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**Hunting in Kangerlussuaq,
East Greenland, 1951-1991
An assessment of local knowledge**

Christian Glahder



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Hunting in Kangerlussuaq, East Greenland, 1951-1991

An assessment of local knowledge

Christian Glahder

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In 1991, hunters from Kangerlussuaq on the east coast of Greenland were interviewed about their knowledge of the number and distribution of hunted animals and the hunting conditions. The background was the fact that exploration for gold and other minerals in the area had increased over the preceding six years. The purpose of the study was to avoid or minimize conflicts of interest between a mine, the hunters and the hunted animals.

A total of 23 hunters were interviewed in Kangerlussuaq, Ammassalik, Tiniteqilaq, Kuummiit and Kulusuk. The material obtained from the interviews covers the years from 1951 to 1991. During these years an average of five to ten hunters had wintered in Kangerlussuaq in three periods: 1951-1954, 1966-1980 and 1986-1991.

By far the most important animals hunted are ringed seal, narwhal and polar bear. About 1000 to 2000 ringed seals, 20 to 30 narwhals and 25 to 35 polar bears are caught in a single season. These three species are described in detail in the paper. Bearded seal, hooded seal and harp seal are caught in numbers of 50 to 200 per season and fish and birds are caught only on a small scale. Information regarding the catch and distribution of marine mammals through the year is listed by the month.

The interview-study has shown that the outer half of the Kangerlussuaq fjord is the most important hunting area for all marine mammals all the year round. The area around Søkongen Ø some 75 km to the east of Kangerlussuaq, is very important for polar bear hunting, and its importance has increased since 1986. This change in the pattern of the polar bear hunting may be due to the increased disturbance from both mineral exploration and hunting.

Key words: Kangerlussuaq, East Greenland, interview, hunting, ringed seal, narwhal, polar bear, mining.

Christian Glahder, National Environmental Research Institute, Department of Arctic Environment, 135,4. Tagensvej, DK-2200 Copenhagen N, Denmark.*

** Former: Greenland Environment Research Institute.*

Introduction

The background of this interview-study about hunting conditions and the animals hunted in the Kangerlussuaq region was the increased mineral exploration in the area over the preceding six years. The Corona Corporation and Platinova Resources Ltd. started gold, palladium and platinum exploration in the Skærgården region in 1986, and in the Kap Edvard Holm region in 1989 (see Fig. 4, where the exploration licences are registered together with base camp, drill camps

and diamond drilling areas). Intensive diamond core drilling was carried out in the Skærgården region in 1989 and 1990. Late in 1990, drilling also started in Kap Edvard Holm/Kangikajik and continued with diamond core drilling in 1991 with the formation of a partnership between RTZ Mining and Exploration Ltd. and Platinova Resources Ltd. Place names in the Kangerlussuaq region referred to in this paper are shown in Figs 1-3.

The Greenland Environmental Research Institute (GERI) carried out a preliminary study in the Skær-



Photo 1. Drilling at Kap Deichmann using hand-held equipment. Lee Barker from RTZ Mining and Exploration Ltd.

gården region between 26th August and 6th September 1989 in order to plan for more detailed studies in the area (Anon. 1989). This reconnaissance included a study of possible sites for deposition of mineral wastes, an assessment of animals and plants, and an assessment of hunting conditions in the Skærgården area.

Deposition possibilities, the location of technical facilities and the infrastructure were more closely examined by Greenland Field Investigations (GFI) and GERI in the period 7th-21st August 1990 (Langager & Lemgart 1990).

Biological background studies were carried out in Kangerlussuaq, Uttental Sund and Miki Fjord by GERI from 8th-19th August 1990 (Glahder 1990). These studies involved the collection of seaweed, mussels, fish, benthic fauna, sediment samples and hydrographic data.

The purpose of the interview-study was to describe the hunting conditions and the number and distribution of hunted animals and other animals in the Kangerlussuaq region, on the basis of interviews with

both present and past Kangerlussuaq hunters. Given this information, possible conflicts of interest between a mine, the hunters and the hunted animals could perhaps be avoided or minimised. The interview-study was carried out from 19th July to 16th August 1991. The study was partly funded by RTZ Mining and Exploration Ltd. and Platinova Resources Ltd.

The environmental regulation of mining exploration and possible mining activities in the Kangerlussuaq region will be based on this interview-study and a review of the literature on the effects of mineral resource activity on Arctic marine mammals (Dietz 1992). The environmental regulation will also be based on knowledge of the licensees' activities in the region.

Methods

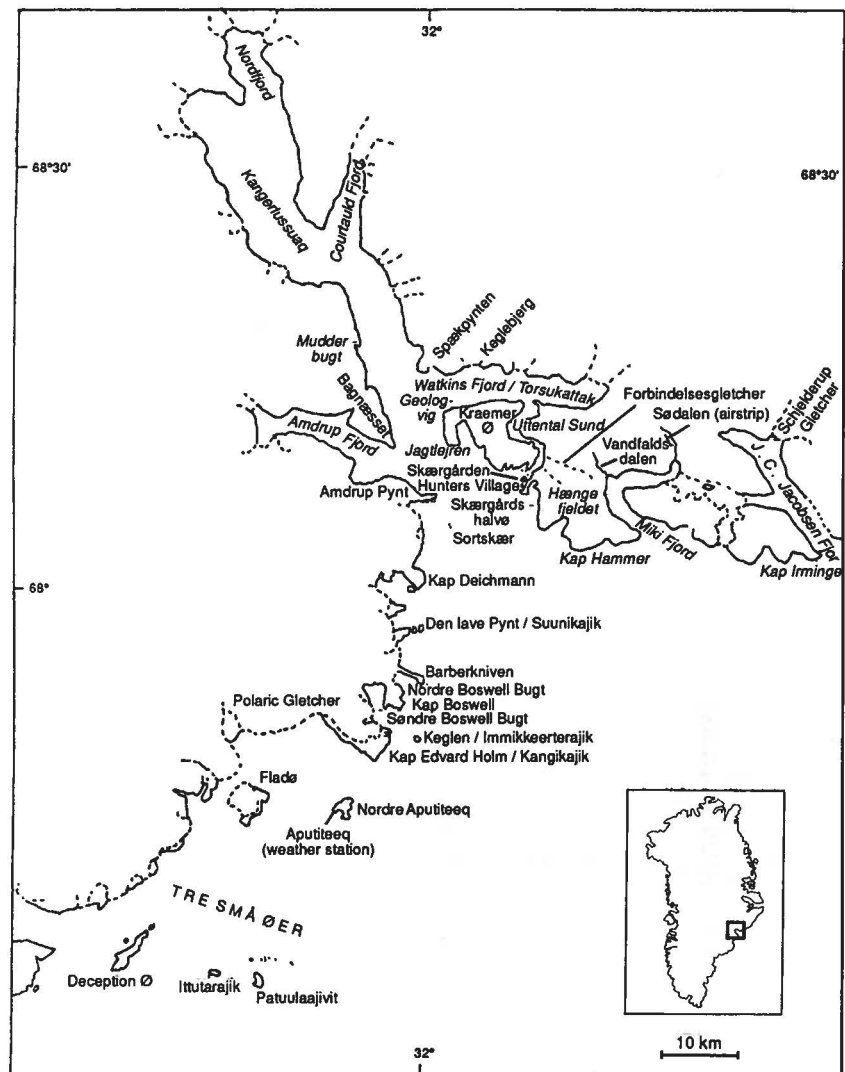
This interview-study was carried out in East Greenland from 21st July to 15th August by an interpreter, Niels Grann and the author. The interview-study started with interviews of three hunters at the Skærgården village on 21st-27th July, 1991. It proved to be a great advantage to start here in the middle of the hunting area, as this gave us first-hand experience of the hunting conditions; among other things, ringed seal hunting and net hunting of narwhals became part of the interview-study. These first interviews were also important because there was plenty of time to gather the information necessary and to gain experience of the study approach. In addition, a long list of the hunters who have been in the Kangerlussuaq region was drawn up here.

From the Skærgården village, we reached Ammassalik (65°36'N; 37°38'W) by plane through Kap Deichmann and Sødalen. In Ammassalik, interviews were carried out on 29th-31st July. Hunters were then interviewed in Tiniteqilaq village (65°53'N; 37°47'W) from 31st July to 2nd August, followed by interviews in Ammassalik on 3rd-6th August. After a boat cruise from Ammassalik to Kuummiit (65°51'N; 37°00'W) hunters were interviewed here on 6th-13th August. The last interview was carried out in Kulusuk (65°34'N; 37°11'W) on 15th August.

A total of 23 hunters were interviewed in Kangerlussuaq (3), Ammassalik (5), Tiniteqilaq (3), Kuummiit (11) and Kulusuk (1). The material obtained from the interviews covers the years from 1951 to 1991. During these years an average of five to ten hunters had wintered in Kangerlussuaq in three periods: 1951-1954, 1966-1980 and 1986-1991. So information has been gathered about catch conditions in the Kangerlussuaq region over a forty-year period. The number of hunters active in Kangerlussuaq over this period is unfortunately not available, which means that the quantitative information in this report represents a minimum.

The interview was designed so that the hunter was

Fig. 1. Place names in the Kangerlussuaq area. Agga Ø (67°23'N, 33°13'W) is located about 40 km south of Deception Ø.



asked a succession of questions that had been prepared in advance in five questionnaires (see Appendix 2). These questionnaires were made up of questions concerning general conditions, ringed seals, narwhals, polar bears, other marine mammals, fish, birds and land mammals. In addition to the questionnaires, a map of the area was prepared with symbol boxes so that information could be filled in during the interview either by the hunter or by the interviewer. The map material (A3) included maps for the distribution of ringed seals (winter), ringed seals (summer), narwhals, polar bears, other marine mammals, fish, birds and land mammals in Kangerlussuaq. A map for ice conditions and sledge routes was also prepared. In addition, a map (A4) of the east coast of Greenland from Ammassalik to Scoresby Sund (70°29'N; 21°57'W) was included. A set of maps and questionnaires was prepared for each hunter.

The interviews were carried out with the assistance of an interpreter, and the hunter's responses were either written down during the interview in a notebook, or filled in on the questionnaires. Much of the information was also drawn on to the maps. The interviews typically lasted two hours, but naturally the duration was highly variable. As soon as possible after the interview the information was written out, following the format of the questionnaires. None of the hunters had kept records of their catches. Some of the hunters had made notes during each season, but unfortunately these had not been kept.

For polar bears and narwhals in particular, a great deal of attention was given to precise information about sex, number, time and place of capture and animals seen. For other animals, especially the ringed seal, information on number and distribution in different seasons was important. Information on the animals'

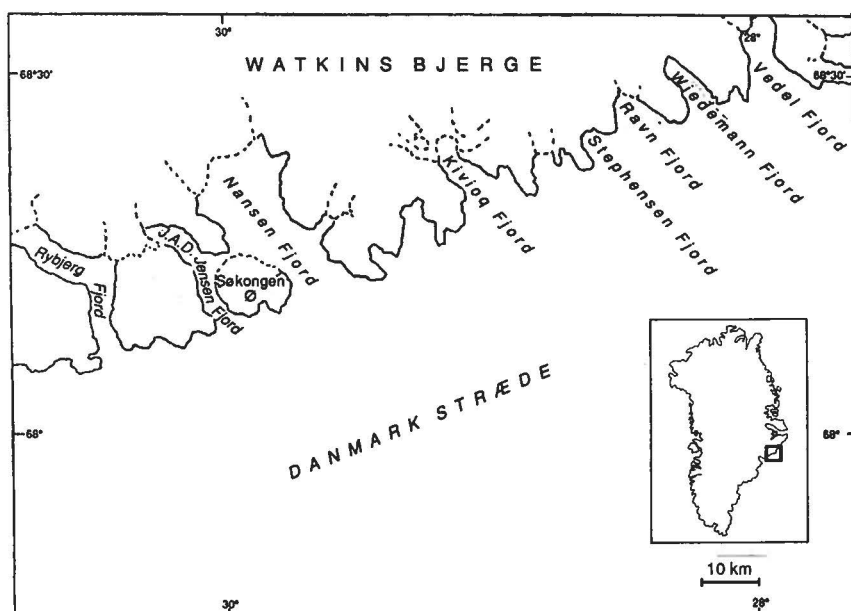


Fig. 2. Place names for the coastal stretch northeast of Kangerlussuaq.

“sensitive periods”, e.g. the breeding season, was also important, as were observations of disturbances, data on hunting methods and the hunters’ use of the area in different seasons.

During the working-up of the material, polar bear observations and catches in particular were cross-checked to avoid multiple recording. Some polar bears were therefore removed from the material, but there may still be multiple recordings. This is because a hunter might quite naturally have some difficulty remembering the exact year, month and place of a particular incident - not to mention who might have accompanied him on any one occasion in the past.

Information from this interview-study is compared with earlier information about the animal life and hunting conditions along the east coast of Greenland. In particular, information was obtained from a review of literature on marine mammals in East Greenland (Dietz et al. 1985) and an interview-study conducted in 1983 on marine mammals and marine birds in Scoresby Sund, catches and occurrences (Born 1983). Recently, a study has been published about hunting conditions and wild life in the Ammassalik area (Robbe 1994). No references are cited in this paper for information obtained from the hunters themselves.

An interview-study like this, utilising the hunters’ local knowledge, has many advantages compared with a quantitative biological study, but it also has some drawbacks. Some of the advantages are that much knowledge can be gained with relatively little effort; that many years can be covered as well as difficult seasons such as the wintertime; and that information on special incidents e.g. a polar bear hunt, and on customs such as the use of sledge routes is of high

quality. Also, an interview-study can shed light on topics relevant to further quantitative studies. Some of the drawbacks are that in many cases accuracy is lost, e.g. as regards how many narwhal males were shot in 1976, or the stomach content of the young ringed seal in summer. Memory, too, can embellish the actual incidents.

Physical environment

Ocean Currents

The dominant ocean current off Kangerlussuaq is the East Greenland Current, flowing southward along the east coast of Greenland from the Arctic Sea and the Greenland Sea. The main flow follows the continental slope. The East Greenland Current carries large quantities of ice and icebergs. According to Buch (1990), the East Greenland Current is composed of three water masses: the upper 150 m is Polar Water with temperatures mostly between 0°C and -2°C and low salinity (30-34.5 per thousand); the water mass below 800 m is Deep Water with temperatures below 0°C and salinity close to 34.9; in between is Arctic Intermediate Water with temperatures in the range of 0-3°C, and with a maximum temperature throughout the year in the depth interval of 200-400 m. The salinity varies from 34.7 to a little above 34.9. This water mass originates from the North Atlantic Current, which is a continuation of the Gulf Stream.

Between Kangerlussuaq and Iceland, the East Greenland Current is forced across a rather shallow ridge with a water depth of about 300-400 m. There, in Dan-

So in Danmark Stræde off Kangerlussuaq the Deep Water body of the East Greenland Current, rich in nutritive salts, meets a branch of the warm, heavy Irminger Current and the Greenland-Iceland ridge. This creates an upwelling of nutritious water, providing ideal

Another implication of the East Greenland Current is that navigation conditions in the ice masses can be particularly difficult for most of the year. It is usually possible to reach Kangerlussuaq in a vessel with a reinforced hull in August, September and October.

The Kangerlussuaq region is alpine in nature, with numerous steep mountains more than 1000 m in height,



Photo 2. Otto and Josef Ignatiussen being interviewed by Niels Grann. Milagtêq Ignatiussen is listening. Skærgården.

and a large number of active glaciers. The Kangerlussuaq fjord extends approximately 100 km inland through this landscape towards the ice-cap. Kangerlussuaq is a deep fjord with a depth of 960 m about one third of the way in (see Fig. 4) (Anon. 1988b). A little farther into the fjord the depth decreases to 686 m and then increases again to 914 m, forming a sill between Bagnæsset and Jagtlejren. At the mouth of the fjord the bottom levels out at a depth of about 600 m and continues as a 500 m deep trench extending approximately 200 km into the ocean in a southeasterly direction (Helland-Hansen 1936; Anon. 1988b).

A number of side fjords run into Kangerlussuaq: Nordfjord, Courtauld Fjord, Amdrup Fjord/Atterteq and Watkins Fjord/Torsukattak; and between the mouth of Kangerlussuaq and Watkins Fjord, Uttental Sund coils in an S-shape. Uttenal Sund is composed of two basins, 75 and 100 m deep, bounded by three sills 10-20 m deep (Anon. 1989; Langager & Lemgart 1990). The first fjord northeast of Kangerlussuaq, Miki Fjord, has slightly increasing depths of up to 200 m near the mouth of the fjord, and a ridge half-way of 150-160 m (Langager & Lemgart 1990). In connection with the background study carried out in August 1990,

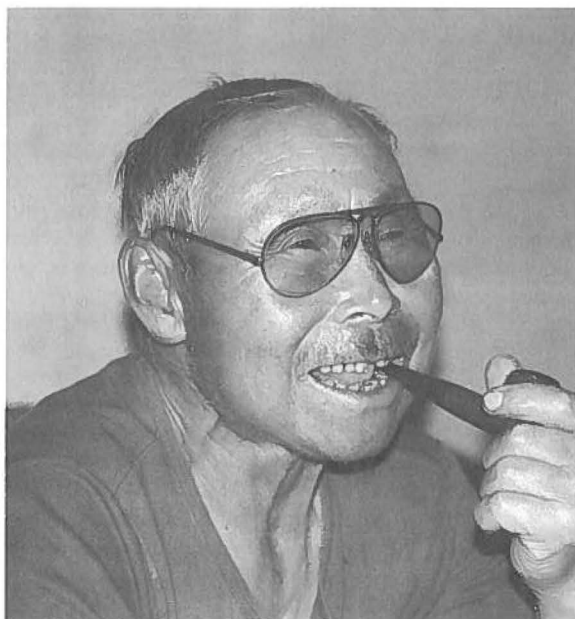
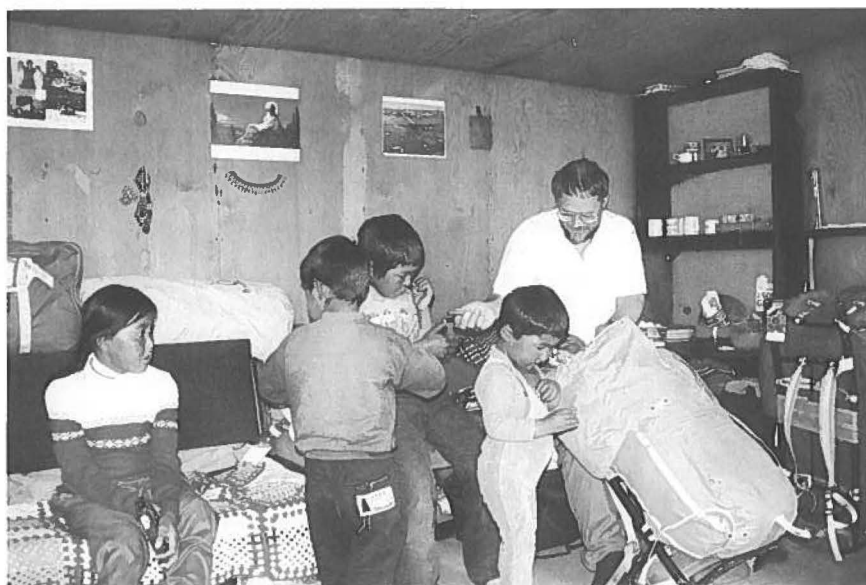


Photo 3. Nikatius Ignatiussen and Ulrik Pivat being interviewed in Kuummiit.

Photo 4. We are welcomed by Rebekka, Bianco, Jonathan and Harald Sanimuinaq in their house in the hunters' village, Skærgården. Niels Grann is unpacking.



hydrographic data were collected in Kangerlussuaq, Uttental Sund and Miki Fjord (Glahder 1990). Because of the quantity of ice aggregations and icebergs, the salinity of the water in Kangerlussuaq was found to be relatively low at the surface, approximately 20.0 per thousand, and increased to a salinity of 35.0 at a depth of 500 m. A similar, but less marked trend was found in the other two areas. The temperature of the surface water in August was $+0.5^{\circ}\text{C}$, and at a depth of 250 m it was measured as $+1^{\circ}\text{C}$.

The lowest temperature (-1°C) was recorded at a depth of 100 m, which is similar to the temperature conditions recorded at other locations along the coasts in August (Helland-Hansen 1936).

Climate

Kangerlussuaq is renowned for its extremely strong winds, the *piteraqs*, and for the great differences in local weather patterns. Weather conditions in the Kangerlussuaq region were recorded for the first time in 1932-1933, when the Norwegians had a weather station located at Mudderbugt, half-way up Kangerlussuaq (Manley 1938). In 1935-1936 an English expedition led by Wager spent the winter in the southern end of Uttental Sund (Manley 1938). During the Second World War and up until 1947, there was a meteorological station at Skærgårdshalvø (Langager & Lemgart 1990), on the same site as the present hunters' village. In fact, the remains of the weather station can still be seen today. From 1949 to 1979 climatic conditions were recorded at a manned weather station at Aputiteeq. From 1979 until today the climate has been recorded automatically at the same place (Langager & Lemgart 1990). The data presented in Fig. 5 were

collected at the Aputiteeq weather station. It is important to note that these data were collected from an area along the coast 25-40 km from the mouth of Kangerlussuaq.

From 1961 to 1978 the average annual temperature was -5°C , and the maximum and minimum temperatures were $+15^{\circ}\text{C}$ and -30° to -35°C respectively. Over an eight-year period the average annual precipitation was around 800 mm (Langager & Lemgart 1990). Fig. 5 shows average monthly temperatures and precipitation recorded at Aputiteeq in 1971-1978. Precipitation is greatest in June, August and September, and the average temperature is positive from June to September. It is estimated that around 500 mm of the annual precipitation (some 63%) falls as snow (Langager & Lemgart 1990).

As mentioned above, the major characteristic of Kangerlussuaq is the strong winds from the ice-cap, the *piteraqs*. These winds fall 2-3 km, from the top of the ice-cap to the bottom of the fjord, and blow 100-200 km out over Danmark Stræde. Wind speeds as high as 80 to 90 knots (approximately 150 km/hr) are not unusual in connection with the passage of low-pressure zones (Langager & Lemgart 1990). Within Kangerlussuaq, estimated from Uttental Sund and recorded at Mudderbugt, there was on average a *piteraqs* every fifth day all year round (Manley 1938). At the sheltered station at Uttental Sund, on the other hand, only 11 *piteraqs* were recorded during the whole year (Manley 1938). According to Manley (1938) there were more *piteraqs* in October and November. Strong *piteraqs* can also come from the west out through Amdrup Fjord (Siegstad 1991, Greenland Home Rule Government, pers. comm.). One of the consequences of these *piteraqs* is that the fast ice in the outermost areas of Kangerlussuaq breaks up and is swept far out to sea.

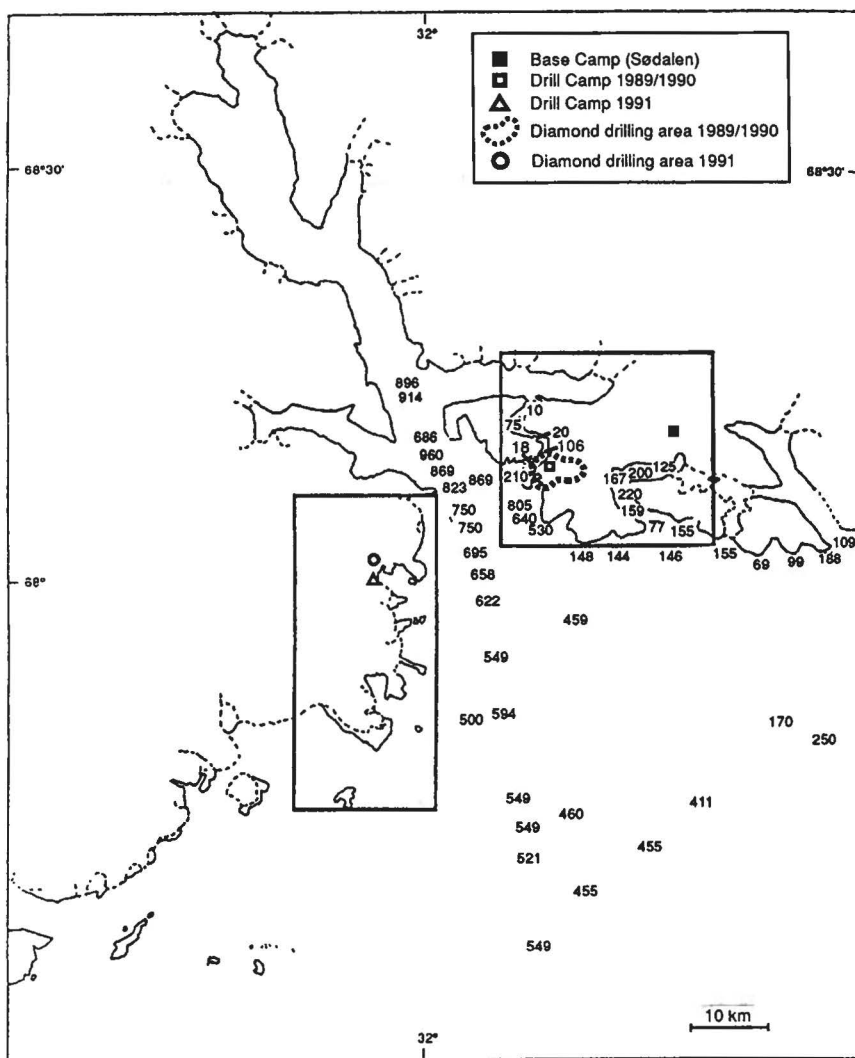


Fig. 4. Exploration licences in the Kangerlussuaq area in 1991, as well as base camp (Sødalén), drill camps and diamond drilling areas. Ocean depths (m) are also given.

The history of Kangerlussuaq as a hunting ground

It is known to archaeologists that Palaeo-Eskimos were living along the east coast of Greenland some 4000 years ago (Møbjerg 1986), so it is likely that hunters were in the Kangerlussuaq region that long ago. The fact that a scraper of quartz was found during the study at the Kap Irminger settlement near J. C. Jacobsen Fjord (Larsen 1938), suggests that hunters were in this area at least two thousand years ago (Møbjerg 1986, 1988; Kapel 1989). Studies and archaeological excavations of sites at the southern tip of Skærgårdshalvø, Eskimonæsset in Miki Fjord and Kap Irminger in the mouth of J. C. Jacobsen Fjord have been carried out by various researchers; e.g. Amdrup in 1900 (Thalbitzer 1909) (East Greenland Coast Expedition 1900), Degerbøl (1936) and Mathiasen (1934) in 1932

(Second East Greenland Expedition in 1932 led by Ejnar Mikkelsen) and Larsen (1938) in 1935 (the Anglo-Danish East Greenland Expedition led by M. A. Courtault). These studies indicate that hunters had settled the region in the 15th century AD, and that they had disappeared by the 19th century.

During the Second East Greenland Expedition in 1932 a number of temporary buildings were constructed in Kangerlussuaq to improve the hunting for the population of Ammassalik (Mikkelsen & Sveistrup 1944). These temporary houses were later used by the hunters from Ammassalik. One of the hunters we interviewed had been in Kangerlussuaq with his father in 1935 or 1936. The hunter himself was only two years old at that time and his father was a successful hunter in Kangerlussuaq. During the three-year period from 1946 to 1948, two, eighteen and eighteen people respectively wintered in Kangerlussuaq (Robert-Lamblin 1986).

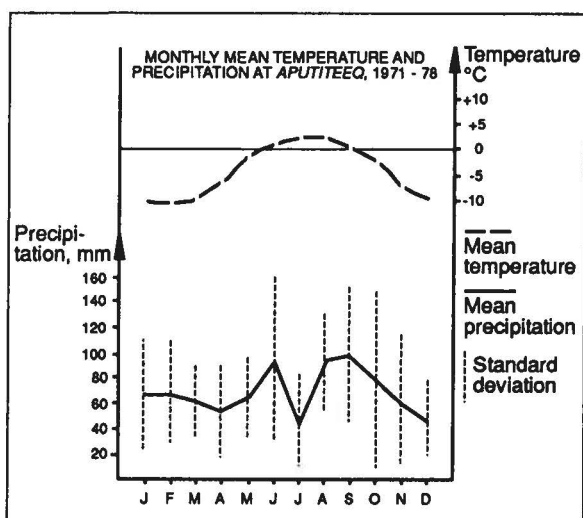


Fig. 5. Mean temperature and precipitation for months of the year measured at Aputiteeq weather station in 1971-1978.



Photo 5. The kayak of Otto Ignatiussen. Skærgården village.

In 1949 a manned weather station was established at Nordre Aputiteeq. One of the hunters interviewed was employed there as a cook from 1951 to 1954. He and other personnel at the weather station also hunted in the area.

