areas where hunters from Grise Fiord have travelled (stippled) and observed belugas (solid) during upingoa (mid-May through early July). Directional arrows indicate seasonal movements by the belugas.

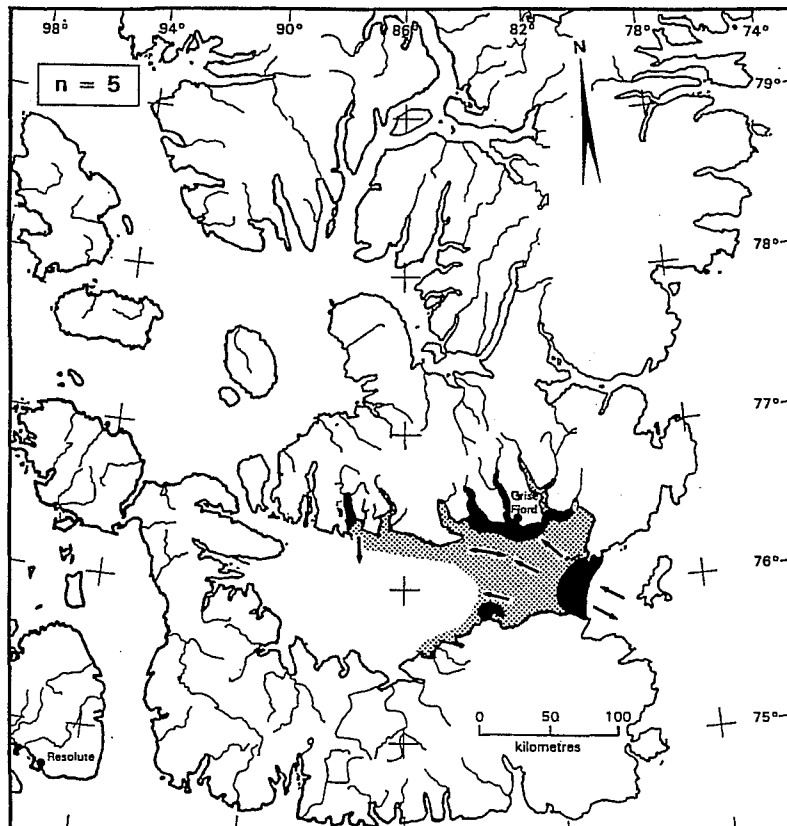


Figure 4. Areas where hunters from Grise Fiord have travelled (stippled) and observed belugas (solid) during auja (early July through August). Directional arrows indicate seasonal movements by the belugas.

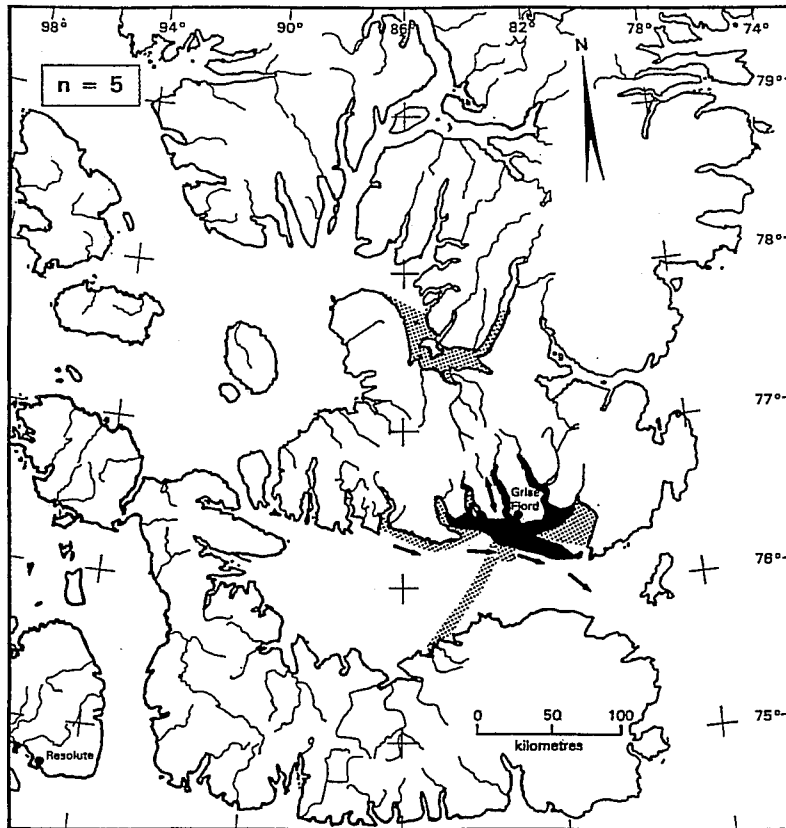


Figure 5. Areas where hunters from Grise Fiord have travelled (stippled) and observed belugas (solid) during ukiaksak (September and October). Directional arrows indicate seasonal movements by the belugas.

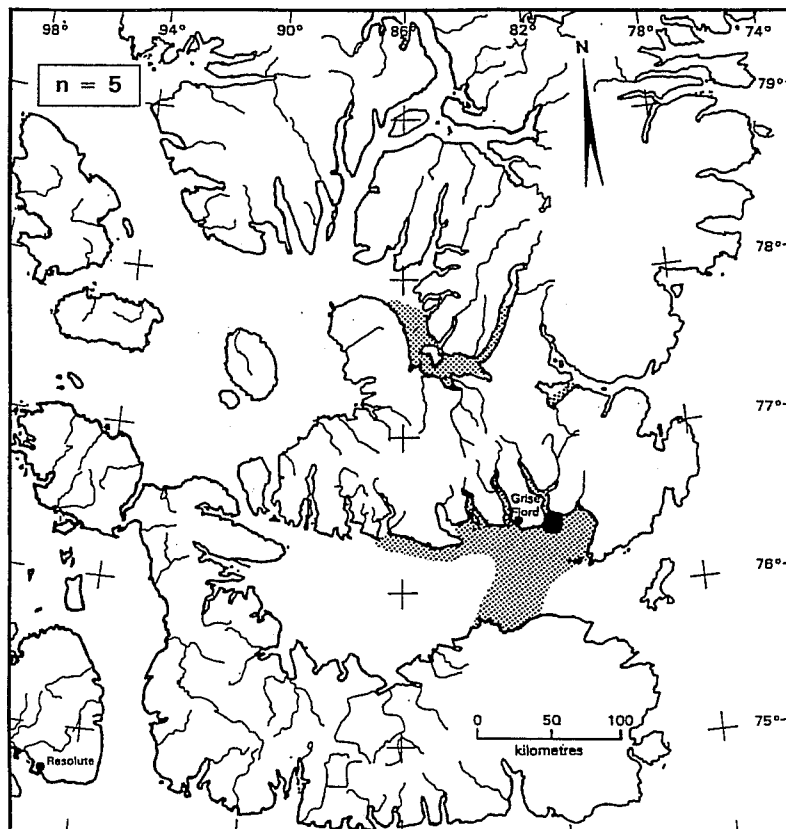


Figure 6. Areas where hunters from Grise Fiord travelled (stippled) and observed belugas (solid) during ukia (November and December).

easily scared; and a third that, during some years, ice prevents the whales from entering Grise Fiord.

During the past two years, belugas have been fewer and their stay shorter in the Grise Fiord area. The hunters (4) attributed this change to the persistent presence of old ice, in auja and ukiaksak, which prevents belugas from following their normal movement routes. Overhunting in the Disko Bay area was cited as another possible causative factor for this change. Another hunter indicated that he now sees belugas even when the fiords are iced up.

Reproduction: None of the hunters had seen belugas mating, although most (4) had seen females giving birth. Births were observed at the floe edge in July, in Grise Fiord in August, and off the mouth of Grise Fiord in September (Fig. 7). Newborn calves or births were seen in each month starting in February and continuing through October.

Opinions regarding whether the belugas give birth at the same time every year were mixed. Some hunters (2) said that belugas give birth at any time of the year--like humans, others did not know. None had observed a individual female from year to year to confirm how often she gave birth.

None of the hunters had observed a grey giving birth. One hunter said that greys do give birth since he had seen larger greys with a calf; another had seen foetuses in grey females but did not believe that grey females give birth; and a third observed that the larger greys are the size of the older whales that have calves, but was unsure whether they give birth. The remaining hunters (2) indicated that greys do not give birth.

The hunters had found foetuses in female belugas killed during ukiaksak (September and October). During this season, some of the pregnant females also had a calf, but none had more than one foetus. The calves were about 2 m (6-8') in length, and the foetuses about 0.6 m (2 ft). One hunter found different-sized foetuses at the same time of year.

Food and feeding: The stomachs of belugas harvested from upingoaksak through ukia (March through December) contained only cod. Using the pictures provided (Appendix 2), they were identified as Arctic cod *Boreogadus saida*, except in one case where the hunter was unsure whether those he found in ukiaksak (September and October) were Arctic or Greenland cod *Gadus ogac*.

One hunter said that belugas killed in Grise Fiord usually have food in their stomachs (Fig. 8).

Predators and ice entrapment: The hunters had seen evidence of killer whales and polar bears preying on belugas, but only one had seen a kill site. It consisted of the remains of a beluga that had been killed at the floe edge by a polar bear. Evidence of unsuccessful attacks included a healed wound on the back of a beluga near the tail made by a killer whale, polar bear claw marks on a number of animals, and possibly polar bear bite marks behind the head of an animal. The bear claws leave four clean, parallel scratches unlike wounds caused by the ice which have ragged edges. Claw marks were generally seen on the sides of the belugas, from behind the front flippers back to the tip of the tail. None of the hunters had seen evidence of sharks attacking belugas.

Ice entrapment of belugas does occur in the Starnes Fiord area. The hunters knew of only one entrapment which occurred between September 1966 and April 1967 (Fig. 8). Three of them had harvested some of these trapped belugas. We were referred to Freeman (1968) for the details!

Three hunters described healed bullet and harpoon scars on the belugas. Most of these scars were located on the animals' backs, from just behind the melon to just back of the dorsal ridge.

Group and stock identification: Hunters did not indicate that they recognize different types or kinds of belugas, apart from males, females, and calves. However, one hunter indicated that their whales seem smaller than those in Cumberland Sound. They can distinguish between the sexes by size and colour. The large males are found together, and the females with their calves. Females and calves are more common in the Grise Fiord area.

Harvesting: Beluga hunting takes place at the floe edge during ukiu through upingoa (February through early July), and near Grise Fiord during auja and ukiaksak (early July through October) (Fig. 9). The greatest hunting effort is expended in auja and ukiaksak (July through October) in the coastal waters of southern Ellesmere Island between South Cape and Starnes fiords, with the greatest hunting success in ukiaksak (September and October). Hunts are generally over the same day they start, but one hunter indicated that his July hunts at the floe edge are week-long.

All of the hunters use both rifles and

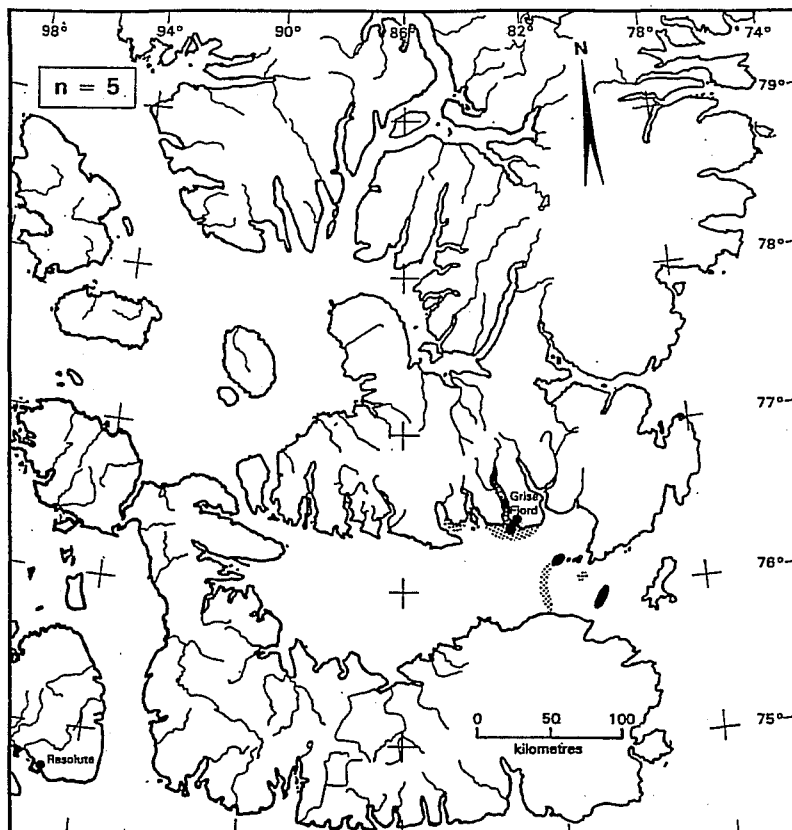


Figure 7. Areas where hunters from Grise Fiord have observed belugas give birth (solid) or seen newborn belugas (stippled).

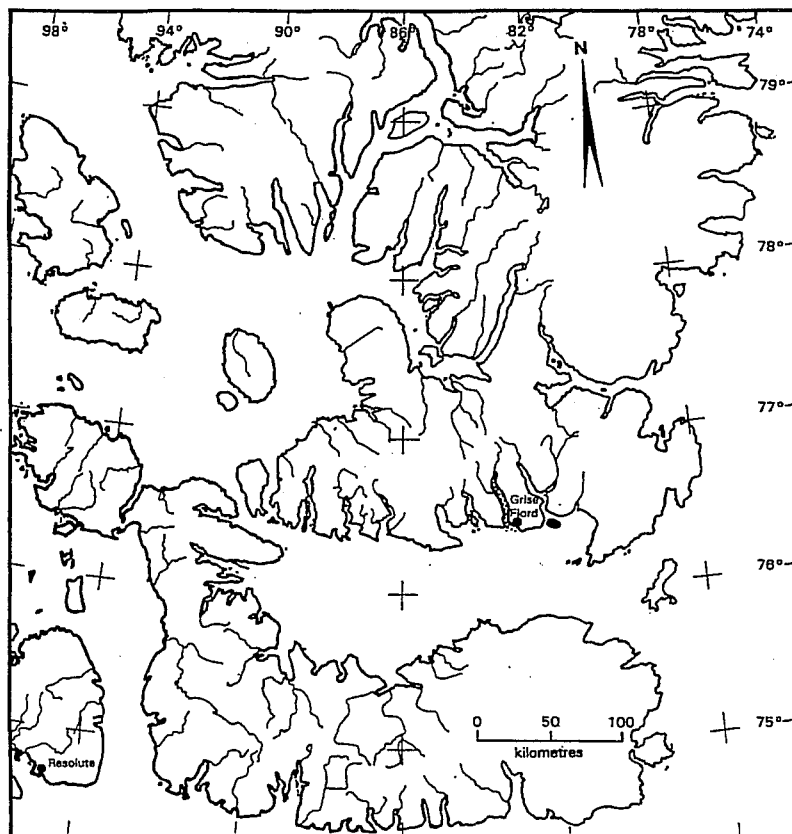


Figure 8. Areas where hunters from Grise Fiord have observed belugas entrapped by ice (solid; n = 4), or where belugas and narwhals generally have food in their stomachs (stippled; n = 1).

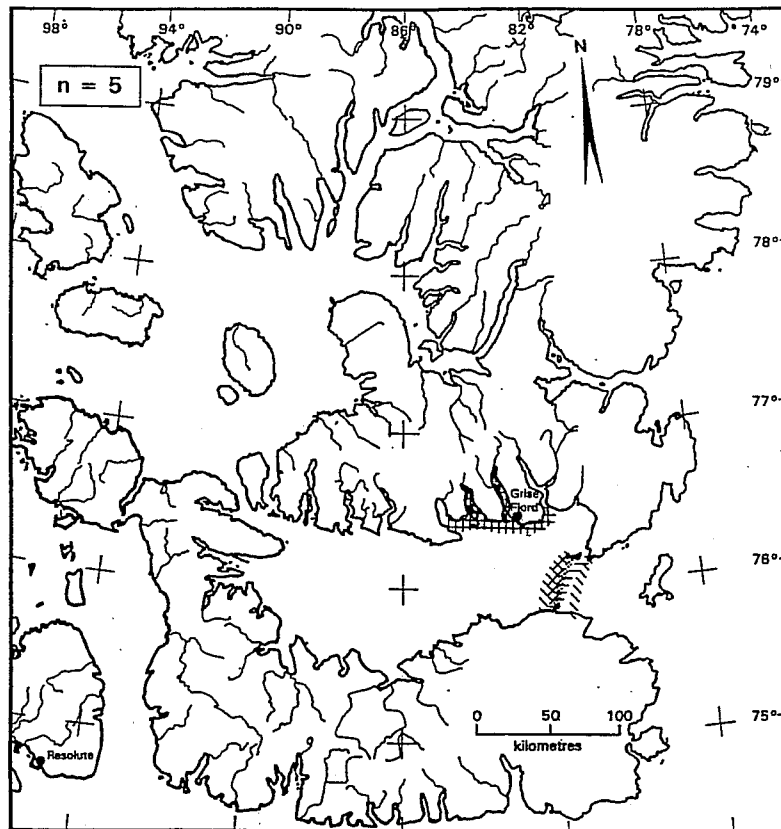


Figure 9.

Areas where hunters from Grise Fiord hunt belugas during each season of the year.

ukiu (January and February)



upingoaksak (March thru mid-May)



upingoa (mid-May thru early July)



auja (early July thru August)



ukiaksak (September and October)



ukia (November and December)

none

harpoons when hunting belugas. Whales are shot and then harpooned except in auja and ukiaksak (July-October), when some hunters harpoon the whales before shooting them. Rifles of a variety of calibres are used, with .303's being the most common (Appendix 3). Whale nets are not used. If possible, the whales are driven into shallow water where they can be recovered using treble grappling hooks if they sink. During ukiu, upingoaksak, and upingoa transportation is by snowmobile with a sled and often a boat. During auja and ukiaksak a variety of boats are used for hunting belugas (Appendix 2, Question 37c). Larger boats are a disadvantage in the Grise Fiord area since they cannot go into shallow water.

Most hunters (4) said that belugas harvested in the Grise Fiord area are a mixture of male, female and young animals. One hunter disagreed and stated that the catch was mostly young animals. They still use the same parts of the animal as when they began hunting. Muktuk and meat were identified as the most important parts of the whale. The muktuk is eaten and most of the meat is fed to the dogs. One hunter indicated that he used every part of the beluga except the head.

Heavy ice conditions during the past three years were identified by hunters as hampering the presence and hunting of belugas in their area. Indeed, one hunter thought that the whales may have stayed at the floe edge year-round during the past two years as they were not passing through Grise Fiord due to heavy ice conditions.

Arctic Bay

Six hunters from Arctic Bay were interviewed for information on belugas. A seventh interview conducted at the workshop may duplicate one of these interviews. Since this could not be confirmed it has been included in the results. Where duplication may have occurred it is marked with an asterisk (*).

Prior to the establishment of Arctic Bay in 1966, the hunters had lived in southern Admiralty Inlet, at Fitzgerald Bay, Bernier Bay and in the Arctic Bay area (one "no response"). They had been taught to hunt by one or both parents or a grandfather.

Seasonal distribution and movements: The seasonal travels of Arctic Bay hunters and their observations of seasonal beluga distributions and movements are summarized in Figures 10 to 15.

The extent of their seasonal travel may be greater than is shown in these figures since few of the hunters provided this information.

UKIU (February through mid-March) (Fig. 10): None of the hunters had seen belugas during ukiu, nor had their parents or grandparents told them of seeing belugas during ukiu. Only one hunter indicated the extent of his marine travel during this season. It was mainly along the ice edge within Admiralty Inlet and Bernier Bay.

UPINGOAKSAK (mid-March through early May) (Fig. 11): During upingoaksak belugas move westward past the ice edge at the mouth of Admiralty Inlet, and southward along the west coast of Brodeur Peninsula to at least Fitzgerald Bay. Most of the hunters had seen them at the ice edge near the mouth of Admiralty Inlet.

UPINGOA (early May through early July) (Fig. 12): During upingoa the belugas continue to move westward along the ice edge near the mouth of Admiralty Inlet, and southward along the west coast of Brodeur Peninsula to at least Fitzgerald Bay. They feed as they go.

AUJA (early July and late-September) (Fig. 13): During auja the belugas move up and down Admiralty Inlet, entering the fiords, and feeding as they go.

UKIAKSAK (late September through November) (Fig. 14): During ukiaksak the belugas move northward out of Admiralty Inlet. Some enter Adams Sound and Arctic Bay on their way northward.

UKIA (December and January) (Fig. 15): Only one hunter had observed belugas during ukia. They moved northward out of Admiralty Inlet and then eastward in Lancaster Sound.

Changes in seasonal distribution: The hunter's parents or grandparents saw belugas in the same areas where they are seen today. Some hunters (3) reported that the number of belugas in the area has decreased since ships began visiting the area on a regular basis, particularly during auja. The others had not noticed any overall trend in the number of belugas. One hunter said that the belugas now get stuck in the ice when it returns because they are late moving northward.

Reproduction: Belugas had been observed mating during upingoaksak (May) and upingoa (July) at the

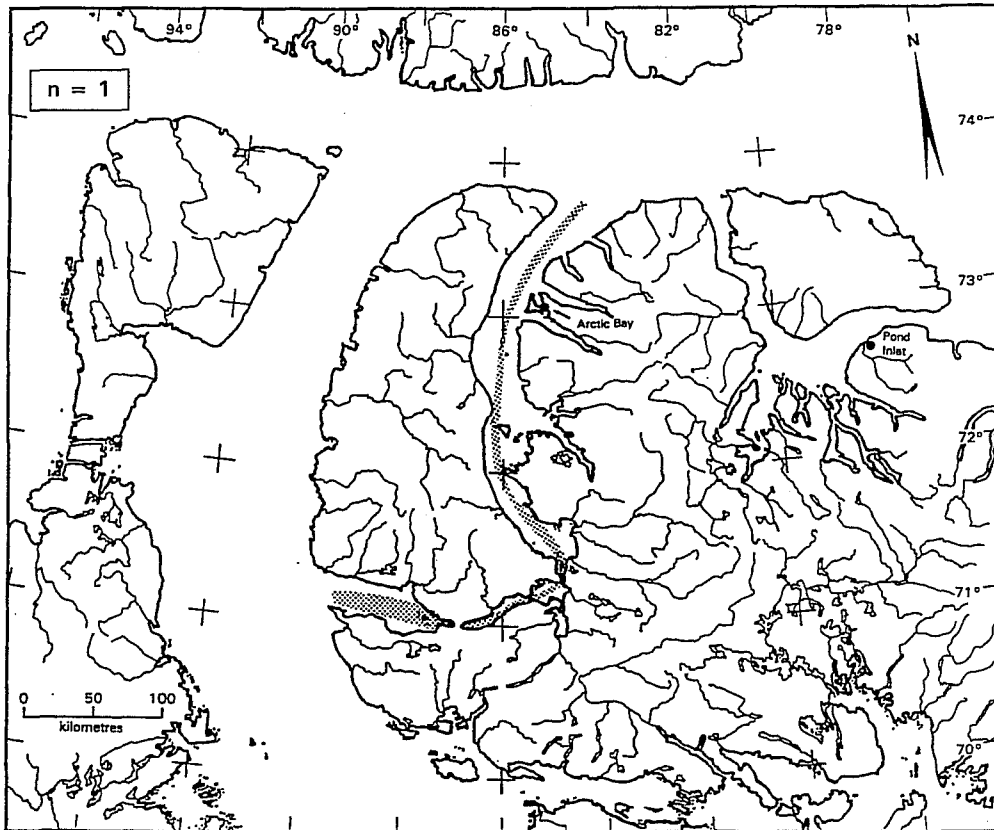


Figure 10. Areas where hunters from Arctic Bay have travelled (stippled) during ukiu (February through mid-March).