It was not until 1966 that organised hunting trips to Kangerlussuaq first began. A total of 65 people took part in the first wintering (Robert-Lamblin 1986). Since then hunters have wintered at Skærgården village, except during the period between 1980 and 1986 and the 1989-90 season. During the period from 1966 to 1979 an average of 24 persons wintered in Kangerlussuaq every year ($SD=18$, $N=11$) (Robert-Lamblin 1986). On average, at least five of these persons were hunters. From 1986 to 1991 an average of 52 persons lived in Kangerlussuaq every year ($SD=33$, $N=4$), including an average of eleven hunters ($SD=8$, $N=4$). Over the whole period 1966-1991 an average of 30 persons including six hunters wintered in Kangerlussuaq every year.

Hunters who wish to winter in Kangerlussuaq today must apply to the authorities for authorisation. An authorised hunting family can borrow money to cover the purchase of fuel for the boat, ammunition and various other necessities such as flour, sugar, coffee, tobacco and milk powder. The municipality pays for transport to and from the hunters' village, usually with the vessel *Ejnar Mikkelsen*. The family, dogs, sledges, dinghies with outboard motor, kayaks and provisions are included in this transportation. In addition the municipality pays for the materials necessary for house maintenance, and the salaries of an assistant teacher and a person in charge of the village radio transmitter.

The Skærgården village has about fifteen houses

located on rocky ground at the base of the Skærgårdshalvø (Fig. 1). The houses have been built by the hunters themselves and consist of a wooden frame, sheets of plywood, a few windows, a door and a felted roof. Inside, an iron stove serves as cooker and heater; the main fuel is seal blubber. The fresh water supply comes from snow in winter and the village lake in summer. Another building in the Skærgården village is the weather station from the Second World War, made of tin plate. Motorboats, dinghies with outboard motor and kayaks are sheltered from Kangerlussuaq by small islands which create a natural harbour.

The hunters in Kangerlussuaq are inhabitants of the Tasiilaq District, the second largest district in Greenland with a total area of 243,000 km² (Berthelsen et al. 1990). It stretches from Kangerlussuaq in the north almost to Kap Farvel. Most people live in Ammassalik proper or in the villages up to 60 km from the town. In 1988 the population of the whole district was 2836, with 1370 in Ammassalik and 1466 in the villages: Isortoq (150), Ikkatteq (36), Tiniteqilaq (208), Kulusuk (368), Kuummiit (413), Sermiligaaq (149), Qerner-tuarsuit (7) and Timmiarmiit (135) (Folke et al. 1990). Nowadays 2-5% of the whole population winters at the seven regular hunting grounds north and south of Ammassalik (Robert-Lamblin 1986). The average distance from Ammassalik is 280 km, with Kangerlussuaq farthest to the north, some 400 km from Ammassalik.

Twice a week aeroplanes from West Greenland and Iceland arrive at Kulusuk Airport, from which there is a helicopter service to Ammassalik. In summer smaller planes from Iceland carry passengers, mainly tourists, for visits of a few hours to Kulusuk. Ships with



Photo 6. Sledge dogs on their way to Kangerlussuaq with *Ejnar Mikkelsen*. The quay in Ammassalik.

supplies call at Ammassalik from Denmark four or five times a year. In summer, internal transport is dealt with by local vessels and private motorboats, in winter by helicopter, sledges and skidoos. For transport to the hunting grounds local boats are used.

Today, hunting is no longer the main occupation of the people in the Ammassalik area, as it was in former days. Many people have wage-earning employment in the administration, in the service sector and in the Greenland Trading Company (KNI). In the private sector people work as tradesmen, in shops and at the hotel, and there are many jobs in the fisheries thanks to the presence of large prawn stocks, redfish and, from time to time, Atlantic cod. But jobs are still scarce; the unemployment percentage in 1991-1992 in the town

of Ammassalik varied seasonally between 2.5% and 9.3%, which is slightly below the unemployment percentage for the whole of Greenland (Anon. 1993). In 1986 the average income (gross revenue of taxpayers) was the third-lowest in all Greenland (Folke et al. 1990). Hunting and small-scale fishing therefore still play an important role in the Tasiilaq District, and in the town of Ammassalik part of the catch is sold at "Brædtet", the local market for hunters and fishermen.

As mentioned above, only a small percentage of the whole population winters at the regular hunting grounds, but between May and September most of the villages are partially abandoned and their inhabitants go on summer hunting trips, short or long. These summer migrations satisfy people's desire to vary their lifestyle, and are important for accumulating food reserves for the wintertime (Robert-Lamblin 1986).

For changes in the Ammassalik community between 1884, when the population was visited for the first time by the Danes (Holm & Garde 1889), and the mid-1980s, reference may be made to Robert-Lamblin (1986).

In 1991, the hunters' families were collected from Kangerlussuaq by the *Ejnar Mikkelsen* on 2nd August, and they arrived at Ammassalik on 3rd August, since no appreciable ice was encountered en route. The *Ejnar Mikkelsen* sailed to Kangerlussuaq again on 15th August with the hunters and their families, some of whom had wintered during the 1990/91 season.

The 23 hunters interviewed comprised hunters living either in Ammassalik itself or most of the villages around Ammassalik. Six of the hunters were from Ammassalik, twelve from Kuummiit, three from Tiniteqilaq, one from Isortoq and one from Kulusuk. The age distribution of the hunters interviewed is shown in Fig. 6.

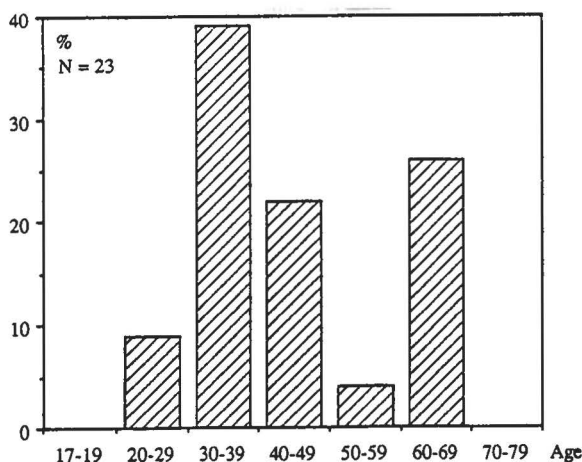
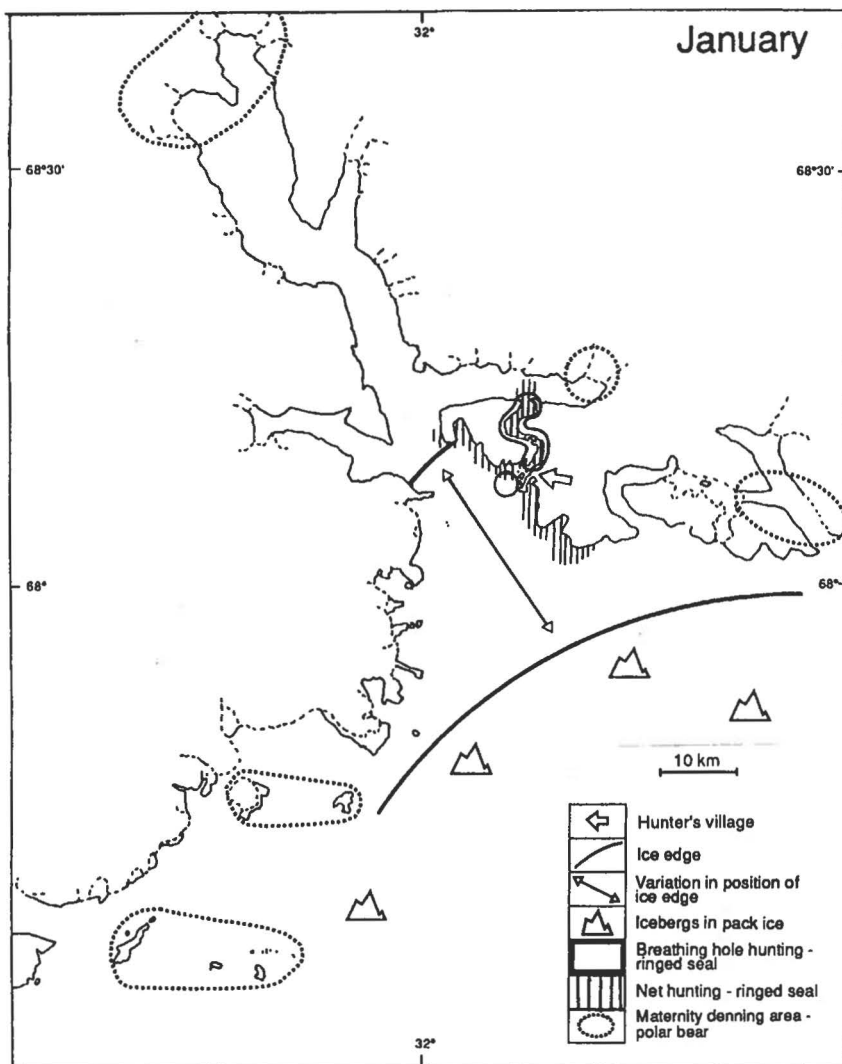


Fig. 6. Age distribution of the 23 hunters from Kangerlussuaq interviewed in summer 1991.

Fig. 7. Catch and occurrence of marine mammals, and the ice conditions in January



Annual hunting cycle

In this chapter, information regarding the distribution and catch of marine mammals over the years is listed by the month. Only the most important quarries are included in the figures, while additional quarries are mentioned in the text.

The description of ice conditions in Kangerlussuaq should be treated with some reservations, as information from the interviews was sporadic and ice conditions are highly variable because of the frequent strong winds - piterags - in the area.

Data on mean temperatures and mean precipitation were collected at the Aputiteeq weather station from 1972 until 1978. It is important to note that these data were in fact collected at the coast, 25-40 km from the mouth of Kangerlussuaq (Langager & Lemgart 1990).

Data on sunrise and sunset are given for the position 68°09'44"N and 31°32'08"W. This position is at the same latitude as the village, but 9 km farther east (in Miki Fjord). The times given are in local time, which is GMT-2 (Langager & Lemgart 1990).

January (Fig. 7)

Mean temperature -10.3°C .

Mean precipitation 66 ± 46 mm.

The sun appears over the horizon around 4th January.

At this time there is usually fast ice all over Kangerlussuaq (depending on the piterags).

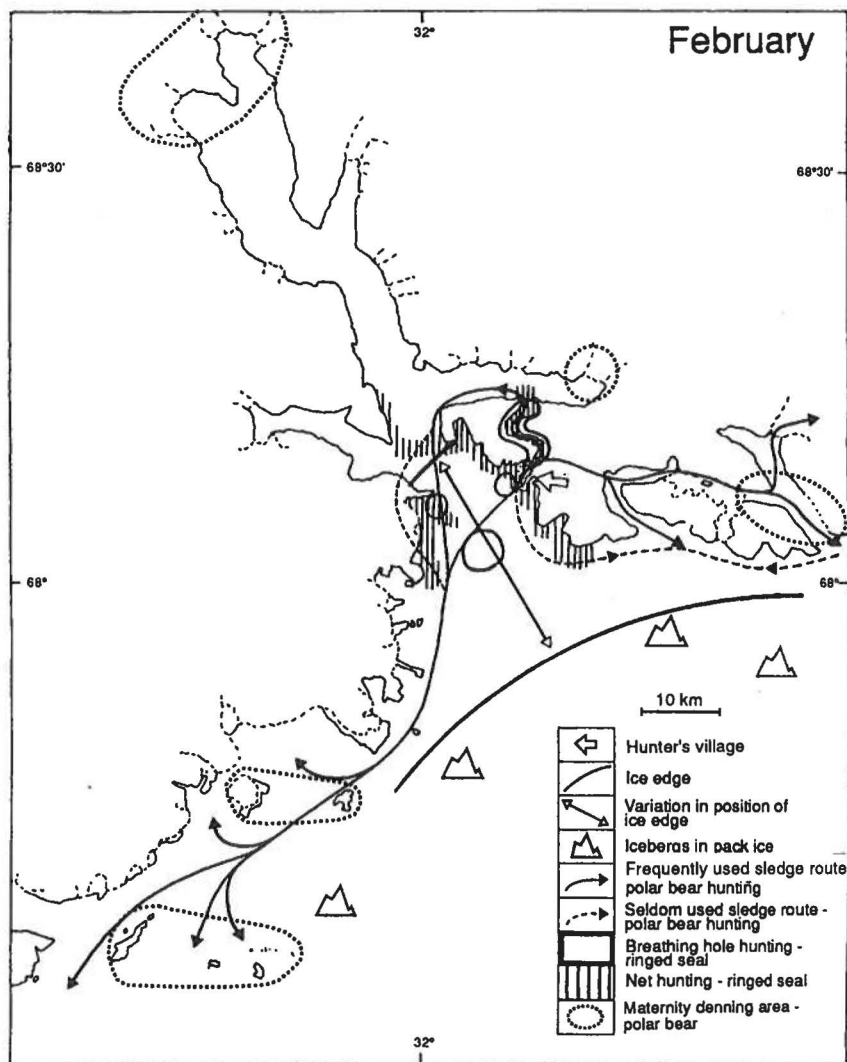


Fig. 8. Catch and occurrence of marine mammals, and the ice conditions in February.

Ringed seal. Breathing hole hunting both opposite the hunters' village and at Uttental Sund (depending on the thickness of the ice and snow).

Nets are set opposite the hunters' village, at Uttental Sund and Watkins Fjord.

Ice edge hunting.

Narwhal. Probably live in the polar ice in Danmark Stræde.

Polar bear. While at present no polar bears are killed in January, in the past a few were killed in this month. During this period females hibernate and other polar bears either roam around or go into dens to hibernate when the weather is bad and there is low food availability.

February (Fig. 8)

Mean temperature -10.8°C .

Mean precipitation 66 ± 43 mm.

On 1st February the sun rises at about 9.30 and sets around 15.15.

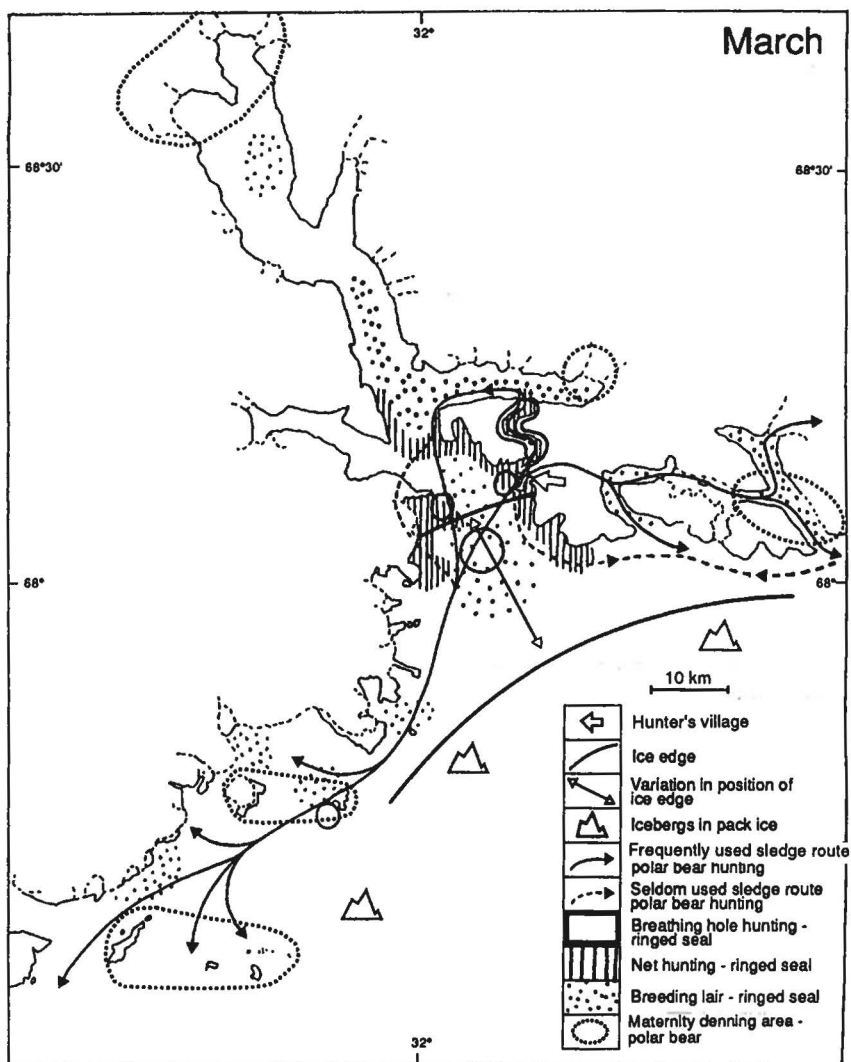
Permanent ice covers the whole of Kangerlussuaq (depending on piteraq).

Ringed seal. Breathing hole hunting opposite the hunters' village, at Uttental Sund, and possibly at Amdrup Pynt and at the mouth of Kangerlussuaq (depending on the thickness of the ice and snow).

Nets are set opposite the hunters' village, at Uttental Sund, at Watkins Fjord, and possibly at Bagnæsset and from Amdrup Pynt to Kap Deichmann.

Ice edge hunting.

Fig. 9. Catch and occurrence of marine mammals, and the ice conditions in March.



Narwhal. Probably live in the polar ice in Danmark Stræde.

Polar bear. Few polar bears are killed. Sledge hunting starts towards Søkongen Ø (NE) and Agga Ø (SW). During this period females hibernate and other polar bears either roam around or go into dens to hibernate when the weather is bad and there is low food availability.

March (Fig. 9)

Mean temperature -9.8°C .

Mean precipitation 61 ± 29 mm.

On 1st March the sun rises at about 7.30 and sets around 17.00.

Permanent ice covers the whole of Kangerlussuaq (depending on the piteraqs).

Ringed seal. Breathing hole hunting opposite the hunters' village, at Uttental Sund, at Amdrup Pynt and at the mouth of Kangerlussuaq, and also at Nordre Aputiteeq (depending on the thickness of the ice and snow).

Nets are set opposite the hunters' village, at Uttental Sund, at Watkins Fjord, and also at Bagnæsset and from Amdrup Pynt to Kap Deichmann (depending on the thickness of the ice and snow).

Ice edge hunting is important.

Ringed seal pups are born in breeding lairs in the permanent ice.

Narwhal. Probably live in the polar ice in Danmark Stræde.

Polar bear. Many polar bears are killed. Sledge hunting to Søkongen Ø and farther towards the NE. Sledge

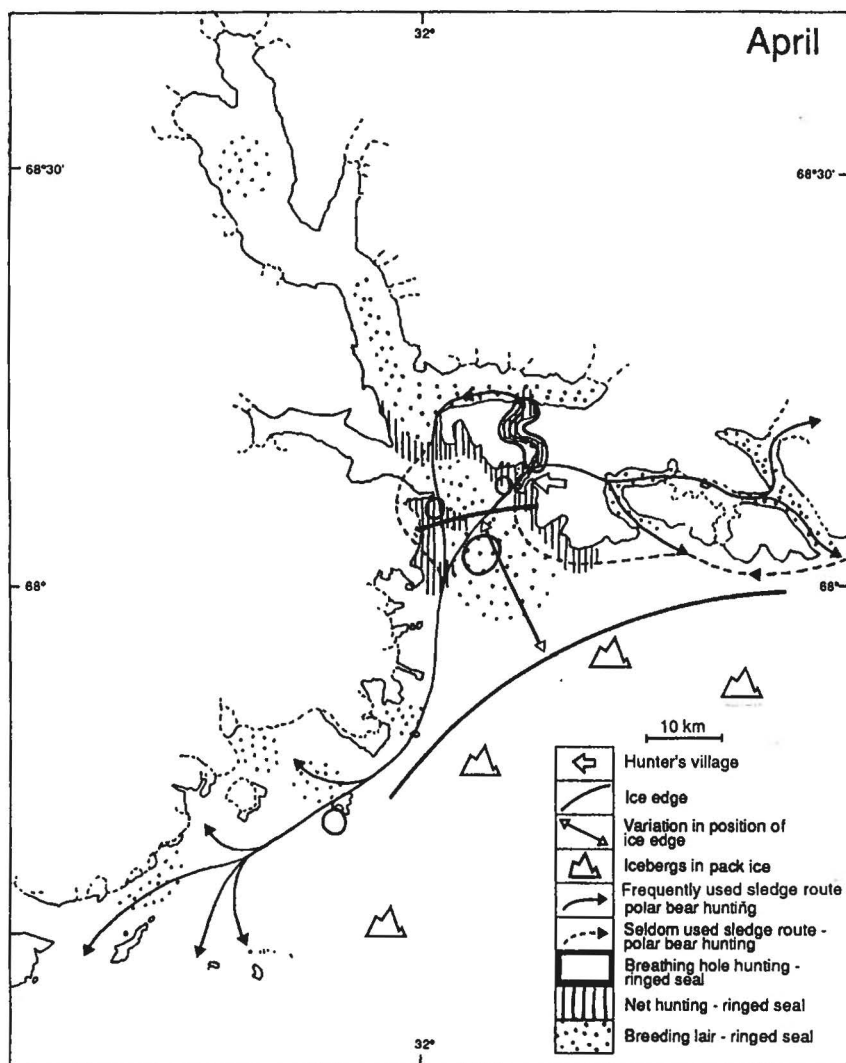


Fig. 10. Catch and occurrence of marine mammals, and the ice conditions in April.

hunting towards Agga Ø (SW). By the end of the month female polar bears have broken out of their dens with their cubs and seek out ringed seal breeding lairs. Many polar bears follow the edge of the ice towards the north. Polar bear courtship season begins.

April (Fig. 10)

Mean temperature -6.3°C .

Mean precipitation 53 ± 35 mm.

On 1st April the sun rises at about 5.00 and sets around 19.00.

Permanent ice covers the whole of Kangerlussuaq (depending on piteraq).

Ringed seal. Breathing hole hunting opposite the hunters' village, at Uttental Sund, at Amdrup Pynt and at

the mouth of Kangerlussuaq, and also at Nordre Aputiteeq (depending on the thickness of the ice and snow).

Nets are set opposite the hunters' village, at Uttental Sund, at Watkins Fjord, and also at Bagnæsset and from Amdrup Pynt to Kap Deichmann (depending on the thickness of the ice and snow).

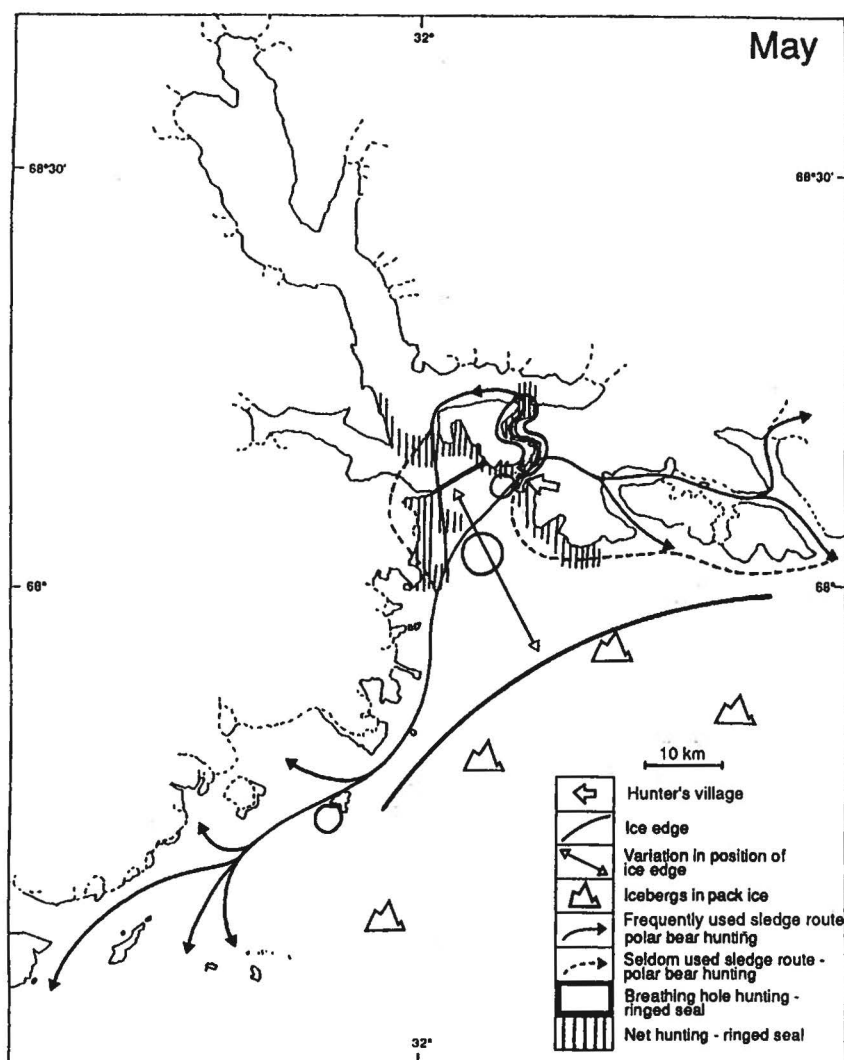
Ice edge hunting is important.

Ringed seal pups are born in breeding lairs in the permanent ice.

Narwhal. Probably live in the polar ice in Danmark Stræde.

Polar bear. A number of polar bears are killed. Sledge hunting to Søkongen Ø and farther towards the NE. Sledge hunting is also done towards Agga Ø (SW). Female polar bears and their cubs search for ringed seal breeding lairs. Many polar bears follow the edge

Fig. 11. Catch and occurrence of marine mammals, and the ice conditions in May.



of the ice towards the north. Polar bear courtship season.

May (Fig. 11)

Mean temperature -1.3°C .

Mean precipitation 63 ± 32 mm.

On 1st May the sun rises at about 3.00 and sets around 21.00. Around 26th May the period of midnight sun begins.

Permanent ice covers the whole of Kangerlussuaq, but the ice begins to break up.

Ringed seal. Breathing hole hunting opposite the hunters' village, at Uttental Sund, at Amdrup Pynt and at the mouth of Kangerlussuaq, and also at Nordre Aputiteeq.

Nets are set opposite the hunters' village, at Uttental Sund, at Watkins Fjord, and also at Bagnæsset and from Amdrup Pynt to Kap Deichmann.

Ice edge hunting is important.

The ringed seals begin to moult and are therefore often seen lying on the ice.

Narwhal. A few narwhals are hunted. The narwhals begin to migrate in towards Kangerlussuaq through open water channels. They are seen for instance at Keglen/ Immikkeerterajik at Kap Edvard Holm.

Polar bear. A number of polar bears are killed. Sledge hunting to Søkongen Ø and farther towards the NE. Sledge hunting also towards Agga Ø (SW). Many polar bears follow the edge of the ice towards the north.

Polar bear courtship season.

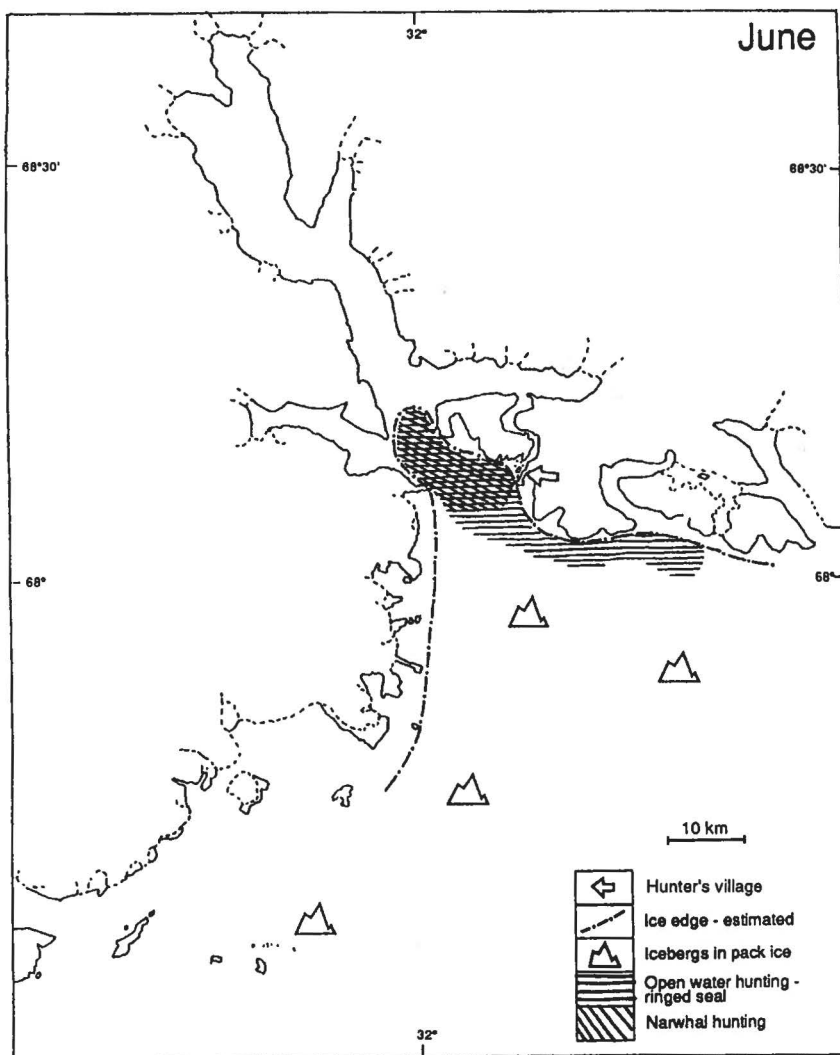


Fig. 12. Catch and occurrence of marine mammals, and the ice conditions in June.