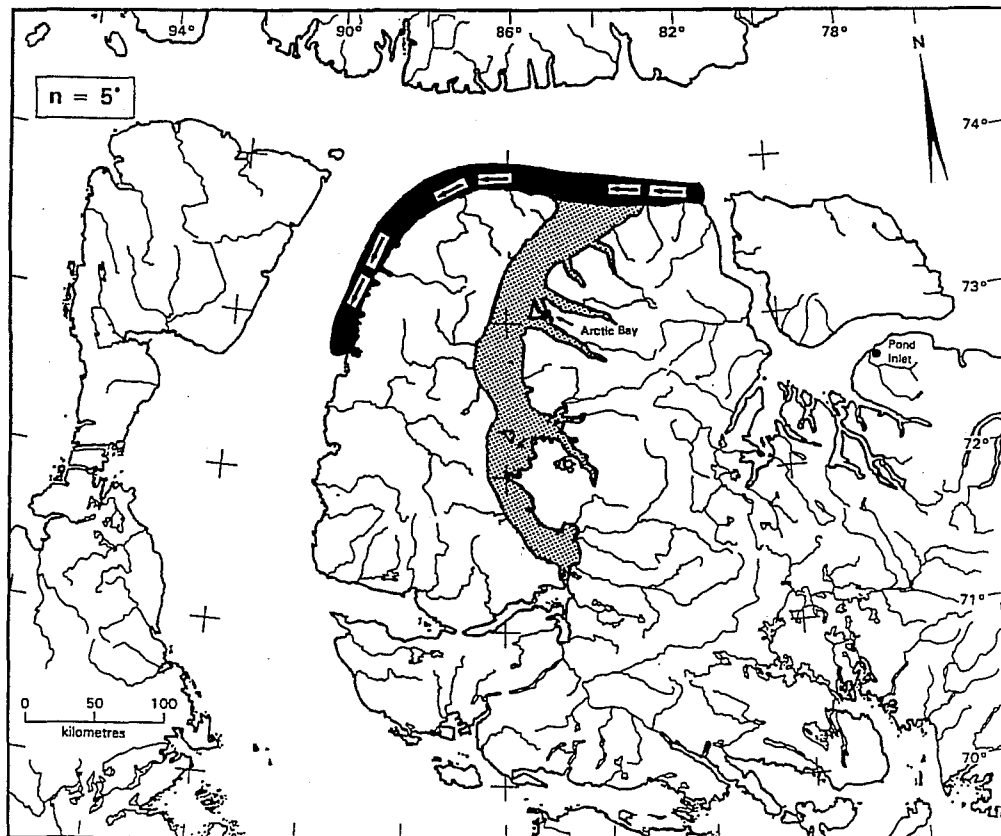


Figure 11. Areas where hunters from Arctic Bay have travelled (stippled) and observed belugas (solid) during upingoaksak (mid-March through early May). Directional arrows indicate seasonal movements by the belugas.

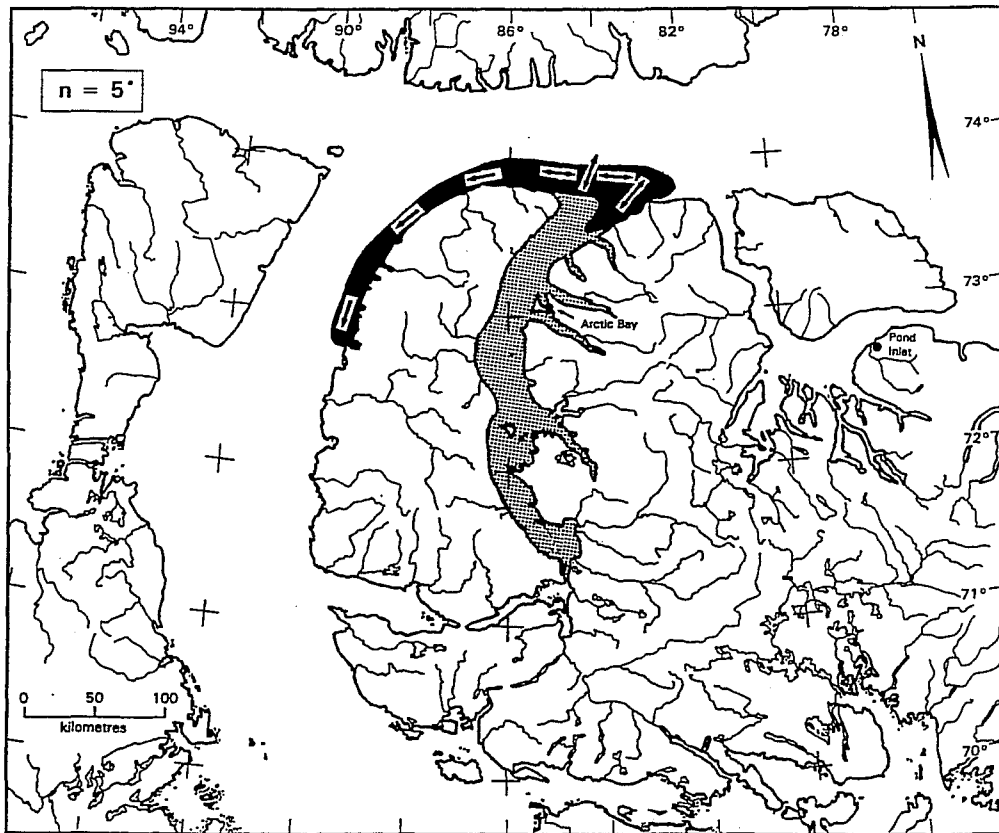


Figure 12. Areas where hunters from Arctic Bay have travelled (stippled) and observed belugas (solid) during upingoa (early-May through early July). Directional arrows indicate seasonal movements by the belugas.

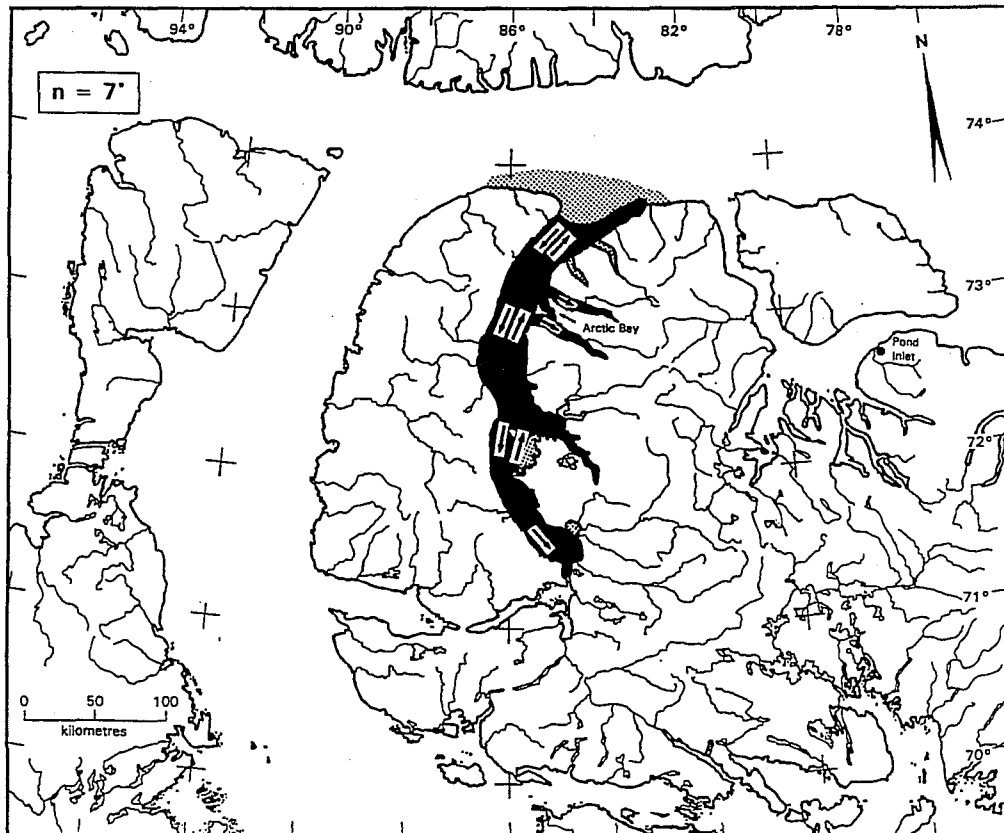


Figure 13. Areas where hunters from Arctic Bay have travelled (stippled) and observed belugas (solid) during auja (early July through late September). Directional arrows indicate seasonal movements by the belugas.

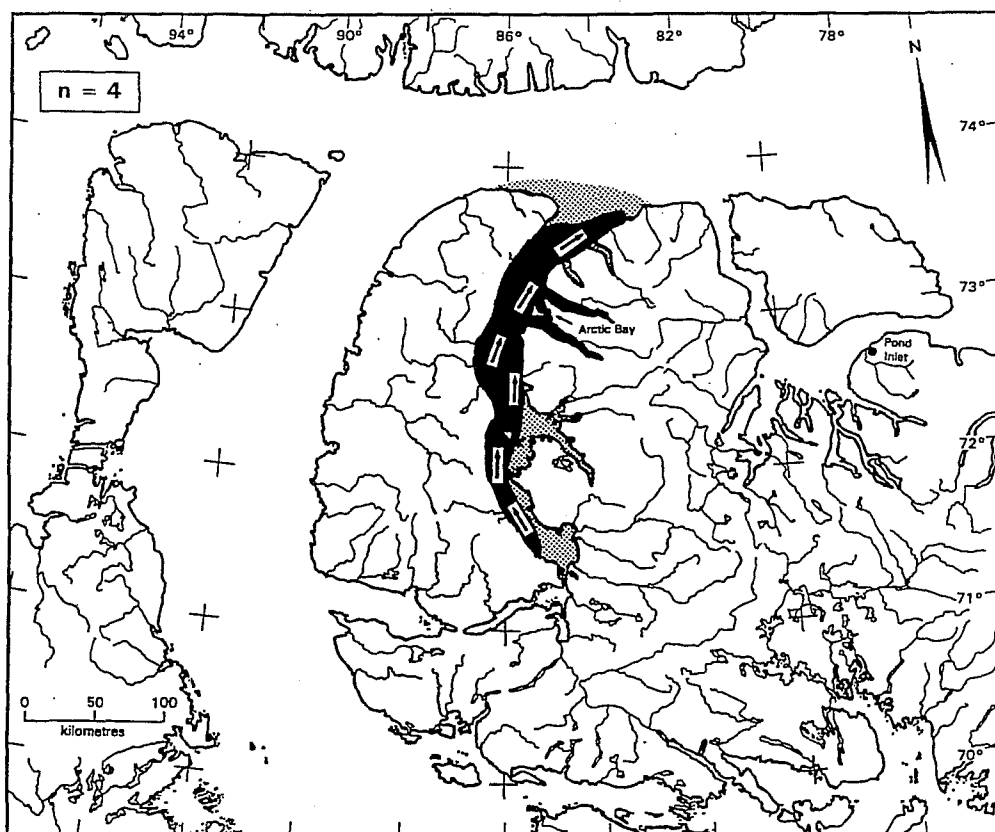


Figure 14. Areas where hunters from Arctic Bay have travelled (stippled) and observed belugas (solid) during ukiaksak (late September through November). Directional arrows indicate seasonal movements by the belugas.

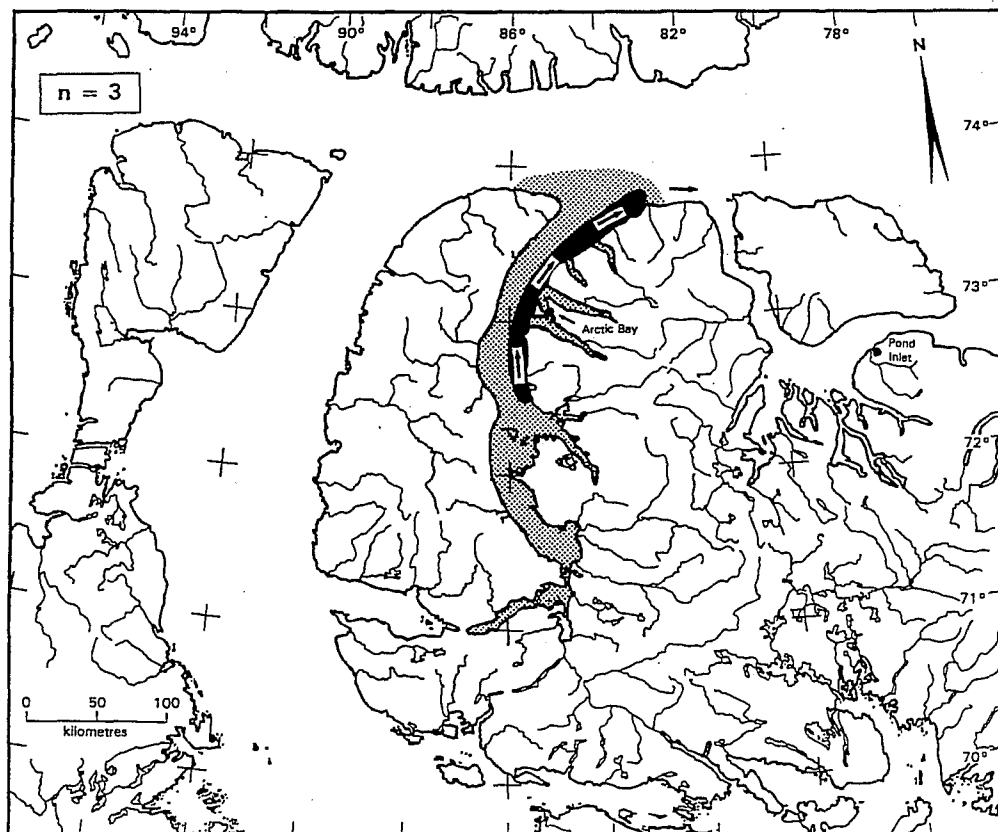


Figure 15. Areas where hunters from Arctic Bay have travelled (stippled) and observed belugas (solid) during ukia (December and January). Directional arrows indicate seasonal movements by the belugas.

Admiralty Inlet floe edge (Fig. 16). In the latter case, the whales were facing each other, going deep and then rising to the surface to breathe.

None of the hunters had seen belugas give birth or been told of birthing areas by their parents or grandparents. Newborn calves had been seen at the floe edge during upingoa (July) (Fig. 17). One hunter indicated that belugas give birth at any time of the year. Another suggested that they give birth during auja (August), but did not indicate whether all whales give birth at this time.

One hunter had observed an individual female beluga for two consecutive years, but not whether she gave birth each year. Grey belugas had not been observed to give birth. The hunters did not believe that greys give birth, or said they did not know.

Foetuses had been found inside female belugas during upingoaksak, upingoa, and auja (May, July, August). None of the females contained more than one foetus, but foetuses of different sizes were seen at the same time of year. Several hunters had killed pregnant belugas that also had a calf. The calves were about 2 m (6') in length while the foetuses were about 1 m (3-4') in length. Most hunters did not indicate the season of these harvests, but one said it was during upingoaksak (May). Another hunter observed that about one in four of the white female belugas killed is pregnant.

Food and feeding: Beluga stomachs examined during upingoaksak and auja contained cod. During upingoa they contained invertebrates ("little sea animals and shrimp") and fish--turbot at the floe edge and cod inside the bay. There are locations where belugas usually have food in their stomachs and others where they do not, but the hunters did not specify locations.

Predators and ice entrapment: A killer whale had been seen to successfully attack a beluga. The beluga was "killed when it was almost on shore". One hunter had seen a beluga scarred on its back, above the front flippers, and in front of the tail from an unsuccessful killer whale attack.

Scars from unsuccessful polar bear attacks had been observed on the flanks of belugas, and on their sides below the dorsal ridge. They generally consisted of four parallel lines of scratches, although one hunter had also seen bite marks, which he could not identify, behind the melon and

on the back mid-way between the dorsal ridge and tail. None of the hunters had seen evidence of attacks by sharks on belugas. One hunter had seen belugas with scars on the back, above the front flippers, from bullets or harpoons.

Belugas and narwhals had been observed entrapped together by ice in Adams Sound during ukiaksak (October) (Fig. 18). The hunter did not harvest any of the animals but observed that they lost weight, and that their skin became ragged. He estimated that such events might occur about every ten years, and did not believe that there had been a change in the frequency of ice entrapment events.

Group and stock identification: Some hunters (3) indicated that they can tell male and female belugas apart by their colour and the strength of their breathing. The males tend to be yellower than the females and they also breathe more strongly. Another hunter indicated that he can only tell the sexes apart when there are calves present, but that the sexes are found in different locations which seem to be consistent from year to year. No other groups or types of belugas were identified.

Harvesting: All but one of those interviewed (7*) had hunted belugas, about half had retired from beluga hunting. Only one indicated where he hunted each season, or how long he had actively hunted belugas.

Belugas are hunted during upingoa (March through June), with the greatest hunting effort and success later in the season (May and June). While none of the hunters indicated that he hunted belugas during auja (August), one said that his greatest hunting success was during that season. This apparent contradiction may indicate that this harvest was opportunistic rather than part of a planned hunt. Several hunters also listed the equipment they used for hunting belugas during upingoaksak and auja, suggesting that the hunt period actually begins before, and ends after, upingoa. The hunts were generally from 2 to 7 days long.

From upingoaksak through auja the whales are usually shot and then harpooned. The hunters use .303 caliber rifles, but one has also used a .338 caliber rifle. When ice conditions permit they travel by snowmobile and sled, sometimes bringing a boat. During the open water period they hunt from a variety of small boats, driving the whales into shallow water if possible (Appendix 3). Whale nets

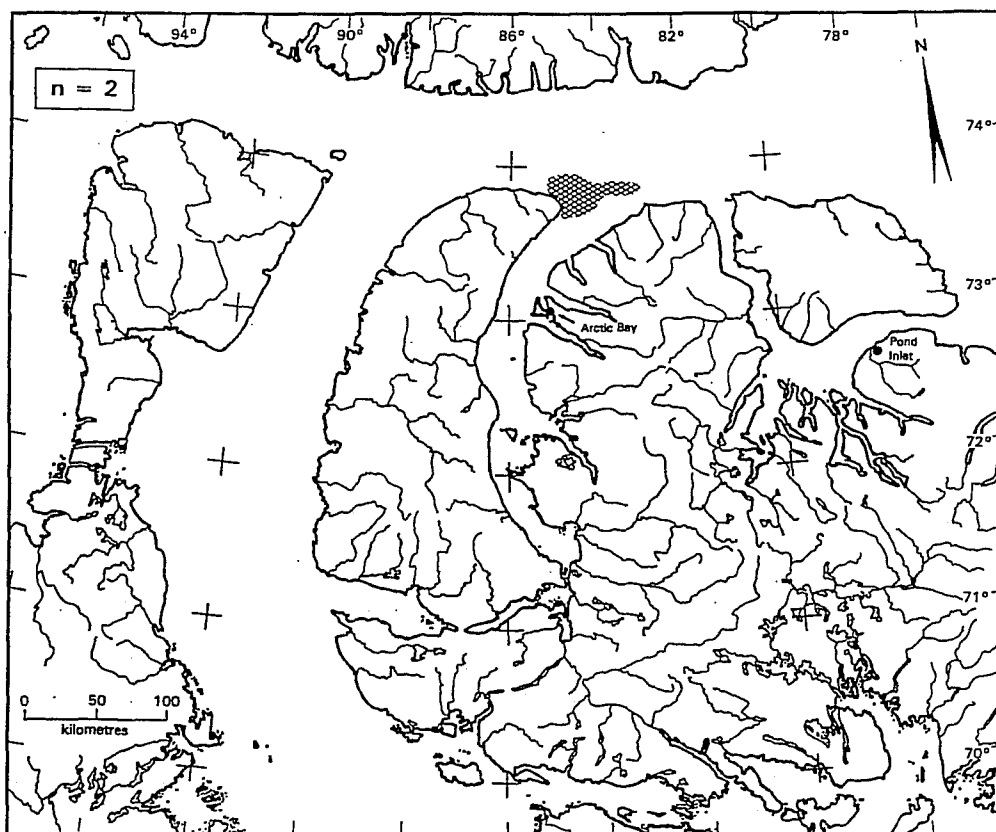


Figure 16. Areas where hunters from Arctic Bay have observed belugas mating (hatched).