June (Fig. 12)

Mean temperature $+1.3^{\circ}\text{C}$.

Mean precipitation 93 ± 65 mm.

There is midnight sun for the whole month.

The ice begins to decay and break up, but still remains in fjords and sounds.

Icebergs in the open water.

Ringed seal. Open water hunting begins opposite the hunters' village and in the outermost part of Kangerlussuaq.

The use of nets ceases during this month. Nets are set opposite the hunters' village, at Uttental Sund and at Watkins Fjord.

The ringed seals moult on the ice.

Narwhal. A number of narwhals are hunted. The narwhals begin to migrate farther into Kangerlussuaq following the retreating edge of the ice.

The calves are born at this time.

Polar bear. Only few polar bears are hunted. Hunting from sledge is discontinued because of the decay of the ice. The polar bears search for food in the pack ice and at the mouths of the fjords.

July (Fig. 13)

Mean temperature $+2.3^{\circ}\text{C}$.

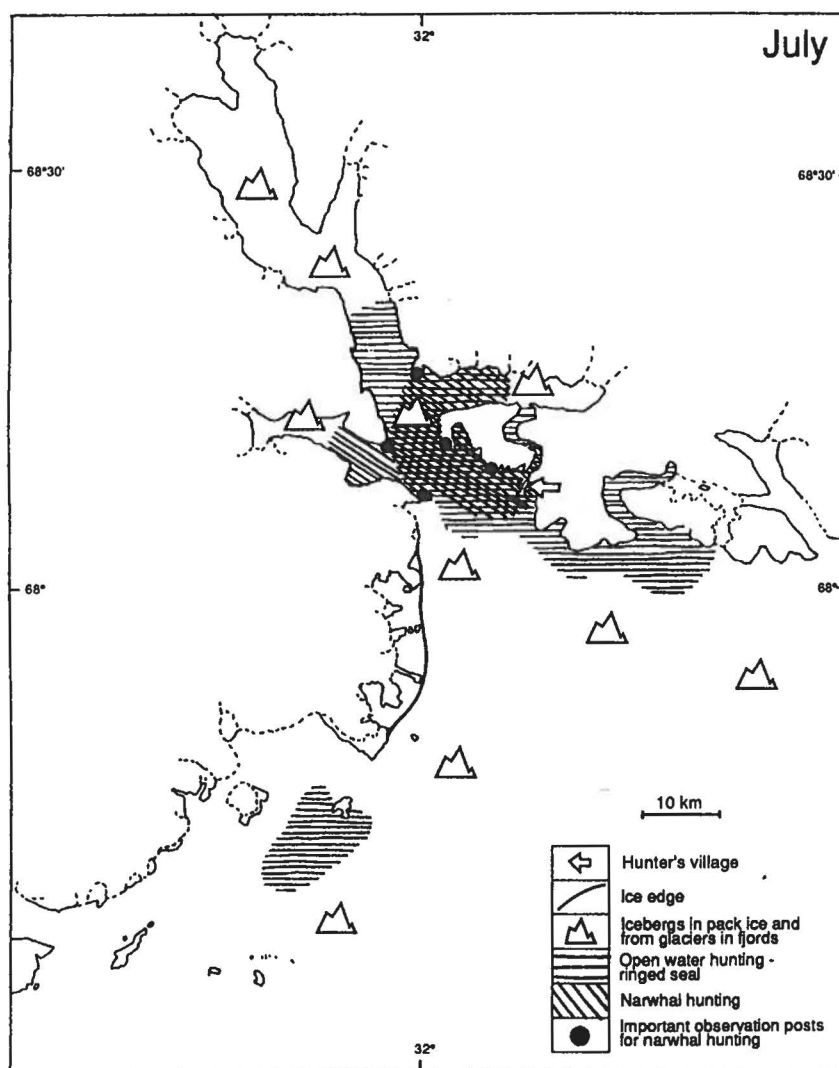
Mean precipitation 41 ± 29 mm.

There is midnight sun until 18th July.

Open water prevails in Kangerlussuaq and most of the adjacent fjords and sounds. However, permanent ice still covers the area from Kap Deichmann to Kap Edvard Holm.

Icebergs are found throughout the region.

Fig. 13. Catch and occurrence of marine mammals, and the ice conditions in July



Ringed seal. Intensive open water hunting in the outermost half of Kangerlussuaq, especially in the area opposite the hunters' village.

The ringed seals moult on the ice.

Narwhal. Many narwhals are hunted during this period. The main hunting area is the outermost half of Kangerlussuaq, where the most important observation posts are situated. The narwhals migrate along the coasts of Kangerlussuaq and the adjacent fjords and sounds in search of food.

The calves are born at this time.

Polar bear. No polar bears have been killed in July in recent years, but in the past a number were killed in July. The polar bears search for food in the pack ice, at the glaciers or on land. All polar bears, with the exception of adult males, are protected north of Kangerlussuaq in the Ittoqqortoormiit municipality.

Walrus. Only a few are seen or killed.

Bearded seal. Only a few are killed around the hunters' village, at the mouth of Kangerlussuaq, and at Nordre Aputiteeq.

Harp Seal. Only a few are killed. They are normally seen at the mouth of Kangerlussuaq and at Nordre Aputiteeq.

August (Fig. 14)

Mean temperature $+2.5^{\circ}\text{C}$.

Mean precipitation 95 ± 35 mm.

On 1st August the sun rises at about 2.15 and sets around 22.00.

Open water prevails in Kangerlussuaq and the adjacent fjords and sounds.

Icebergs are found throughout the region.

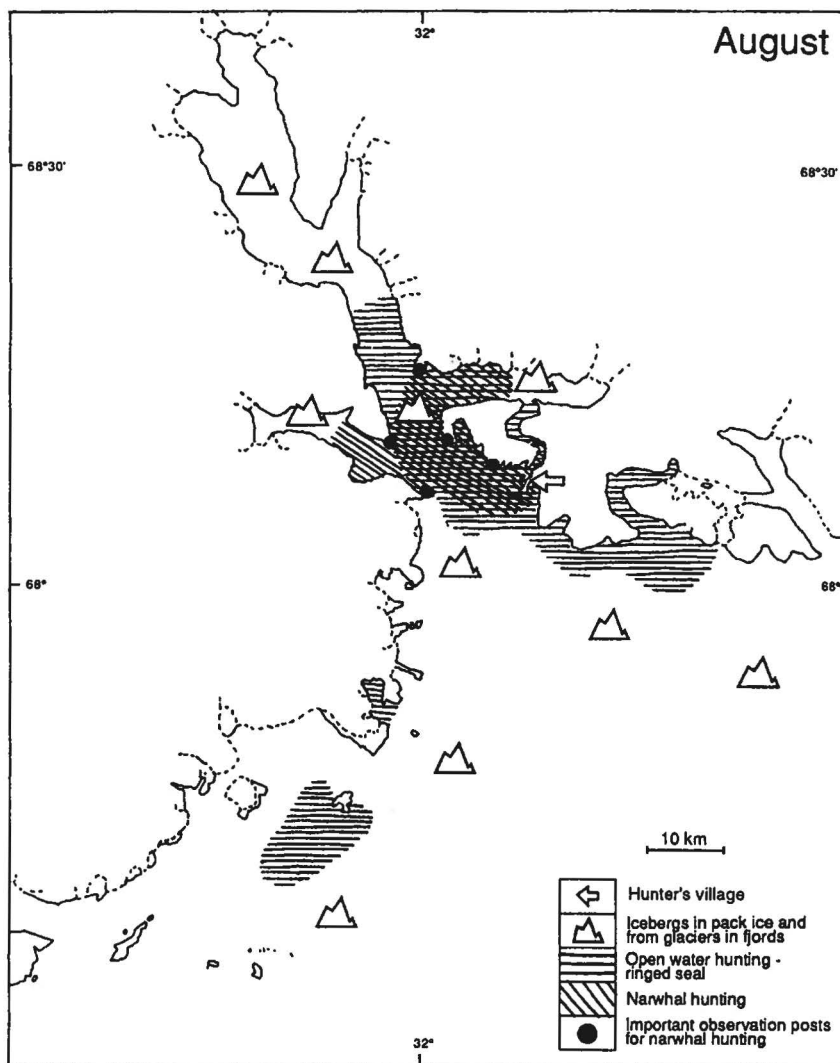


Fig. 14. Catch and occurrence of marine mammals, and the ice conditions in August.

Ringed seal. Intensive open water hunting in the outermost half of Kangerlussuaq, especially in the area opposite the hunters' village and in Søndre Boswell Bugt.

The ringed seals cease to moult. Young seals in particular migrate out of Kangerlussuaq.

Narwhal. A number of narwhals are hunted. The main hunting area is the outermost half of Kangerlussuaq, where the most important observation posts are situated. The narwhals migrate along the coasts of Kangerlussuaq and the adjacent fjords and sounds in search of food.

The calves are born at this time.

Polar bear. A few polar bears are hunted. The polar bears search for food in the pack ice, at the glaciers or on land. In general, the polar bears migrate towards the south following the pack ice. All polar bears, with the exception of adult males, are protected both north

and south of Kangerlussuaq in the municipalities of Ittoqqortoormiit and Tasiilaq.

Walrus. Only a few are seen or killed.

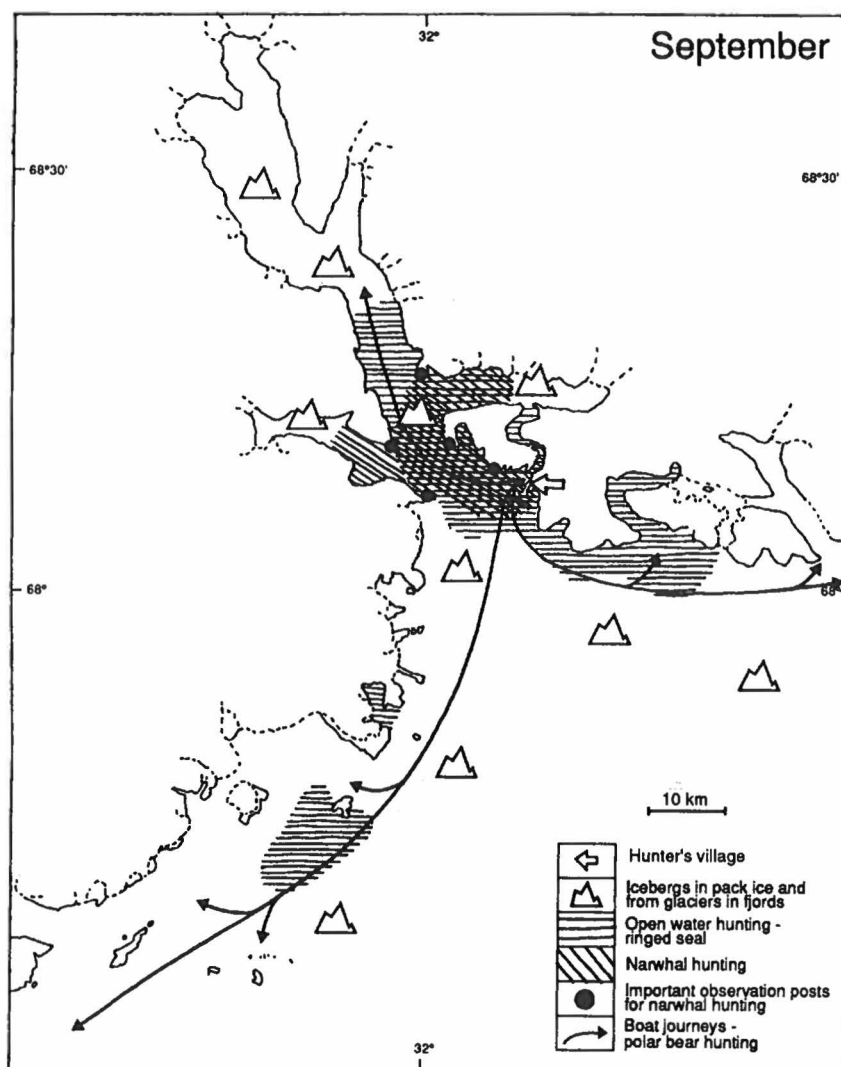
Bearded seal. Only a few are killed around the hunters' village, at the mouth of Kangerlussuaq, and at Nordre Aputiteeq.

Hooded seal. Only a few are killed. They are normally seen in Kangerlussuaq and in the mouth of the fjord.

Harp Seal. Only a few are killed. They are normally seen at the mouth of Kangerlussuaq and at Nordre Aputiteeq.

Sperm whale. One was seen in 1987.

Fig. 15. Catch and occurrence of marine mammals, and the ice conditions in September.



September (Fig. 15)

Mean temperature $+0.8^{\circ}\text{C}$.

Mean precipitation 98 ± 53 mm.

On 1st September the sun rises at about 4.30 and sets around 19.45.

Open water prevails in Kangerlussuaq and the adjacent fjords and sounds.

Icebergs are found throughout the region.

Ringed seal. Intensive open water hunting in the outermost half of Kangerlussuaq, especially opposite the hunters' village and in Søndre Boswell Bugt.

Narwhal. A number of narwhals are hunted. The main hunting area is the outermost half of Kangerlussuaq, where the most important observation posts are situated. The narwhals migrate along the coasts of Kangerlussuaq and the adjacent fjords and sounds in search of food.

Polar bear. A few polar bears are hunted. Hunting with boats begins in Kangerlussuaq towards Søkongen Ø (NE) and towards Agga Ø (SW). The polar bears search for food in the pack ice, at the glaciers or on land. In general, the polar bears migrate towards the south following the pack ice. All polar bears, with the exception of adult males, are protected south of Kangerlussuaq in the Tasiilaq municipality.

Walrus. Relatively few are seen or killed.

Bearded seal. Only a few are killed around the hunters' village, in the mouth of Kangerlussuaq, and at Nordre Aputiteeq.

Hooded seal. A number are killed. They are normally seen in Kangerlussuaq and at the mouth of the fjord.

Harp Seal. A number are killed. They are normally

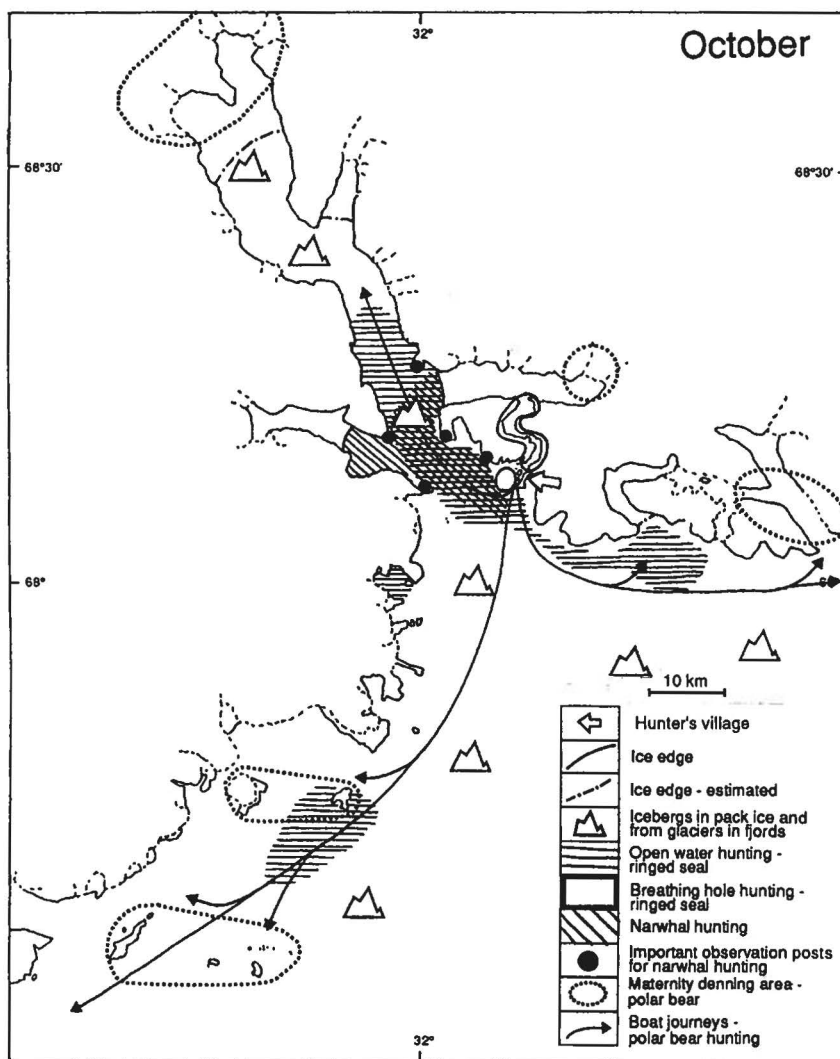


Fig. 16. Catch and occurrence of marine mammals, and the ice conditions in October.

seen at the mouth of Kangerlussuaq and at Nordre Aputiteeq.

Minke whale. Few are seen in this month.

October (Fig. 16)

Mean temperature -2.3°C .

Mean precipitation 79 ± 69 mm.

On 1st October the sun rises at about 6.15 and sets around 17.30.

Open water prevails in most of Kangerlussuaq, although permanent ice begins to cover the adjacent fjords and sounds and the head of Kangerlussuaq.

Icebergs are found throughout the region. Strong winds - piteraq - are frequent.

Ringed seal. Open water hunting declines, but is still

done in the outermost half of Kangerlussuaq and in the bay at Kap Deichmann.

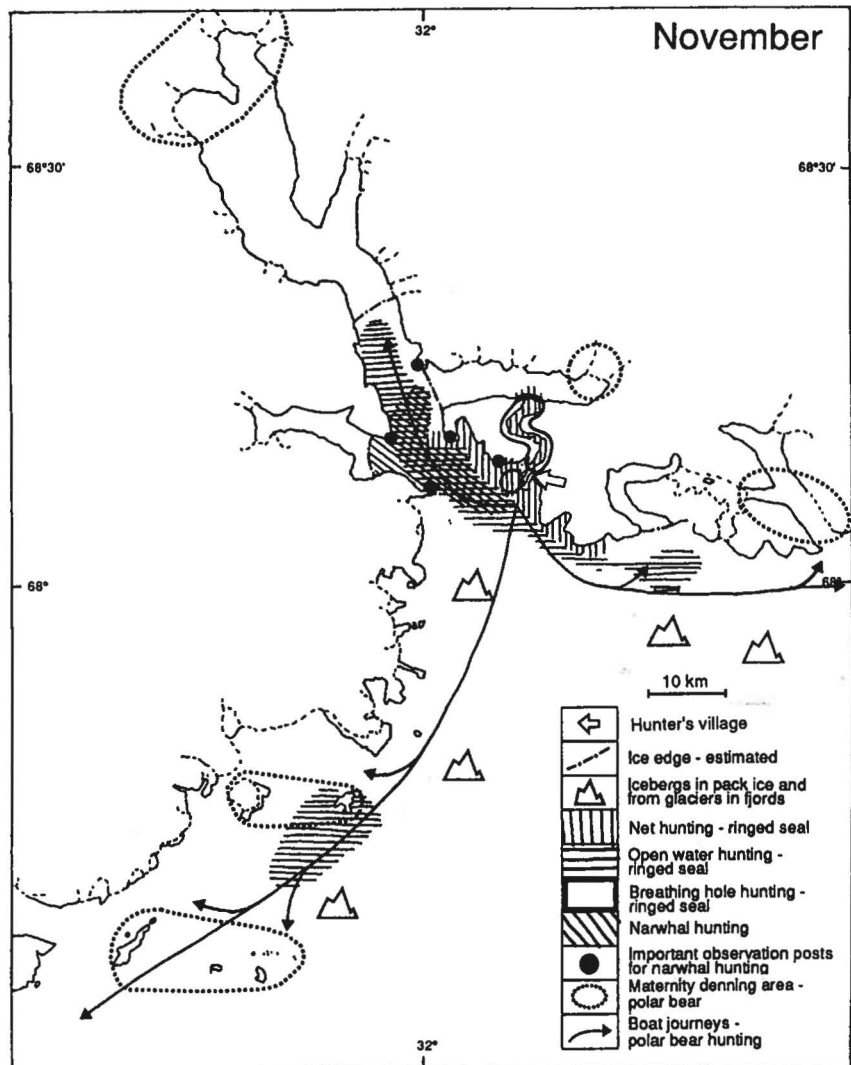
Breathing hole hunting starts on the new ice, especially near the hunters' village and in Uttental Sund. Ice edge hunting begins in the mouths of the adjacent fjords.

Ringed seals begin to migrate into Kangerlussuaq with the formation of the new ice.

Narwhal. A number of narwhals are hunted. The main hunting area is the outermost half of Kangerlussuaq, where the most important observation posts are situated. The narwhals migrate along the coasts of Kangerlussuaq and the adjacent fjords and sounds in search of food. With the formation of new ice, the narwhals begin to migrate out of Kangerlussuaq.

Polar bear. A number of polar bears are hunted. Hunting from boats in Kangerlussuaq towards Søkongen Ø

Fig. 17. Catch and occurrence of marine mammals, and the ice conditions in November.



(NE) and towards Agga Ø (SW).

Pregnant females begin to look for suitable areas for maternity dens, while other polar bears either roam around or go into dens to hibernate when the weather is bad and food availability is low.

Walrus. Relatively few are seen or killed.

Bearded seal. Only a few are killed around the hunters' village, at the mouth of Kangerlussuaq, and at Nordre Aputiteeq. They begin to migrate out of Kangerlussuaq.

Hooded seal. A number are killed. They are normally seen at the mouth of Kangerlussuaq.

Harp Seal. A number are killed. They are normally seen at the mouth of Kangerlussuaq and at Nordre Aputiteeq. They begin to migrate out of Kangerlussuaq.

November (Fig. 17)

Mean temperature -7.3°C .

Mean precipitation 60 ± 47 mm.

On 1st November the sun rises at about 8.15 and sets around 15.30.

Part of Kangerlussuaq has open water, while the adjacent fjords and sounds, and the head of Kangerlussuaq, are covered with permanent ice.

Icebergs are found in open waters.

Strong winds - piteraq - are frequent.

Ringed seal. Open water hunting declines, but is still done in the outermost half of Kangerlussuaq.

Breathing hole hunting on the new ice opposite the hunters' village and at Uttental Sund.

Nets are set opposite the hunters' village, in Uttental Sund and in Watkins Fjord.

Ice edge hunting.

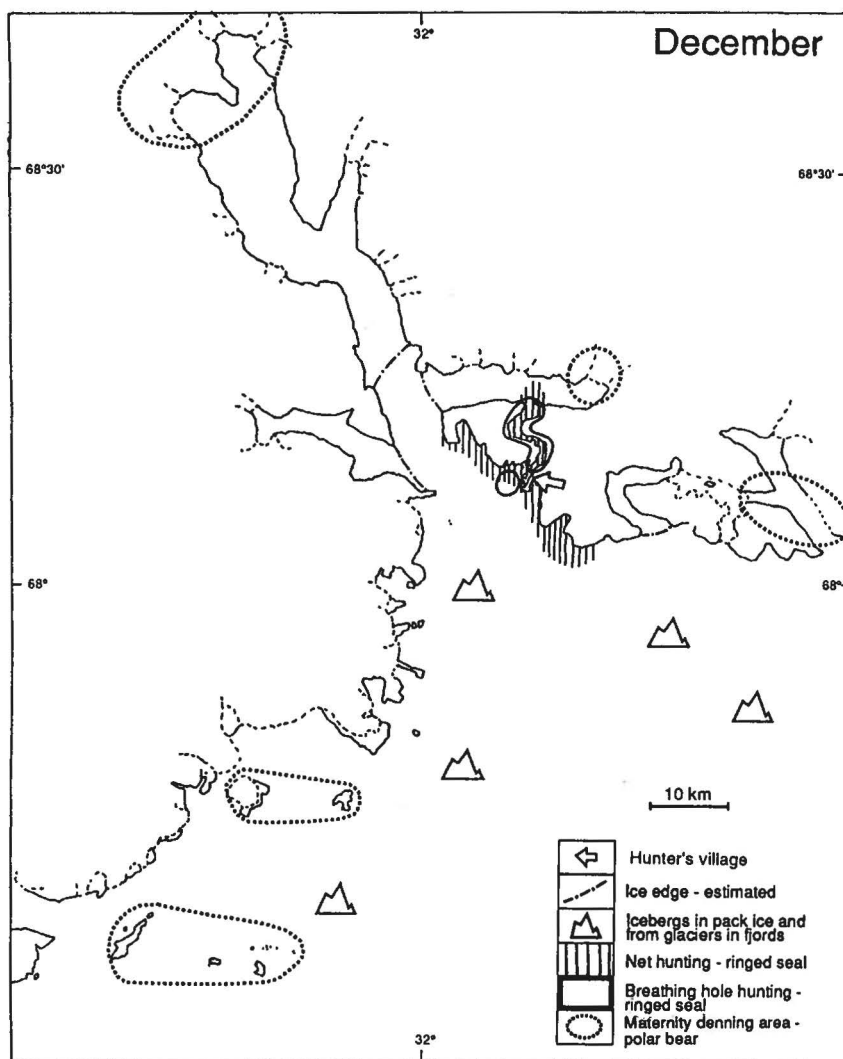


Fig. 18. Catch and occurrence of marine mammals, and the ice conditions in December.

The ringed seals migrate into Kangerlussuaq.

Narwhal. Few narwhals are hunted. The main hunting area is the outermost half of Kangerlussuaq, where the most important observation posts are situated. The narwhals migrate along the coasts of Kangerlussuaq and the adjacent fjords and sounds in search of food. With the formation of new ice, the narwhals begin to migrate out of Kangerlussuaq.

Polar bear. Few polar bears are killed. Hunting with boats in Kangerlussuaq towards Søkongen Ø (NE) and towards Agga Ø (SW) declines. During this period pregnant females search for maternity dens and other polar bears either roam around or go into dens when the weather is bad and food availability is low.

Hooded seal. Some are killed. They are normally seen in the outermost half of Kangerlussuaq.

December (Fig. 18)

Mean temperature -9.8°C .

Mean precipitation 45 ± 27 mm.

On 1st December the sun rises at about 10.45 and sets around 13.00. The sun disappears around 8th December.

Open waters only in the outermost half of Kangerlussuaq, while the adjacent fjords and sounds and the innermost half of Kangerlussuaq are covered by permanent ice.

Icebergs are found in the open waters.

Ringed seal. Breathing hole hunting opposite the hunters' village, in Uttental Sund and in Watkins Fjord.

Ice edge hunting.

Narwhal. Probably live in the polar ice in Danmark Stræde.

Photo 7. Ulrik Sanimuinaq (right) and Niels Grann (interpreter) in front of Ulrik's house in the hunters' village, Skærgården.



Polar bear. Few polar bears are killed. During this period females hibernate and other polar bears either roam around or go into dens to hibernate when the weather is bad and there is low food availability.

Ringed seal (*Phoca hispida*)

Introduction

Ringed seals are found throughout the area between Kap Farvel and Scoresby Sund (Dietz et al. 1985), and are normally seen in the Ammassalik district all year round, according to Holm and Petersen (1921). Ringed seals were seen along the coastal stretch between Scoresby Sund and Kangerlussuaq during July and August, when the Second East Greenland expedition passed through the area in 1932 (Degerbøl 1937). On 8th August 1900, Amdrup (1902b) commented "that hunting might be excellent in Kangerlussuaq, for there were enough seals". Presumably, he was referring to ringed seals in particular. According to Pedersen (1931) ringed seals are as abundant in Kangerlussuaq as in Scoresby Sund, where the ringed seal is the most common marine mammal. Large numbers of ringed seals have been observed in Uttental Sund (Mikkelsen 1933) and also in Kangerlussuaq (Iversen 1936).

Catch

All the hunters interviewed had hunted ringed seal in Kangerlussuaq. Table 1 shows the minimum number of ringed seals caught per season in the area. The

numbers given here for ringed seals hunted in the 1986/87, 1988/89 and 1990/91 hunting seasons are fairly reliable, as between 3/4 and all of the hunters at the village provided information regarding ringed seal catches in these periods. For the 1966/67 and 1987/88 seasons, the total numbers of ringed seals caught were estimated from information given by less than half of the hunters who were present at the village in these seasons. The total number of seals caught in 1966/67 and 1967/68 was given by Siegstad (1989). Information about the number of ringed seals caught in Kangerlussuaq from July 1966 to June 1967, and from July 1968 to June 1969 is recorded in the catch lists (Anon. 1966-1970). For the 1967/68 season however, the records only cover the period from July to August, during which 320 ringed seals were caught. From 1966 until 1970 the catch in Kangerlussuaq was also recorded in calendar years, i.e. from 1.1 to 31.12 (Anon. 1966-1971). In Table 1 the catch per calendar year is listed under the first year of a season - e.g. the 1966 calendar year is listed under the 1966/67 hunting season. The same applies to the information about the number of hunters in Kangerlussuaq.

In Table 1, 59 hunting seasons are represented. One hunting season is one season spent by one hunter - for example there were three hunting seasons in 1990/91. On the basis of this, one hunter hunted an average of approximately 200 ringed seals per season ($\bar{x} = 199$, $SD = 96$, $N = 59$). This average is rather high compared with the catch in the Ammassalik area (Robbe 1995, Musée de l'Homme, pers. comm.).

In contrast to this, it is estimated that the total catch in Scoresby Sund in 1983 was around 6000 ringed seals, and these were caught by 77 hunters (Born 1983), i.e. approximately 100 ringed seals per hunter. Pedersen (1930) states that from 1925 to 1928 the annual

Season	No. of hunters at the hunters village		No. of hunters who reported seal-hunts	Total no. of ringed seal shot	Catch according to		
	According to the interview investigation	According to catch lists			Catch lists		Siegstad (1989)
					July-June	Calendar year	
1990/9	3		3	> 650			
1988/89	7		7	1.100-1.200			
1987/88	21		11	1.550-1.750			
1986/87	11		8	1.200-1.300			
1979/80	min. 6-11		4	850-950			
1978/79	min. 1		1	c. 200			
1977/78	?		-	-			
1976/77	min. 2		2	500-600			
1975/76	min. 2		1	c. 200			
1974/75	min. 3		2	c. 400			
1973/74	min. 7		3	950-1.000			
1972/73	min. 3		2	450-500			
1971/72	min. 5	5	3	650-700		-	
1970/71	min. 9	6	2	c. 320		216	
1969/70	min. 4	9	2	450-500		183	
1968/69	min. 3	8	2	c. 550	692	536	
1967/68	min. 2	10	1	250-300	-	476	> 1.500
1966/67	min. 10	11	5	1.000-1.100	1.029	700	> 2.000

Table 1. Ringed seal catch in Kangerlussuaq from 1966 to 1991. Number of hunters active in each season.

catch of ringed seals in Scoresby Sund was around 4000 for ten families, or 400 ringed seals per family (where a family could have more than one hunter). Hunters from Ammassalik occasionally go on summer hunting trips to Kangerlussuaq in their own dinghies with out-board motors or in motorboats. One hunter went on four hunting trips in the 1980s, and on each trip (14 days) to Kangerlussuaq he shot approximately 140 ringed seals. Another hunter went on a trip for three weeks in summer 1989 and shot 35-40 ringed seals.

Hunting methods

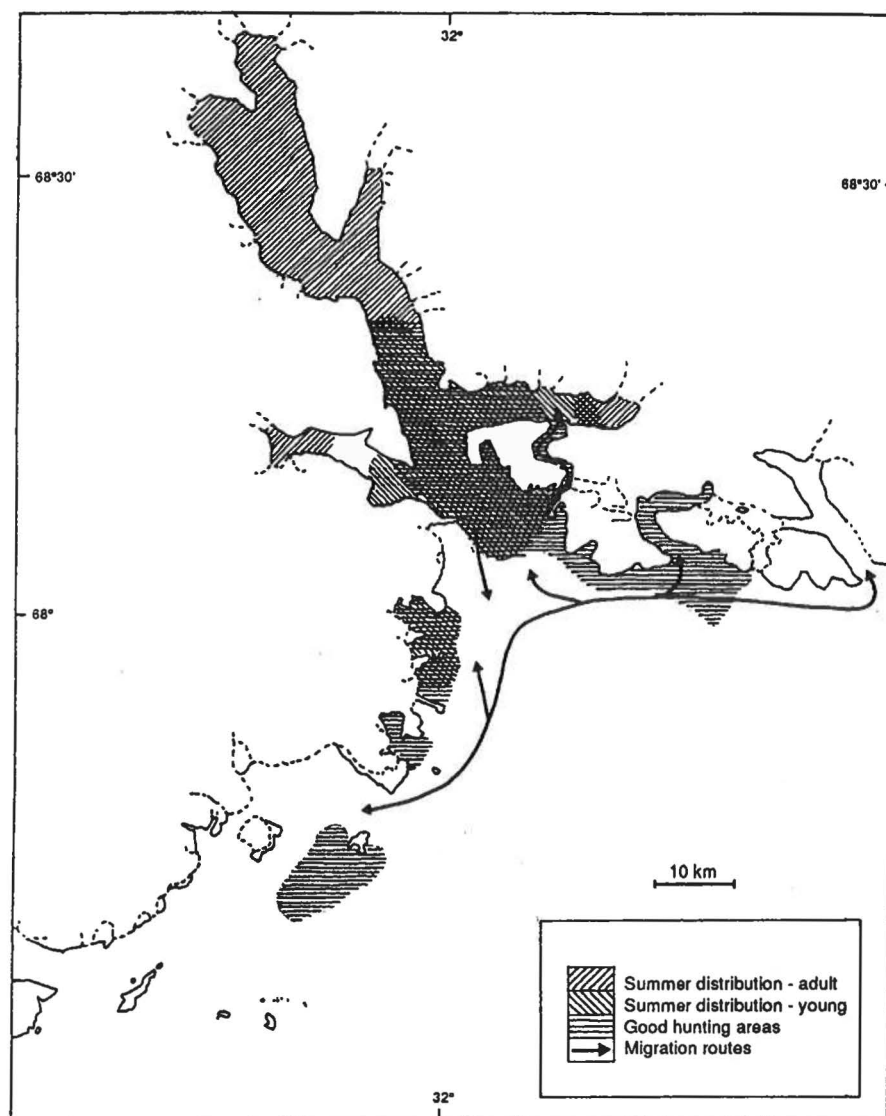
Ringed seal are hunted all year round in Kangerlussuaq, with different hunting methods. In summer, during the open water period, ringed seals on the ice or in the water are hunted from a boat, often quite close to the village. By October or November, when ice begins to form, first in the smaller fjords and later in Kangerlussuaq itself, hunting is done either on the ice or from the ice. Breathing hole hunting begins in autumn, when the ringed seal establish breathing holes in the new ice, and continues until the ice and snow become too thick. When spring arrives, this type of hunting resumes. Nets are set in autumn at the time when the light diminishes. Nets can be used throughout the winter until springtime, although they are not

used when the ice gets too thick. Ringed seals are also shot from the edge of the ice as early as October. This form of hunting is mainly practised from March to May. The interviews did not reveal whether they did any "sneaking" hunting at this time, although this method is normally used during the spring months while the seals lie moulting on the ice (this hunting method is called *uuttoq* or *qatsimalit* hunting, referring respectively to the West and East Greenlandic words for a seal lying on the ice). The different hunting methods mentioned are described in more detail below.

Open water hunting

Open water hunting is mainly done in the outermost part of Kangerlussuaq, and along the coast to Nordre Aputiteeq and Miki Fjord (see Fig. 19, which shows the good hunting places). A few of the hunters have hunted ringed seal at Søkongen Ø during polar bear hunting trips. By far the most exploited area lies opposite the hunters' village at Skærgårdshalvø, bounded by Kraemer Ø and by a line from Jagtlejren to Amdrup Pynt and on to Hængefjeldet. Uttental Sund, which lies close to the hunters' village, is also used by the hunters. Here there is usually a large number of ringed seals in autumn, and Mikkelsen (1933) reported having seen a large number of seals in this sound. Open water

Fig. 19. Ringed seals - summer (June-September). Summer distribution of adult and young ringed seals and their migratory routes. Good hunting places are also indicated.



hunting is also carried out in Watkins fjord. The area in Søndre Boswell Bugt, close to Kap Edvard Holm, is considered to be a good hunting place from August, when the ice disappears. The bay area behind Kap Deichmann is considered to be a good hunting place in October. On 27th July 1991, 275 seals were counted in this bay when the author visited the mining companies exploring the area. The seals were lying on the ice beside openings and tidal channels. Not all the seals were ringed seals; a number of harp seals and a few hooded seals were observed too. Hunting is also considered to be good in Miki Fjord and outside the mouth of the fjord. The last three areas mentioned are not used as intensively as the area opposite the hunters' village, because they are situated farther away from the village.

There is typically open water hunting from June until October, most intensively from the end of July to the beginning of October. One hunter also hunted from his dinghy with an outboard motor in the winter. He pulled the dinghy over the ice to the open water if the distance was short. If the open water was farther out, he pulled the dinghy on a sledge. On New Year's Day he shot 21 ringed seals in two hours.

When a hunter goes open water hunting he moves slowly about in his boat, looking for seals that are either lying moulting on the ice or swimming. At this slow speed it is possible to move within shooting distance of the seals. When a swimming seal has been shot the hunter gets hold of it as quickly as possible; otherwise the seal sinks. Yet this is not the case with the young seals 3-4 months old. The ringed seals are retrieved

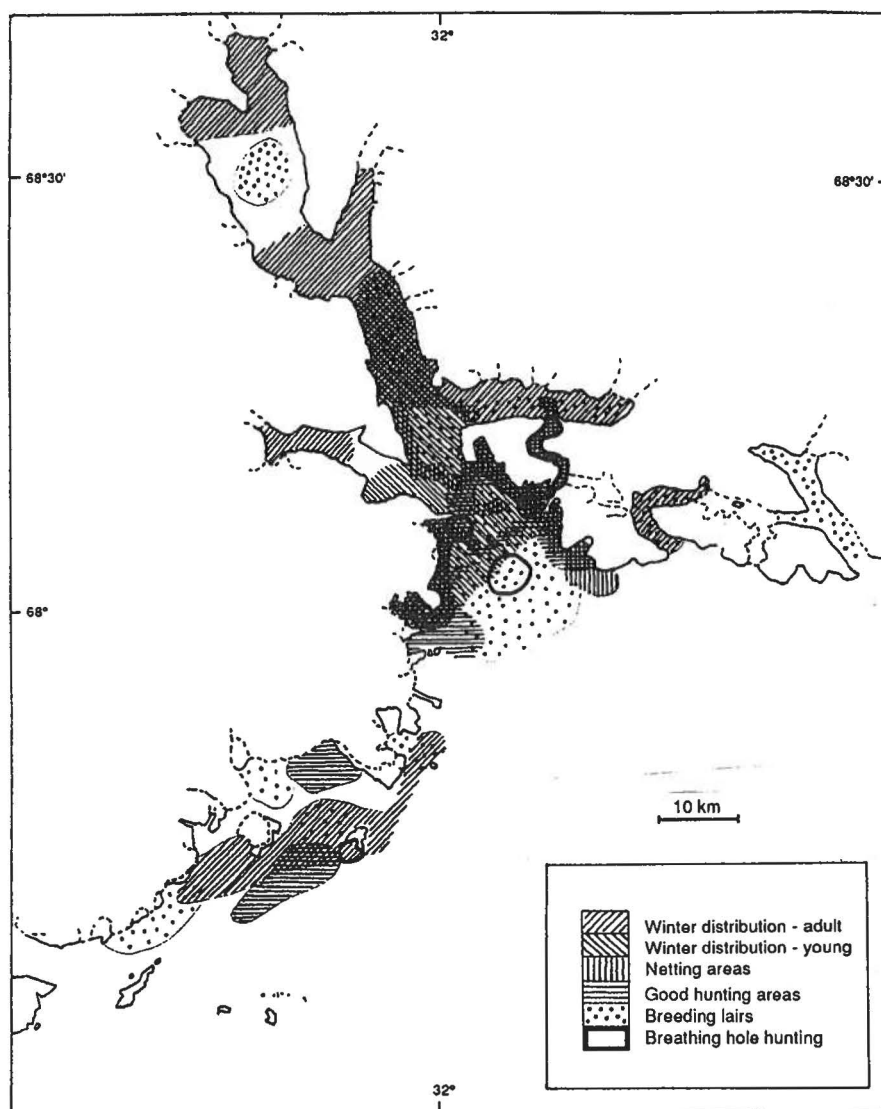


Fig. 20. Ringed seals - Winter (October-May). Winter distribution of adult and young ringed seals, and the location of breeding lairs. The areas used for net hunting and breathing hole hunting are also indicated.

with either a gaff or a jig. Some ringed seals sink and are lost in the summer, but this loss is minimised because a number of the seals shot are yearlings.

Breathing hole hunting

Breathing hole hunting takes place relatively close to the village, more or less in the area where the most intensive open water hunting occurs in summer (see Fig. 20). Uttental Sund and Nordre Aputiteeq are also important places for breathing hole hunting.

Breathing hole hunting starts in October-November when ice begins to form and the ringed seal establish breathing holes. The hunting continues until the ice or snow gets too thick, and then resumes in spring

(April and May) when the breathing holes can be found again. During the winter fast ice can actually be broken up by a piteraqaq. In this case new breathing holes are often established as the ice starts to form again.

Breathing hole hunting usually ceases when the ice is thicker than about half a metre, as it is then hard work to enlarge the breathing hole and haul up the shot seal. Many hunters explained that dogs are able to locate breathing holes with their keen sense of smell, however, it was not clear whether the dogs are actually used in breathing hole hunting. When a breathing hole is located the hunter positions himself with his rifle and waits. When a ringed seal comes up to breathe, the hunter then shoots diagonally down through the ice a little in front of the breathing hole, hitting the seal either in the neck or the head. The shot seal floats

Photo 8. Ulrik Sanimuinaq hunting ringed seals in Kangerlussuaq. Amdrup Pynt in background.



because of its thick blubber layer. Then it is secured with a hook and pulled up on to the ice once the hole has been sufficiently widened. Two hunters can cooperate in breathing hole hunting. Together they walk to the breathing hole, where one of them stays while the other walks on. The idea is to fool the seal into believing that the danger has passed. Nearly half of the interviewed hunters do not go breathing hole hunting because the success rate is very low. There is no information on the number of ringed seals lost using this hunting method.

Net hunting

Nets are mainly used at the mouth of Kangerlussuaq, along the coast of Kap Hammer, across Skærgårdshalvø, Kraemer Ø, Bagnæsset, Amdrup Pynt to Kap Deichmann. The use of nets is also important in Uttental Sund and Watkins Fjord (see Fig. 20). Some hunters set nets in the fjords at Søkongen Ø while they are hunting polar bear. Seal nets are set after the formation of ice in November or December, and can remain in use until May or June. When the snow cover or the ice becomes too thick, e.g. in February, the nets are not set.

A total of 19 out of 23 hunters set nets in Kangerlussuaq. On average, each hunter has nine nets ($\bar{x} = 9.3$; $SD = 13.2$; $N = 19$) within a range from one to twenty nets. The number of ringed seals that a hunter can catch per net is highly variable. The biggest catch was about 100 seals caught in 10-20 nets in one season, and eight seals are caught each day in certain periods



Photo 9. Two shot ringed seals. Amdrup Fjord in background.

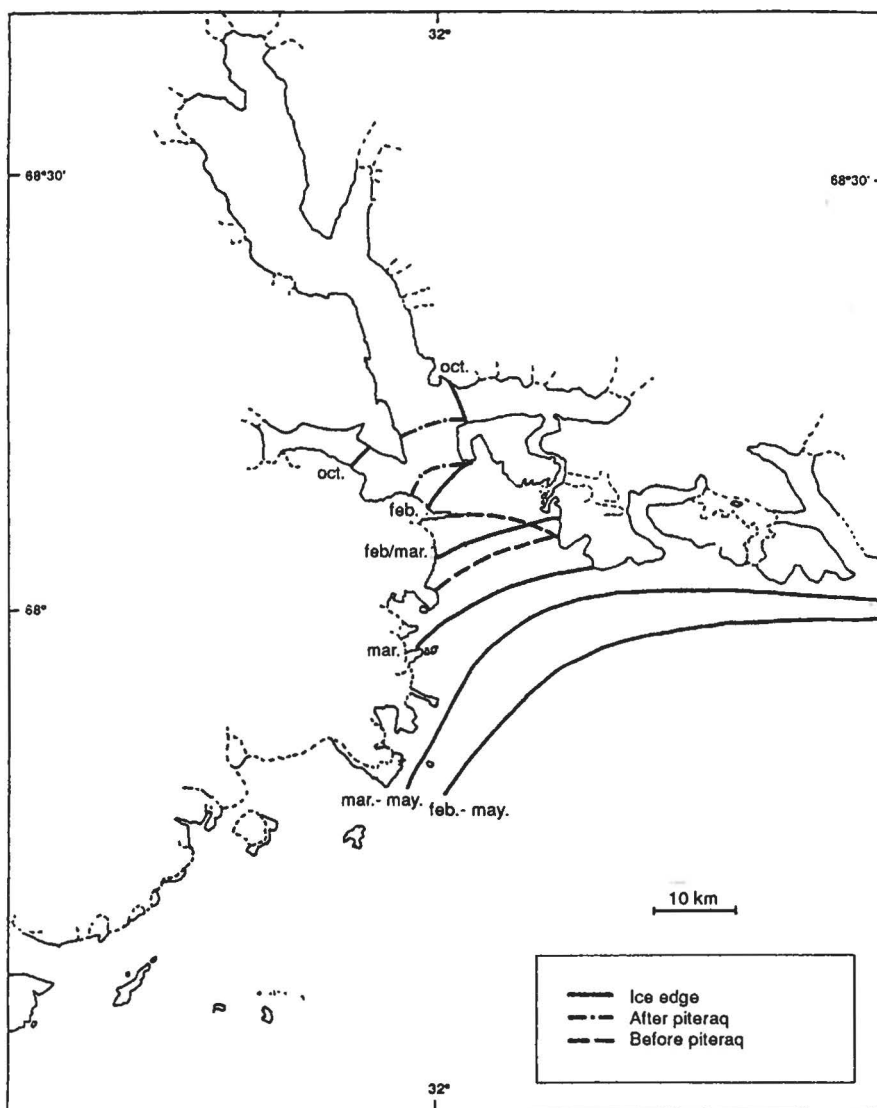


Fig. 21. Ice edge in Kangerlussuaq from October to May. Examples of the position of the ice edge before and after a piteraqa are shown.

using 10-15 nets. In contrast to this, the smallest catch in nets was one seal out of a total of 50-80 seals caught throughout the winter, and five seals caught in three nets out of a total of 250 seals caught over the whole 1990/91 season.

It should be noted that nets can be set in a number of different ways. Some hunters set them across tidal channels, fastening them to the rocks on the coast, while other hunters avoid tidal channels because the nets can easily be lost there. These hunters prefer to set their nets in places where holes have been hewed in the ice. For example they hew three holes in the ice at 2 m intervals and push the net under the ice from hole to hole. It is important that the nets are tended every day, especially from December to March, as many small crustaceans will colonise and quickly eat the

seals. Nets can also be set in breathing holes, e.g. in Watkins Fjord, in holes in the ice, e.g. at Hængefjeldet and near icebergs and pressure ice.

Ice edge hunting

Ice edge hunting is done from the edge of the ice, but the actual location depends very much on the month and the occurrence of piteraqs. The winters of different years also vary considerably. These very variable conditions for ice edge hunting can be seen in Fig. 21. When ice begins to form in October or November, a number of ice edges are formed at the mouth of Watkins Fjord and Amdrup Fjord - and across Kangerlussuaq from Bagnæsset to Kraemer Ø (Geologvig). In the

middle of the winter, from February to May, the edge of the ice is some distance from the coast, sometimes so far off, in fact, that the hunters do not consider it to be the edge of the ice. In the winter of 1987/88 the ice edge was that far from the coast. The ice edge varies between these extremes in the course of the winter. It typically moves farther out as winter progresses, and from time to time it is broken up by a piteraq so that it starts to form closer to the coast again. Fig. 21 shows an example of how the ice edge might look before and after a piteraq.

Ice edge hunting can start as early as October, but is most intensive from March to May. This form of hunting may be associated to some degree with polar bear hunting, which is also most intensive during these months, but this was not stated in the interviews.

When hunters go on an ice edge hunting trip, they travel by sledge to the edge of the ice. A number of the hunters also bring a kayak on the sledge and one of the hunters in the interviews took a small rubber dinghy with him. Seal hunting conditions in particular are quite good where cracks and holes have appeared in the edge of the ice. These conditions are said to be present often at Kap Hammer. Early in the winter or in the period immediately after a piteraq, when the edge of the ice has not yet reached the hunters' village (i.e. when there is still open water opposite Skærgården), the hunters take their sledges through Uttental Sund up to Watkins Fjord, and farther out into Kangerlussuaq to reach the edge of the ice.

Ringed seals that are shot are retrieved either with jigs or with a kayak or the rubber dinghy. Seals are seldom lost in the winter because of their thick blubber layer, but it can happen if the hunter only has a jig at his disposal.

Migratory routes and annual rhythms

Ringed seals moult from May to July, and by August moulting is generally over (Born 1983). After this period many ringed seals migrate out of Kangerlussuaq to the coast. It is not clear if the seals then follow the polar ice southward or go north, since both possibilities were mentioned in the interviews. At the mouth of Scoresby Sund, north of Kangerlussuaq, the seals show a tendency to leave the area during the open water period in August, but it is not clear if this relates to a general outward migration from the whole fjord complex (Born 1983). Many of the young ringed seals remain in the Kangerlussuaq region and some also come to Kangerlussuaq from other areas. During summer a lot of ringed seals have been observed moving through Uttental Sund. By the end of October and early November the ringed seals have returned to Kangerlussuaq, especially when the new ice forms. The distribution in Kangerlussuaq of young and adult seals throughout the year is typically such that adults occupy the heads of the fjords, while the young are seen in the mouths of the fjords (see Figs 20 and 21, which show the distribution in more detail). The reason for this distribution of young and old seals is, according to Born (1983), that older seals search for areas where the ice is more stable so that they can establish breeding lairs. It is highly likely that sexually mature ringed seals establish territories during the breeding seasons and drive young seals off to areas with more unstable ice (McLaren 1958; Frost & Lowry 1981). Despite this typical pattern, young and old seals are often seen together opposite the hunters' village.



Photo 10. Ane Sanimuinaq cleaning the skin of a ringed seal.



Photo 11. Ane Sanimuinaq cutting out white skin (hairless seal skin).

Breeding lairs

Breeding lairs are found anywhere in Kangerlussuaq where there is fast ice, i.e. in Watkins Fjord, Uttental Sund, Miki Fjord, J. C. Jacobsen Fjord, Søndre Boswell Bugt and Nordre Aputiteeq (see Fig. 20). The breeding lairs in Kangerlussuaq are not distributed evenly, but are often found in scattered groups. The hunters often discover the breeding lairs when they travel by sledge because the dogs can smell the lairs. Breeding lairs can also be identified from the fact that the snow usually melts around them.

Most breeding lairs in Kangerlussuaq are found in March and April, and most pups are born in March. According to McLaren (1958) and Smith & Stirling (1975) ringed seals give birth to a single pup in the period from the end of March until the middle of April.

A number of hunters have observed breeding lairs destroyed by polar bears, for instance in Watkins Fjord, at the head of Kangerlussuaq, south of Nordre Aputiteeq and south of Tre Små Øer. The remains of partly-eaten seals were also found in one of these breeding lairs. One hunter stated that the female polar bear with cubs breaks up the breeding lairs and feeds her young with the ringed seal pups. According to Amstrup and DeMaster (1988) young ringed seals under two years old constitute up to 80% of the ringed seals caught by polar bears during spring. Other animals can also benefit from the breeding lairs. A hunter saw a raven take a very small ringed seal pup from the breeding lair opposite the hunters' village. Much of the ice had melted, so the breeding lair was open and the raven must have been able to see the pup inside the lair. Arctic foxes can also take ringed seal pups in a similar fashion to the raven (Dietz 1992, GERI, pers. comm.).

Food preference

Half of the hunters gave information on the ringed seal stomach content. Small crustaceans, ranging from 2 to 5 cm, were the most common food item. Different species of fish were also common in the stomachs. Small polar cod were the most frequently-found fish species, followed by the redfish. In addition to this, remains of redfish were observed in a ringed seal breathing hole. Other fish species occasionally found were Greenland halibut, capelin and Atlantic cod. Capelin was mostly observed in winter. Finally, deep water shrimp and jellyfish were reported.

The ringed seals that occur in the mouth of Scoresby Sund feed mainly on polar cod (Born 1983). According to Pedersen (1930), crustaceans are the main diet of older seals at the head of Scoresby Sund, while younger seals feed on polar cod in particular. Born (1983) assumes that ringed seals feed on polar cod, sculpins and pelagic crustaceans, in varying amounts and mixes during the year. In the Ammassalik district it has been found that ringed seals eat small crustaceans and polar cod, and squid on one occasion (Jensen 1909; Chapman 1934 fide Dietz et al. 1985).

Trade and utilisation

Close to two thirds of the ringed seal skins are usually sold, varying from half to almost all of the skins. The selling price for washed and dried skins, which are purchased by KNI, depends on the quality. In 1991 the selling prices were as follows: DKr 435 (+ DKr 50 bonus) for first-grade skins, DKr 319 for second-grade, and DKr 180 third-grade. The selling prices for salted and wet skins were DKr 180 per skin and DKr 150 per

moulted skin (U. Witthaus 1992, the tannery Great Greenland, pers. comm.). With an average selling price of approximately Dkr 400 per seal skin, and the sale of about two thirds of the skins, the average annual profit to be made on the 200 ringed seals caught is approximately Dkr 50,000 per hunter. Many of the skins the hunters do not sell are used to make kamiks (skin boots). Kamiks that are made for celebrations are made from the white skin (hairless seal skin).

At the hunters' village at Skærgården seal skins were used for children's parkas, skin bags and kamiks. Seal skin is also used underneath skis, making them less noisy and faster. In 1991 skis with seal skin underneath were seen in Isortoq at Ammassalik (F. Kapel 1992, Greenland Fisheries Research Institute (GF), Marine mammals section, pers. comm.). The seal meat is eaten by humans as well as dogs, and the blubber is used as fuel in the house's iron stove and for dog food.

Disturbances

During the interviews the hunters were asked whether they had observed any disturbances of ringed seals in connection with the mineral exploration activities (e.g. by helicopters, ships, rubber dinghies and skidoos). The hunters were also asked whether their own hunting activities disturbed the ringed seals.

The hunters did not have any information concerning possible disturbances caused by helicopters or other aeroplanes.

Only one of the hunters had observed disturbances caused by large ships. However, this hunter did not think that big ships sailing to and from Kangerlussuaq would present a problem to seals in the area. As an example he referred to the vessel *Ejnar Mikkelsen*, which brings hunters up to the hunters' village from Ammassalik, and the supply vessel *Polar Bear* which called at the Aputiteeq weather station approximately three times a season. These vessels did not appear to disturb seals or polar bears.

In the summer of 1989 the geological diamond drilling, especially at Skærgårdshalvø, disturbed the ringed seals a lot. The result was that no ringed seals were seen in Uttental Sund, which is known as an important migratory path in summer, and opposite Skærgården far fewer seals were seen.

According to one hunter, the use of skidoos could cause the ringed seals to disappear from the area. Skidoos should only be used on land.

If a mine was established in the Kangerlussuaq region the hunters were concerned about waste disposal in Uttental Sund and about oil pollution in general.

During the period when there is open water, ringed seal are mainly hunted from dinghies with an outboard motor or motorboats. Apart from the disturbances caused by hunting itself, there are disturbances caused by dinghies with an outboard motor and motorboats going out to the hunting locations. Hunters normally

know how to avoid disturbing the seals, but if there are too many hunters in the area and too many inexperienced hunters, the level of disturbance can also become a problem.

Narwhal (*Monodon monoceros*)

Introduction

"The number of narwhals in Kangerlussuaq is said to be so great that the fjord simply smells of their expirations." This was what Gustav Holm was told in 1884 by the hunters from the Ammassalik district (Dietz et al. 1985). Today, the hunters who come to Kangerlussuaq for the first time say that they have never seen so many narwhals before.