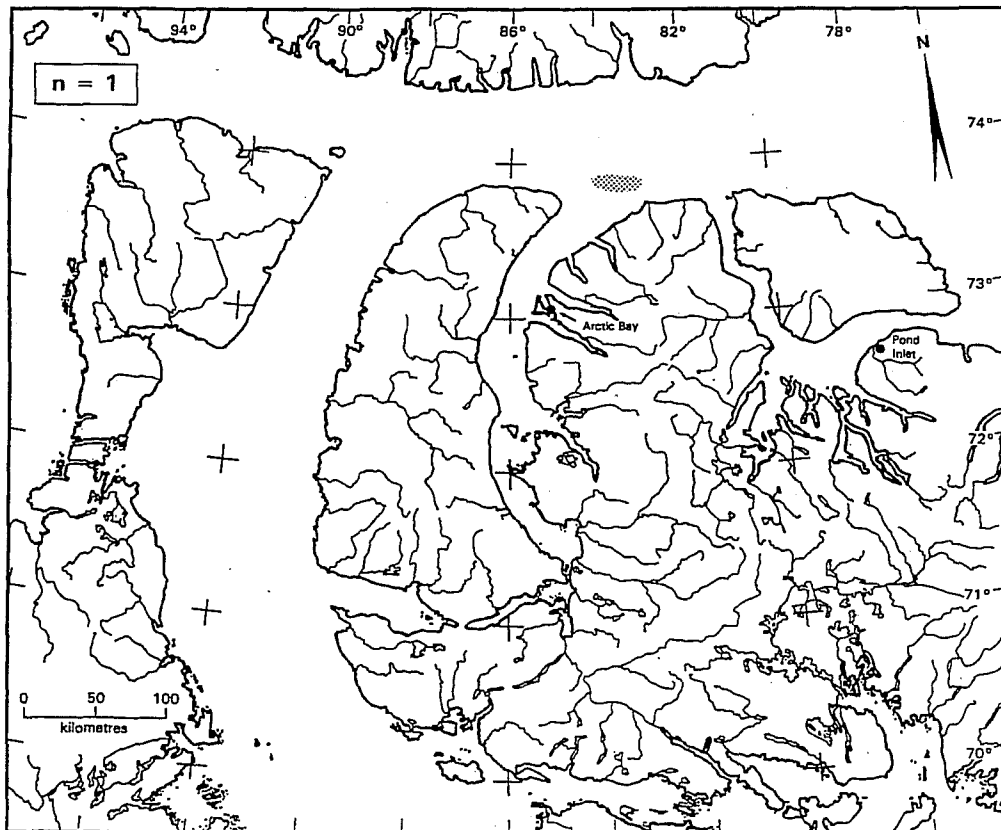


Figure 17. Areas where hunters from Arctic Bay have observed newborn belugas (stippled).

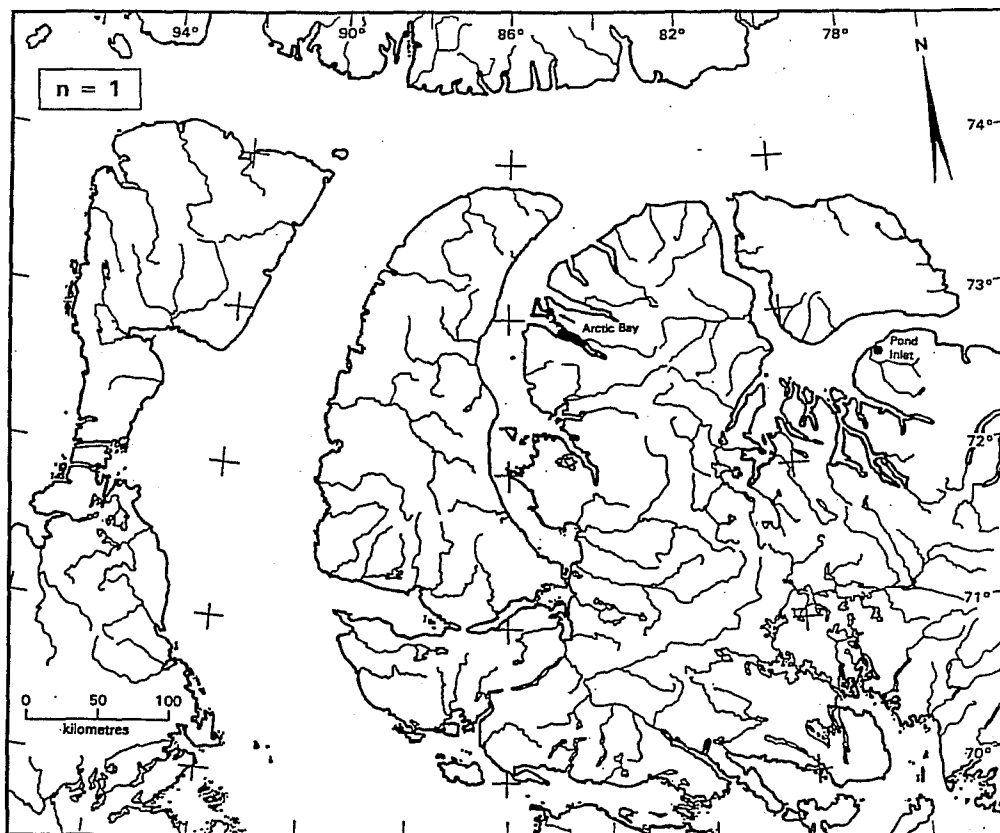


Figure 18. Areas where hunters from Arctic Bay have observed belugas entrapped by ice (solid).

are not used. One hunter indicated the use of a cabin cruiser and motor canoe during upingoaksak, but this seems unlikely given the ice conditions during that season.

Arctic Bay hunters harvest a mixture of males, females, and young animals. They consider the muktuk and meat to be the most important parts of the whales. All but one still use the same parts of the whales now as they did when they began hunting.

None of the hunters had noticed anything that was clearly hampering the presence and hunting of belugas in their area. Indeed, one hunter reported that the belugas seem to be tamer now than they were a few years ago, and attributed this change to their becoming accustomed to ship noise.

Igloolik and Hall Beach

Only two hunters were interviewed in Hall Beach. Apparently, most of the local hunters concentrate on caribou and walrus, so whales are poorly known and few hunters have information to provide. Those who were interviewed had lived and hunted in same general area as those from Igloolik, so information they provided was pooled with that from Igloolik.

Only five of the twenty knowledgeable hunters identified by the Igloolik HTA were interviewed. This may be due in part to the short time frame, and to the inability of the interviewer to pay for interviews.

The seven hunters interviewed for information on belugas had lived in the Igloolik area, at Jens Munk Island, in the Port Parry area, at Hall Beach, and in the Murray Maxwell Bay area (two "no responses"). Six were active hunters and had hunted belugas for many years, having been taught to hunt by a father, grandfather, or someone else. The seventh, from Hall Beach, did not hunt belugas.

Seasonal distribution and movements: The seasonal travels of Igloolik and Hall Beach hunters, and their observations of seasonal beluga distributions and movements, are summarized in Figures 19 to 24.

UKIU (late November through April) (Fig. 19): During ukiu hunters had observed belugas entrapped by the ice at the entrance and exit to Fury and Hecla Strait, and in Murray Maxwell Bay.

Entrapped whales were also seen by the hunters' parents or grandparents in Agu Bay, northern Committee Bay, eastern Fury and Hecla Strait and Guiliam Bay.

UPINGOAKSAK (May through mid-June) (Fig. 20): Belugas had been observed during upingoaksak in western Fury and Hecla Strait and east of Igloolik.

UPINGOA (mid-June through mid-July) (Fig. 21): During upingoa they had been seen west of Rowley Island and near the southeastern coast of Melville Peninsula, following the floe edges looking for food.

AUJA (mid-July through early September) (Fig. 22): Belugas had been observed during auja mainly in the area between Igloolik, Hall Beach, and Rowley Island. They were searching for food, and some were moving northward.

UKIAKSAK (early September through mid-October) (Fig. 23): During ukiaksak the hunters had travelled in northwestern Foxe Basin and the Agu and Garry bay areas to the west. Most belugas were seen feeding in the Igloolik Island/Jens Munk Island area. During ukiaksak, belugas move southward and northward in the Igloolik Island area.

UKIA (mid October through late November) (Fig. 24): Only one hunter had observed belugas during ukia. The whales were moving southward in October from the Igloolik area past Hall Beach in search of open water.

Changes in seasonal distribution: The hunters' parents or grandparents generally saw belugas in the same areas they are seen today. Over the years belugas have been entrapped by ice in different areas but, given that entrapment is uncommon, this is as expected. The hunters' parents or grandparents did, however, see belugas during auja in the area between Igloolik Island and Melville Peninsula--an area where they were not reported by the hunters (Fig. 22).

One hunter said that the number of belugas has been decreasing at every season. The others noted seasonal and interannual variations in the numbers of belugas, but had not recognized an overall change. The belugas were said now to prefer deep water during auja and ukiaksak.

Reproduction: The Igloolik hunters did not answer

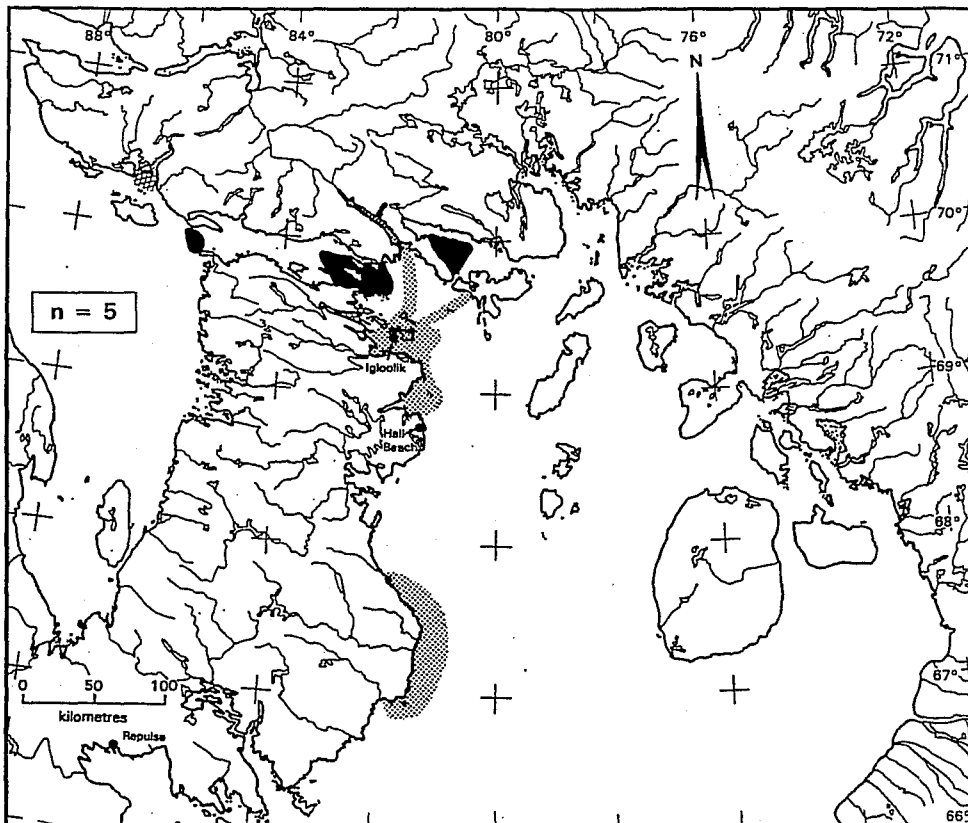


Figure 19. Areas where hunters from Igloolik and Hall Beach have travelled (stippled) and observed belugas (solid) during ukiu (late November through April). Directional arrows indicate seasonal movements by the belugas.

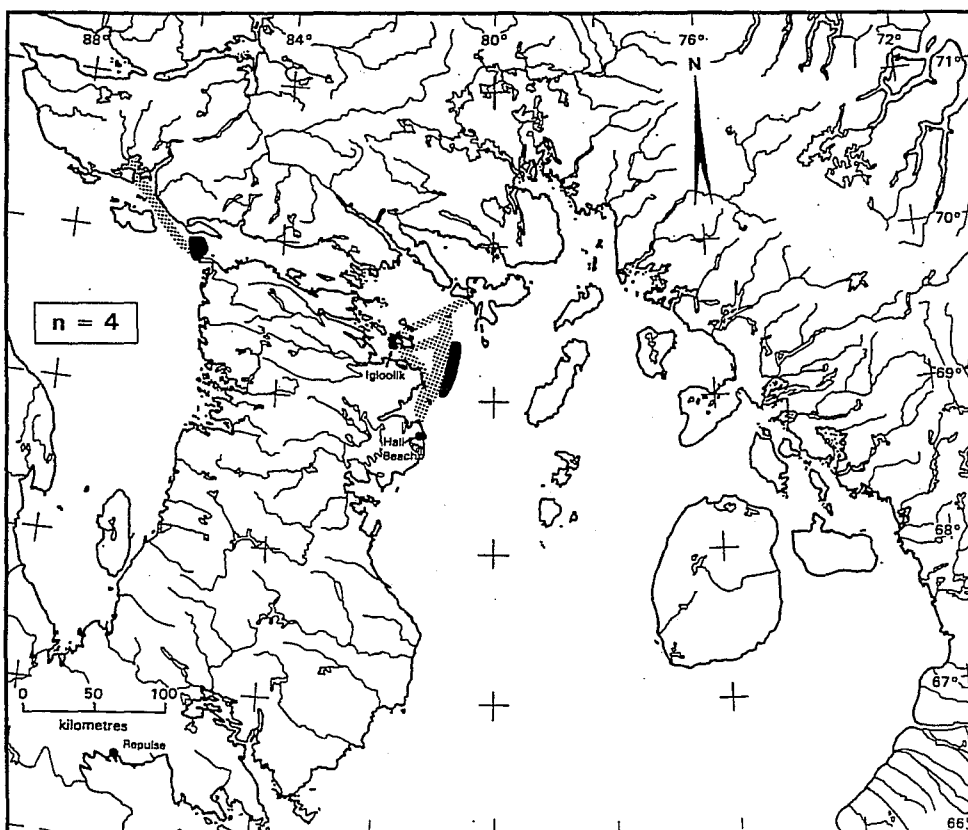


Figure 20. Areas where hunters from Igloolik and Hall Beach travelled (stippled) and observed belugas (solid) during upingoaksak (May through mid-June).

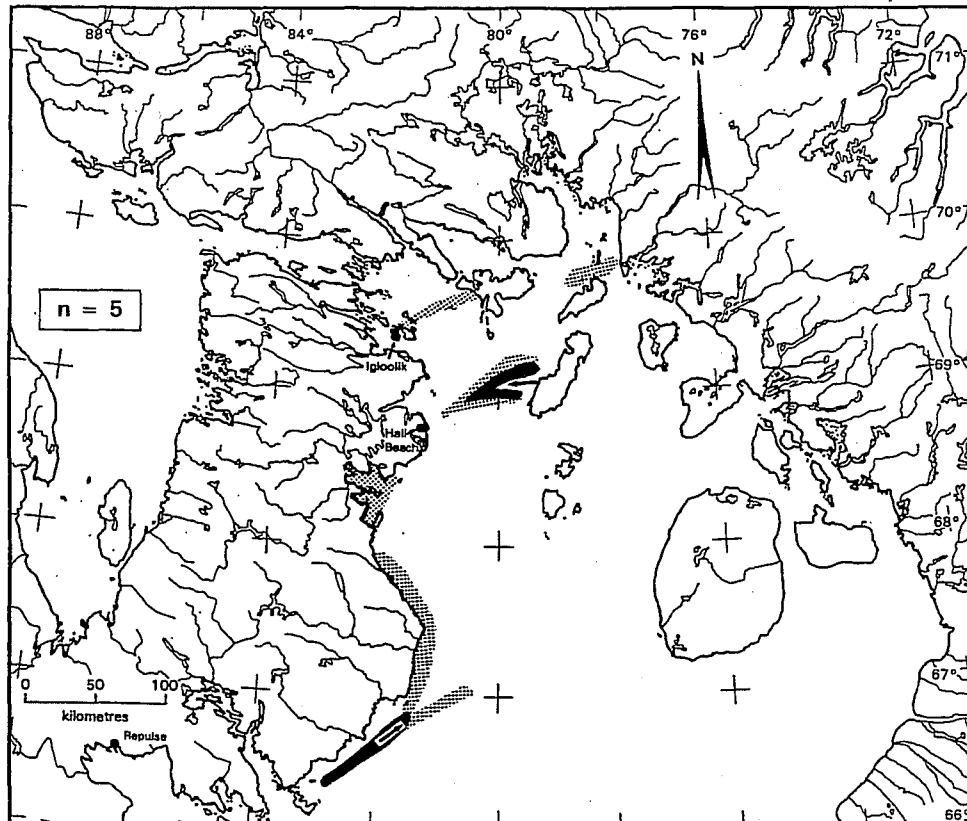


Figure 21. Areas where hunters from Igloodik and Hall Beach have travelled (stippled) and observed belugas (solid) during upingwa (mid-June through mid-July). Directional arrows indicate seasonal movements by the belugas.

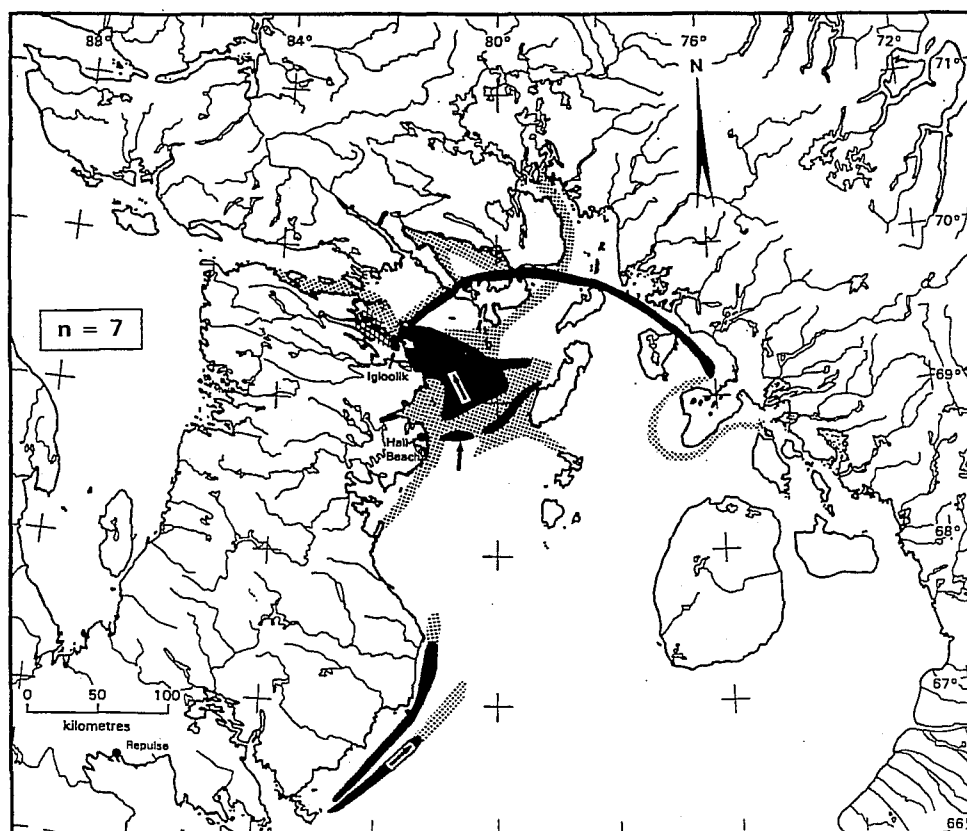


Figure 22. Areas where hunters from Igloodik and Hall Beach have travelled (stippled) and where they (solid) or their parents or grandparents (cross hatched) observed belugas during auja (mid-July through early September). Directional arrows indicate seasonal movements by the belugas.

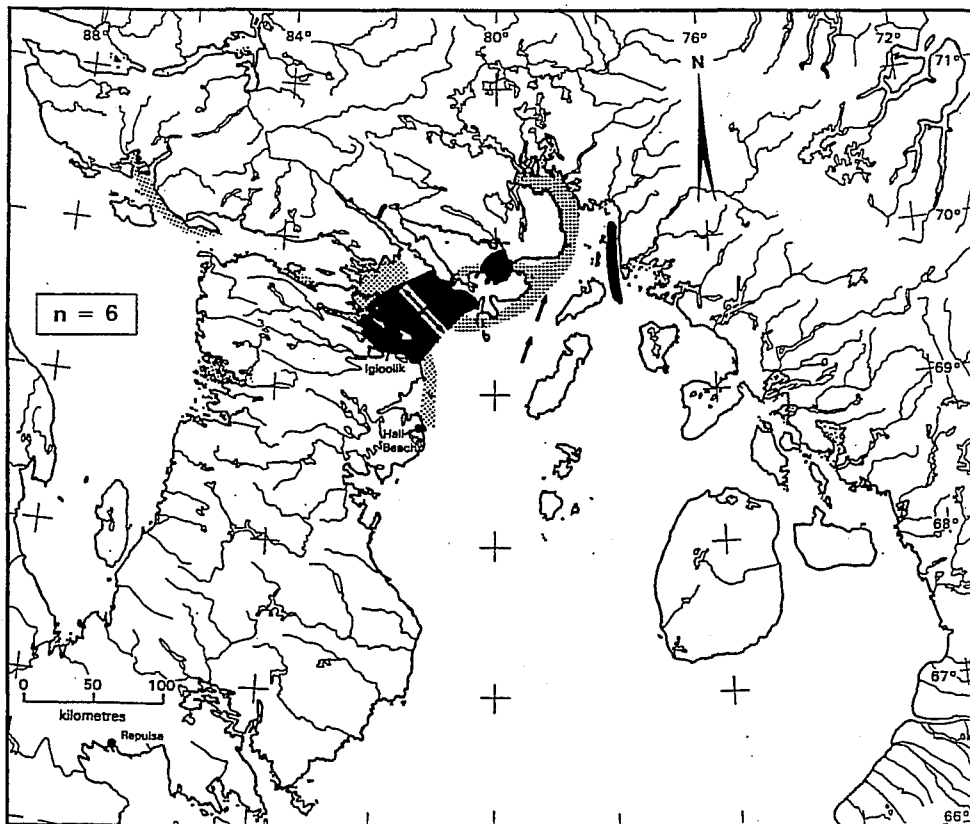


Figure 23. Areas where hunters from Igloolik and Hall Beach have travelled (stippled) and observed belugas (solid) during ukiaksak (early September through mid-October). Directional arrows indicate seasonal movements by the belugas.