The southernmost distribution of narwhals in Greenland is in the Ammassalik area (Dietz et al. 1985) and their southernmost occurrence there is in Umiivik Fjord, about 200 km south of Ammassalik (Dietz et al. 1994). Narwhals are encountered frequently in Kangerlussuaq all through the year (Holm & Garde 1889; Pedersen 1930). Information regarding narwhals and narwhal flocks in Kangerlussuaq was recorded from 1900 to 1932 (Amdrup 1902a; Chapman 1932 fide Dietz et al. 1985; Iversen 1936; Degerbøl 1937). Information on the occurrence of narwhal in East Greenland has recently been published (Dietz et al. 1994).

Catch

Nearly all of the hunters interviewed - 20 out of 23 - had hunted narwhals in Kangerlussuaq. In the three periods 1951-54, 1966-1980 and 1986-1991, the hunters reported a total catch of 275 narwhals. The number of narwhals that were caught in Kangerlussuaq per season is shown in Table 2. A typical season extends from August in one year to July in the next. The first column gives the total number of narwhals shot, based on information from individual hunters, while the second column gives the total number to the knowledge of only one hunter. The third column represents the totals given by Siegstad (1989). The last column gives the catch of narwhals as stated in the hunting lists (Anon. 1966-1970; Anon. 1966-1971). A season, according to one type of hunting list (Anon. 1966-1970), usually extends from July to June. The 1967/68 season includes only July and August in 1967, and April, May and June in 1968. The 1969/70 season includes only July and August, 1969. From 1966 to 1970 the information for Kangerlussuaq applies to the calendar year 1st January to 31st December (Anon. 1966-1971). In Table 2 numbers are listed under the first year of the season; for example the 1966 calendar year is listed under the 1966/67 hunting season. In addition to this,

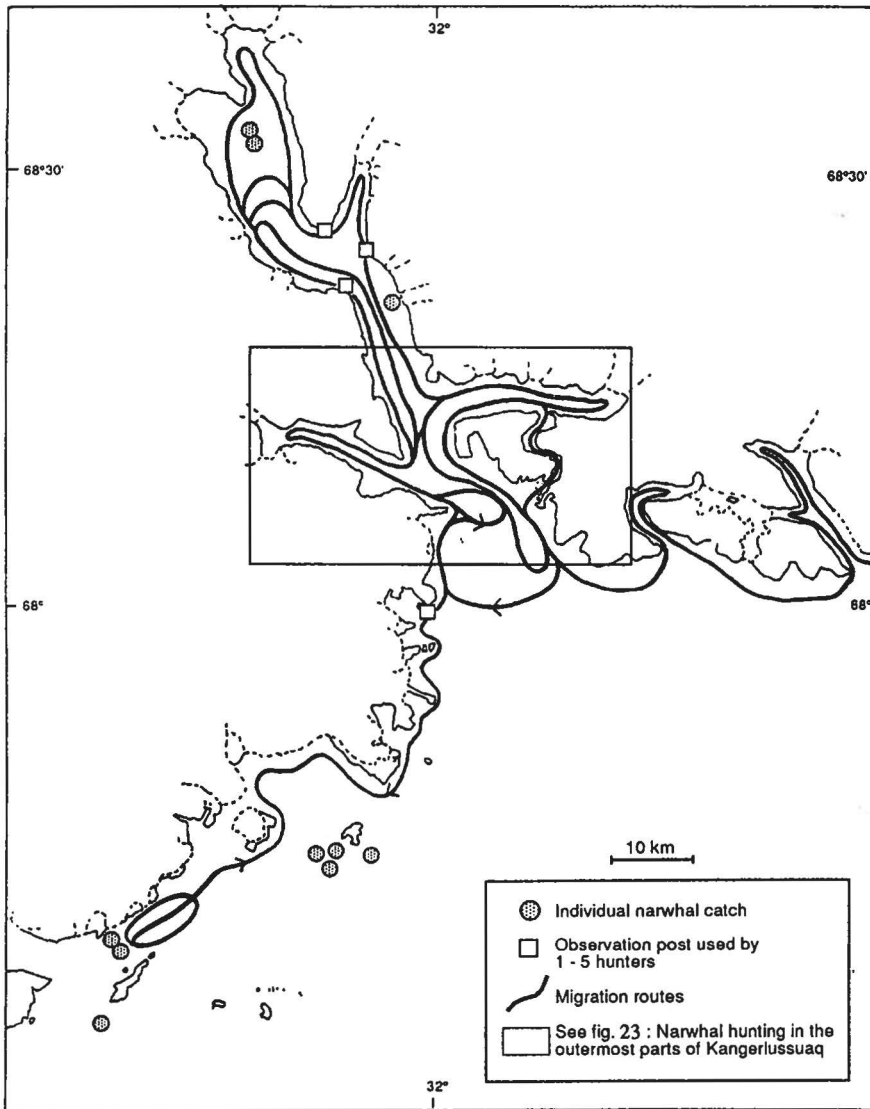


Fig. 22. 1951-1991 narwhal catch; observation posts used and narwhal migratory routes.

about 60 narwhals were caught in the 1970s and 1980s.

No hunters wintered in Skærgården village from 1980 to 1986 or in 1989/90, and although there were hunters in the area from 1975 to 1979, no information is available regarding the narwhal catch. The narwhals caught in the period 1951-1954 were reported by a hunter who worked as a cook at the weather station at Nordre Aputiteeq.

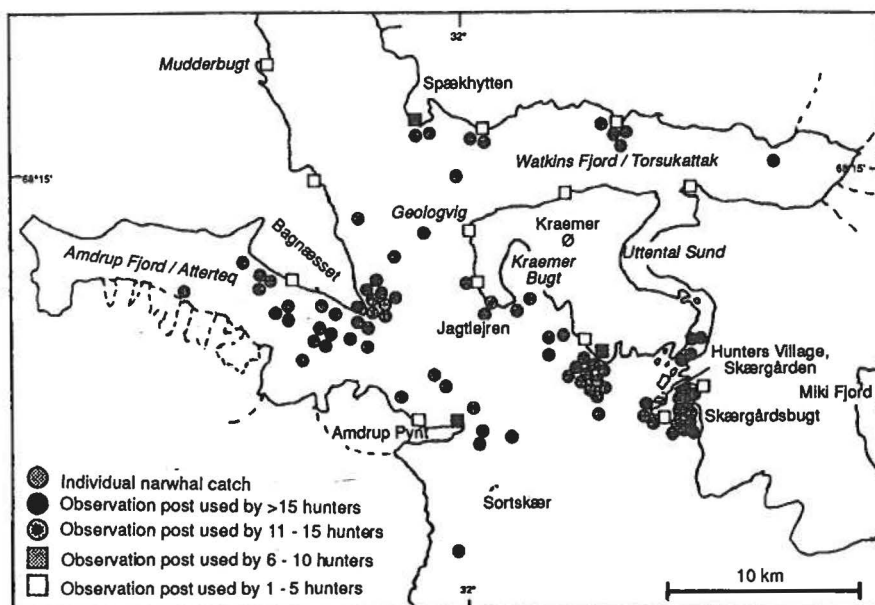
The locations of particular hunting incidents were given for 96 of the 275 narwhals caught in Kangerlussuaq, and for most of these the sex and month of the catch were also given.

Of these 96 narwhals, 81 (84%) were caught from 1989-1991. Figs 22 and 23 illustrate the locations in Kangerlussuaq where the narwhals were caught. It can be seen from Fig. 23 that the majority (90%) were caught in the outermost part of Kangerlussuaq, which

includes Watkins Fjord, Amdrup Fjord and Uttental Sund. Most narwhals were caught in three main areas. Some 20-25% of the narwhals were caught in the area around Bagnæsset, which lies at the northern part of the mouth of Amdrup Fjord. Almost as many (20%) were caught in the area around the hunters' village at Skærgårdshalvø, mainly in Skærgårds Bugt. The third place is in the southern part of Kraemer Ø, where 15% were caught. The great number of narwhals caught here was partly due to one hunter, who started to set nets here in 1991 and managed to catch eight narwhals by the end of July.

An average of 20 to 30 narwhals were caught per season from 1951 to 1991, although there were great variations from year to year. In 1967/68 and 1988/89, 7 and 11 narwhals were caught respectively, while in 1966/67 and 1990/91, 62 and 44 narwhals were caught

Fig. 23. 1951-1991 narwhal catch in the outermost part of kangerlussuaq and the positions of observation posts used.



Season	Total no. of narwhal shot	Total no. given by a single hunter	Catch according to Siegstad (1989)	Catch according to catch lists	
				July-June	Calendar year
1990/91	44				
1988/89	11				
1987/88	21		ca. 20		
1986/87	22		> 30		
1979/80	13	19			
1974/75	ca. 7				
1973/74	9-12				
1972/73	4-5				
1971/72	11-12				
1970/71		ca. 23			6
1969/70	11-12			16	16
1968/69	1		16	25	25
1967/68	8-9		7	19	20
1966/67	14		62	43	42
1951-54	3				

Table 2. Narwhal catch in Kangerlussuaq in 1951-1991.

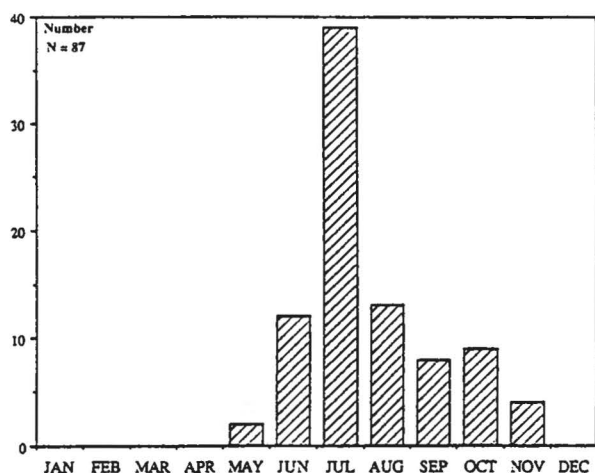


Fig. 24. Narwhals caught between 1966 and 1991 by month (77 of the 87 narwhals were caught in 1986-1991).

respectively. From 1970 to 1980 not more than 20 were caught per year in the whole Ammassalik district, including Kangerlussuaq (Dietz et al. 1985). In Scoresby Sund the catch is estimated to have been between 10 and 20 narwhals per season (Born 1983). When the catches for the whole east coast are combined, a total of 40 to 60 narwhals were caught per season. Narwhals occur in the Atlantic part of the Arctic, both east and west of Greenland, and as far east as Franz Joseph Land and Novaya Zemlya. The latest results from DNA analyses suggest that narwhals from east and west of Greenland probably do not mix, and that there are probably no subpopulations on the east coast (Dietz 1994, GERI, pers. comm.). As the size of the possible eastern population is unknown, it is not possible to say whether a catch of 40-60 narwhals per season is sustainable. With a birth rate of approximately 0.07 (Hay 1984), it can be calculated that the population must consist of at least 600 - 900 individuals, if the actual catch is to be sustainable.

Annual variations in the catch

Information about the month of capture was given for 87 of the narwhals caught. For seven of the narwhals the catch was given for a two-month period, e.g. June/July. In these cases the first month was selected as the month of the catch. The only months for which this has any implications are June and July, when five narwhals were caught.

Narwhals are usually caught from May to November, although the great majority are caught in the summer months. Approximately half the narwhals are caught in July alone, and three quarters are caught in June, July and August.

In the period 1974-1983, most of the narwhals in

the Ammassalik district (in which the Kangerlussuaq catch is included) were caught in July (Dietz et al. 1985). In Ammassalik, in contrast to Kangerlussuaq, many of the narwhals were also caught in August and September, and a number were caught in April and May too. Finally, the season is longer in Ammassalik district, with hunting beginning in February and ending in December.

The main hunting period in Scoresby Sund (from 1974 to 1983 (Dietz et al. 1985)) is in June, although a few narwhals may be caught in July. This is earlier than the main hunting period in Kangerlussuaq. In contrast to Kangerlussuaq, the catch is relatively good in Scoresby Sund in August and September, while narwhals are not hunted in Scoresby Sund in November.

Migratory routes and annual rhythms

When the ice begins to break up in May, narwhals begin to appear in Kangerlussuaq. At Keglen in the mouth of Kangerlussuaq narwhals were seen in May moving in through open water channels in the ice. Some narwhals are also caught in May. When the ice begins to retreat, the narwhals move ever deeper into the fjord complex. During summer narwhals move up and down the coasts of Kangerlussuaq and the adjacent fjords: the Amdrup, Courtauld and Watkins Fjords (illustrated in Fig. 22). From time to time the narwhals also enter Uttental Sund where four narwhals were caught in the southern part. Narwhals are able to continue into Watkins Fjord, but this probably depends on ice conditions in the fjord. As for the fjords to the northeast of Kangerlussuaq, Miki Fjord is seldom visited by narwhals; narwhals are seen in J. C. Jacobsens Fjord, and many are seen entering the next fjord, Ryberg Fjord. In the Søkongen Ø area, too, narwhals are abundant. In Kangerlussuaq, narwhals migrate along the coasts in both directions, and at the mouth of Kangerlussuaq they either return or cross over to the coastal stretches on the other side. One hunter, while rowing out from the village to the area south of Kraemer Ø, heard a large number of narwhals, and when he climbed up onto a chunk of ice he saw around 100 narwhals on their way into the fjord.

When the ice begins to form in the fjords in October-November, the narwhals move out towards the ocean. Some of the hunters suggested that the narwhals spend the winter outside the polar ice in Danmark Stræde, while others believe they migrate northward towards Scoresby Sund. The reason for this is that the narwhals come from the north in spring.

The above description of narwhal migration and annual rhythm accords with what we know about narwhals in the Scoresby Sund area (Born 1983; Dietz et al. 1985). Narwhals are seen along the ice edge south of and across Scoresby Sund from February to April, where some are apparently migrating northward (Born

Photo 12. Narwhal foetus from female caught in August in Kangerlussuaq. Photo of photo by Mathæus Gustav Holm Knudsen, Kuummiit.



1983). During the winter months the narwhals stay in the polar ice (Dietz et al. 1985), not outside it as mentioned above. It has earlier been pointed out that narwhals spend the winter between Iceland and Kap Farvel (Gray 1931 fide Dietz et al. 1985). This is supported by a single observation made opposite Kangerlussuaq on the 21st October 1933 (Bistrup 1924 fide Dietz et al. 1985) and by observations made by the whalers in former days, that narwhals come from the southwest in spring from their presumed winter quarters. On the basis of the many observations of narwhals in April between Scoresby Sund and Svalbard, the wintering areas mentioned above seem doubtful (Dietz et al. 1985, 1994). The wintering areas are probably associated with the polar ice off the east coast of Greenland, and it is possible that they aggregate in certain areas, e.g. opposite Scoresby Sund. This is supported by observations from Scoresby Sund (Born 1983).

Sex ratio and size distribution

Information regarding sex was given for 81 of the 96 narwhals caught. Of these 55.6% were female and 44.4% were male. Close to half (53%) of the males were reported as having tusks, while 11% did not have tusks. No details of the remaining 36% were given. Tusk length was given for fourteen of the males: three of the males had a tusk under 0.5 m, four had a tusk between 0.5 and 1.5 m, and six had a tusk over 1.5 m in length. Two of these tusks were more than 2 m in length, one of these 2.19 m. According to Hay (1984) a male with a whole tusk longer than 1.2 m is sexually mature. At least one male with two tusks was caught -

one long and the other short. At least one female was caught with a tusk that was over 1 m long.

The hunters in Kangerlussuaq offered many observations on the use of the narwhal tusk and ideas about its function. In many ways they agree with the scientists. According to Silvermann (1979) and Hay (1984), the tusks are a secondary sexual characteristic used in connection with aggression and sexual behaviour.

A hunter saw a flock of 30-40 males opposite Skærgårdshalvø in October. There were so many tusks that at first he thought they were pieces of wood floating on the water. The males seemed to be playing with their tusks, crossing them gently or resting them on one another. Another hunter saw something similar at Bagnæsset in June, where five males with very long tusks gently bumped their tusks together. Yet another hunter, who has also seen this "play", suggested that they might have been fighting over a female. Some hunters suggested that the tusk might be used as a weapon. On one occasion, a hunter had felt threatened by a male with a 2 m long tusk. He had also seen a male narwhal steer into another hunter's skin kayak, forcing him to take flight. It could also be used against the killer whale, for example. A hunter told us how a female narwhal was attacked by a killer whale in Scoresby Sund and was saved by two male narwhals that came to help and impaled the killer whale. Another way of using the tusk was for feeding, e.g. for impaling squid, halibut and jellyfish - in the case of squid perhaps such that they were wound around the tusk.

Exclusively male or female flocks are often seen in Kangerlussuaq. This accords well with the observations of Silverman (1979) in Arctic Canada, where narwhal flocks appeared in four categories: males only, females only, males and females mixed, and females with newborn calves and only few males. The large majority of

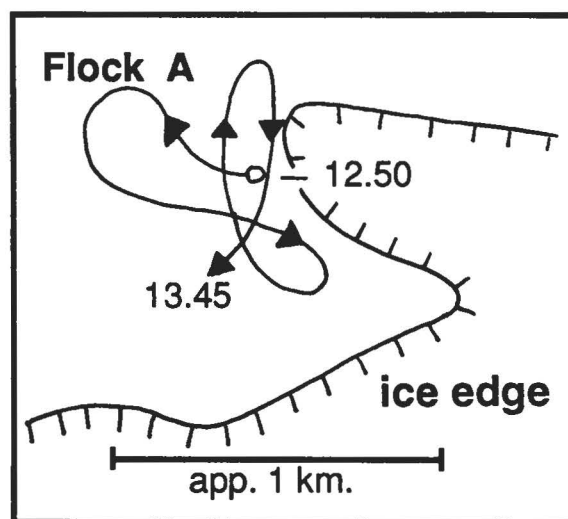
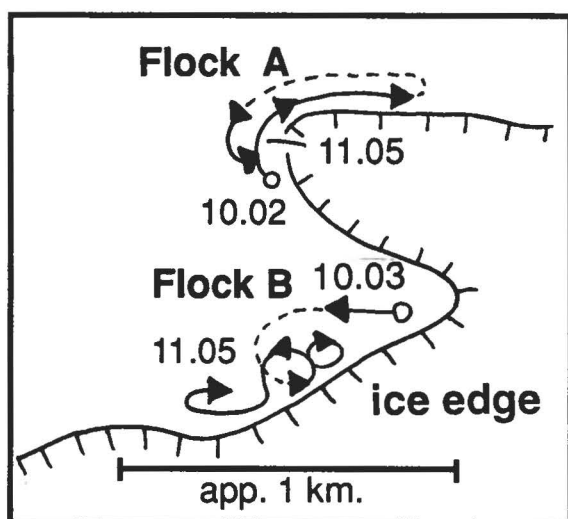


Fig. 25. The sketch shows the movement of narwhals, probably in search of food opposite the ice edge at Kap Deichmann. 28.7.1991. 11.00 am - 2.00 pm (see Appendix 3).

males (82%; $N = 1980$) were classified as "males only", and over half the females (56%; $N = 1221$) were classified as "females only". 25% of the females were seen in groups of "females with new-born calves and only few males".

One hunter speculated as to why more females were caught than males (in this material 56% females). He explained that females do not dive as deep or as long as the males, when they are either pregnant or with calves, so the females are more frequently visible on the surface. Another explanation could be that the male flocks often go farther off shore and are therefore seen less frequently than the "female with new-born calves and only few males" (Silverman 1979). On the other

hand, the hunters selectively hunt males for their tusks. This of course does not apply to net hunting.

On 21st July 1990, six narwhals that had been caught were measured (a straight line from the head to the base of the tail). Five of these were females and one was a male. The lengths of the five females were 310, 327, 380, 395 and 400 cm. The length of the male (which had no tusk) was 450 cm. Sexually mature females and males measure 340 and 390 cm respectively (Hay 1984).

Foetuses and calves

In Kangerlussuaq, both foetuses and calves are seen in the period from May to August.

In June or July a foetus of 25-30 cm was seen, and by the end of June larger foetuses appeared. In July both a small foetus and an almost-developed foetus were seen. The latter was from a female shot between 18th and 20th July 1991 and measured approximately 150 cm. In August a small foetus (30-40 cm, see photo) was seen as well as bigger foetuses.

Gray (1889, fide Dietz et al. 1985) reported narwhals with almost fully-developed foetuses (150 and 155 cm) which were shot on 1st July and 5th July in the sea between Scoresby Sund and Shannon Ø ($75^{\circ}10'N$; $18^{\circ}30'W$). According to Hay (1984) the narwhals give birth in July and August, and the calves are about 160 cm at birth.

Small calves are seen as early as May, and calves are seen during the summer until September. In June a calf of two metres was shot.

The earliest reported sightings of calves in the area between Scoresby Sund and Svalbard were from the beginning of June and July (Dietz et al. 1985). A new-born calf was seen in the same area on 15th July. A suckling calf was seen on 20th July by Manby (1822, fide Dietz et al. 1985), however, the position of this sighting was not mentioned. According to one of the hunters a narwhal calf may suckle for up to three years, while Hay (1984) stated that calves can suckle from their mother for over twelve months.

Food preference

Half of the hunters interviewed provided information on narwhal food preferences. The most abundant food item seems to be squid up to about 20 cm in length. Small Greenland halibut were also often found in the stomachs, while small redfish occurred occasionally. Shrimps up to 10 cm in length were found, and some believed shrimps to be the narwhals' only food. Finally, redfish, starfish and jellyfish were reported.

According to Born (1983) the summer diet consists mainly of polar cod, together with Greenland halibut,

Photo 13. Tobias Boassen and Josef Ignatiussen on their way to hunt narwhals at Bagnæsset. Amdrup Fjord in background.



squid, and pelagic crustaceans. Isachsen (1925, fide Dietz et al. 1985) found remains of fish, squid, and worms in the stomach of a narwhal that was shot south of Scoresby Sund in October. According to Dietz et al. (1985) narwhal stomachs contain mainly squid and crustaceans.

The information provided by the hunters in Kangerlussuaq accords well with the available literature on the subject. However, there was no mention of polar cod in the stomachs of narwhals caught in Kangerlussuaq. Similarly, the narwhal diet reported in the literature did not include redfish, starfish and jellyfish.

Behaviour

During a visit to the mining companies' drilling sites at Kap Deichmann on 28th July 1991, 2-3 flocks of narwhal were sighted. They were kept under observation from 10 to 11 a.m. and from 1 to 2 p.m. During this period the narwhals remained along the edge of the ice, which stretched in an S-shape from Kap Deichmann to Den Lave Pynt. As can be seen from Fig. 25, the narwhals moved in circles or small loops during the observation period, probably actively searching for food. The diving rhythm of the flocks was monitored



Photo 14. Four narwhals caught in nets at Kraemer Ø by Ulrik Sanimuinaq.

Photo 15. Ane and Ulrik Saniuinnaq cutting mattak from narwhal at the hunters' village, Skærgården.



from the observation post with binoculars and a wristwatch. The observation post was approximately 500 m above sea level at a distance of 5-6 km from the flock. From that distance it was difficult to identify individual narwhals, but it was easy to see the dark flock against the light background water. On the basis of 27 periods when the flocks dived underwater and 31 periods when they were at the surface, it was estimated that a narwhal flock searching for food spends an average of about four minutes underwater and slightly less than one minute at the surface. The ratio of time spent underwater to time spent at the surface is 5:1 (see Appendix 3).

In Arctic Canada a female narwhal and her calf were observed to be diving deep in search of food at the ice edge in a deep fjord. The average period spent underwater was 898 ± 362 secs. ($N = 10$) and the average period spent on the surface was 212 ± 102 secs. ($N = 17$) (Silverman 1979). These diving periods were considerably longer than those observed in Kangerlussuaq. However, the underwater/surface ratios in Kangerlussuaq and in Arctic Canada were not so different, i.e. 5:1 and 4.2:1 mins. respectively.

In the Thule region in North West Greenland, the diving rhythm of *rapidly migrating* narwhals has been observed. In this case the average period spent underwater was 264 ± 168 secs. ($N = 19$) and the average period spent on the surface was 117 ± 128 secs. ($N = 13$). The ratio here is 2.3:1 (Born 1992, GF's Marine mammals section, pers. comm.).

Hunting methods

When a hunter goes on a narwhal hunt, he goes to sea in a motorboat or dinghy with an outboard motor, often

taking along a skin or fibre-glass kayak. The hunters go to one of the 24 observation posts shown in Figs 22 and 23. The most popular of these posts is Bagnæsset at the mouth of Amdrup Fjord. It is used by seventeen of the hunters, and is described as being the best place in the summer, from July to August. It is further said to be a good place in December, presumably if there is an ice edge there at that time. The observation post on the opposite side of Kangerlussuaq on Kraemer Ø is the next most popular site, used by eleven of the hunters. This place is used if there is so much ice in Kangerlussuaq that one cannot get over to Bagnæsset. Not as many narwhals are seen from here. The third-best places are located at the point of Amdrup Pynt and at Spækpynten, at the mouth of Watkins Fjord. Spækpynten is said to be a good place in December. These places are used by eight of the hunters. The southern point of Kraemer Ø, not far from the hunters' village, is used by six of the hunters and is described as a good place in the spring. This was where one hunter set his nets in 1991. Other observation posts are used by one to five hunters, and half of all the posts are only selected by one hunter. Fig. 23 shows that the narwhal catch is not surprisingly high at three of the five highest-rated observation posts.

From the observation posts narwhals are often seen relatively close to the coast. When narwhals have been spotted, the hunter sets out after them in his kayak or boat. Ten of the hunters use kayaks. This was the case with both present-day hunters and hunters who had been active in the past. Just as many hunters use skin kayaks as fibre-glass kayaks, but there is a tendency these days for the hunters to buy fibre-glass kayaks so they have both types. The narwhals are harpooned and afterwards shot with rifles. A few narwhals are still caught with a harpoon alone. One hunter could not

Photo 16. Bianco Sanimuinaq eating mattak.



use a throwing board because it was too difficult a tool to handle. Whether or not the other hunters use throwing boards and to what extent is not clear, as the question was not a part of the interview-study. Ten of the hunters usually chase narwhals with motorboats or, less frequently, with dinghies with an outboard motor. When they travel at low speeds, it is possible to get close enough to harpoon the narwhals and to shoot them afterwards. The hunters preferred this method of hunting because they found the kayak too dangerous, too difficult to use with a bad back, or they became dizzy in it. Six hunters shoot narwhals with a rifle only and afterwards secure them with a jig or a gaff. With a boat, narwhals can be chased ashore, after which the beached whales are shot, or they can be shot from land when they swim close to the coast.

Net hunting was first used in the Kangerlussuaq region in the 1987/88 hunting season, but was not successful until the 1990/91 season. In July 1991, eleven narwhals were caught in this way. Five of the hunters interviewed had set nets at Keglen close to Nordre Aputiteeq, at Bagnæsset and at two places at Kraemer Ø.

We watched a net being set at the southern point of Kraemer Ø. It was a nylon net 30-40 m long and 6-7 m deep, with a mesh size of approximately 35x35 cm. The net was attached to a thick nylon rope which was held afloat by 6-7 floats. It was held approximately 1 m below the surface. A number of small stones were attached to the bottom of the net to ensure that it would remain open. The net was fastened to the rocks at one end and anchored out in the water at the other end with a large stone. The tidal movements fairly quickly pushed the net closer to the coast, with the positive effect that floes of ice slipped off along the nylon rope. The drawback was that instead of covering 30-40 m

perpendicular to the coast, the net only covered 15-20 m. However, this apparently did not prove to be a great problem as eight narwhals were caught in this net from 21st-29th July. On 26th July, while the net was being set, six narwhals were discovered lying still on the surface approximately 30 m away. They were 5-10 m off the coast. A short time afterwards they dived and disappeared. The motorboat was then used to try and chase the narwhals into the net, but without success.

The hunters were asked whether any of the narwhals they hit during a hunting trip were lost. The answers ranged from "none lost" to "just as many lost as caught". If there are too many ice floes in the area, the narwhals often slip away either under the ice or between the ice floes. In many cases the narwhal takes the harpoon and float with it. One hunter told us that his father harpooned a narwhal that escaped, but three years later another hunter caught the same narwhal with his father's harpoon point still in it.

The hunting methods employed in Kangerlussuaq correspond to the methods used in Thule but are different from those used at Scoresbysund. In contrast to Kangerlussuaq, where kayaks and harpoons are still used extensively, at Scoresbysund the narwhals are shot with rifles either from the edge of the ice or from boats. The use of kayaks and harpoons ceased at the beginning of the 1970s except for one hunter (Born 1983).

Trade and utilisation

The value of a narwhal tusk depends on the weight and the intactness of the point. In 1991, the selling price was Dkr 725 per kg for an entire tusk and Dkr 200 per kg for broken tusks (K. Skamriis 1992, KNI in Ammassalik, pers. comm.). Many of the hunters



Photo 17. Ulrik Saniuiniaq and Niels Grann eating mattak and dried meat from narwhal.

give the tusks away, often to their families. A hunter who had been in Kangerlussuaq in the late 1960s and the early 1970s had used many of them himself, for example to make harpoons.