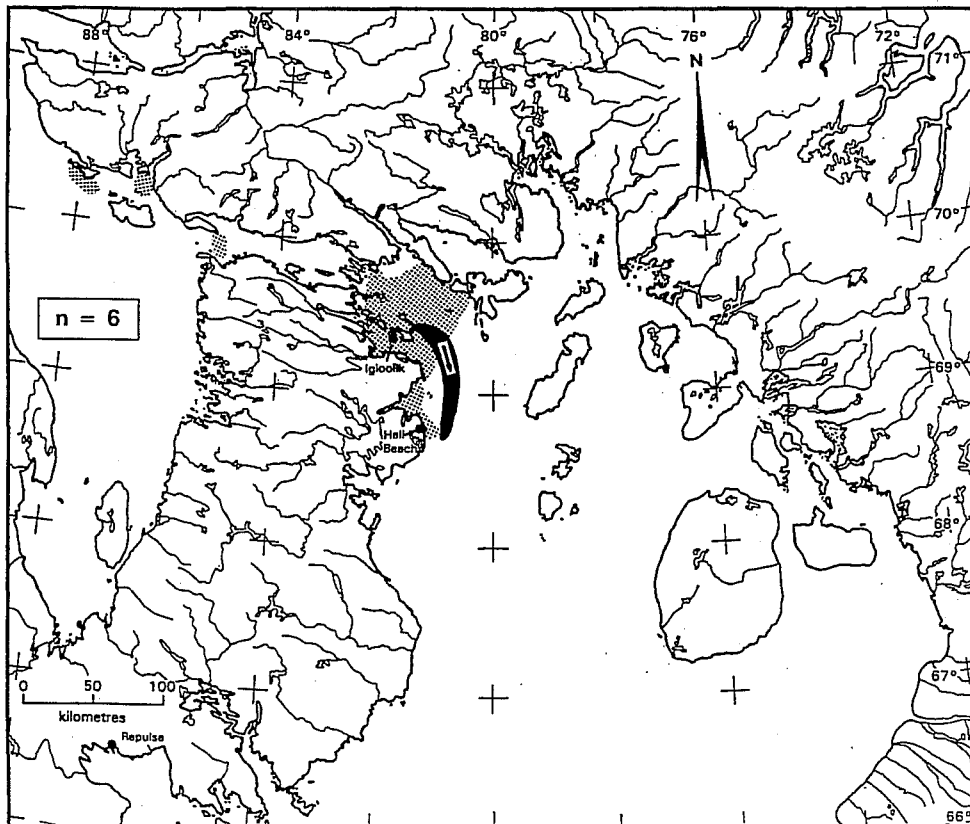


Figure 24. Areas where hunters from Igloolik and Hall Beach have travelled (stippled) and observed belugas (solid) during ukia (mid-October through late November). Directional arrows indicate seasonal movements by the belugas.

questions 20b through 23 on beluga reproduction. These questions were either missing from their questionnaires, or were removed.

Belugas had not been observed mating or giving birth. However, newborn calves had been seen during upingoa or auja (June, August, and September) in the Igloodik and Jens Munk Island areas (Fig. 25). Some hunters (3) said that belugas give birth at the same time each year, another that they give birth at any time of the year. None had observed an individual female beluga from one year to the next.

Grey belugas had not been observed to give birth, but several hunters said that they do on occasion. One of the Hall Beach hunters had found twin fetuses in a beluga during ukiaksak (September). Neither of the Hall Beach hunters had ever killed a pregnant female beluga that also had a calf, nor had they noticed how many of the white female belugas killed are usually pregnant.

Food and feeding: Fish were the main food items that the hunters had identified from beluga stomachs. Arctic cod were found in beluga stomachs during all seasons except ukia and upingoa; Greenland cod and sculpin during auja and ukiaksak; shrimp and eelpout during auja; and, unidentified fish during upingoa and auja. One hunter indicated that "ugac" or cod are found in the Igloodik area, and that belugas generally have more food in their stomachs in the Bray Island, Grant-Suttie Bay, and Steensby Inlet areas.

Predators and ice entrapment: None of the hunters had seen another animal successfully attack a beluga, but they had seen evidence of unsuccessful attacks on belugas by killer whale and polar bear. One hunter had seen scars caused by a killer whale on the side of a beluga below the dorsal ridge. The Igloodik hunters, but not the Hall Beach hunters, had seen the claw marks of polar bears on belugas. The animals were scarred on their sides below and behind the dorsal ridge, on the sides of their heads, and on their tails. The scars generally consisted of four parallel lines of scratches on each side of the whale, but bite scars were sometimes present. None of the hunters had seen evidence of sharks attacking belugas.

Belugas had been observed with scars from bullets or harpoons on their dorsal surface behind the melon, or in the dorsal ridge area. One hunter reported that the bullets were of an unfamiliar type, and suggested that the whales may have been

wounded in Greenland.

Ice entrapment of belugas occurs during ukia and ukiu (October through February) in the Igloodik area. Sites of entrapment were identified in Murray Maxwell Bay, Guiliam Bay, eastern Fury and Hecla Strait, Agu Bay, and northern Committee Bay. Presumably the whales observed at the western end of Fury and Hecla Strait during this period (Fig. 26) were either in a polynya or entrapped by ice. One hunter indicated that entrapment occurs less often than every ten years, and that this frequency has not changed. Only one hunter had harvested ice-entrapped belugas.

Group and stock identification: The hunters did not indicate that they recognized different types or kinds of belugas, apart from males, females, and calves. Most (4) did indicate that male belugas generally frequent one area and females, greys and calves another.

Harvesting: Hunting areas frequented by the respondents are shown on Figure 27. The greatest hunting effort is expended in auja (August) by the Igloodik hunters but most (4) have their greatest hunting success in ukiaksak (September). The greatest hunting effort and success by the hunter from Hall Beach is also in ukiaksak (September). Some Igloodik hunters said they only hunt belugas during auja (August), but later indicated that their greatest hunting success was in ukiaksak (September). This apparent contradiction may indicate that the September harvests were opportunistic rather than part of a planned hunt. Hunting trips are generally over the same day they begin.

During auja and ukiaksak, most whales are harpooned and then shot. They are hunted as they feed in shallow water and, if possible, driven into shallows using open motor boats and motor canoes. One hunter who had used a kayak to hunt belugas in the past, said that it is not necessary to have a fast motor to hunt belugas. The rifles they use to hunt belugas are generally .30-30 calibre and larger, although one hunter has used a .22 magnum.

Some hunters (3) considered larger boats to be a disadvantage when hunting belugas due to their larger turning circle. However, the hunters said that large or small boats could be used provided they were safe.

One hunter said that most belugas

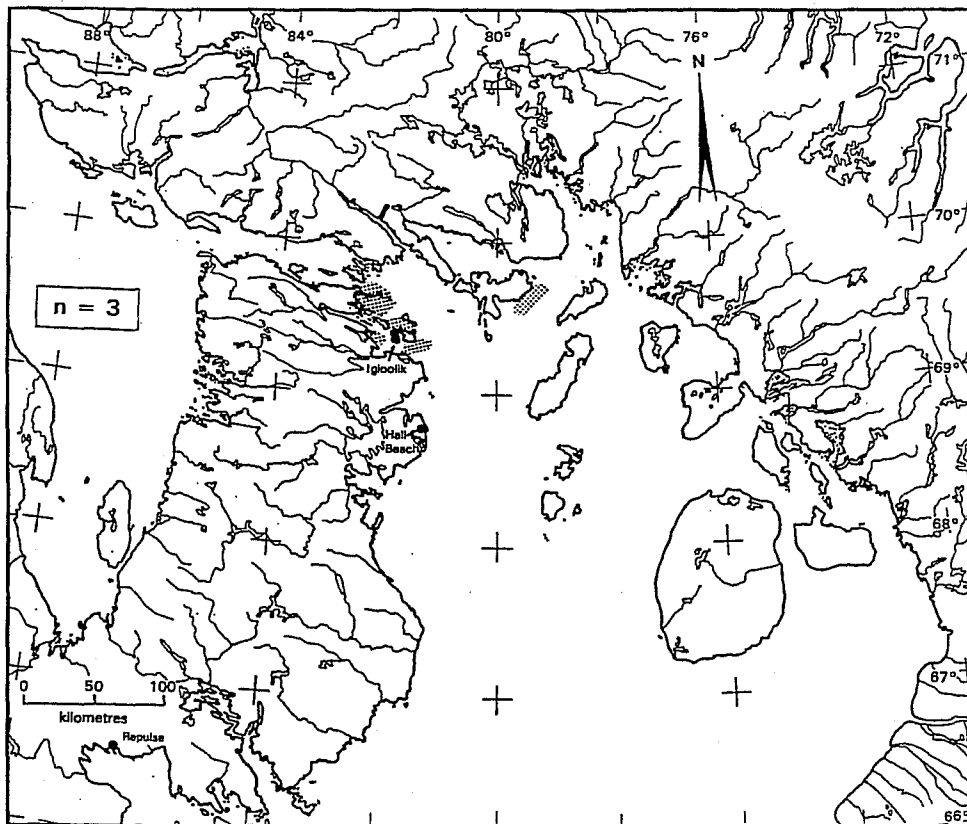


Figure 25. Areas where hunters from Igloodik and Hall Beach have observed newborn belugas (stippled).

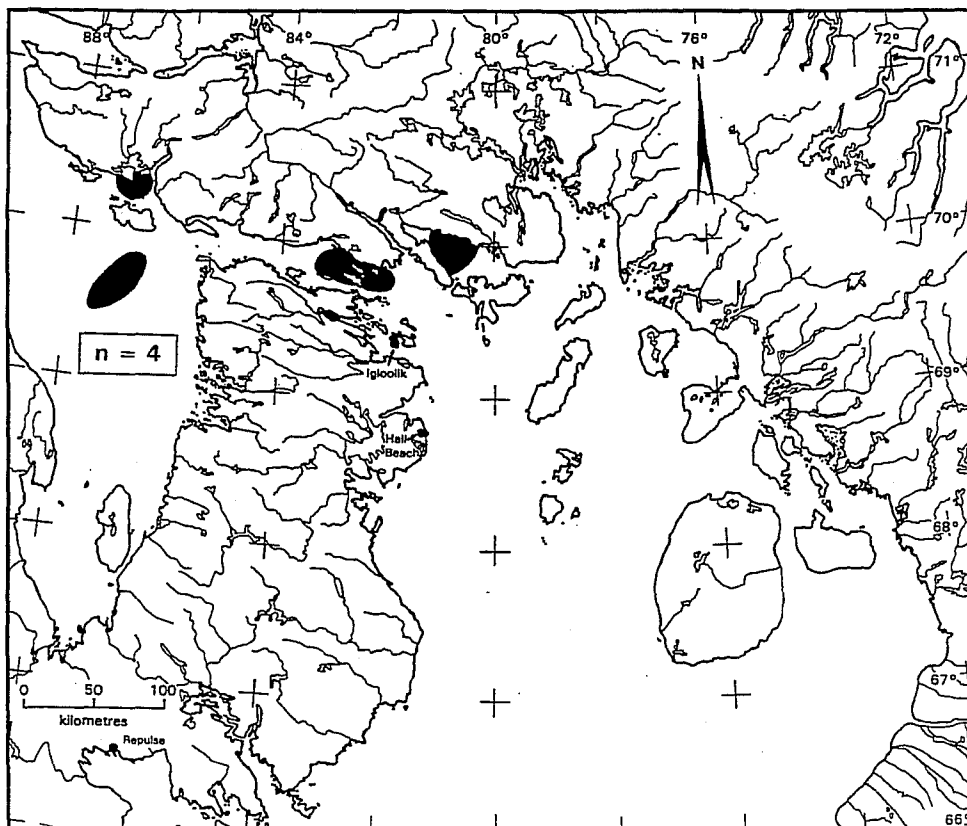


Figure 26. Areas where hunters from Igloodik and Hall Beach have observed belugas entrapped by ice (solid).

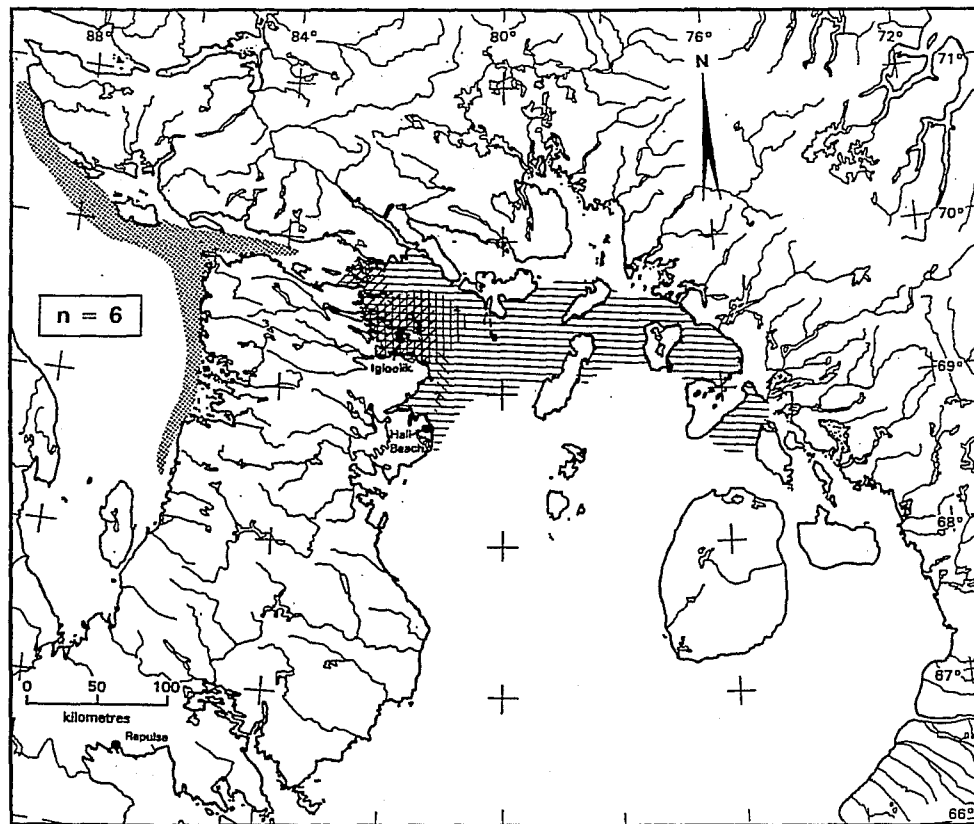


Figure 27. Areas where hunters from Igloolik and Hall Beach hunt belugas during each season of the year.

ukiu (late November thru April)



upingoaksak (May thru mid-June)



upingoa (mid-June thru mid-July)



auja (mid-July thru early September)



ukiaksak (early September thru mid-October)



ukia (mid-October thru late November)

none

harvested in this area are female, another that most are young, but most hunters (4) reported that a mixture of adult males and female, and calves are harvested. Usage of the animals has not changed. All parts of the whale are considered important, but the fins and muktuk, which are eaten, were mentioned most often.

The hunters did not identify anything as hampering the presence and hunting of belugas, but one hunter said he did not want to see belugas with radio tags.

NARWHAL

Grise Fiord

Three active hunters were interviewed for information on narwhals. They had over 75 years of combined experience hunting narwhals.

Seasonal distribution and movements: The seasonal travels of Grise Fiord hunters and their observations of seasonal narwhal distributions and movements are summarized in Figures 28 to 33.

UKIU (January and February) and UPINGOAKSAK (March through mid-May) (Fig. 28 and 29): Despite extensive travels on Jones Sound, Baumann Fiord and Norwegian Bay and Makinson Inlet and Smith Bay, none of the hunters had seen narwhal during these seasons.

UPINGOA (early-May through mid-July) (Fig. 30): During upingoa narwhals frequent the floe edge in eastern Jones Sound. They are usually feeding, tussing, and resting at the ice edge. When disturbed they move eastward and return in 6 to 12 hours.

AUJA (early-July through August) (Fig. 31): During auja, the hunters' marine travel had been limited to Jones Sound. They had observed narwhals moving westward into the sound and trying to follow leads into the fiords of southern Ellesmere Island. When not being hunted, the narwhals are usually feeding. Some usually enter Grise Fiord, where they pass by the community as they enter or exit. While they are found at the floe edge every summer, narwhals do not enter Grise Fiord every year. Sometimes they are not seen in the fiord for 3 or 4 years, other times they are seen every year for a number of years.

UKIAKSAK (September and October) (Fig. 32): During ukiaksak the hunters' had travelled the

coastal waters of southern Ellesmere Island. They had observed narwhals in Harbour, Grise, and Starnes fiords. By late September the whales are travelling out of the fiords and eastward back to open water, feeding as they go. Some pass by the community and are scared by hunters.

UKIA (November and December) (Figure 33): During ukiaksak the hunters' had travelled the coastal waters of southern Ellesmere Island from South Cape Fiord to King Edward Point. None had seen a narwhal during ukiaksak.

Changes in seasonal distribution: Because of the short history of the community, only one hunter had local knowledge from his parents or grandparents. He had seen narwhal in the same areas as his father, but recalled being told that narwhals did not frequent the Grise Fiord area in the early 1950's.

One hunter reported that the number of narwhal had increase during the past 15 years. The others had not observed any change in abundance.

Reproduction: The hunters had not observed narwhals mating or giving birth. Newborn calves had been observed in mid-June and late July at the floe edge, and in August and September in Grise and Starnes fiords (Fig. 34). None of the hunters had observed an individual female narwhal from one year to the next. Pregnant narwhals had been harvested in upingoa, auja, and ukiaksak (June through September). None of these animals was accompanied by a calf or had more than one foetus, although foetuses of different sizes were found at the same time of year. The hunters did not know what proportion of the female narwhals killed were pregnant.

Food and feeding: Cod, tentatively identified from the pictures as Arctic cod Boreogadus saida, and krill were found in the narwhal stomachs from upingoaksak through ukiaksak. Squid were found in the narwhal stomachs in upingoa, and turbot Reinhardtius hippoglossoides in auja and ukiaksak. During August and September narwhals killed in Grise Fiord usually have food in their stomachs (Fig. 8).

Predators and ice entrapment: None of the hunters had seen narwhals being attacked by another animal. They had seen scratches, usually in four parallel lines, from unsuccessful attacks by polar bears on the back, flukes, and sides of the narwhals. They had not seen evidence of killer

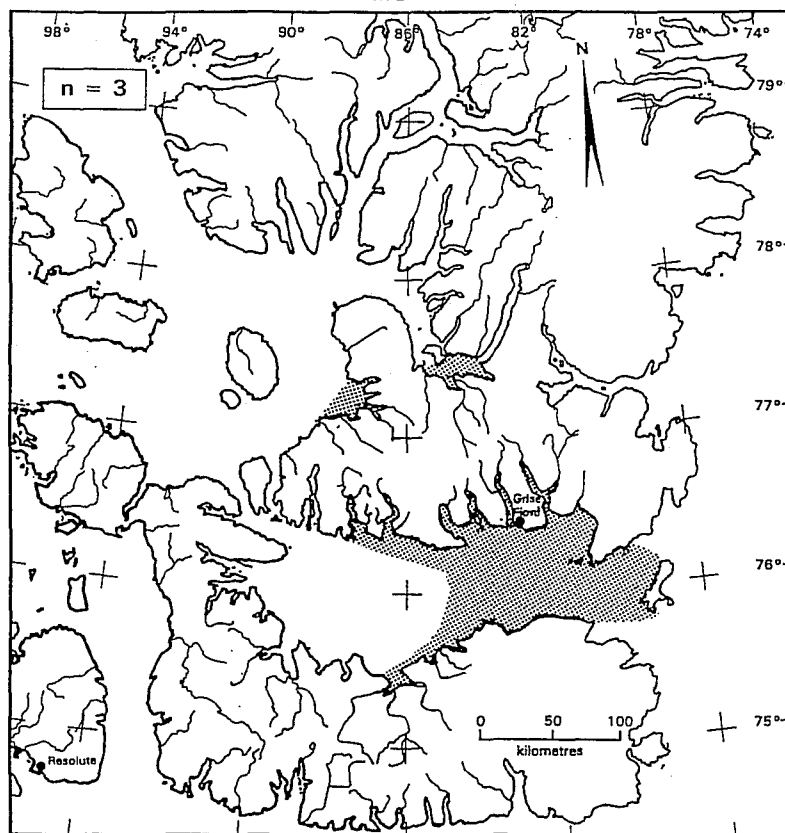


Figure 28. Areas where hunters from Grise Fiord have travelled (stippled) during ukiu (January and February).

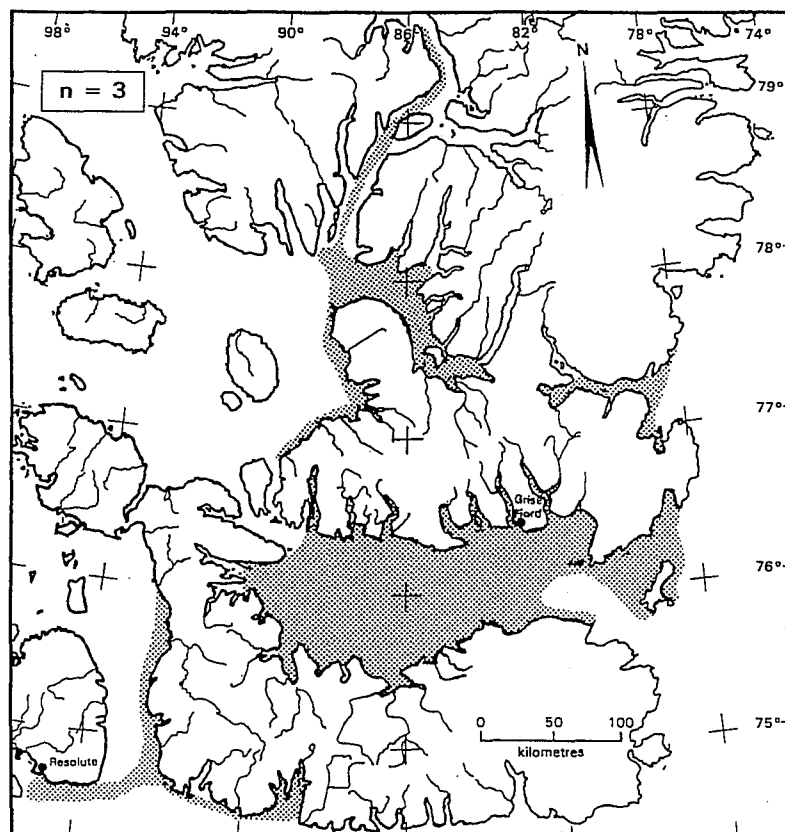


Figure 29. Areas where hunters from Grise Fiord have travelled (stippled) during upingoaksak (March through mid-May).

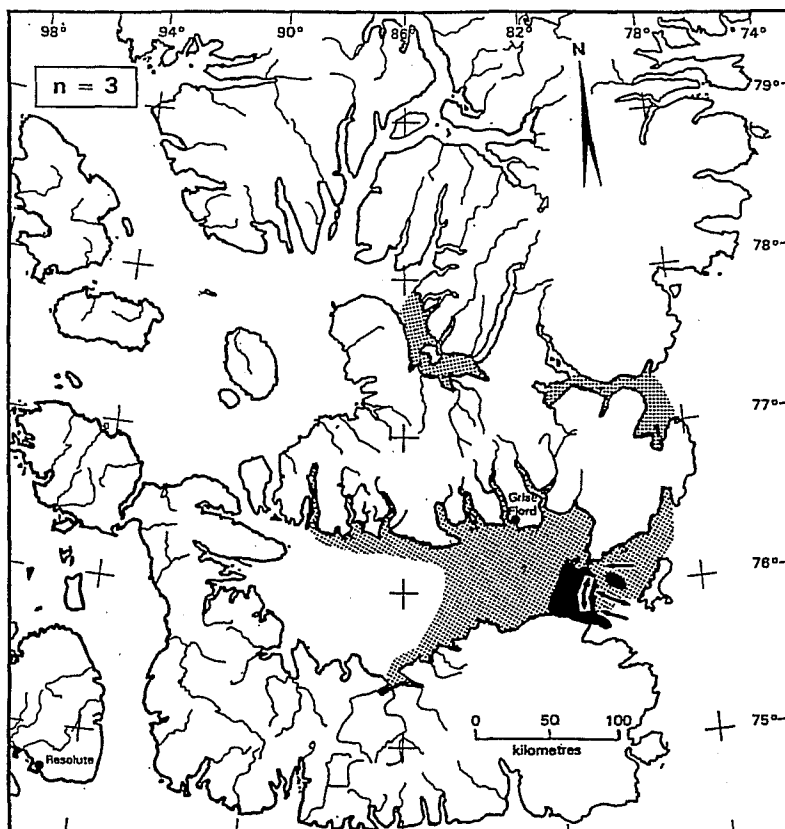


Figure 30.

Areas where hunters from Grise Fjord have travelled (stippled) and observed narwhals (solid) during upingoa (mid-May through early July). Directional arrows indicate seasonal movements by the narwhals.

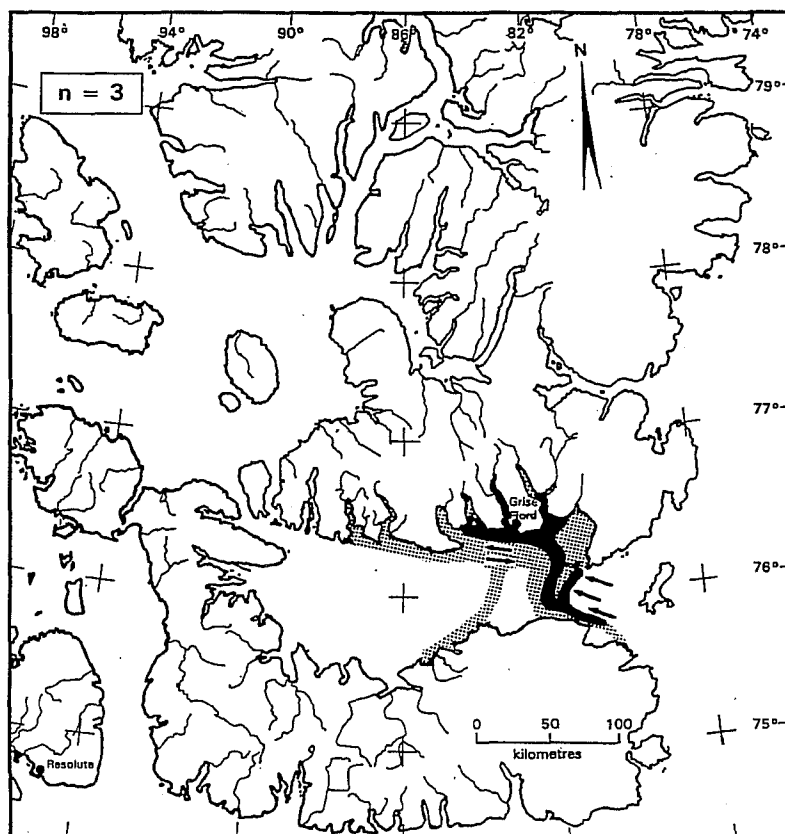


Figure 31.

Areas where hunters from Grise Fjord have travelled (stippled) and observed narwhals (solid) during auja (early July through August). Directional arrows indicate seasonal movements by the narwhals.

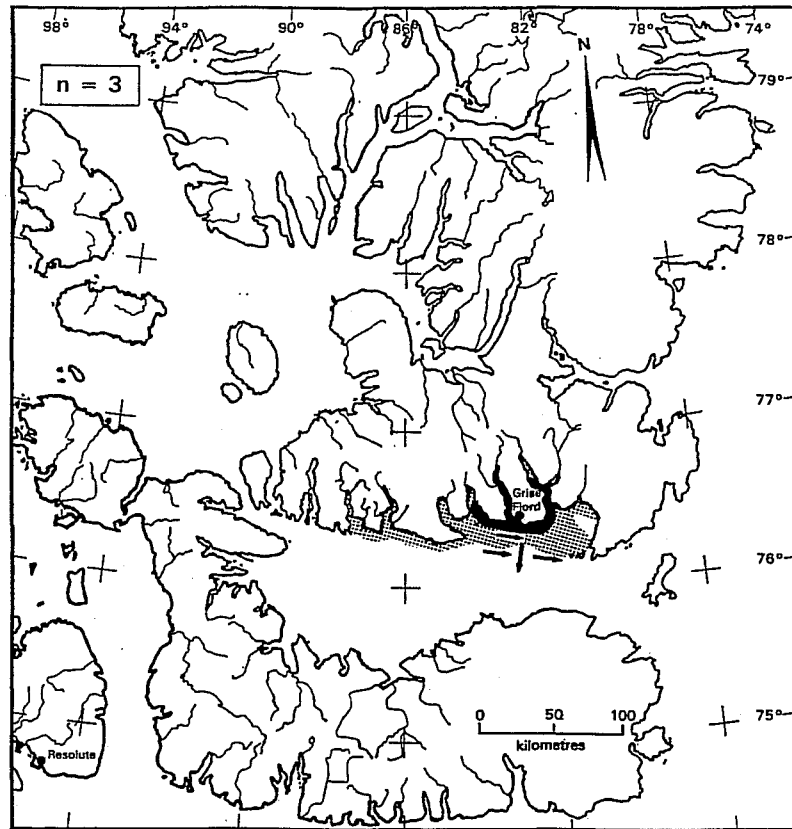


Figure 32. Areas where hunters from Grise Fiord have travelled (stippled) and observed narwhals (solid) during ukiaksak (September and October). Directional arrows indicate seasonal movements by the narwhals.

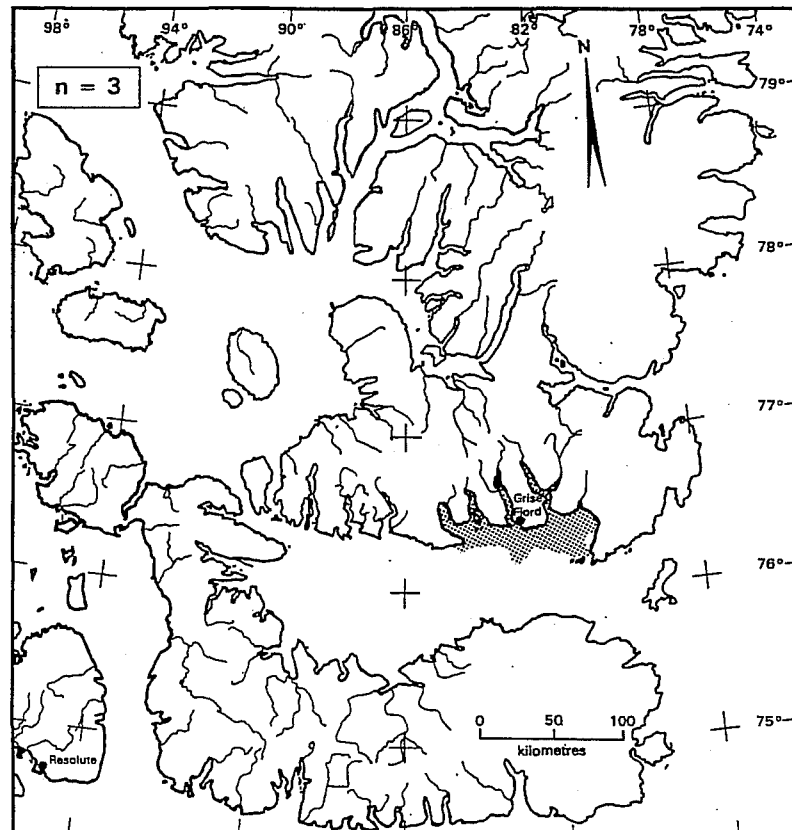


Figure 33. Areas where hunters from Grise Fiord travelled (stippled) during ukiak (November and December).

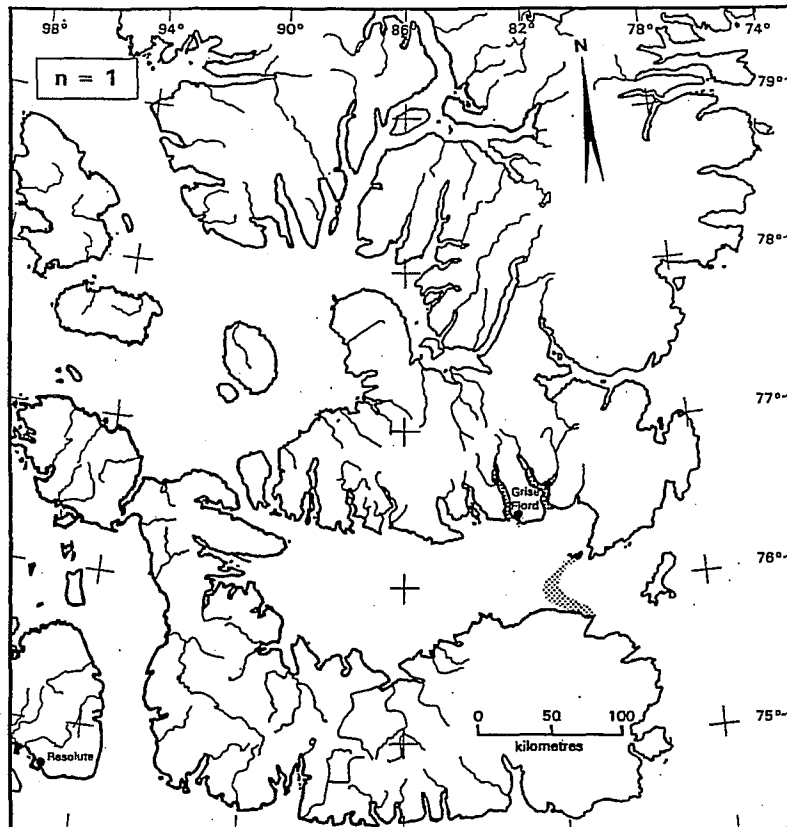


Figure 34. Areas where hunters from Grise Fiord have observed newborn narwhals (stippled).

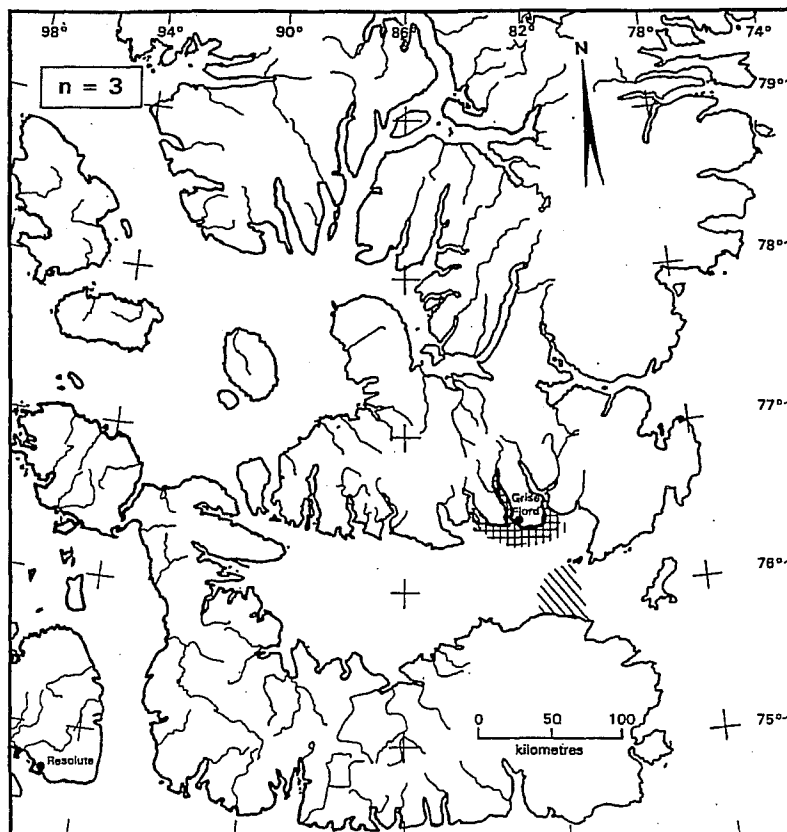


Figure 35. Areas where hunters from Grise Fiord hunt narwhals during each season of the year (see Figure 28 for symbol key).

whale or shark predation on narwhals. Animals with white, healed bullet and harpoon scars on the dorsal surface, from the front of the head to mid-back, had been seen.

The hunters were not aware of any ice entrapment of narwhals in their area.

Group and stock identification: Two of the hunters believed narwhals in Jones Sound to be a separate stock from that in the Pond Inlet/Arctic Bay area, because of their behavioural differences. Narwhals in the Grise Fiord area are more readily herded into shallow water, than those in Lancaster Sound and off Greenland. Visitors from Greenland and Pond Inlet have remarked on how, compared to those in other areas, narwhals at the floe edge in Jones Sound are not alarmed at the sight of hunters.

Most narwhals that frequent the Grise Fiord area are young, and old animals are rare.

Tusked female narwhals have been killed in Grise Fiord. One hunter said that some pods of narwhals have much older tusks without a hollow inside; others have smaller tusks with a hollow; and some come with hardly any tusk.

Harvesting: Narwhals are hunted at the floe edge during upingoa (June and early July), and near Grise Fiord during auja and ukiaksak (early July through October) (Fig. 35). Hunters expend the greatest effort and have the best success in auja and early ukiaksak (July through September). The hunts are generally over the same day they begin except at the floe edge, during upingoa (June and July), where they can last a week to ten days.

Two of the hunters shoot whales before harpooning them, while the third does the reverse. Rifles of a variety of calibres are used to hunt narwhals, but .303 calibre rifles are most common (Appendix 3). Whale nets are not used. If possible the whales are driven into shallow water where they can be recovered using treble grappling hooks if they sink. During upingoa transportation is by snowmobile with a sled and often a boat. During auja and ukiaksak a variety of boats are used for hunting narwhals (Appendix 3, Question 37c). The use of larger boats is a disadvantage in the Grise Fiord area since they cannot go into shallow water.

Two hunters said that narwhals harvested in the Grise Fiord area are a mixture of male, female and young animals, while a third said that most are

males. They still use the same parts of the animal as when they began hunting. Muktuk and meat were identified as the most important parts of the whale. The muktuk, back part of the tail flukes, and some of the meat are eaten, the rest is fed to the dogs or left for the fulmars and gulls. No mention was made of the tusks.

As with belugas, the heavy ice conditions over the past three years was the only factor identified by the hunters as hampering the presence and hunting of narwhals in their area.

Arctic Bay

The hunters interviewed for information on belugas were also interviewed for information on narwhals.

Seasonal distribution and movements: The seasonal travels of Arctic Bay hunters and their observations of seasonal narwhal distributions and movements are summarized in Figures 36 to 41.

UKIU (February through mid-March) (Fig. 36) Only one of the hunters had seen narwhals during ukiu. He said that his father had also seen narwhals trapped by the ice during this season.

UPINGOAKSAK (mid-March through early May) (Fig. 37) During upingoaksak narwhals feed on cod as they move westward into Lancaster Sound. They follow the floe edge near the mouth of Admiralty Inlet, and some proceed southward along the west coast of Brodeur Peninsula to at least Fitzgerald Bay.

UPINGOA (early May through early July) (Fig. 38) During upingoa the narwhals continue to feed on cod as they move along the ice edge near the mouth of Admiralty Inlet, and along west coast of Brodeur Peninsula southward to at least Fitzgerald Bay. As the season progresses they follow leads, and possibly seal holes, southward from the ice edge into northern Admiralty Inlet.

AUJA (early July and late-September) (Fig. 39) The whales travel throughout most of Admiralty Inlet during auja, moving north and south and penetrating into the heads of the bays, feeding and mating.

UKIAKSAK (late September through November) (Fig. 40) During ukiaksak the narwhals move northward, entering the fiords as they travel out of Admiralty Inlet to Lancaster Sound and then

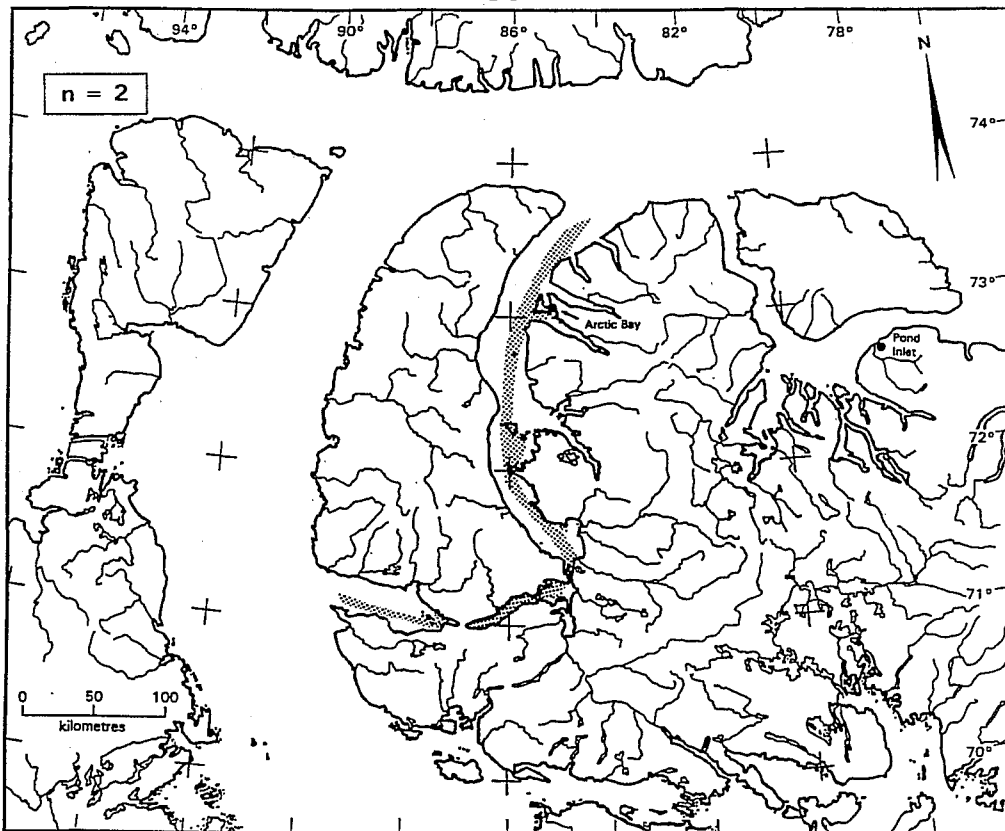


Figure 36. Areas where hunters from Arctic Bay have travelled (stippled) during ukui (February through mid-March).

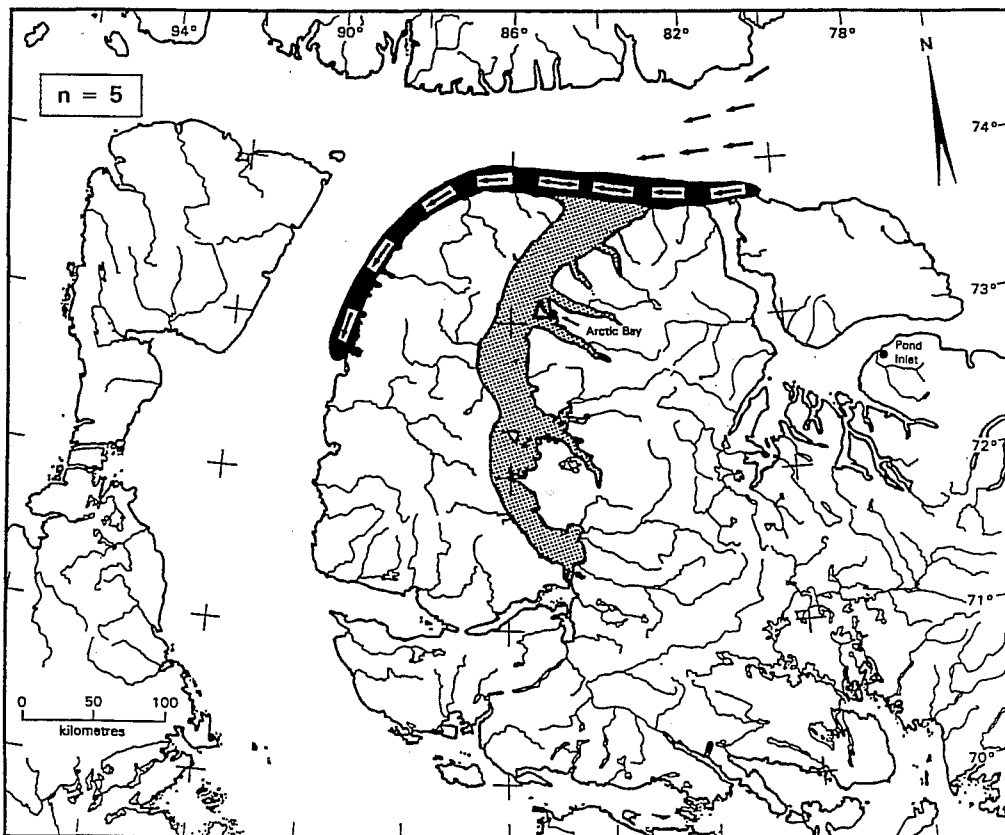


Figure 37. Areas where hunters from Arctic Bay have travelled (stippled) and observed narwhals (solid) during upingoaksak (mid-March through early May). Directional arrows indicate seasonal movements by the narwhals. The observations of narwhal movements suggest that the hunters have also travelled in eastern Lancaster Sound during upingoaksak.