Ammassalik municipality has laid down recommended prices for the mattak (narwhal skin) at "Bræd-tet", the local market place for hunters and fishermen. For mattak without blubber attached, the selling price in 1991 was DKr 90 per kg, and for mattak with blubber the price was DKr 60 per kg (Skamriis 1992, KNI in Ammassalik, pers. comm.). Many of the hunters give mattak away to families and friends after the hunting season. Mattak from narwhals caught in the middle of

the summer is kept out in seawater or buried in snow patches to preserve its quality.

Narwhal meat is normally not sold, but is eaten fresh or dried by humans and dogs. Some people use most of the meat as dog food.

Disturbances

The interviewees were asked whether they had observed any disturbances of the narwhals in connection with the mineral exploration activities (e.g. by helicopters, ships, rubber dinghies and skidoos) in the area.

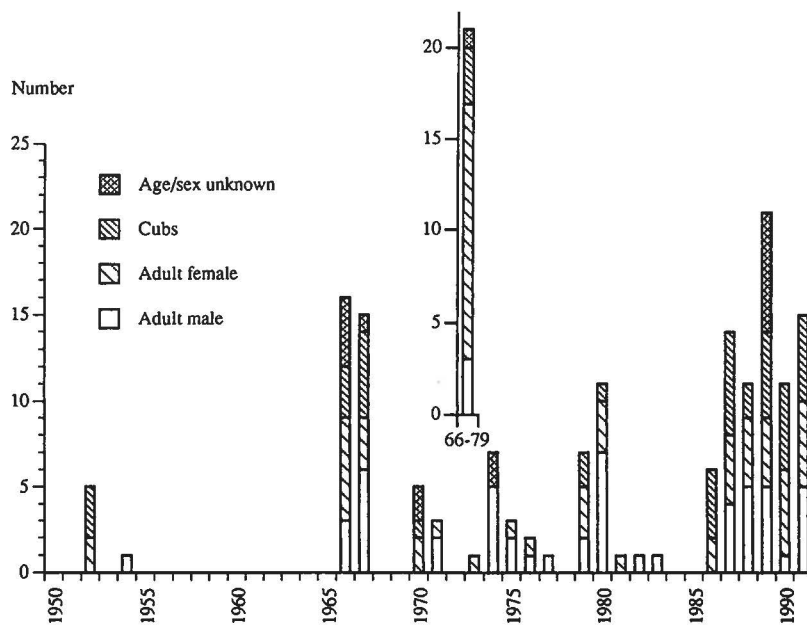
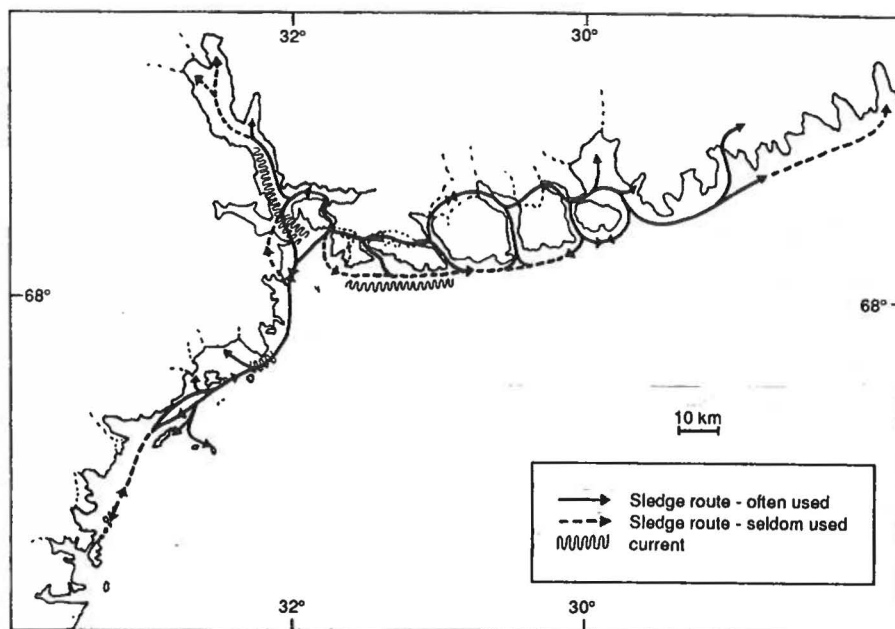


Fig. 26. The annual distribution of 162 polar bears which were shot and 17 seen (adult males, females and young) in 1951-1991. Of these 179 polar bears 21 were shot/seen in the periods from 1966 to 1979.

Fig. 27. Sledge routes for polar bear hunting trips, and places with currents under the ice.



The general opinion on low-flying helicopters was that they do cause narwhals to dive or move away from the fjord. High-flying helicopters, on the other hand, did not appear to affect narwhals. This was confirmed by a Greenland helicopter pilot, but unfortunately no information was given on the altitude at which no disturbance occurred. No disturbances were observed from the Twin Otters which flew people and supplies from Iceland, probably because of their high flying altitude.

When asked about the effects of large ships in the area, a hunter referred to the research vessel *Adolf Jensen*, which conducted biological background studies in Kangerlussuaq around Bagnæsset on the 12th and 13th August 1990 (Glahder 1990). During the period when the *Adolf Jensen* was in the area, no narwhals were observed, and narwhals were not sighted until the 14th August, when the research vessel had entered Miki Fjord. Otherwise only a few ships have visited the area in past years. Two supply vessels from Iceland have entered Uttental Sund and Miki Fjord respectively, but no disturbances were reported in connection with these calls. The general opinion was that ships could disturb narwhals in their direct route or if there was heavy traffic, but that otherwise they were probably not a problem. One hunter did not think a harbour in the area would cause much disturbance, and referred to the Sermilik Egede and Rothe Fjord, into which the narwhals migrate despite the position of Ammassalik harbour. Yet the mouth of the fjord is approximately 20 km from Ammassalik.

Most hunters did not believe a mine on land would cause the narwhals to disappear, but one of the hunters believed that drilling on shore would frighten the

narwhals farther out to sea. The greatest fear was that the area would be polluted with oil and chemicals such as cyanide.

Finally, the hunters were asked if their own motorboats and dinghies with an outboard motor disturbed the narwhales in any way. Dinghies caused more disturbance than motorboats, and speed was an important disturbance factor. At low speeds the hunters were able to come within 25 m or less of the narwhales, close enough to harpoon them. At high speeds most of the hunters claimed that the narwhals were frightened away 100 to 500 m ahead of the boat. A boat that bumped into an ice floe would cause more disturbance than a propeller.

Polar bear (*Ursus maritimus*)

Introduction

In August 1932 several polar bears were observed at Skærgårdshalvø and on Kraemer Ø; and "bearpaths" were described between Watkins Fjord and Miki Fjord, i.e. at Vandfaldsdalen and Sødalen (Degerbøl 1937). Finds of teeth and other skeletal parts in house ruins show that polar bears were also common in the area in the past (Degerbøl 1937).

Of the 23 hunters interviewed, 17 had hunted polar bears. The remaining six hunters contributed information on polar bears and their footprints. Information was provided for a total of 179 polar bears, of which 162 were shot and 17 were seen but managed to escape. The majority of these polar bears were seen or shot in 1951-1954, 1966-1980 and 1986-1991 (Fig. 26).



Photo 18. Polar bear paw.

Hunting trips

Polar bears are hunted within the area bounded by latitude 67°30'N and 68° 30'N and longitude 33°00'W and 28°00'W.

In the spring, from February to May, the hunters travel by sledge either to the north east, where the longest journeys reach Kap Vedel (approximately 200 km from the hunters' village), or to the south west, where the journeys can go as far as Agga Ø (approximately 120 km from the village).

The northeastern sledge journey normally ends up at the area around Søkongen Ø, and most often the inland route from fjord to fjord over the glaciers is used (Fig. 27). The coastal stretches may be difficult and dangerous to follow because of areas where the ice is weakened by strong currents flowing under it, e.g. at Hængefjeldet and at Kap Hammer. Opposite J. C. Jacobsen Fjord, too, the hunters may encounter open water. The inland route takes the hunters into Uttental Sund, and then continues east over Forbindelsesgletscher to Miki Fjord. At the head of Miki Fjord they travel over the glacier and down into the westerly arm of J. C. Jacobsen Fjord. From this point the hunters have a choice of either moving out of the fjord and along the coast or going over Schjelderup Gletscher at the head of J. C. Jacobsen Fjord and into Ryberg Fjord. The glacier can then be followed from the middle of this fjord on to J. A. D. Jensen Fjord, or the hunters can leave the fjord and move to the coast. Søkongen Ø is reached by following J. A. D. Jensen Fjord, and once there they can go around the back of the island to Nansen Fjord. Open water may be encountered around Søkongen Ø. The hunters can also follow the coast up to Kap Vedel from Søkongen Ø. According to the interviews, this was the longest hunting trip from the

Skærgården hunting village, and had been made in March 1991. If the condition of the sledge route is good, the hunters can make it to Søkongen Ø within 24 hours.

The southwestern sledge journey often ends at the area around Nordre Aputiteeq and Fladø, or even farther down at Tre Små Øer "three small islands": Deception Ø, Ittutarajik and Patuulaajivit. If the ice edge lies near the mouth of Kangerlussuaq, the fjord can be crossed from the hunters' village to Kap Deichmann or farther south to Barberkniven, after which the coast is followed. At some places along this route there may be currents under the ice, e.g. opposite Kap Edvard Holm. If the edge of the ice lies farther to the north, for example between Amdrup Pynt and Kraemer Ø, the hunters can either be ferried over to Kap Deichmann by motorboat and then continue by sledge along the coast, or go by sledge back around Kraemer Ø. This route goes through Uttental Sund, out of Watkins Fjord and over to Amdrup Pynt. If the coast cannot be followed at this point, the hunters can go over the glacier and then resume following the coast a little north of Kap Deichmann.

The hunters normally leave together in groups of 2-5 sledges. However, it is not unusual for hunters to travel alone as far as Søkongen Ø. On one occasion ten sledges left together. A dog team usually consists of 10-11 dogs, with a range from eight to thirteen dogs.

Sledge journeys cease in June or July, depending on the state of the sledge routes. In these months the ice can be so decayed that it is not possible to travel by sledge, by dinghy with an outboard motor, or by motorboat.

From July to November, most often in September and October, the hunting journeys to the north east and south west are made in dinghies with an outboard

motor or motorboats. The polar bears shot in the summer are usually a by-catch during narwhal and seal hunting.

Catch regulations

The existing regulations for polar bear hunting are rather unusual in the region around Kangerlussuaq. The border between Tasiilaq municipality and Ittoqqortoormiit municipality runs through the middle of Kangerlussuaq, and these two municipalities have different hunting regulations. According to the Home Rule Government (Anon. 1988a), all polar bears (excluding single adult males) north of Kangerlussuaq (Ittoqqortoormiit municipality) are protected from 1st July to 31st August, while south of Kangerlussuaq (Tasiilaq municipality) they are protected from 1st August to 30th September. In the areas north of Kangerlussuaq, hunters are permitted to hunt young polar bears over twelve months old as well as the adult females that accompany them, outside the above-mentioned protection periods. In areas south of Kangerlussuaq on the other hand, young polar bears up to two years old and their mothers are protected. In the whole Kangerlussuaq region it is forbidden to disturb and dig up hibernating polar bears.

The decision to preserve all polar bears during the summer months (1st June to 31st August) and female bears with cubs less than two years old all year round, was adopted in January 1975 (Anon. 1974). These regulations were changed in 1976 so that only young polar bears less than one year old and their mothers were protected all year round, while other polar bears were protected from 1st July to 31st August (Anon. 1976). In 1978 the regulations were changed again so that all polar bears south of Kangerlussuaq were protected from 1st August to 30th September, while polar bears north of Kangerlussuaq were still protected from 1st July to 31st August. Finally, in 1988, the existing rules were introduced.

Polar bear catch

As mentioned earlier, information has been gathered on 162 polar bears shot and 17 observed over a 40-year period from 1951 to 1991. The location, sex and size of the bears that were shot can be seen in Figs 34 and 35. Table 3 shows the number of polar bears shot in the period between 1951 and 1991 according to different sources. The total number of polar bears shot refers to the bears the hunters told us of during the interviews. A hunting season usually extends from August one year until July the following year. The 162 successful catches included three polar bears that were shot in 1981, 1982 and 1983 respectively, and another 21 that were shot between 1966 and 1979. The information on catches in the seasons from 1966/67 to 1969/

70 was based on the catch lists (Anon. 1966-1970). A season in these catch lists goes from July one year to June the next. The 1967/68 season included only July and August in 1967, and April, May and June in 1968. Similarly, the 1969/70 season included only July and August 1969. From 1966 to 1970 the polar bear catch was also recorded in the catch lists for the calendar year, i.e. 1st January to 31st December (Anon. 1966-1971). In Table 3 the catch per calendar year is listed under the first year of the season, e.g. the 1966 calendar year is listed under the 1966/67 hunting season. Finally, Table 3 also contains information derived from Siegstad (1989).

It is not possible to say how many polar bears were shot between 1951 and 1991. However, an estimate derived from this interview-study is somewhere between 300 and 600 animals. The assumptions on which this estimate is based are discussed below.

According to the hunters interviewed and Siegstad (1989), a total of 95 polar bears were shot between 1986 and 1991. This figure is presumed to be close to the actual figure.

According to the different sources available, 143-164 polar bears were shot in 1966-80. Of these, 108 were shot in 1966-69 (Siegstad 1989), or approximately 36 per season. If this catch level (i.e. 36 bears per season) was maintained throughout the period from 1966 to 1980, then the total catch over the years would approximate 500 polar bears. If it is assumed that the catches that were mentioned in the interview-study represent about 30% (31:108, see Table 3) of the total number, then the total catch should be around 300 (87 polar bears shot, according to the interviews, multiplied by 108/31). If polar bears shot according to the two catch lists are representative of the whole period 1966-1980, then the total catch is somewhere between 200 and 300.

Finally, in the period 1951-54, the hunter at the Aputiteeq weather station shot six polar bears himself and the rest of the personnel shot fourteen.

Thus the total number of polar bears shot in the whole period can be estimated at between 300 and 600 (20 in 1951-54 + 200-500 in 1966-80 + 95 in 1986-91).

Annual variations

Of the 162 polar bears shot, 153 could be matched with a particular month. For 18 polar bears this was not quite true, as they were shot within a two-month period, e.g. February and March; in these cases the first month was chosen. Moreover, exact dates were given for many of the catches.

Over half the polar bears were caught in March, April and May (Figs 28 and 29), and about 25% of these were caught in March. In the rest of the months, excluding November, the monthly percentage of the total polar bears shot was approximately 5%. Male bears were mostly shot in March and April, although there was

Season	Total no. of polar bear shot	Catch according to Siegstad (1989)	Catch according to catch lists		Total no. of polar bears seen but not shot
			July-june	Calendar year	
1990/91	26				
1988/89	11				11
1987/88	11	14			
1986/87	18	44			1
1979/80	15				1
1978/79	2				
1977/78	0				
1976/77	3				
1975/76	0				
1974/75	1				4
1973/74	5				
1972/73	1				
1971/72	0				
1970/71	3			4	
1969/70	5		0	18	
1968/69	0	18	21	3	
1967/68	0	52	2	28	
1966/67	31	38	38	12	
1951/54	6				

Table 3. Polar bear catch in Kangerlussuaq in 1951-1991. The number of polar bears seen but not shot is also given.

also a small peak in August. The graph curves for catches of females and young polar bears resemble each other. Females and young bears were mainly shot in March and May, with a drop in April. For the rest of the year the catch was more variable for them than for males (Fig. 29).

It is thought that in recent years there has been a change in the polar bear catch compared with earlier years. The material has therefore been broken up into two periods; the first from 1951 until 1983 (primarily 1966-1980), and the second from 1986 until 1991. During the first period 96 polar bears are reported to have been shot, and during the second period 66 were shot.

The polar bears which were shot during these two periods are distributed differently over the different seasons. From 1986 to 91 there are distinct peaks in

the catch in spring and autumn and a marked drop during the summer months, from July to August (Figs 30 and 31). From 1951 to 1983 there is a distinct peak in spring but no peak in autumn. In addition, a relatively large number of polar bears were killed during the summer months in this period (Figs 32 and 33). If the curves for the total number of polar bears shot are split up into separate curves for adult males, adult females and young bears, it can be seen there is a spring and an autumn peak for all three groups in 1986-91 (Fig. 31) while only the curve for adult males shows a peak in spring and autumn from 1951 to 1983. Adult females, and to some degree their young, were probably shot all year round during this period (Fig. 33).

From 1951 to 1983, three quarters of all the polar bears shot were hunted in the Kangerlussuaq area, i.e. Kangerlussuaq and the adjacent fjords as well as J. C.

Fig. 28. Season, sex and age distribution of 167 polar bears shot and seen in 1951-1991.

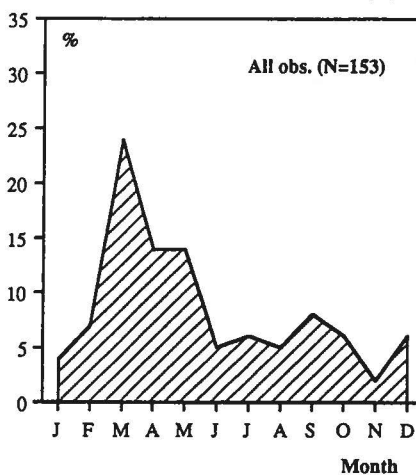
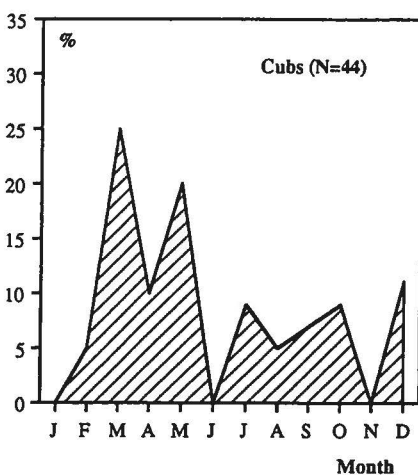
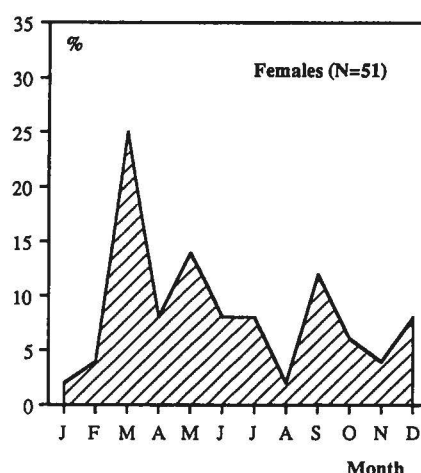
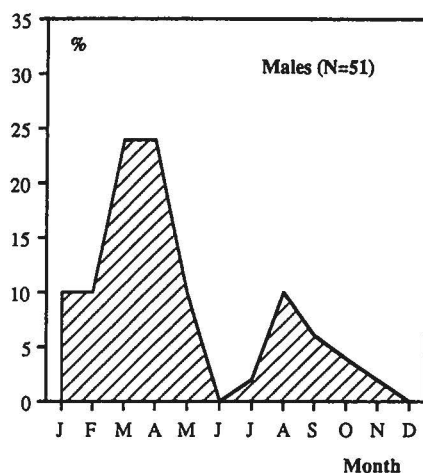
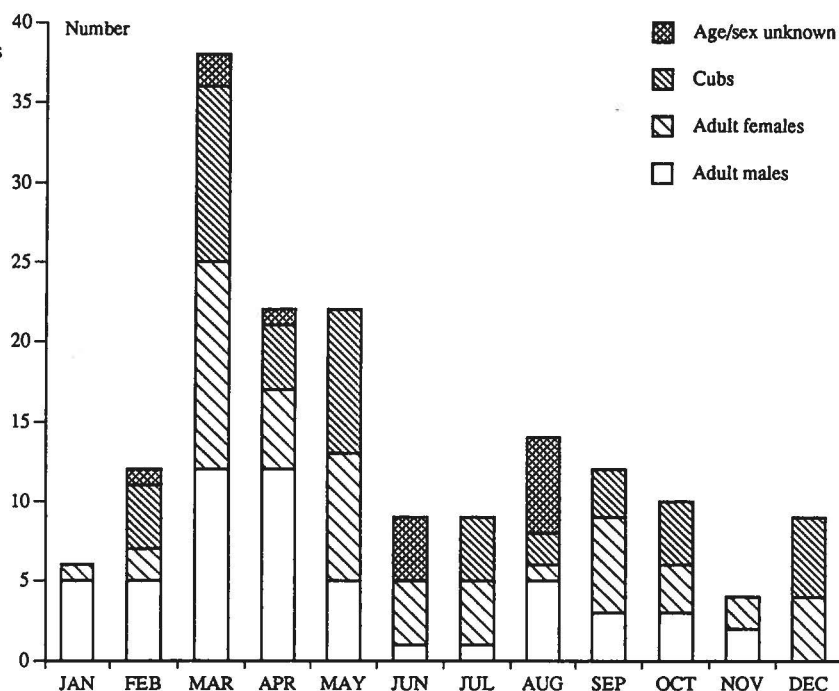


Fig. 29. Percentage of male (adult), female (adult) and young polar bears shot in different months of the year in 1951-1991.

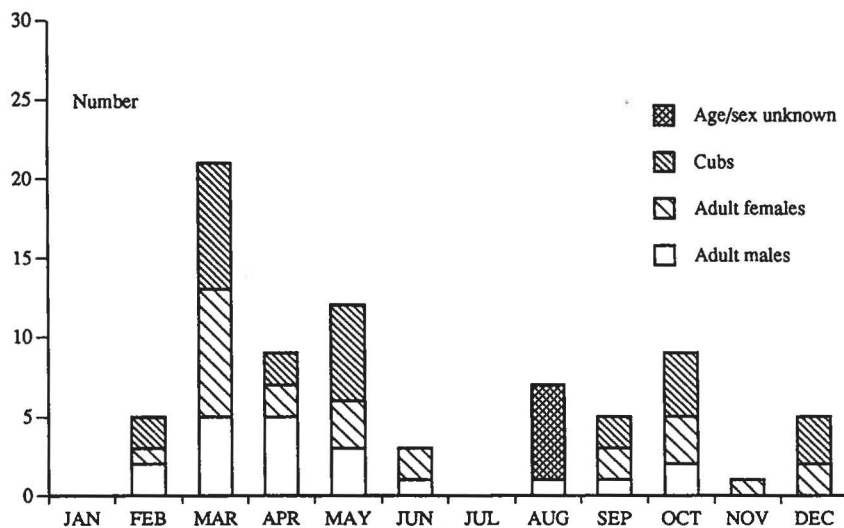


Fig. 30. Season, sex and age distribution of 77 polar bears shot and seen in 1986-1991.

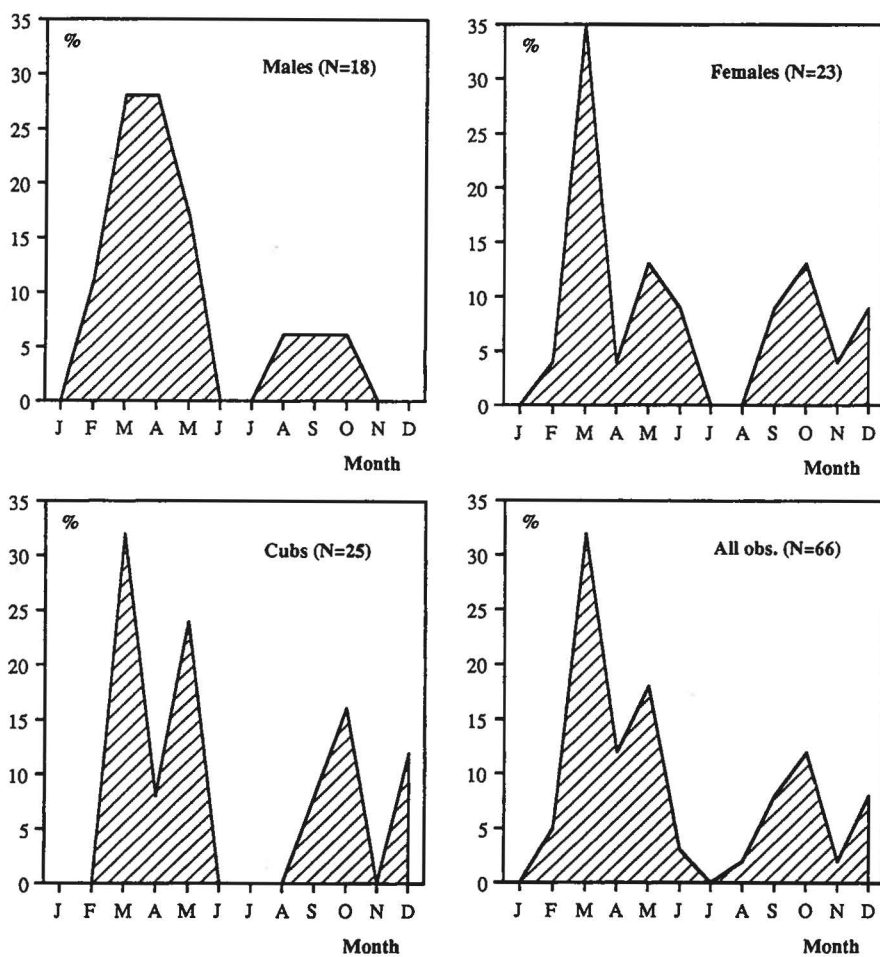


Fig. 31. Percentage of male (adult), female (adult) and young polar bears shot in different months of the year in 1986-1991.

Fig. 32. Season, sex and age distribution of 90 polar bears shot and seen in 1951-1983.

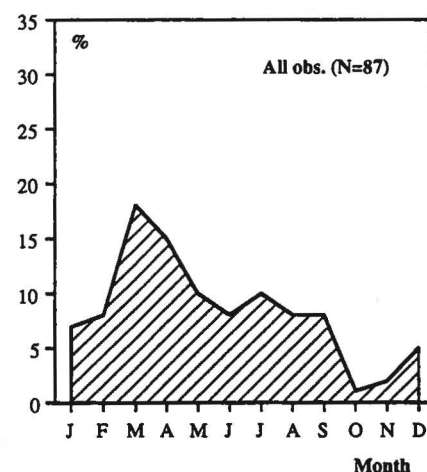
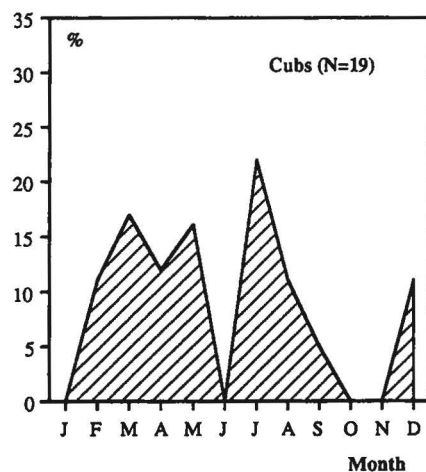
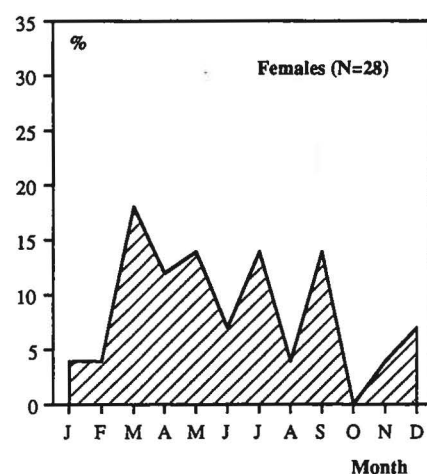
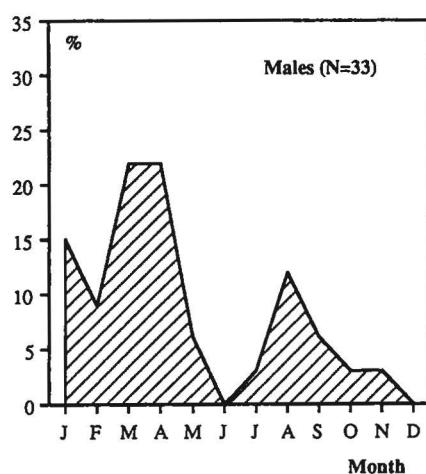
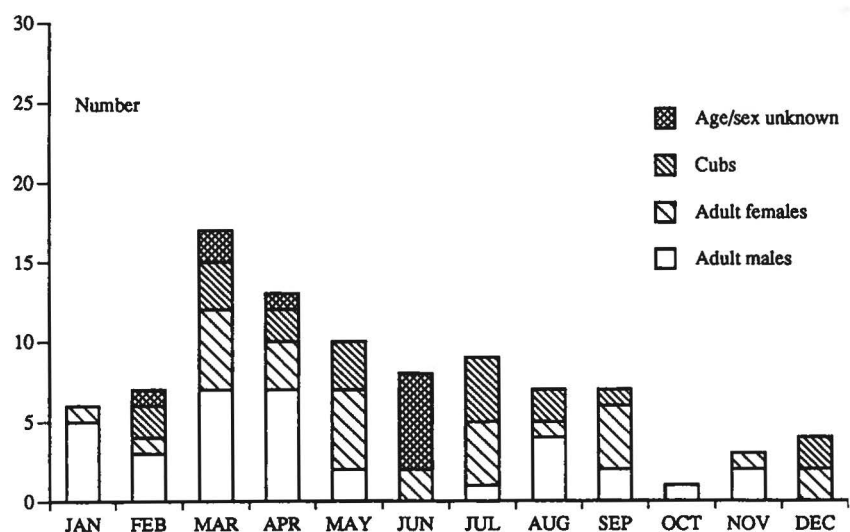


Fig. 33. Percentage of male (adult), female (adult) and young polar bears shot in different months of the year in 1951-1983.

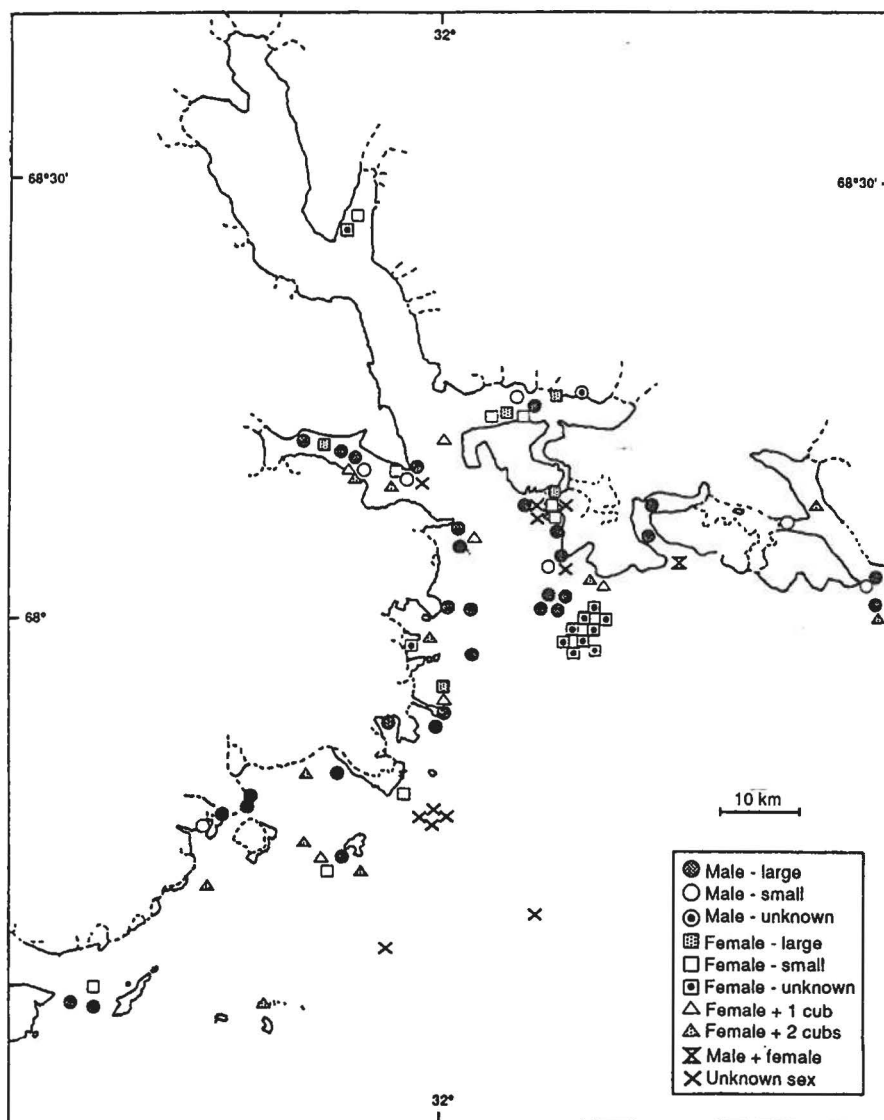


Fig. 34. Polar bears shot and seen in the Kangerlussuaq area in 1951-1991, by sex, age and family group (females with one or two cubs).

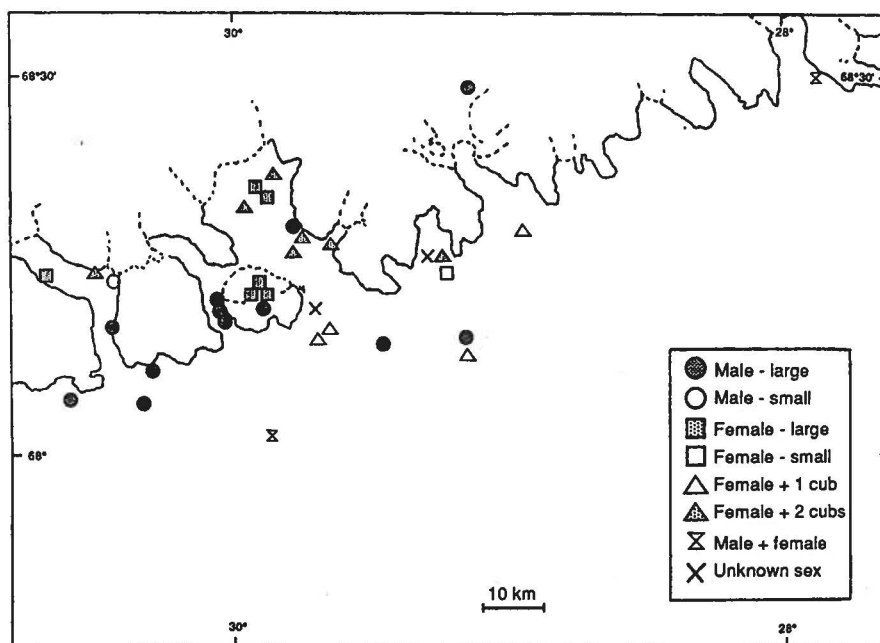
Jacobsen Fjord to the north east, and Aputiteeq and Fladø to the south west. The great majority of the remaining catch, approximately 15%, was hunted in the area around Søkongen Ø. On the other hand, in 1986-91 half of the polar bears were hunted in the area around Søkongen Ø and the other half were hunted in the Kangerlussuaq area (Figs 38 and 39). There is an obvious difference between the catches in Kangerlussuaq for the two periods. Within a radius of 20 km from the hunters' village (an area which includes Watkins Fjord, the mouth of Amdrup Fjord, Kap Deichmann and Miki Fjord) 48 polar bears (50%) were shot and four were seen in 1951-83, while in 1986-91 only one (2%) was shot and three seen in the same area. Within a radius of 21 to 40 km from the hunters' village (an area which includes Courtauld Fjord, Amdrup

Fjord, Kap Edvard Holm - but not Aputiteeq - and J. C. Jacobsen Fjord) 15 polar bears (16%) were shot and one was seen in 1951-83, while in 1986-91 22 bears (33%) were killed in the same area. So in recent years (1986-91) polar bears have been hunted at considerably greater distances from the hunters' village than before. These days the hunters go on long journeys up to Søkongen Ø for example, and on longer journeys into Kangerlussuaq itself, than they did in the past.

Age and sex ratio

Of the 162 polar bears shot in 1951-91, the sex of 142 is known. Of these 47.9% were males and 52.1% females. Independent (adult) males constituted 35.9%

Fig. 35. Polar bears shot and seen in the Søkongen Ø area in 1951-1991, by sex, age and family group (females with one or two cubs).



of the catch (84% of the males were said to be large, 16% small), independent females 42.3% and dependent young 21.8%. The sex of 13 dependent young polar bears was not known; if these are added to the above 142 polar bears, dependent young constituted 28.4% of the 155 polar bears shot. The remainder of the 162 polar bears shot is seven polar bears of unknown sex and age. A total of 28 family groups (i.e. a female with one or two young) were reported, which indicates that 46.7% of the independent females had young. The average litter size was 1.6 cubs per litter. Of the 31 young bears whose sex was known, 55% were males and 45% were females. Of the 44 dependent young, 32 can be divided into age categories: four were three years old (13%), nine were 2-3 years old (28%), 11 were two years old (34%), three were 1-2 years old (9%), three were one year old (9%) and two were 0 years old (6%). So most of the young were two years old or more.

In the period 1951-83, 96 polar bears were shot, and the sex of 81 of these was stated. 48.1% were males and 51.9% were females. Independent males constituted 40.7% of the catch (82% of the males were said to be large, 18% small), independent females 45.7% and dependent young 13.6%. The sex of eight dependent young bears was not known. If these young polar bears are added to the above 81 polar bears of known sex, dependent young constituted 21.3% of the 89 polar bears that were shot. The remainder of the 96 polar bears shot is seven polar bears of unknown sex and age. A total of thirteen family groups were reported, which indicates that 35.1% of the independent females had young. The average litter size was 1.5 young. Of the 11 young whose sex was known, 55% were males

and 45% females. Of the 19 dependent young that were shot, 11 can be divided into age categories: 0 were three years old (0%), one was 2-3 years old (9%), three were two years old (27%), three were 1-2 years old (27%), two were one year old (18%) and two were 0 years old (18%). So most of the young were between 0 and 1-2 years old.

Finally, 66 polar bears were killed in 1986-91; the sex of 61 of these was known. 47.5% of them were males and 52.5% were females. Independent males constituted 29.5% of the catch (83% of the males were said to have been large, 17% small), independent females 37.7% and dependent young 32.8%. The sex of five dependent young polar bears was unknown. If these are added to the above 61 polar bears of known sex, dependent young constituted 37.9% of the 66 polar bears that were shot. A total of 15 family groups were reported, which indicates that 62.5% of the independent females had young. The average litter size was 1.8 young. Of the 20 young whose sex was known, 55% were males and 45% females. Of the 25 dependent young that were shot, 19 can be divided into age categories: four were three years old (21%), six were 2-3 years old (32%), eight were two years old (42%), 0 were 1-2 years old (0%), one was one year old (5%), 0 were 0 years old (0%). So most of the young were two years old or more.

Hunting methods

Polar bears are hunted from sledges in two ways. Either the hunters catch up with the bears in their sledges and shoot them, or one or more of the dogs are released

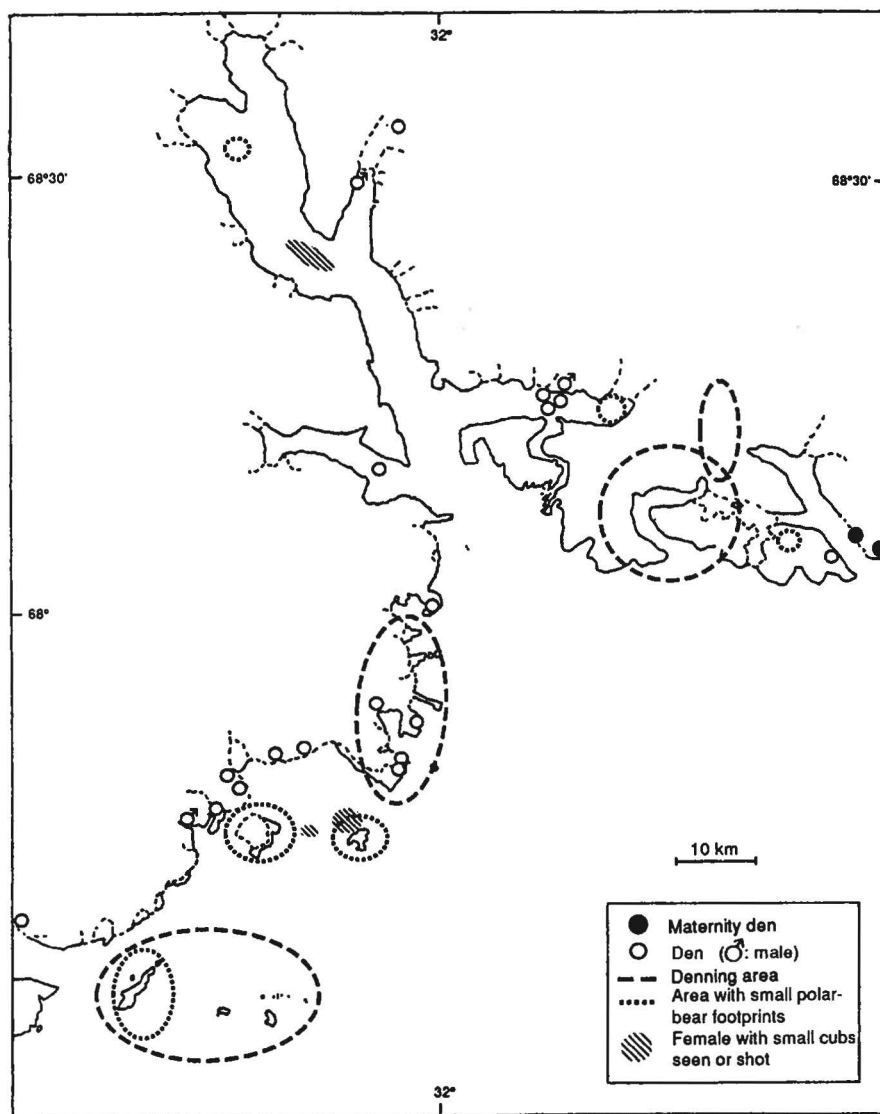


Fig. 36. The location of dens, denning areas and small polar bear footprints in the Kangerlussuaq area.

to surround and stop the bear while the hunters get close enough to shoot. An individual hunter often lets only one of his dogs loose, particularly if the snow is thick, causing the sledge to go slower. If the polar bear is far away, then two dogs are often released. Other hunters usually let three or four of their dogs loose. Only one incident was mentioned where a dog was injured by a polar bear. Dogs are not released if the polar bear runs over unstable ice. Dogs may be released before the polar bear is seen if fresh tracks are found. One hunter, who estimated that his dogs probably would not be able to stop a female bear with two cubs, left the dogs behind an iceberg and sneaked up on the polar bears himself; the female was shot first, followed by the cubs.

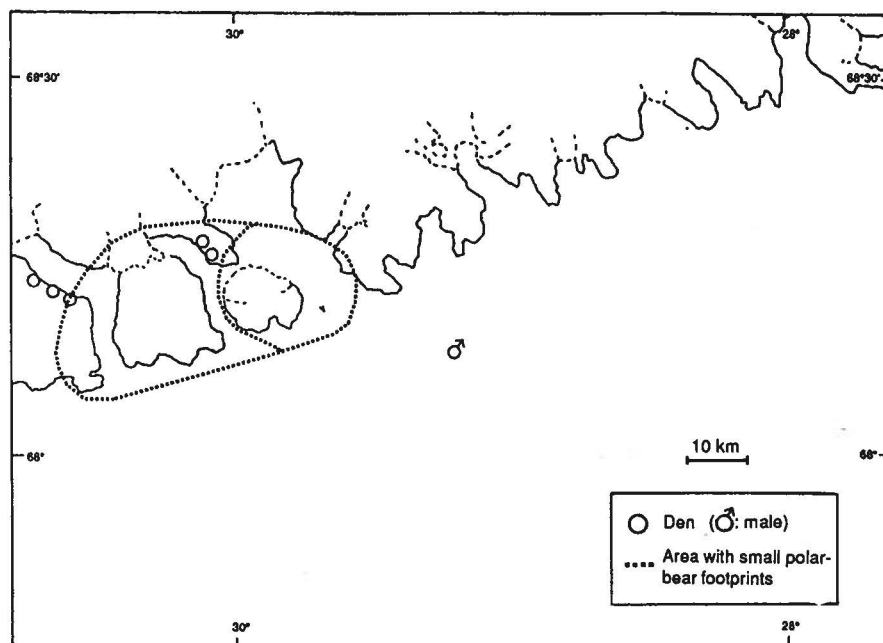
If the hunters are in motorboats or dinghies with an outboard motor, polar bears are usually shot on the

ice, as is also the case if they are discovered in the water.

Marked polar bears

The hunters were asked whether they had shot any marked polar bears, or if they knew of anyone who might have, but all answers were in the negative. From 1973 to 1975, 64 polar bears were marked in North East Greenland (between 72°N and 77°N) and from 1966 to 1988 a total of 220 polar bears were marked, mainly at Svalbard, but also in North East Greenland (1977) and in Franz Joseph Land (1980) (Born & Rosing-Asvid 1989). Some of the marked animals were recaptured in Scoresbysund, Kulusuk and Nanortalik.

Fig. 37. The location of dens, denning areas and small polar bear footprints in the Søkongen Ø area.



Maternity dens and other dens

There are few reports in the literature regarding dens in the Kangerlussuaq region. One den with fresh excrement was found at Nordre Aputiteeq in August (Amstrup 1902b), and it is presumed that the area along the coast at Blosseville, from 69°N to Kangerlussuaq, is a denning area (Vibe 1976).

Only two definite finds of maternity dens were mentioned during the interviews. One of the maternity dens was found east of the mouth of J. C. Jacobsen Fjord at the end of August 1990. It was located in a steep area and there were no cubs in it. It was not clear whether the den had been abandoned in spring the same year, or why the hunter thought it may have been a maternity den. The other maternity den was found in February 1976, some way up J. C. Jacobsen Fjord on the eastern side. Inside the den a thin, dead polar bear cub was found. The locations of these maternity dens are shown in Figs 36 and 37, where the rest of the maternity denning area is also marked.

One indication that there might be maternity dens in an area is the occurrence of small polar bear footprints. These small prints are often compared to dog prints. Another indication of a maternity denning area could be that a female with small cubs (0 years old) is either shot or seen in the area in March and April. In March 1967 a female polar bear with two cubs 0 years old was shot between Fladø and Nordre Aputiteeq. In April 1988 a female was shot at Nordre Aputiteeq after the dogs had attacked and killed her 0-year-old cub. In May 1987 large and quite small polar bear prints were seen on Deception Ø and in the area between this island and Fladø. The tracks were interpreted as belonging to two family groups, each consisting of one

female with a 0-year-old cub. One of the family groups came from the north while the other group came from inland. Finally, between 1987 and 1991 a female with small cubs was seen at the head of Kangerlussuaq near Courtauld Fjord; the time of the year was not mentioned.

From the finds and indications discussed above, the following areas can be designated as possible maternity denning areas:

1. Tre Små Øer: Deception Ø, Ittutarajik and Patuulaajivit

Most of the small footprints are seen at Deception Ø, and this was also where the two above-mentioned family groups met. In addition, one of the hunters who came past the islands in a motorboat in summer noticed dens there. Other hunters mentioned that they had seen small polar bear footprints in the area.

2. Fladø and Aputiteeq

In this area family groups with 0-year-old cubs have been shot. One of the above-mentioned family groups probably came from this area. In addition, many of the hunters have observed polar bear prints as small as dog prints in the area around Aputiteeq, and in March-April a large number of small footprints were seen. The hunter who was a cook at the Aputiteeq weather station in 1951-54 had seen polar bear dens close to the station, and along the main coast many dens were observed.

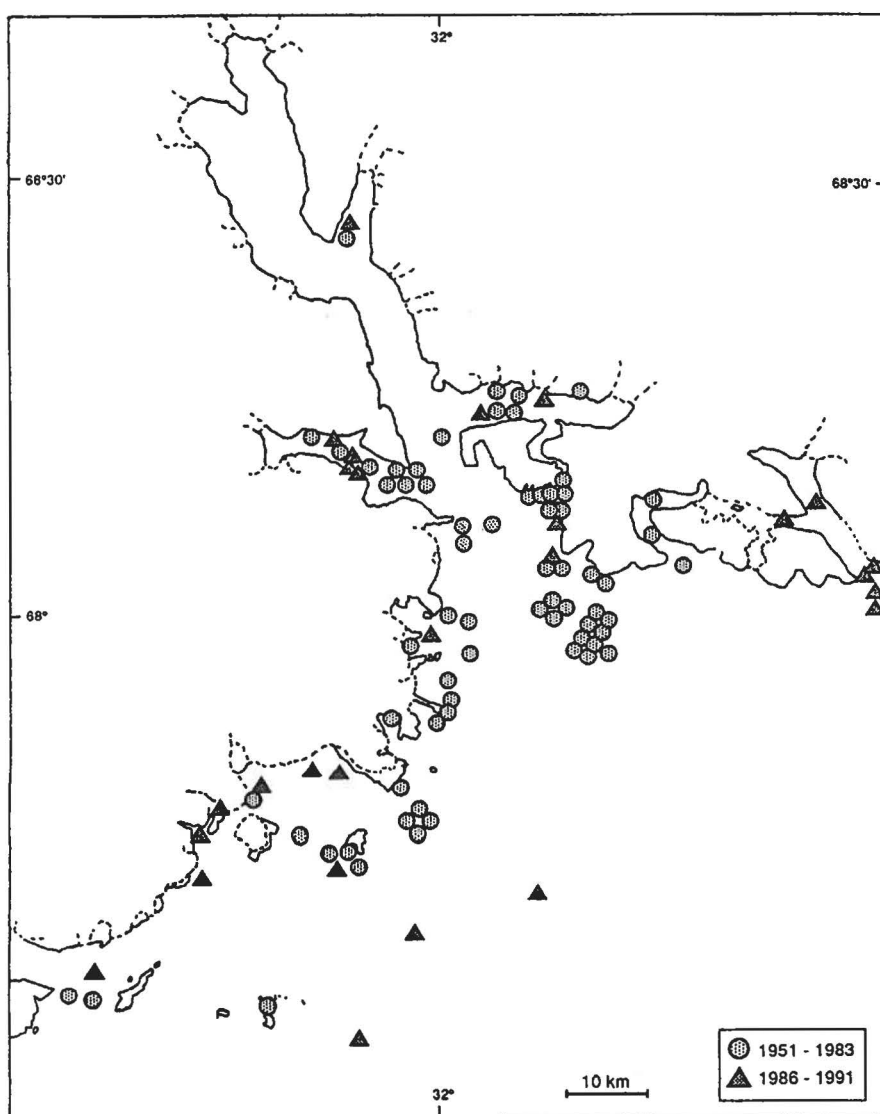


Fig. 38. Polar bears shot and seen in the Kangerlussuaq area in 1951-1983 and in 1986-1991.

3. The head of Kangerlussuaq

In March or April, at the end of the 1960s or the beginning of the 1970s, a number of small polar bear footprints were seen disappearing on to a glacier (i.e. the polar bears had come from the glacier). During the period 1987-91 one female with small cubs was seen in the area. The hunters were asked in particular about the distribution of maternity dens and small polar bear footprints in this area, as it was thought that the head of Kangerlussuaq was a maternity denning area. But little information was available for this area, probably because the hunters very seldom go there. The area is thought to be dangerous because of the many glaciers and icebergs.

4. The head of Watkins Fjord

Small polar bear prints were seen disappearing on to the glaciers in March and April at the end of the 1960s or the beginning of the 1970s. In addition to this, many dens are seen in the area.

5. J. C. Jacobsen Fjord

The only two definite observations of maternity dens were in this area, as mentioned before. In March-April 1987 small polar bear prints were seen in the area south of the western branch of J. C. Jacobsen Fjord.

6. Søkongen Ø

A large number of hunters have seen small polar bear prints in the area around Søkongen Ø, including the Nansen, J. A. D. Jensen and Ryberg Fjords. To the general information about small footprints in the area, observations can be added of small prints in February 1988 or 1989, when there was a thick layer of snow, and in March or April at the end of the 1970s and 1980s. Some of the hunters believe that most family groups are found in this area, and this is confirmed by reports of the number of polar bears shot there, as discussed above.

In addition to the six areas mentioned above, which can be regarded as maternity denning areas, a number of observations were made of dens other than maternity dens (Figs 36 and 37). These denning areas were said to be in the following areas: a) around Nuuaalik at Søndre Aputiteeq, b) the glacier area between Agga Ø and Tre Små Øer, c) the area from Kap Edvard Holm to Den Lave Pynt (said to be a denning area in the 1960s, and dens were also found there in 1970-71 and in March 1987 or 1989), d) Miki Fjord and the Sødalen area (the hunters had been told of dens in this area).

The locations of dens can vary greatly. Some dens were located high up on the glaciers. Thus an old male was shot in a den in Watkins Fjord which had a "staircase" leading up to it. In the den area around Sødalen the dens were located high up on the sides of the glaciers. The hunters were not able to make it up to one den on Courtauld Gletscher because it was too far up. However the hunters could see footprints that led up to the den. A maternity den in J. C. Jacobsen Fjord was situated on a glacier in a steep area, and similarly small polar bear footprints were found quite high up. By contrast, a den at Kap Edvard Holm was found only 3 m from the waterline, and another den found opposite Nansen Fjord was 15 km off the coast. Four dens were observed on the fjord ice in Watkins and Amdrup Fjord. They were discovered thanks to obvious bumps in the terrain and footprints leading to them.

The use of dens other than maternity dens can vary considerably. For instance one male was shot after leaving the den in September, while another male was shot inside the den in November. A male was shot in J. C. Jacobsen Fjord in March or April, after a hunter had followed the footprints from the den at the head of Courtauld Fjord. A few examples of maternity dens left earlier than usual were given. A female bear had already left the maternity den in J. C. Jacobsen Fjord in February, but this may have been because her cub had died. Small polar bear footprints are also seen around Søkongen Ø in February, but it is most usual to see small footprints in March and April.

Migratory routes and annual rhythms

Earlier observations of polar bears in the Kangerlussuaq region suggest that the bears migrate to the north (Dietz et al. 1985). The information from this interview-study shows that early in the year, around March, polar bears migrate northward following the edge of the fast ice. One hunter believed that about 100 bears migrate northward along the ice edge. The ice edge may be close to the coast or far off the coast. Polar bears migrate early in spring from the area west of Fladø northward along Polaric Gletscher and this is said to be one of the "main routes". The migrating bears sometimes encounter open water opposite the mouth of Kangerlussuaq, for example if a piteraq has broken up the ice. If this happens, the polar bears are forced to travel up the fjord and swim across. In spring there is often open water at the mouth of J. C. Jacobsen Fjord and many polar bears gather there. At Søkongen Ø, too, open water is often encountered in spring, and many tracks have been seen heading off in a north-easterly direction in May-July. In summer polar bears arrive at the Søkongen Ø area from the north. During migration the polar bears may make detours into the outer parts of the fjords. A few, especially the family groups, move further into the fjords in search of ringed seal breeding lairs on the fjord ice. The polar bear routes up through the fjords are, for instance, through Uttental Sund, Vandfaldsdalen, Sødalen, Hammerdalen and over Forbindelsesgletscher.

The following observations support the route through Sødalen. In August 1986 a female with two cubs approximately one year old migrated from Miki Fjord up through Sødalen (Gannicott and Wilson 1991, Platinova Resources Ltd., pers. comm.). In August 1990 polar bear footprints were seen between Sødalen airport and Miki Fjord (Langager 1991, GFI, pers. comm.). The route between Watkins Fjord and Miki Fjord was mentioned as being a definite overland polar bear route which the polar bears use to avoid the area around Kap Hammer (Degerbøl 1937). During summer and autumn the polar bears follow the southward movement of the drifting ice in the East Greenland Current. Many of the bears search for food either along the glaciers at the coast, or deep inside the fjords, or on land if too few seals are available. On land polar bears have been found at altitudes of 200-300 m above sea level. Once on land, they can survive for 2-3 months with virtually no food, perhaps eating mainly moss and herbs. T. Nielsen (1992, GGU, pers. comm.) assumed that a polar bear he heard rummaging outside his tent was eating crowberries. One of the hunters thought that polar bears go ashore when they moult.