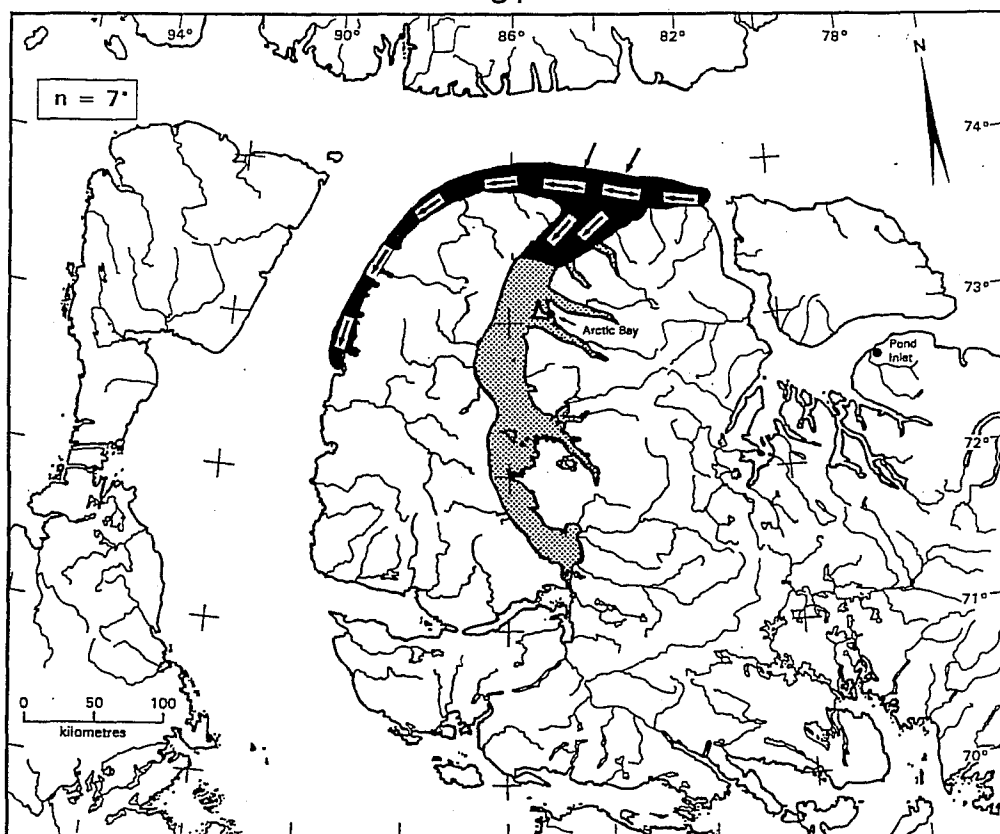


Figure 38. Areas where hunters from Arctic Bay have travelled (stippled) and observed narwhals (solid) during upingoa (early-May through early July). Directional arrows indicate seasonal movements by the narwhals.

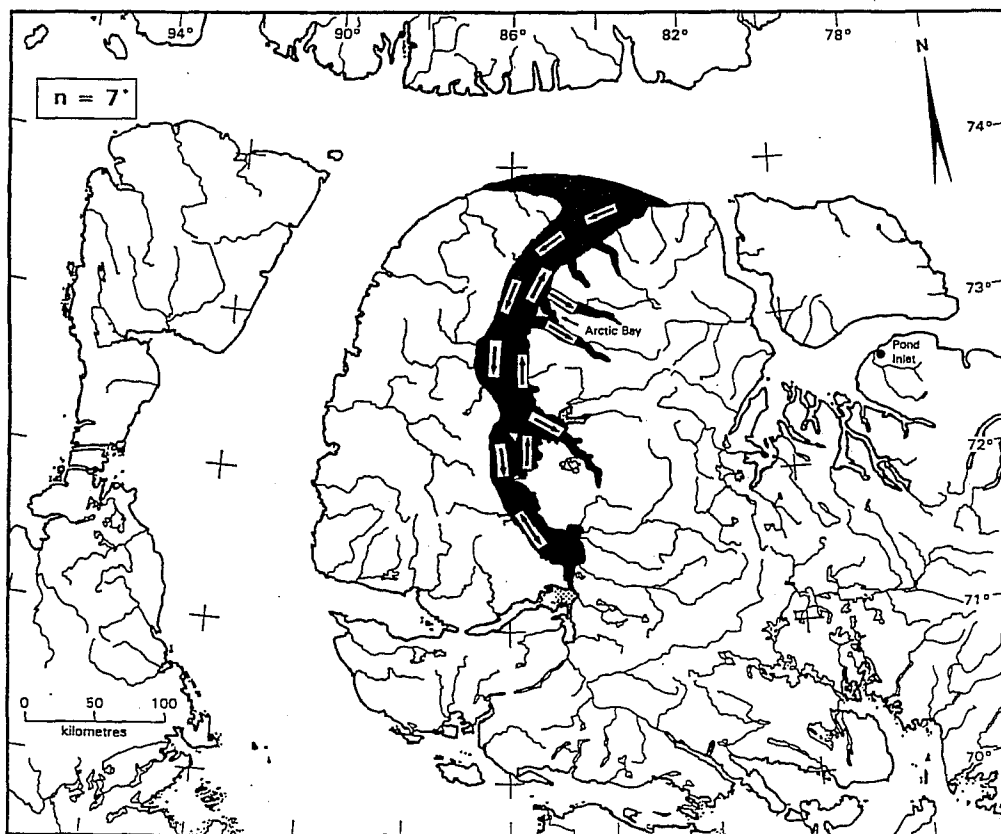


Figure 39. Areas where hunters from Arctic Bay have travelled (stippled) and observed narwhals (solid) during auja (early July through late September). Directional arrows indicate seasonal movements by the narwhals.

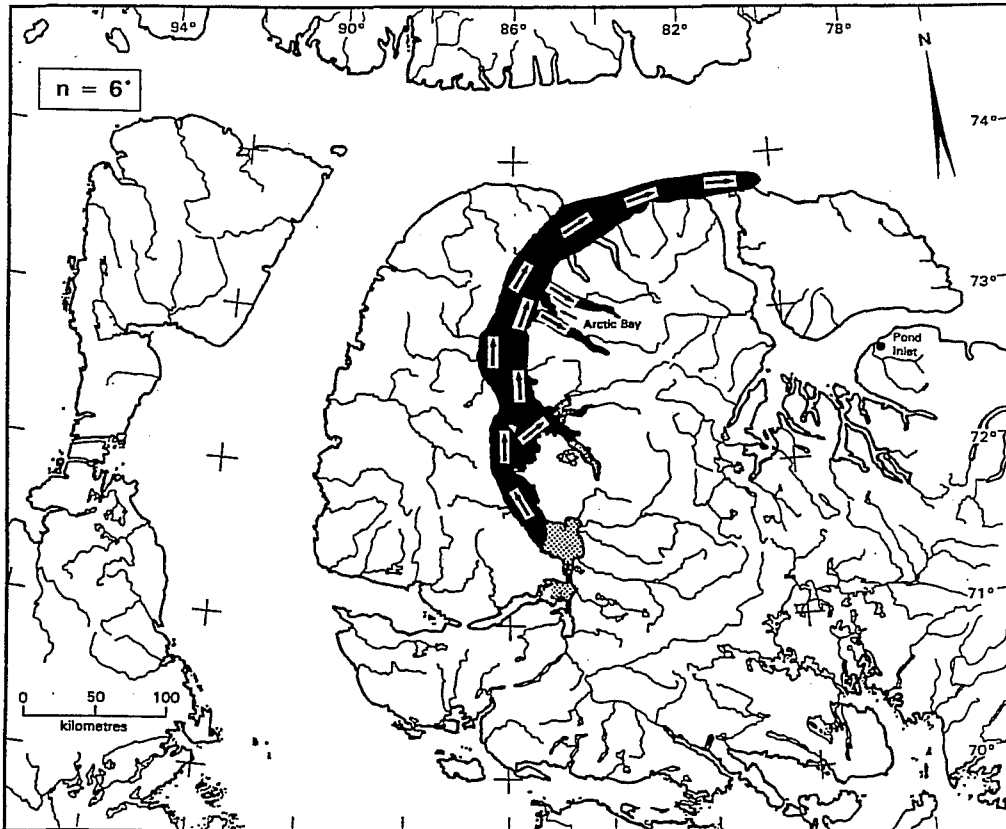


Figure 40. Areas where hunters from Arctic Bay have travelled (stippled) and observed narwhals (solid) during ukiaksak (late September through November). Directional arrows indicate seasonal movements by the narwhals.

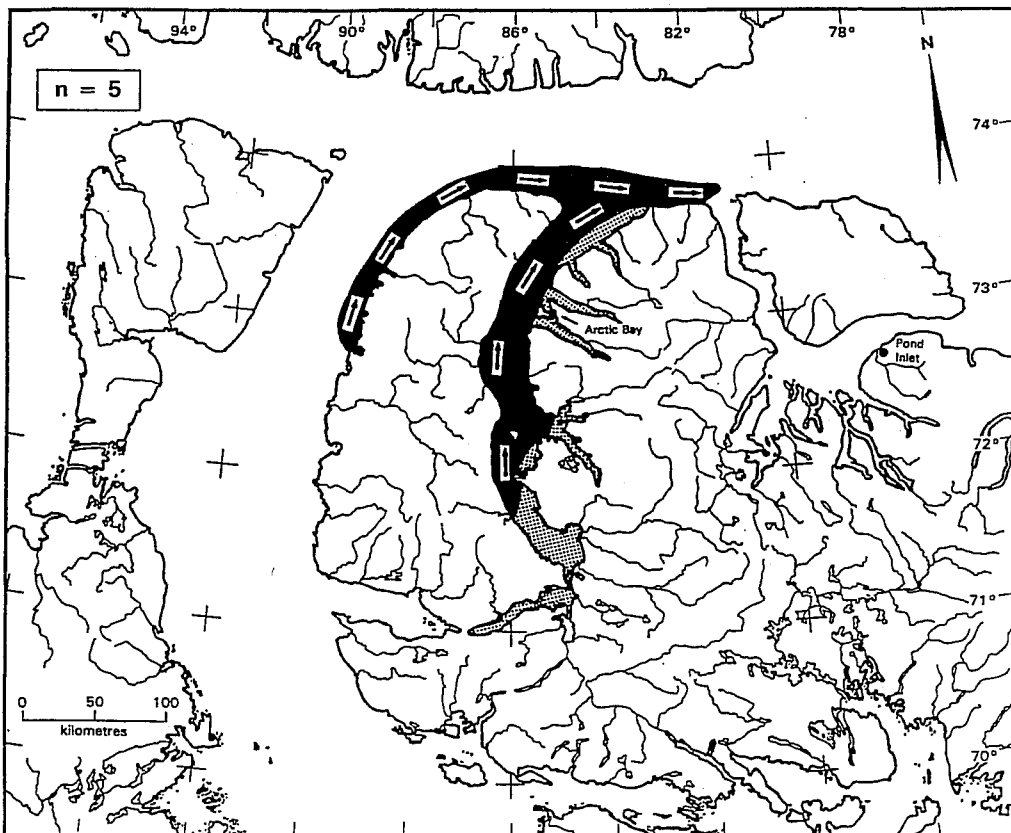


Figure 41. Areas where hunters from Arctic Bay have travelled (stippled) and observed narwhals (solid) during ukia (December and January). Directional arrows indicate seasonal movements by the narwhals.

eastward towards Baffin Bay. One hunter indicated that there are fewer whales present than in summer (auja).

UKIA (December and January) (Fig. 41) During ukiaks the narwhals continue to move northward out of Admiralty Inlet and Prince Regent Inlet.

Changes in seasonal distribution: Hunters reported a number of changes in how narwhals use their area. During upingoaksak the whales now arrive later in the year, when the ice is becoming unsafe for travel. Narwhals no longer enter the bays during upingoaksak and ukiaksak. Some said that the increased ship traffic is scaring narwhals away, others that there are more narwhals now. They also said that the patterns of seasonal abundance are changing, and that narwhals no longer visit "the bay on the other side of Arctic Bay".

Most hunters said that their parents and/or grandparents had seen narwhals in the same areas where they see them now. One hunter said his parents saw narwhals in different areas, but did not elaborate.

Reproduction: Narwhals had been observed mating during upingoa (June) at the Admiralty Inlet floe edge, and during auja (August) in western Admiralty Inlet (Fig. 42). The whales face one another. Birthing areas are widely distributed in Admiralty Inlet (Fig. 43). All but one of the hunters had seen narwhals give birth, and learned of birthing areas from parents or grandparents.

All of the hunters had seen newborn calves, but only one indicated the season, auja (August). Some (3) said that all the narwhals give birth during auja (July through September), others (2) that they give birth at any time of the year, and the remainder did not know. During the birth, a calf will sometimes help its mother as it is emerging. Some newborns cannot dive and others cannot swim.

One hunter had observed an individual female narwhal over two years, identifying it by its scarring pattern, but did not notice whether it gave birth during that time. Some hunters (3) indicated that narwhals give birth annually. Another said that they give birth every two years. During summer hunting (auja) he had seen a narwhal accompanied by four calves of different sizes, one of which was noticeably smaller.

Foetuses had been found in female narwhals during upingoa and auja (July and August). None of the hunters had seen a female with more than one foetus. All had seen foetuses of different sizes at the same time of year.

Pregnant females with calves had been killed during upingoa and auja (July and August). The calves ranged in length from 2 to 2.5 m (6-8') and the foetuses from 1.3 to 1.5 m (4-5'). The hunters did not know what proportion of the females killed are usually pregnant.

Food and feeding: During upingoaksak and ukiaksak the narwhal stomachs contained fish, mostly cod (Appendix 3). They also contained "shrimp" during auja and ukiaksak. There are areas where the narwhals usually have food in their stomachs and others where they do not, but these areas were not specified.

Predators and ice entrapment: Killer whales had been seen to prey successfully upon narwhals. One hunter had seen six killer whales attacking a narwhal in August. Another had seen a narwhal killed by a killer whale. The killer whales ate the meat and fat but left the skin. They also "smashed" a smaller narwhal. Another hunter had seen a whole narwhal on the ice, but did not indicate how it came to be there. Interestingly, narwhals had also been observed following killer whales.

Scars from unsuccessful attacks by killer whales had been seen on the tail flukes, on the flanks in front of the tail, on the back behind the melon and above the front fins, and on the sides behind the front fins of narwhals. Scratches from unsuccessful attacks by polar bears had been seen on the backs, sides and tails of narwhals. They were differentiated from scars made by ice which generally chips the skin on the back between the melon and the mid-back.

Two hunters had seen evidence of sharks attacking narwhals. One hunter had seen circular pieces chewed off a refloated narwhal carcass, but did not know whether the shark was scavenging from the carcass or had killed the whale. The other had seen a narwhal with its skin "broken to pieces" in a manner that he recognized was from a shark attack. He did not indicate whether the whale was alive or dead when it was bitten.

Healed scars from bullets or harpoons had been seen around the neck and blow hole, from the

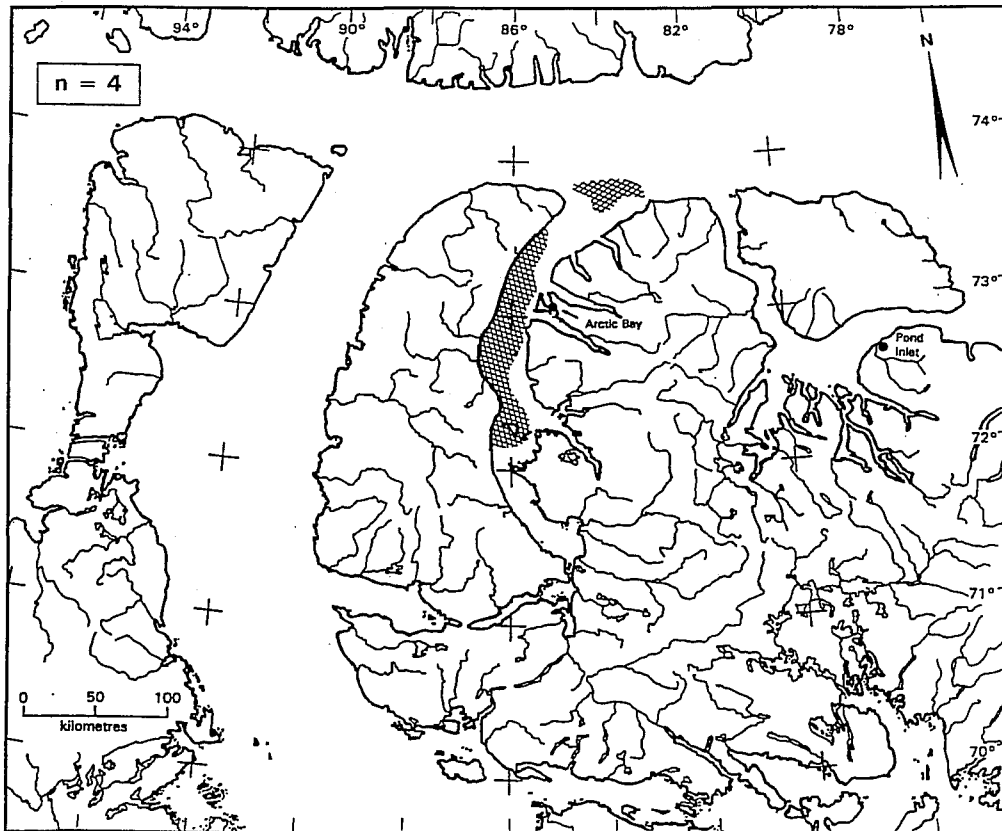


Figure 42. Areas where hunters from Arctic Bay have observed narwhals mating (hatched).

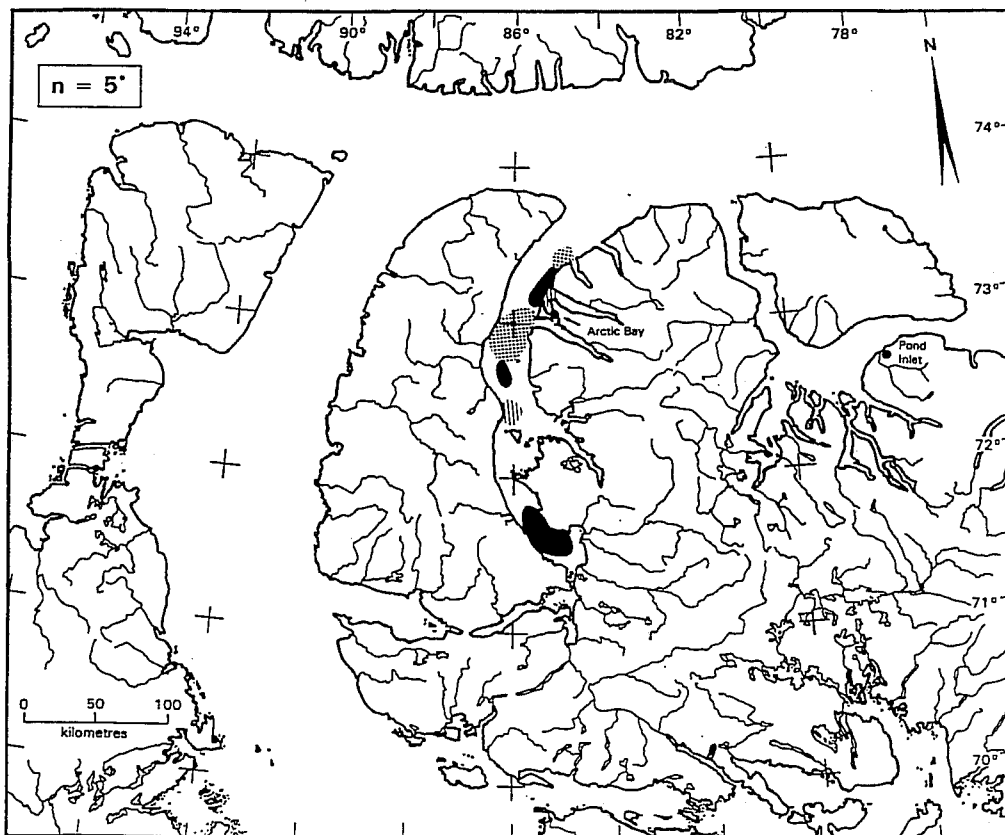


Figure 43. Areas where hunters from Arctic Bay (solid) or their parents or grandparents (vertical lines) have observed narwhals give birth, or seen newborn narwhals (stippled).

melon back to the hump.

Narwhal had been entrapped by ice in the Arctic Bay area during auja, ukiaksak, and ukia (August, October, November). This occurs every ten years or less, a frequency said to be unchanged. Narwhals are harvested at ice entrapments when possible.

Group and stock identification: The hunters did not identify different types or groups of narwhals in their area apart from males and females. The males are generally larger, breathe more strongly, and have tusks. Most females lack tusks, and they are often accompanied by a calf. One hunter said that whales of both sexes are found in the same areas.

Harvesting: Hunting takes place during upingoa, auja, and ukiaksak (May through August). The hunters expend their greatest hunting effort and have their greatest success during upingoa and auja (June through August), particularly during upingoa (July). Most hunting trips are to the floe edge and last between six days and two weeks. Only one hunter said that his hunting trips were over the same day they began.

Narwhals are generally shot before they are harpooned. Most hunters (6) use a .303 caliber rifle to hunt narwhals, although some also use .338 and .30-30 caliber rifles. Only one of the hunters has used a whale net to harvest narwhals. Whenever possible, the whales are driven into shallow water before they are shot. Snowmobiles with sleds and often boats are used to harvest whales during upingoa. A variety of boats are used for the hunt during upingoa and auja (Appendix 3).

Hunters said that most of the narwhals harvested in this area are males (4*) and young animals (3). Muktuk and meat are the most important parts of the whale to them and their families. Several hunters also consider the tusks to be important, and one the fat. None indicated that their use of the whales had changed since they began hunting.

All of the hunters had killed female narwhals that had tusks. One hunter indicated that the tusks were generally about a metre long (3-4'), and that there were lots of tusked females in the area.

Narwhal hunts are more difficult and thrilling than beluga hunts. The narwhals reach their top escape speed when they roll and spin, and

attack boats belly-upwards.

Three hunters indicated that seasonal ship traffic hampers the hunting of narwhals. The ships break up the ice in May and June when the hunters are travelling to the ice edge to hunt. They said that this makes snowmobile travel over the ice difficult and dangerous, and also causes the ice to disappear earlier than normal.

Igloodik and Hall Beach

Five hunters from Igloodik and one from Hall Beach were interviewed for information on narwhals. They had been taught to hunt by their father or someone else, or were self taught. All had hunted for many years, and all but one still hunted.

Seasonal distribution and movements: The seasonal travels of Igloodik and Hall Beach hunters and their observations of seasonal narwhal distributions and movements are summarized in Figures 44 to 49. There are unexplained differences in the hunters reports of their seasonal travel between the beluga and narwhal sections.

UKIU (late November through April) (Fig. 44); UPINGOAKSAK (May through mid-June) (Fig. 45); and UPINGOA (mid-June through mid-July) (Fig. 46): The hunters' parents and/or grandparents had not told them of seeing narwhals during these seasons, and only two hunters had observed narwhals during this period themselves. Some animals were entrapped by ice and trying to free themselves during ukiu, and others were trying to move southeastward from the Gulf of Boothia into Fury and Hecla Strait during upingoa.

AUJA (mid-July through early September) (Fig. 47): All of the hunters had observed narwhals during auja in the Igloodik and Fury and Hecla Strait areas. The whales move through the strait in one direction or another, searching for food. Some enter Guiliam Bay from the north, while others pass east of Igloodik Island on their way north to Fury and Hecla Strait.

UKIAKSAK (early September through mid-October) (Fig. 48) and UKIA (mid October through late November) (Fig. 49): During ukiaksak and ukia narwhals are occasionally observed searching for food in the Igloodik area.

Changes in seasonal distribution: No changes in the seasonal distribution of narwhals were

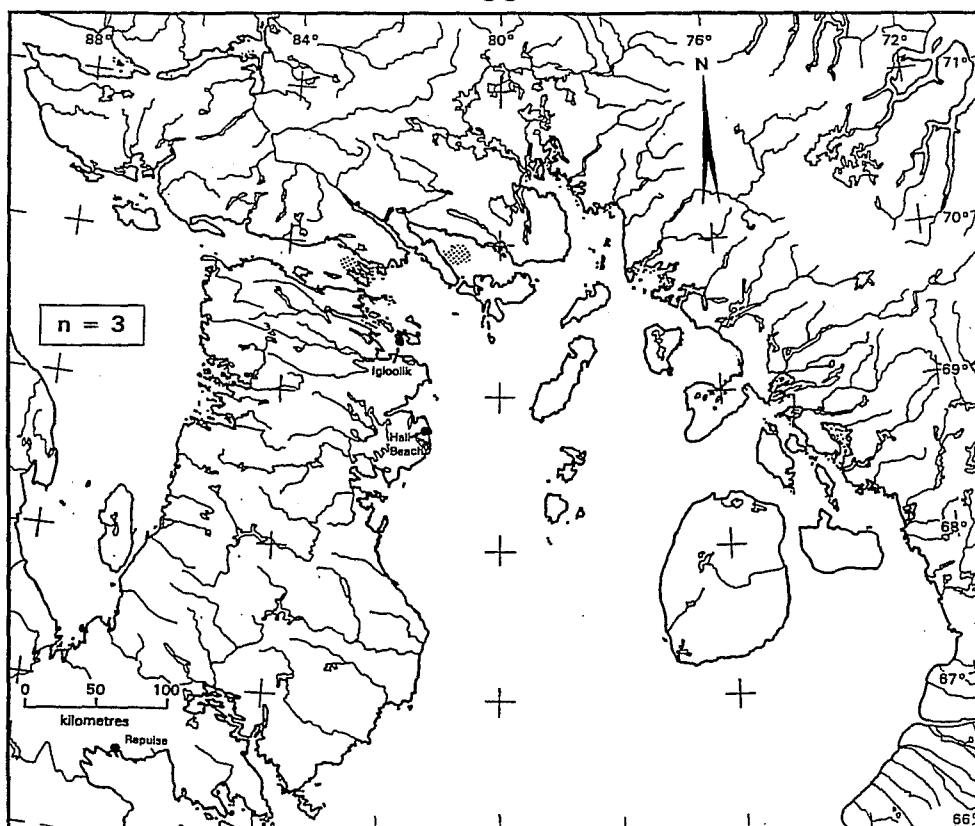


Figure 44. Areas where hunters from Igloolik and Hall Beach have travelled (stippled) during ukiu (late November through April).

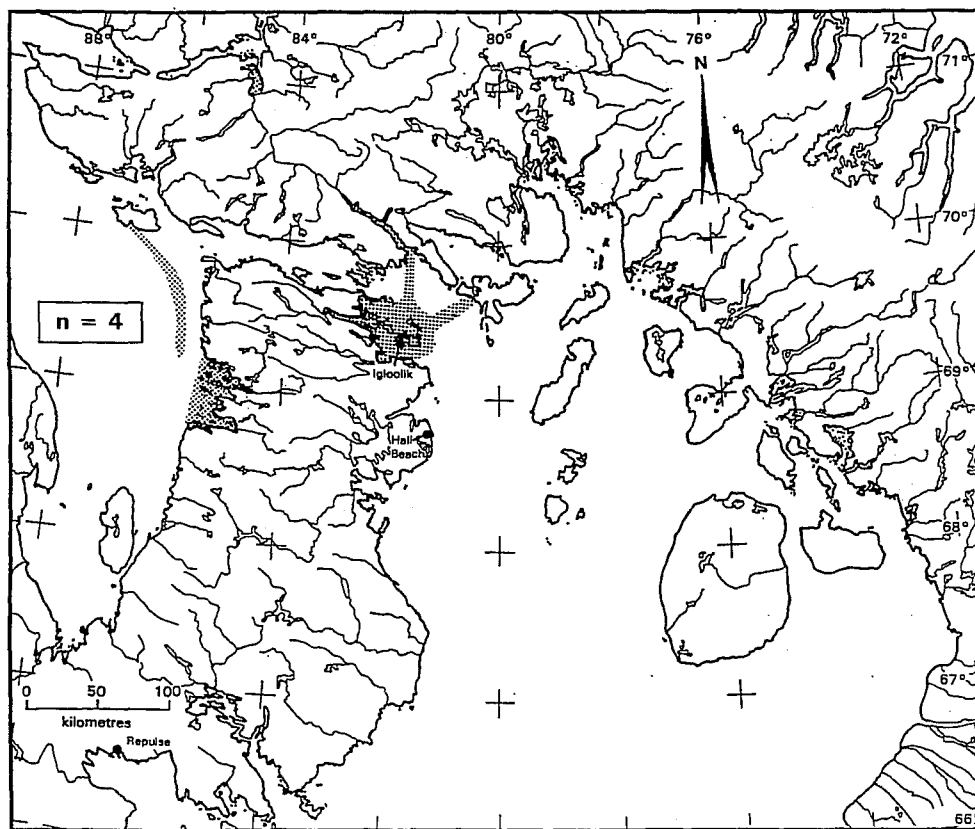


Figure 45. Areas where hunters from Igloolik and Hall Beach travelled (stippled) during upingoaksak (May through mid-June).

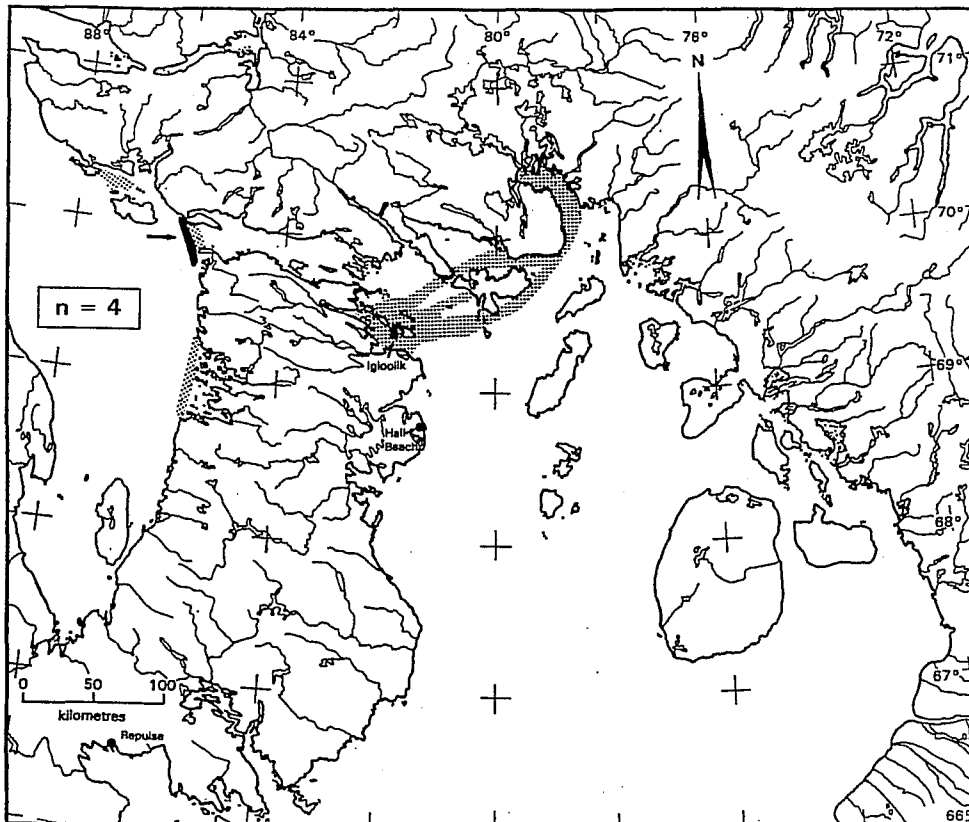


Figure 46. Areas where hunters from Igloolik and Hall Beach have travelled (stippled) and observed narwhals (solid) during upingoa (mid-June through mid-July). Directional arrows indicate seasonal movements by the narwhals.

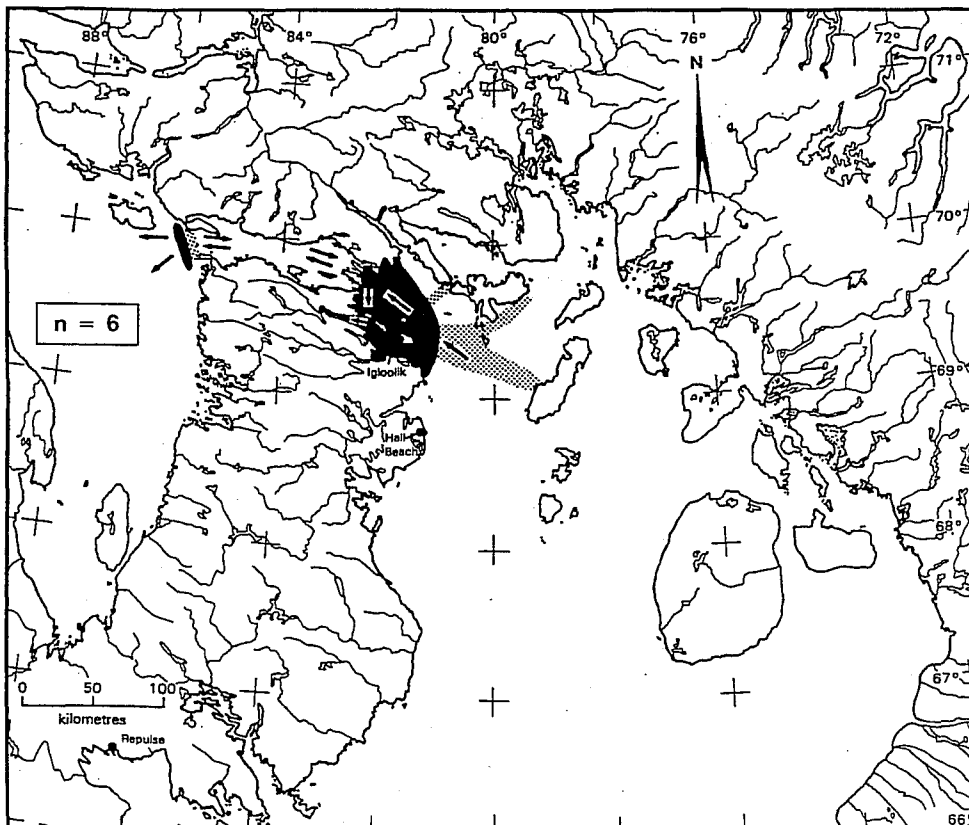


Figure 47. Areas where hunters from Igloolik and Hall Beach have travelled (stippled) and observed narwhals (solid) during auja (mid-July through early September). Directional arrows indicate seasonal movements by the narwhals.

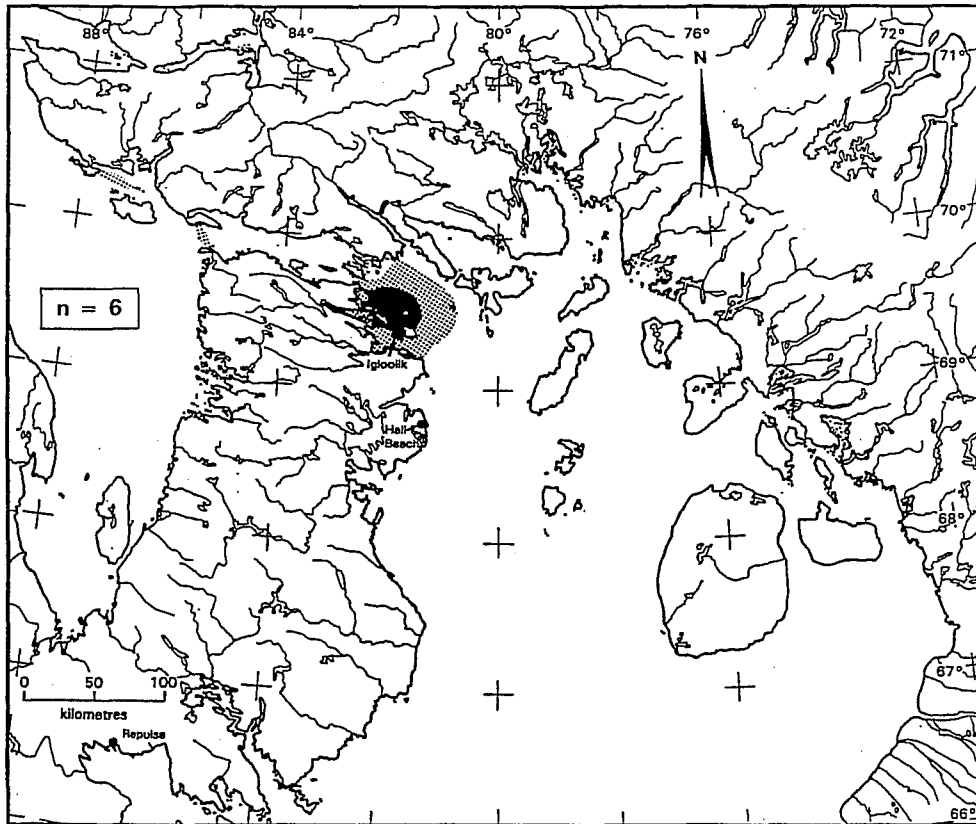


Figure 48. Areas where hunters from Igloolik and Hall Beach have travelled (stippled) and observed narwhals (solid) during ukiaksak (early September through mid-October).

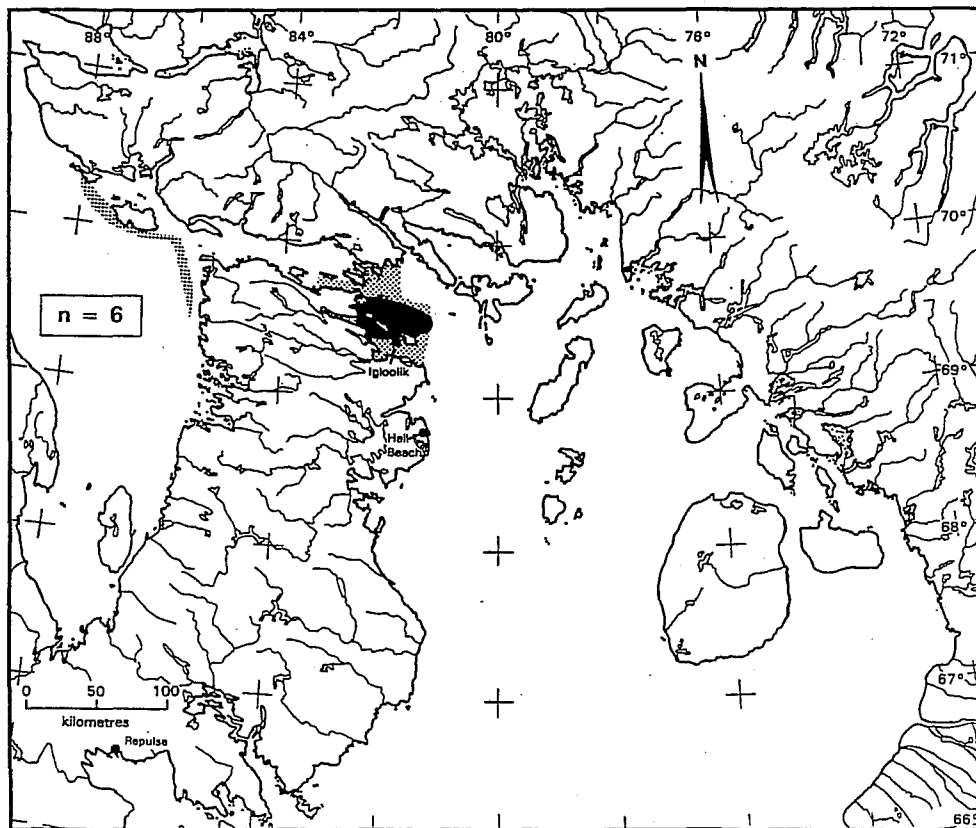


Figure 49. Areas where hunters from Igloolik and Hall Beach have travelled (stippled) and observed narwhals (solid) during ukia (mid-October through late November).

identified. One hunter observed that, during summer, there are more narwhals and they seem to increase in size. Belugas were said to outnumber narwhals in this area.

Reproduction: Narwhals had been observed mating in auja (August), with one animal on top of the other. Mating narwhals had also been heard but not seen. No mating areas were identified. Births had been observed at the west end of Fury and Hecla Strait during auja (July or August), and newborns during auja (August) in the Igloodik area (Fig. 50). None of the hunters had been told by their parents or grandparents of areas where narwhals mate or give birth. None had observed an individual female narwhal from one year to the next, or looked inside a female narwhal and found her to be pregnant. None had killed a pregnant female that also had a calf. They did not know what proportion of females killed are usually pregnant.

Food and feeding: "Shrimp", Arctic cod, and unidentified fish had been found in narwhal stomachs during auja and ukiaksak, and Greenland cod and sculpin during auja. No feeding areas were identified.

Predators and ice entrapment: None of the hunters had seen narwhals being attacked by other animals. They had seen evidence of unsuccessful attacks by polar bears and sharks, but not by killer whales. Parallel lines of scratches from bear claws had been seen along the sides of narwhals behind their flippers. One hunter had seen a shark bite, with an "opening", on the side of a narwhal midway between the hump and the tail.

Narwhals have been seen with scars from bullets or harpoons on the dorsal surface of their necks and upper backs behind the melon.

The hunters had observed narwhals entrapped by ice during auja (August) in Guiliam Bay and eastern Fury and Hecla Strait, and during ukia and ukiu (October through January) in Murray Maxwell Bay, Agu Bay, Guiliam Bay, and eastern Fury and Hecla Strait (Fig. 51). No explanation was given for the auja entrapment. These events were thought to occur less often than every ten years. Two of the hunters had harvested entrapped narwhals. They located the whales in January but did not hunt them until April, or catch many.

Group and stock identification: The hunters did not identify different types or groups of narwhals in

their area apart from males and females. Two hunters from Igloodik indicated that the males generally stay together in one area, females in another, and females with calves in another. None of the hunters had ever killed a tusked narwhal and found it to be female.

Harvesting: Areas frequented during the seasons by the hunters are shown in Figure 52. Hunting takes place in auja and ukiaksak (August through October), except when narwhals are trapped by ice and hunting is possible in ukiu (April). The greatest hunting effort is expended during auja and ukiaksak (mainly-August but also September), with the greatest hunting success a bit later in the season (August to October). Hunts are generally over the same day they start.

During the auja and ukiaksak hunts, hunters generally harpoon the whales before shooting them and, if possible, drive them into shallow water. Most use motor canoes, although one uses an open motorboat. Hunts do not require "fast" motors, so a variety of motors are in use. The rifles used are generally "stronger" than those used for belugas, .30-.30 calibre or larger. There are advantages and disadvantages to using either large or small vessels to hunt narwhals.

While hunters indicated that all parts of the whale are important, several singled out the muktuk and flippers, which are eaten, the meat which is fed to the dogs and the tusk which is sold, as most important. Those who responded to the question (2) indicated that they use the same parts of the narwhal now as they did when they began hunting.

None of the hunters had noticed anything that clearly hampers the presence and hunting of narwhals in their area.

DISCUSSION

The qualitative information gathered using this approach provides a useful basis for future dialogue between the resource managers and researchers and the hunters. The data, however, do not not lend themselves well to quantitative scientific analysis. In general, they agree with current scientific knowledge. This is not surprising considering that much of the scientific information has been derived from studies based in part on Inuit local knowledge, gathered formally through HTA or community meetings or through informal discussions between hunters and scientists.

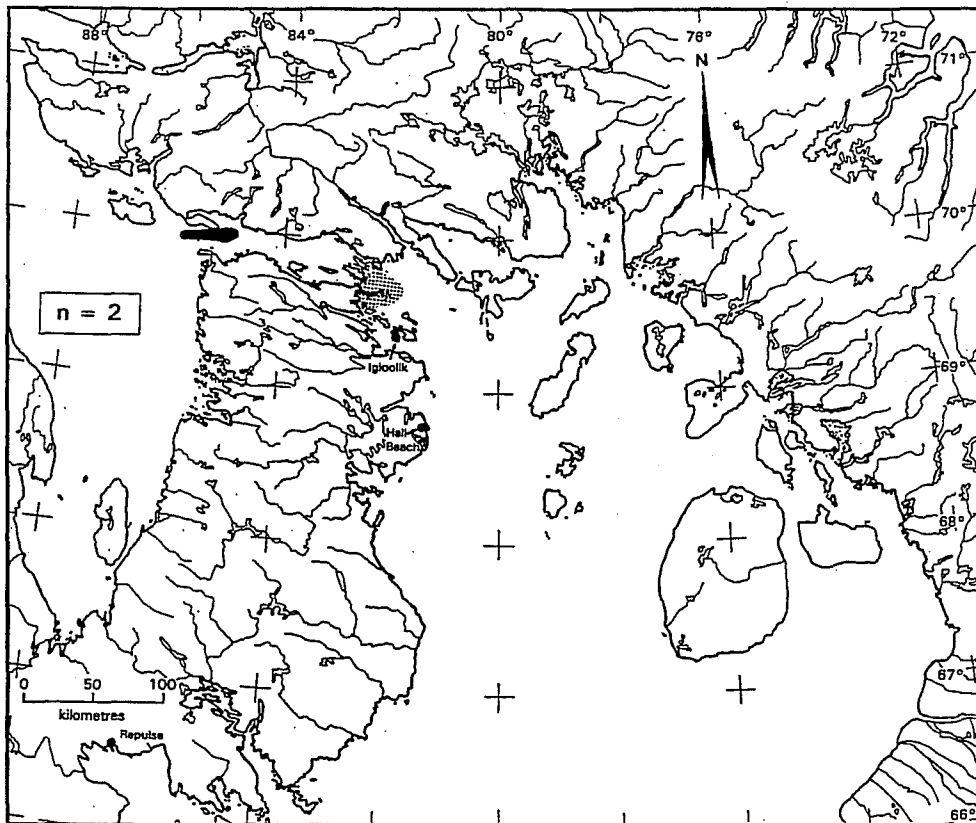


Figure 50. Areas where hunters from Igloolik and Hall Beach have observed narwhals giving birth (solid) or seen newborn narwhals (stippled).

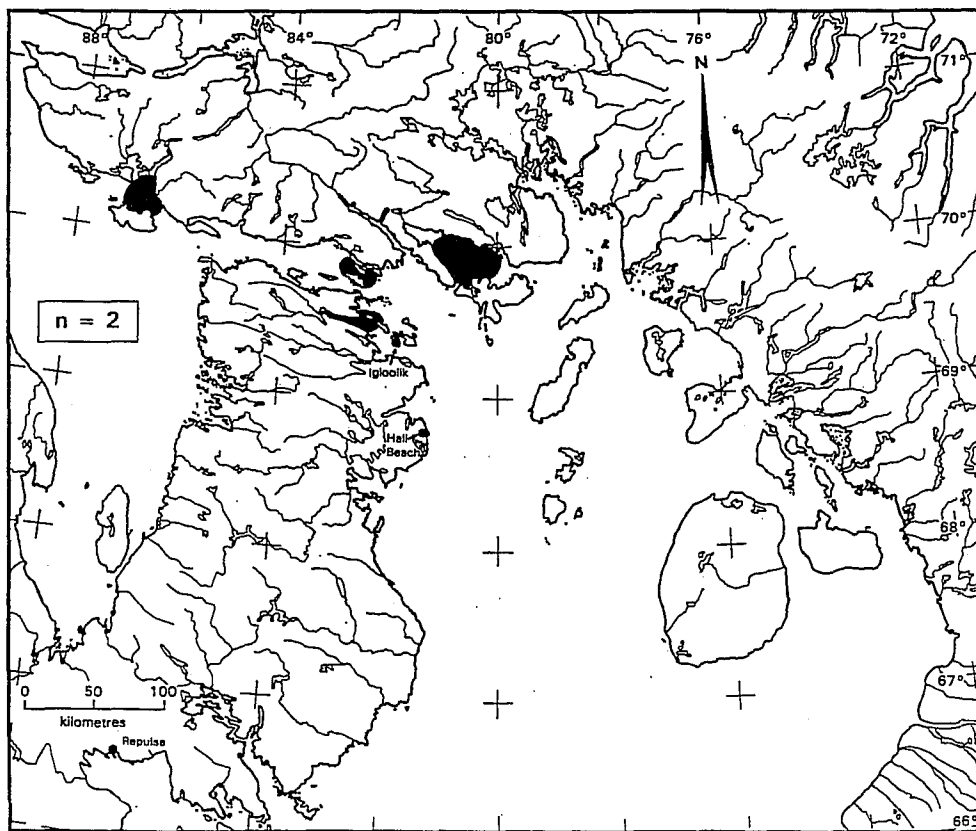


Figure 51. Areas where hunters from Igloolik and Hall Beach have observed narwhals entrapped by ice (solid).

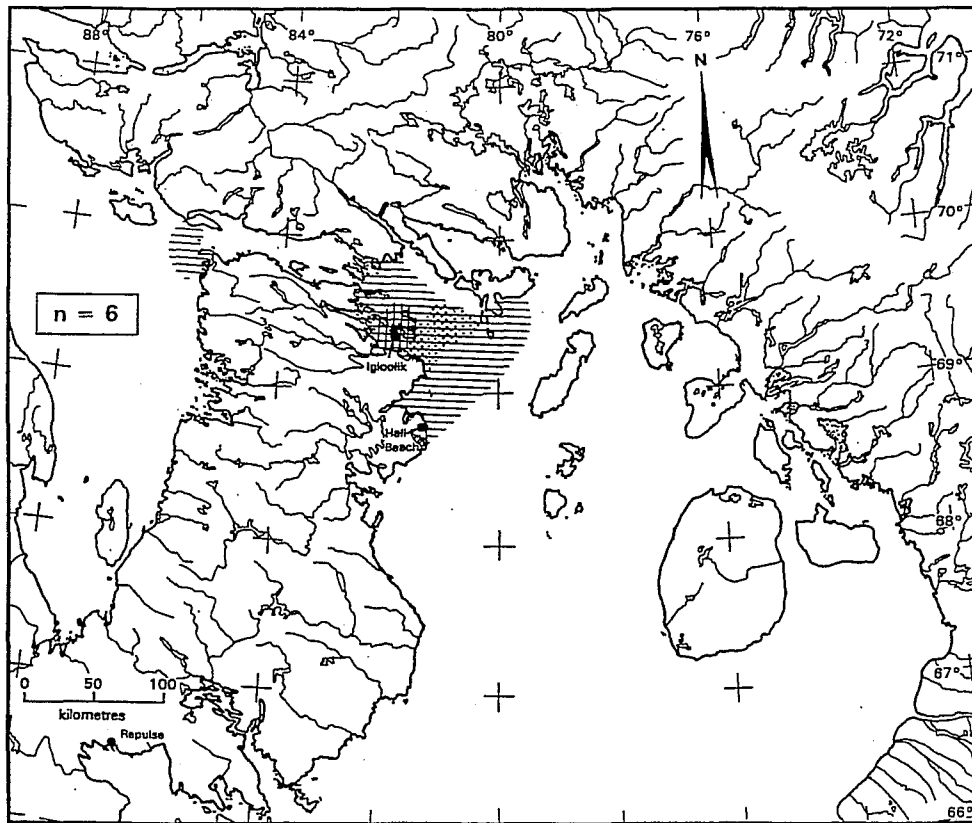





Figure 52. Areas where hunters from Igloolik and Hall Beach hunt narwhals during each season of the year.

ukiu (late November thru April)	none
upingoaksak (May thru mid-June)	none
upingoa (mid-June thru mid-July)	none
auja (mid-July thru early September)	
ukiaksak (early September thru mid-October)	
ukia (mid-October thru late November)	

The qualitative information gathered here complements the quantitative scientific studies. In particular, it relates the distributions and activities of the whales to their seasonal environment, through long term observations over a wide area. Of interest, for example, is the observation that the persistence of old ice has altered the seasonal movements and distributions of belugas and narwhals in Jones Sound over the past three years. The observation of unfamiliar bullets in belugas entering Foxe Basin, and suggestion that they may have come from Greenland is also potentially useful information; as is the fact that belugas are eating turbot (*Reinhardtius hippoglossoides*) at the Admiralty Inlet floe edge during upingoa (early May through early July).

This type of observational information is not available to resource managers or researchers except through the gathering of local Inuit knowledge, unless they are on-site over the long term or undertake a large-scale research project. It is important that better methodology be developed in order that the potential contributions of these observations can be properly assessed.

We do not agree with Remnant and Thomas (1992) that the use of questionnaires by local interviewers should be favoured for future studies of this kind. Studies based on the exclusive use of such questionnaires are very vulnerable to failure if the questions are inappropriate or the answers ambiguous. These problems can be addressed to some extent through careful pre-testing and follow-up, but this is virtually impossible unless the principal researcher is involved at the community level. Indeed, Thomsen (1993) attributed her relative success using this method in part to her travel to the communities, to locally inform about the survey and to conduct the interviews together with the local resource people. The fact remains that such structured interviews are quite unlike the usual long narrative that Inuit have traditionally used to impart knowledge (Bielawski 1992).

Questionnaires do serve a useful purpose provided they differentiate between knowledge based upon personal observation, knowledge imparted by others, and opinion. Sensitively and clearly worded, the questions can yield good, unambiguous information on specific questions. This information can be very important from a resource management perspective, both as a basis for further dialogue between the hunters and the scientists and for its contributions to research and management decisions.

Questionnaires are less successful as a means of accessing the broad ecological knowledge held by Inuit. It is this extensive, year-round, long-term knowledge of local ecosystems that may be most valuable to resource managers and researchers. This knowledge is not readily accessible via a short series of structured, focussed questions. Consequently, it has been largely missed by this and the previous studies which are not designed to gather it. Knowledgeable hunters may, for example, be reluctant to impart their detailed knowledge to someone who has not proven to be deserving of it (G. Williams, pers. comm.).

Using the questionnaire approach, it is also difficult to achieve consensus among the hunters--particularly on items that are difficult to observe. Thomsen (1993), also noted this problem, and suggested that, in addition to the interview component, there be a recording of collective knowledge to enable hunters to internally debate and evaluate their observations.

Considering how difficult it is to successfully gather local knowledge using questionnaires, one has to question the cost effectiveness of this approach. A study that successfully addresses these limitations may take longer and cost more over the short term, but the quality of the information it yields may pay long-term dividends. It would be unfortunate if the questionnaire approach, given its many limitations, were to become the accepted method for gathering local knowledge on belugas and narwhals--there are better ways.

RECOMMENDATIONS

1. The principal researcher should be directly involved in any future interview process.
2. Future studies should collect information from a broad cross-section of the community, not just the experienced male hunters. There are three main reasons for this. First, to learn what types of information these people can contribute to the knowledge base. Second, to determine how the lack of this information may have biased past studies. Third, to have them participate in the reputational sampling process by helping to identify experts in the community who for some reason may fall outside the purview of the HTA.

3. Future studies should not rely exclusively on individual interviews. Instead, they should take a three-phase approach. In the first phase a broad spectrum of community members should be approached for general information, and for recommendations on whom to interview in detail. The second phase would consist of detailed interviews of those who were identified by consensus as being most expert. These interviews would still be based on a standardized questionnaire, but would attempt to record more in the way of general observations on behavior and physiology. The third phase would begin after information from the second phase had been analysed. It would consist of a forum, or workshop, to record the collective knowledge of the hunters and to allow them to internally debate and evaluate their observations. Workshops have been used by the Hudson Bay Programme, and were recommended by Thomsen (1993) for future studies in Greenland. Overall, this method should yield a broader, more consistent knowledge base.
4. Further studies should not be undertaken until hunters and resource managers have discussed the existing studies, and evaluated the applicability of their information for research and management. This feedback should be incorporated into any future studies. Seasonal information should be collected using both the Inuit seasons, which are based upon environmental conditions, and calendar months.
5. To ensure that the methods, timeframe and resources are adequate for the purpose, a design phase should precede the establishment of core funding for any future study.

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REFERENCES

- BIELAWSKI, E. 1992. Inuit indigenous knowledge and science in the Arctic. *North. Perspect.* 20(1): 5-8.
- FREEMAN, M.M.R. 1968. Winter observations on beluga (Delphinapterus leucas) in Jones Sound, N.W.T. *Can. Field-Nat.* 82: 276-286
- FREEMAN, M.M.R (ed.). 1976. Inuit land use and occupancy project. Milton Freeman Research Limited for the Department of Indian and Northern Affairs, Ottawa. 3 vols.
- GUNN, A., G. ARLOOKTOO, and D. KAOMAYOK. 1988. The contribution of the ecological knowledge of Inuit to wildlife management in the Northwest Territories, p. 22-30. In M.M.R. Freeman and L.N. Carbyn (ed.) *Traditional knowledge and renewable resource management in northern regions.* University of Alberta, Boreal Institute of Northern Studies, Occasional Publication 23.
- JOHNSON, M. 1992. Dene traditional knowledge. *North. Perspect.* 20(1): 3-5.

REMNANT, R.A., and M.L. THOMAS. 1992. Inuit traditional knowledge of the distribution and biology of High Arctic narwhal and beluga. North/South Consultants Inc., Winnipeg for the Canada/Greenland Joint Commission for the Conservation and Management of Beluga and Narwhal. vii + 96 p.

ROBERTS, L.W. 1993. A review of traditional knowledge survey methodology. Unpublished report prepared by Sociometrix Inc., Winnipeg for Department of Fisheries and Oceans, Winnipeg. 11 p.

STEWART, D.B. 1993. Researching Hudson/James Bay. Can. Water Watch 6 (7-8): 11.

THOMSEN, M.L. 1993. Local knowledge of the distribution, biology, and hunting of beluga and narwhal. Inuit Circumpolar Conference for Greenland Hunters' and Fishermen's Association, Greenland Home Rule Authorities, and the Inuit Circumpolar Conference. 98 p. + appendices.

TKWG (Traditional Knowledge Working Group). 1991. Report of the Traditional Knowledge Working Group. Department of Culture and Communications, Government of the Northwest Territories, Yellowknife. 116 p.

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APPENDIX 1. QUESTIONNAIRE APPROACH TO LOCAL KNOWLEDGE SURVEYS

The purpose of this appendix is to outline how and why the sampling method and questionnaire used for this study differ from those used by Remnant and Thomas (1992) and Thomsen (1993).

REPUTATIONAL VERSUS PROBABILITY SAMPLING

There was nothing to be gained in this study by using a random or "probability" sampling method that ensured each member of the community an equal chance of being selected. What we required was good information from the most knowledgeable members of each community. This information is best obtained using a "reputational" sampling procedure, whereby members of a community are asked to identify those who are most knowledgeable (Roberts 1993). The individuals about whom there is consensus are then interviewed.

We used a variation of this reputational approach to sampling for this study. The HTA in each community was asked to identify which hunters and elders they considered to be most knowledgeable of belugas and/or narwhals in their area. These people were then approached for interviews. Thomsen (1993) used a similar approach.

This method of selecting people to be interviewed introduces a variety of biases into the study. In particular, no information was collected from women or non-hunters. These people are often astute observers of species biology and physiology. Because of their roles in the community, and interests, they may hold knowledge that is different from that of the hunters. Women also tend to live longer and may therefore have a greater span of traditional knowledge than the men. The effects of these biases were not measured.

The reputational sampling method also results in a small sample size. This does not diminish the information obtained. In fact, it may reduce misinformation that can be introduced by less experienced observers.

Remnant and Thomas (1992) selected an arbitrary number of hunters to be interviewed from

each community and left the selection of hunters to be interviewed to the discretion of the interviewers. A sample selected in this way is not likely representative of the community, nor does it necessarily identify and interview only the most experienced hunters.

QUESTIONNAIRE APPROACH

The success of a questionnaire approach for gathering local knowledge depends upon many factors, but is especially vulnerable to failure if the questions are inappropriate or the answers ambiguous. The formulation of appropriate questions requires an understanding of what knowledge may be gathered. The wording must be simple and the intent clear. Despite a thorough review of the questionnaire by biologists and social scientists, and by the authors during the workshop, a number of questions were unclear or were answered ambiguously. These are detailed below in the section on "Problems with the questionnaire".

A particular flaw in the questionnaire approach to gathering information using local interviewers is the difficulty of follow-up questioning. Distance, lack of personal phones, and language are only some of the barriers to communication that effectively prevented the clarification of inconsistencies in the data.

The esteemed in which elders and senior hunters are held may also pose difficulties for this method of gathering information. Young interviewers may not understand some of the technical terms used by these experts, and may thereby miss important nuances of the information (Johnson 1992; G. Williams, pres. comm.). They may also be in awe of the elders and reluctant to ask questions for clarification. Likewise, a younger hunter may be reluctant to volunteer information that contradicts what an elder has said. Indeed, we may have an example of this in this survey. One of the interviewers, an expert hunter, was interviewed as part of the workshop. Following the workshop he was identified by his HTA as one of the experts to be interviewed, so he interviewed himself. The second interview, which may have been completed in company with a group of elders, was less forthcoming. This apparent duplication and the discrepancies have not been resolved. Rather than arbitrarily eliminate these interviews we have included the data from both. An asterisk (*) has been included in text and on maps wherever duplication of information may have occurred.

Knowledge versus opinion

In wording the questions it is vital to distinguish between knowledge and opinion. While Inuit observations are rarely wrong, their interpretations of what they have seen may be (Gunn et al. 1988). A major criticism of the questionnaire used by Remnant and Thomas (1992) was that it asked general questions, such as "How many calves does a beluga usually have in a year". While the intent of this question is to learn "what the hunter knows", the basis of that knowledge remains hidden. In fact, the response may be based on the hunters interpretation of what he has seen, on hearsay from other hunters, or on the latest aerial survey information. Instead, we asked the hunters what they had seen, what they had been told by a parent or grandparent, and for their opinions on a number of topics.

Area coverage

To properly interpret the hunters observations we also need to know where they have travelled during each season. This information was not gathered by Remnant and Thomas (1992) or Thomsen (1993). Without it we do not know whether gaps in the hunters observations suggest that an area may not be used by whales, or simply that none of the hunters visits that area during that season. To obtain this information we asked hunters to indicate where they had travelled during each season. The hunters' observations were then matched to their seasonal travels. Seasonal observations from a particular area were not accepted if the hunter indicated that he had not visited that area or seen whales during that season.

Seasonal information

Several reviews of the previous studies suggested that the use of western seasons (i.e. spring, summer, fall, winter) might be confusing for those being interviewed. Inuit base their six seasons on the environmental conditions, not on the calendar. If the information gathered is related to the calendar and not to the environmental conditions we risk losing a valuable component of the traditional knowledge. We need to know how aspects of the whale's biology correspond to the environmental conditions and also to the calendar year. Consequently, we asked hunters to relate their observations to the Inuit seasons and, if possible, also to the calendar.

There is some variation in the months

assigned to each season between communities due to different latitudes and oceanographic and climatic conditions, and within communities due to year-to-year variation in conditions. It is not unusual for the Inuit seasons to vary by a month or more on either end due to annual variations in climate.

The six Inuit seasons are characterized below with their approximate calendar months for comparison:

UKIU--(winter: early January through mid-March) extensive sea ice which continues to thicken and coalesce, snow on the land and ice, short daylight with the sun returning, very cold;

UPINGOAKSAK--(early spring: mid-March to late May) period of maximum ice cover and ice thickness; snow on the land and ice; daylight period long and increasing.

UPINGOA--(late spring: late May to mid-July) progressive snow melt, widening of ice leads, and disappearance of ice; 24 hour daylight.

AUJA--(summer: mid-July to early-September) open water with some drifting pack ice, daylight period long but decreasing.

UKIAKSAK--(early fall: early September to late October) open water with ice beginning to form late in the season along the shoreline; snow on the land and ice on the lakes; daylight period short and decreasing.

UKIA--(late-fall: late October to early January) new ice hardens and thickens to form extensive areas of landfast or drifting pack ice; snow on the land and ice; 24 hour darkness.

QUESTIONNAIRE FORMAT

The questionnaire format was also revised. Following both a written and oral description of the purpose for the study, each hunter was asked to sign a consent form if he was willing to participate in the study. This was to ensure that he understood how the information he provided would be used before consenting to participate.

At the start of each new section, the purpose of the questions and their relationship to resource co-management were explained. The questions were formatted to direct the interviewer as clearly as possible using a "skip or sort"

approach (Appendix 2). Check boxes were included for "yes", "no", and "don't know" responses. If a hunter chose not to respond to a question, the interviewer was asked to note that there was "no response" and to indicate any reason given.

PROBLEMS WITH THE QUESTIONNAIRE

Several survey questions (Appendix 2) were unclear or ambiguous, and should be corrected if this questionnaire is used again.

First, the purpose of Questions 26 and 65 was to learn whether the hunters recognize different types or kinds of belugas or narwhals, apart from males, females, and calves. Properly interpreted, the answer to this question may be very important to population managers since it may indicate whether hunters are harvesting whales from one stock or from several stocks. In fact, despite a thorough review of the question in the workshop, it is clear from the hunter responses that the question was misinterpreted. The responses addressed the question of whether males, females, and calves travel in distinct groups and how they can be recognized.

Second, Questions 27c and 66c were ambiguous since they did not ask whether the hunters had seen belugas or narwhals and killer whales together before asking them whether they had seen them together without attacks.

Third, the answers to Questions 37d and 76d, which asked whether the use of larger boats to hunt belugas was an advantage or disadvantage, were ambiguous unless the interviewer circled either advantage or disadvantage. This was not done for six of the Arctic Bay interviews.

APPENDIX 2. SURVEY QUESTIONNAIRE SAMPLE

This Appendix includes the English text of the survey questionnaire. It is located on the accompanying computer disk in a DOS 6.01, WordPerfect 6.0 file entitled "Appendix.two". The community area maps which accompanied the questionnaires have been omitted, as were three pages of illustrations which accompanied the questionnaire to assist interviewers with terminology and the identification of food items. These pages are available in the unpublished consulting report, see below.

The unpublished consulting report upon which this work is based contains a complete hard copy of Appendices 2 and 3, including examples of the maps and the three pages of illustrations. A copy of that report will be deposited in the libraries of the: 1) DFO, Central and Arctic Region, 501 University Crescent, Winnipeg, MB, R3T 2N6; 2) Arctic Institute of North America, 2500 University Drive, N.W., Calgary, AB, T2N 1N4; and 3) Scott Polar Research Institute, Lensfield road, Cambridge, UK, CB2 1ER. The correct citation for that report is:

Stewart, D.B., A. Akeeagok, R. Amarualik, S. Panipakutsuk, and A. Taqtu. 1994. Local knowledge of beluga and narwhal from four communities in Arctic Canada. Arctic Biological Consultants, Winnipeg for Canada/Greenland Joint Commission for the Conservation and Management of Beluga and Narwhal. vi + 135 p.

APPENDIX 3. TABULATION OF HUNTER RESPONSES

This appendix summarizes hunter responses to the questionnaire found in Appendix 2. The tabulations can be found on the accompanying computer disk, on DOS 6.01 in WordPerfect 6.0 files entitled "Append3.bel" and "Append3.nar". The data follow the sequence of the questionnaire, with information on belugas (.bel) preceding that on narwhals (.nar). Responses to questions that required mapping are summarized in the maps (Fig. 1 to 52) which were presented earlier. The number of hunter responses upon which each map was based is shown either on the map or in the map caption (e.g. n = 5). General background information collected from and by the interviewers on hunter profiles and seasons has been summarized in the text and is not included here.

Note: Numbers in the Arctic Bay responses that are followed by an asterisk may include duplicate responses (i.e. 6* possibly should be 5). See the Methods for further explanation.

The unpublished consulting report upon which this work is based contains a hard copy of Appendices 2 and 3. The Introduction to Appendix 2, earlier on this page, describes where copies of this report are available.