Pregnant females go into hibernation in October or November, and do not break out of their dens with their cubs until the end of March or the beginning of April (Born & Rosing-Asvid 1989). Other polar bears also go into hibernation during autumn and winter, which is presumably a mechanism which enables po-

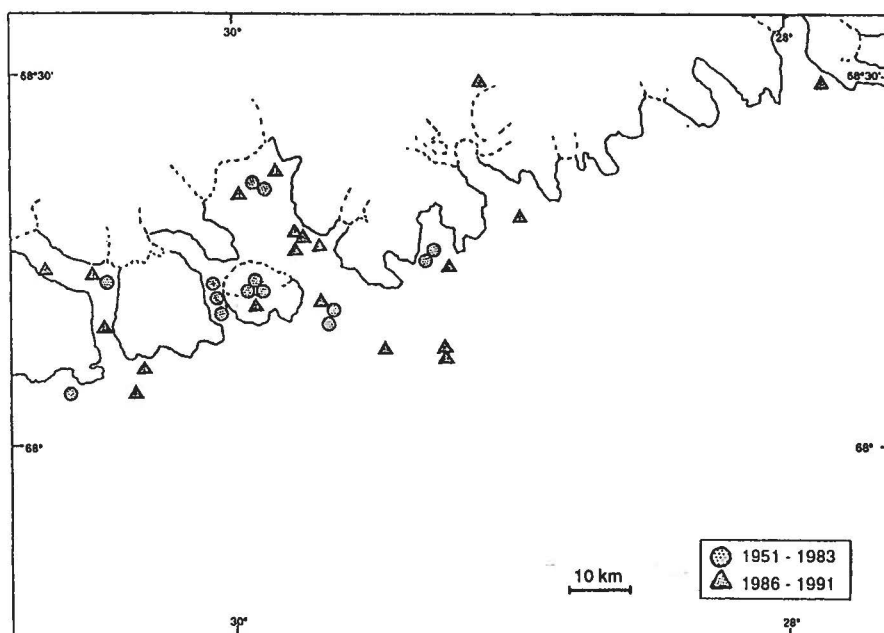


Fig. 39. Polar bears shot and seen in the Søkongen Ø area in 1951-1983 and in 1986-1991.

lar bears to survive during periods of bad weather or low food availability (Born & Rosing-Asvid 1989). An example was mentioned in the interview-study, where an old male was shot in September 1990 at Fladø just after he had come out of his den. Fig. 28 illustrates that polar bears do not hibernate throughout the winter period, as they are shot or seen all through the year.

Pairs and mating

Observations of only four pairs of polar bears were collected in the interview-study. One pair was killed at Vedel Fjord on 21st March, 1991. The pair of bears first attempted to chase the hunter and his dogs away as they slid down towards them. When that did not work they tried to escape up the mountain side, but the female was not able to get up; the male, which was farther up the slope, reared on his hind legs and roared. Apparently the female had milk in her breasts, indicating that she had cubs which the male could have chased away. Another pair was shot in Miki Fjord in May 1975. The female succeeded in getting away while the male was being shot. The third pair was hardly a pair; a male was observed to be following a female, although he appeared to be keeping his distance. The time of the year was not noted, but the hunter mentioned that the bears usually mate in April and May. Finally, in March, a hunter followed tracks belonging to a pair of bears.

These few pairs were seen in the period from March to May, which accords well with the findings of Born & Rosing-Asvid (1989) who state that the bears normally mate in the period from March to May, and some

way into June, and with those of Vibe (1976) who observed two pairs of mating polar bears after 13th April.

Food preference

The most important food item for polar bears is seal, especially seal blubber. Fourteen of the 23 hunters informed us of polar bear feeding, and thirteen of these had found seal blubber in the stomachs. Seal skin is often found in stomachs, while seal meat is found less frequently. Ringed seals are the most important prey, but the remains of young hooded seals have also been found. Apart from seals, the hunters mentioned different types of plant food, e.g. herbs, grasses, mosses and seaweed. One polar bear that was shot in October had so much moss in its stomach that it found it difficult to walk and in the middle of winter one year a thin bear was shot which had much seaweed in its stomach. Amdrup (1902b) observed a polar bear at Nordre Aputiteeq in August that was pulling up herbs and moss, and remains of herbs were present in its fresh faeces. It was not unusual for the hunters to find pieces of polar bear skin inside the stomachs of male bears or hear of remains of polar bear skin in the stomachs. It was suggested that male bears often eat young cubs after the female has been frightened away. Finally, feathers and Arctic char were found in polar bear stomachs. During one of the interviews a hunter described a ringed seal kill: a ringed seal lay on the edge of the ice resting. Some distance away from the seal a polar bear came swimming up. The polar bear swam closer and dived underwater to sneak up on the

Photo 19. Polar bear hides bleached in the sun. Julia Boassen, Skærgården.



seal. It came up a little to the left of it and immediately dived again. It surfaced a little to the right of the seal, found its bearings and dived quickly. The polar bear then came up close in front of the seal, and gave it a fatal blow with its left paw. The use of the left paw to kill the prey has also been mentioned by other hunters.

Trade and utilisation

Until the end of the 1960s and the beginning of the 1970s polar bear hides were used to make trousers. The hides from the young bears were prepared for children's trousers. These polar bear trousers were described as being especially good in rainy weather. At that time mittens, parkas and kamiks were also made from the hides. At the beginning of the 1970s, when hunters were offered good prices for the hides, it was no longer worth their while to use the hides for clothing, so all hides were sold to KGH/KNI or to private buyers. In 1966-67 the value of a hide was between DKr 1500 and 3000; a very large male with an extraordinarily beautiful hide (the pubic hair was about 50 cm long) was sold for DKr 3000 plus a DKr 6000 bonus. The KGH/KNI prices are normally a couple of thousand *kroner* lower than if the hides are sold privately. In the 1970s the selling price was around DKr 5000 (KGH), and in the mid-1980s the price was between DKr 4000 and 7000. The prices mentioned above were given by the hunters. The current selling prices for polar bear hides purchased by KNI (in 1991) is from U. Witthaus (1992, Great Greenland, pers. comm.). The selling price depends on the length of the hide (measured from the snout to the tip of the tail) and its quality. The smallest hides accepted are 190 cm in length. The

selling price for a first-grade hide is DKr 3300 per m, second-grade hides cost DKr 2200 per m and third-grade hides sell at DKr 1100 per m. So an average first-grade polar bear hide that is 240 cm in length is worth approximately DKr 8000 to the hunter.

Disturbances

During the interviews, the hunters were asked whether they thought that polar bears would be disturbed by future or present mining activities. Many of the hunters responded by referring to the situation around the Aputiteeq weather station and the radar station at Kulusuk. The weather station was manned from 1949 to 1979. During this period ships visited the area a couple of times every summer. After 1979 the weather station was automated. The hunters had experienced that the polar bears became accustomed to the constant noise from the generators at Aputiteeq, and were still in the area, but probably avoided the weather station. One of the hunters did not think that more polar bears came to Nordre Aputiteeq after the weather station ceased to be manned. At Kulusuk hunters had observed polar bears bypassing the radar station, forcing the hunters to move farther off the coast to hunt them. One hunter thought that there were more polar bears at Kulusuk before the radar station was established. The situation at Kulusuk is different from that at Nordre Aputiteeq, because at Kulusuk helicopter flights are part of the disturbance, causing the polar bears to move away from the area. This is the opinion of most of the hunters, but one of the hunters did not think the helicopters caused any real disturbance, as polar bears are still seen in the area despite the flights. The general opinion among the hunters is that the bears

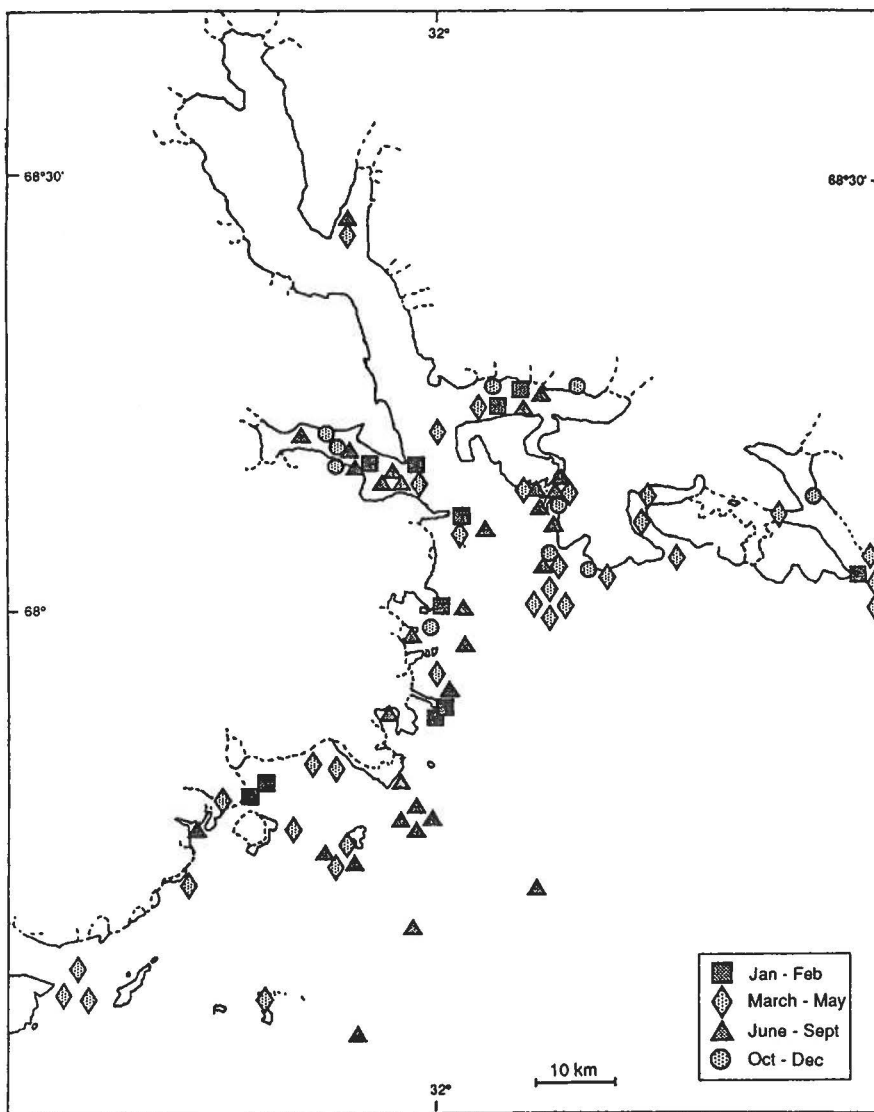


Fig. 40. Polar bears shot and seen in the Kangerlussuaq area at different times of the year.

have a good sense of hearing and can therefore hear noise over long distances. The polar bears would normally avoid a noise source by by-passing it. Polar bears have been seen to react somewhat differently to noise. If bears were hungry, they would probably disregard the noise and continue to walk along the edge of the ice in search of food. One hunter thought that the smell of the machinery, among other things, would force the bears to avoid areas with mining activities. One of the hunters believed that hibernating polar bears would not be disturbed in their dens.

Besides this, the hunters were asked whether the polar bears would be attracted by the mining activities, for example by the waste. Polar bears have been seen to be attracted to the hunters' village and have eaten supplies. However, they seldom come to the Skærgår-

den village for supplies or waste, and in the mining camps waste is buried, burnt or taken away from the area.

Discussion

This interview-study gives an account of 162 polar bears shot between 1951 and 1991. It is estimated that this number represents 30-50% of the total number of polar bears shot during this period. There are various reasons for this degree of coverage in the interview-study: one being that it was not possible to contact all the hunters who had been in Kangerlussuaq. Some of them are dead, some lived too far away to be included in the study, there were probably some who were

unknown to the author, and some were away on hunting trips, possibly to Kangerlussuaq, so our paths did not cross. Of the hunters interviewed, many could not remember all the catches, especially if they had shot many polar bears. It was usually the first polar bears hunted that were remembered, while the later ones were difficult to keep apart in their memories. But since polar bears are a highly desirable quarry, it is fairly certain that the hunters reported the majority of the bears they had shot. Besides the *number* of polar bears shot, it was important to obtain details of them. Naturally enough this presented some difficulty, especially when the details were of polar bear catches in the more distant past. Nevertheless it was astonishing how many details many of the hunters were able to recall. The fact that they were able to remember details like location, date, and the sex and age of the bear shows how much the polar bear must mean to the hunters.

From 1966 to 1980 three quarters of all polar bears shot were hunted in the Kangerlussuaq area, i.e. Kangerlussuaq and the adjacent fjords, J. C. Jacobsen Fjord in the north east, and Aputiteeq and Fladø in the south west. Half of these were shot within a radius of 20 km from the hunters' village. Approximately a fifth were shot at Søkongen Ø. During this period polar bears were shot relatively frequently over the years, with most being shot in March and April.

From 1986 to 1991, half of the polar bears shot were hunted in the Kangerlussuaq region, but only about 2% of these were within a radius of 20 km from the hunters' village. The other half were shot at Søkongen Ø. In this period most of the bears were shot in spring (March and May); however, many were also shot in autumn (October). Hardly any polar bears were shot in summer (June, July, August) during this period.

The difference between polar bear hunting in these two periods is that from 1966 to 1980 the hunters hunted in the area close to the Skærgården village all through the year, while in more recent years they have concentrated their efforts in spring and autumn. This is most marked with the spring catch around Søkongen Ø (Figs 40 and 41).

No comments were made during the interview-study that could help to explain the changes in hunting patterns over the years. One possible explanation might be the hunting regulations that came into force in January 1975. According to these regulations, all polar bears were protected during the summer, and females with cubs were protected all through the year. Because of Kangerlussuaq's position on the border between two municipalities with different protection policies for polar bears, the rules that came into effect in 1978 meant only that polar bears were protected in August and that females and their cubs (if under one year old) were protected for the whole year. To compensate for the loss of summer hunting and the hunting of females with cubs, the hunters had the possibility of increasing their efforts at other times of the year

and in other places, e.g. in the Søkongen Ø area in spring. If the number of polar bears that were shot and sighted (three animals sighted) from 1975 to 1980 is combined with the period from 1986 to 1991, the most marked difference is that more polar bears were shot in July and August in 1975-1991. At the same time it can be seen that 67% of the 24 bears mentioned from 1975 to 1980 were either shot or seen within a radius of 20 km of the hunters' village (50% in 1966-1980), and only 13% were shot at Søkongen Ø (15% in 1966-1980). The polar bear catches of 1975-80 are therefore not essentially different from the catches for the whole period between 1966 and 1980, so the changes in the hunting regulations do not seem to explain the difference between the catches in 1966-80 and in 1986-91. Another explanation could be the increase in activity in the area since 1986, partly in connection with the mineral exploration and partly in connection with the reintroduction of wintering hunters in the area after a pause since 1980. The increased activity and associated disturbances in the area could mean that polar bears bypass the area, as they did at Aputiteeq weather station and the radar station at Kulusuk.

Actual mineral exploration started in the area in 1986 with helicopters and different types of drilling machinery. In 1986 the only activity was in July, when the helicopters were used frequently. In the next few years the activity increased. Helicopters were used more often in the Skærgården area and in Sødalen, and from 1989 they were also used in the Kap Edvard Holm area. In 1988 saws were used to take geological samples and in 1989, 1990 and 1991 drilling rigs and hand-held drills were also used. In 1989 and 1990 skidoos were introduced to the area. This information was obtained from T. Nielsen (1992, GGU, pers. comm.).

A second activity that started in the area in 1986 was the reintroduction of hunters wintering in the Skærgården village after a pause since 1980. In the 1987/88 season approximately a hundred people were at the hunters' village, possible the largest number ever. In 1988/89 there were 39 people and in 1990/91 there were only 16. Some of the disturbances that may result from hunting include the noise from dinghies with out-board motors or from motorboats, rifles and barking dogs. Looking at the catches in the 1960s and 70s, the level of disturbance in the area could have been greater in the 1980s if one considers the noise from the dinghies and the greater number of people in the area (for one season). The combined effect of the two activities, i.e. hunting and mineral exploration, could also have forced polar bears to move to the outermost areas of Kangerlussuaq.

Of all the 142 polar bears shot in the Kangerlussuaq area between 1951 and 1991, 42.3% were independent females. This is a rather large proportion compared with other studies. Born & Rosing-Asvid (1989) reported that, of 41 polar bear catches from Scoresbysund, 34% were independent females. In a tagging study in North East Greenland carried out from 1973

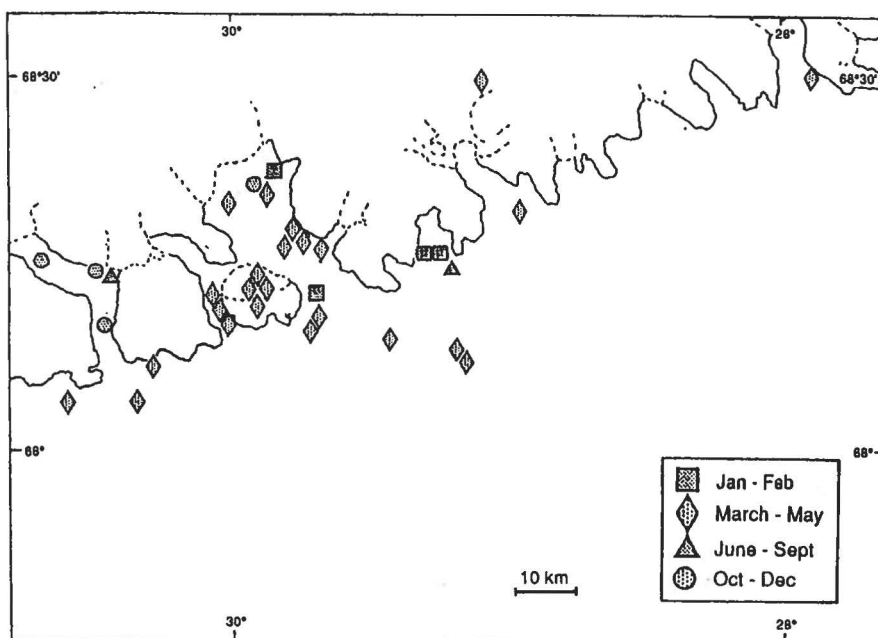


Fig. 41. Polar bears shot and seen in the Søkongen Ø area at different times of the year.

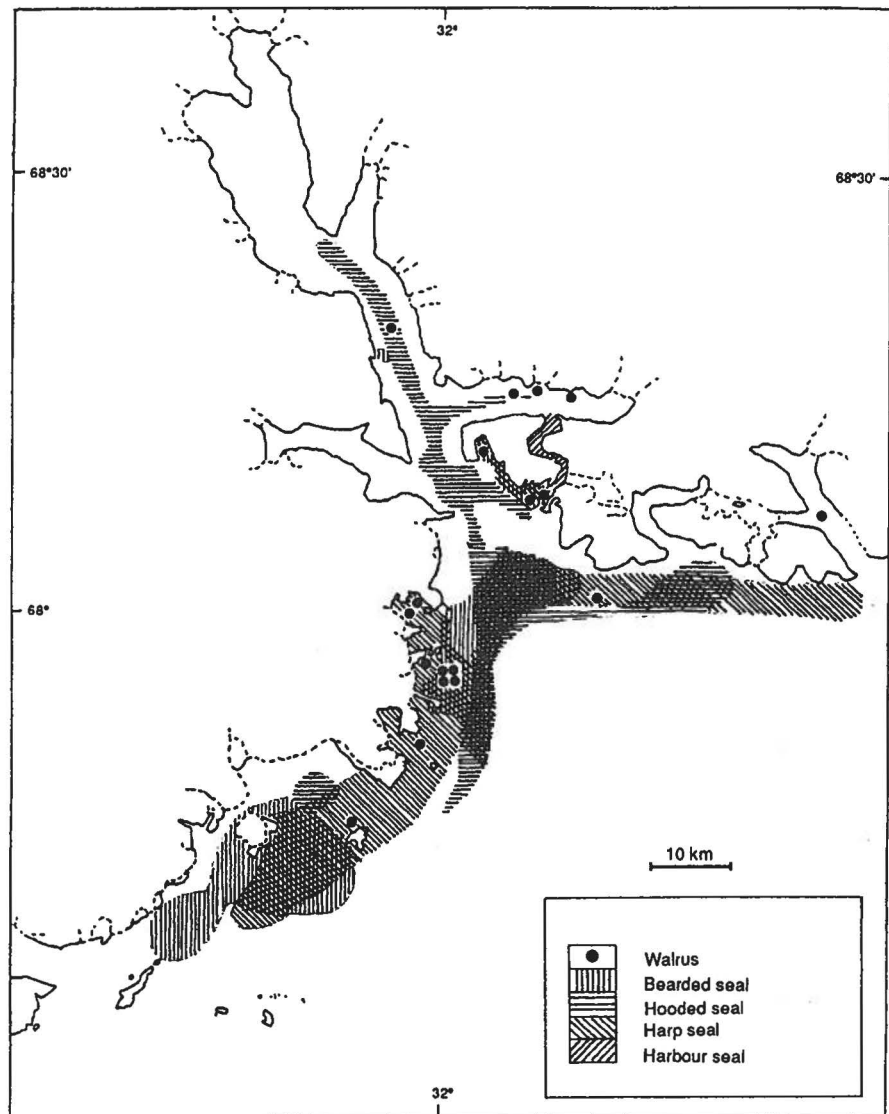
to 1975, independent females constituted 31% of a total of 51 polar bears. From an interview-study in North West Greenland (Rosing-Asvid & Born 1990) it was found that independent females constituted 31.1% (of 151 bears) in Avanersuaq municipality and 27.0% (of 48 bears) in Upernavik municipality. So it can be seen that the proportion of independent females in the Kangerlussuaq region is high compared with other studies. This proportion is important when the size of the sustainable catch is estimated in relation to a polar bear population, as the number of reproducing females is considered to be the critical factor (Born & Rosing-Asvid 1989). Born & Rosing-Asvid (1989) estimated that the sustainable annual harvest of the polar bear population in East Greenland, Svalbard and Franz Joseph Land is between 130 and 300 animals. For this estimate, it is assumed that the population consists of between 3000 to 6700 animals, and that reproducing females constitute 34% of the catch. As the average annual catch in Ittoqqortoormiit and Tasiilaq municipalities is 76 polar bears, Born & Rosing-Asvid (1989) estimated that this was a sustainable catch rate (no polar bears are shot at Svalbard and Franz Joseph Land). The catch in the Scoresbysund area is probably between 50 and 70 bears (Born 1983), which is higher than the average of 35 animals per year that is reported in the catch lists. According to this interview-study, the catch in Kangerlussuaq is between 25 and 35 animals per year, and it is estimated that 10-15 bears per year are shot in the Ammassalik area. According to the catch lists, the average for both areas is 37 polar bears per year (Born & Rosing-Asvid 1989). On the basis of the above, an estimate of the total number of

polar bears shot annually in East Greenland is 85-120. If the number of independent females constitutes 42.3% of the polar bears shot, then the annual sustainable harvest would be between 110 and 240 polar bears. With these new assumptions, especially regarding the catch of reproducing females, it still seems likely that the catch rate is within the sustainable level.

The proportion of the catch in the Kangerlussuaq region that was made up of dependent cubs has been rather high in recent years. In 1986-1991 cubs constituted 37.9% of the total catch, compared with 21.3% in 1951-1983. In Avanersuaq municipality 10.6% of the bears shot between 1974 and 1989 were dependent cubs (Rosing-Asvid & Born 1990). The proportion of independent females with cubs shot has also been very high in recent years (65.2%) compared with earlier years (35.1%). In Avanersuaq this proportion is 27.1% (Rosing-Asvid & Born 1990). In order to estimate the sustainable catch rate, the survival of adult females has to be taken into account as well as other factors of some importance. Among these is the mortality rate of young polar bears (Born & Rosing-Asvid 1989), which appears to have been rather high in recent years, because of the hunting at Søkongen Ø in particular.

As discussed above, many of the family groups have been shot around Søkongen Ø in recent years. This suggests that the area could be similar to the area at Traill Ø on the east coast (Born & Rosing-Asvid 1989), which is an important denning and feeding area for the family groups after they break out of the dens. It is possible that the Søkongen Ø area has a relatively local population of adult females in particular, as was the case around Traill Ø (Rosing-Asvid & Born 1990).

Fig. 42. The areas and places where seals (except ringed seal) and walrus are seen and hunted in the Kangerlussuaq area. The observations of harbour seals in Uttental Sund are from the 1940s.



An increased catch in such an area has a proportionately greater impact on the local polar bear population than on the entire population in East Greenland, Svalbard and Franz Joseph Land.

Walrus and seals

Walrus (*Odobenus rosmarus*)

The hunters reported a total of 20 incidents where walrus were either observed or hunted in Kangerlussuaq (Fig. 42). Approximately half of the walrus observations were made in the 1980s, one in 1990, two in the 70s, three in the 60s and one in the period between 1951 and 1954. Information about the month or the

time of the year was provided for twelve of the incidents; five of these were during the summer period (July-August), five in the autumn (September-October) and two in the winter period. One of the hunters said that walrus were seen most often in the autumn. Nine of the incidents mentioned involved walrus that were hunted.

When hunters started to spend the winter at the Skærgården village in 1966, walrus were seen crawling up on the shore beside the village. Not that many walrus were seen at that time, nor are many seen nowadays. One walrus was seen at Bagnæsset, at the mouth of Amstrup Fjord, in August 1979 (Nielsen 1992, GGU, pers. comm.). A walrus was also seen in the mouth of Kangerlussuaq on 7th August 1990, during the research cruise (Glahder 1990).

In East Greenland a small number of walrus are found south of Scoresby Sund (Holm 1887 fide Dietz



Photo 20. A young hooded seal at the mouth of Kangerlussuaq in August.

et al. 1985; Poulsen 1900; Jensen 1909; Holm and Petersen 1921; Petersen 1951). The catch list for the Ammassalik district from 1970 to 1980 shows an average catch of two walruses per year (Dietz et al. 1985). In Kangerlussuaq one was seen in 1930 (Chapman 1932 fide Dietz et al. 1985), some were seen in 1932 (Iversen 1936; Degerbøl 1937) and three were seen at Kap Hammer in 1980 (Andersen 1981). All these observations were made in August. Siegstad (1989) reported that in 1967/68, two walruses were killed while no walruses were killed in 1966/67, 68/69, 86/87, and 87/88. At the mouth of Scoresby Sund and at Stewart Ø walruses are seen from February until the middle of June, although individuals are encountered at other times of the year. The walrus catch at the beginning of the 1970s was approximately five per year at Scoresby Sund, rising to ten per year by the 1980s (Born 1983).

Bearded seal (*Erignathus barbatus*)

Bearded seals are frequently seen in the Kangerlussuaq area from May to October, and during the winter. They are normally shot in the summer (July-August) and autumn (September-October), usually 1-5 bearded seals per year per hunter. One hunter shot 20-30 one winter. Another hunter had caught a bearded seal with nets. Bearded seals are seen mainly in the area around Aputiteeq and Fladø, along the coast from Kap Edvard Holm to Kap Deichmann, in the mouth of Kangerlussuaq, at Kraemer Ø and at Skærgården (Fig. 42). Most are seen and shot in the area between Barberkniven and Kap Deichmann. Besides this there are many at Agga Ø in October. In the autumn (October) the bearded seals move out into the open sea. According to the catch lists (Anon. 1966-70; Anon. 1966-71) an average of

twelve bearded seals were caught per year from 1966 to 1970, with a range from 1-24.

Bearded seal skins are used for whips, traces and for the soles of kamiks. Today bearded seal rope can be purchased for about DKr 8 per m; 30 m of rope can be made from a single skin.

There are bearded seals in the Ammassalik area all year round. In the 1970s there was an average catch of 182 animals a year (Dietz et al. 1985). In the past bearded seals were seen in Kangerlussuaq and Miki Fjord (Iversen 1936; Degerbøl 1937). At the mouth of Scoresby Sund bearded seals are seen all year round, although the majority move away from the area when ice begins to form. The annual catch at the end of the 1970s and early 80s in Scoresby Sund is estimated to be between 30 and 50 (Born 1983).

Hooded seal (*Cystophora cristata*)

Hooded seals are normally seen all over Kangerlussuaq, mainly from August to November. Since many hooded seals sink in the summer, most are shot in the autumn at the rate of 5-10 per hunter. Over three seasons one hunter shot a total of 75. Another hunter shot about thirty hooded seals a year in the 1960s and 1970s. Hooded seals are frequently seen in the area between the hunters' village and Amstrup Fjord, at the mouth of Kangerlussuaq, at Kap Edvard Holm, and opposite the mouth of Miki Fjord. In addition, hooded seals are seen north of Nordre Aputiteeq and in Kangerlussuaq up to Courtauld Fjord (Fig. 42). When the fast ice begins to form, the hooded seals disappear. According to the catch lists (Anon. 1966-70; Anon. 1966-71) an average of two hooded seals were hunted per year from 1966 to 1970, with a range from 0 to 11.

In the Ammassalik area hooded seals are seen in small numbers in spring and again from summer to autumn, although some individuals are also seen in the fjords during the winter (Dietz et al. 1985). During the 1970s an average of 1533 hooded seals were caught per year in the Ammassalik district (Dietz et al. 1985).

In the past, hooded seals frequently occurred in Kangerlussuaq from the end of July to the end of August (Pedersen 1930). Hooded seals do not appear to be very numerous in Scoresby Sund (Born 1983). Although a few are seen between May and June, most are seen from the middle of August until ice forms in the middle of October. The annual hooded seal catch in Scoresby Sund at the beginning of the 1980s was estimated by Born (1983) to be 10-30 animals.

Harp seal (*Pagophilus groenlandicus*)

Harp seals are normally found at the mouth of Kangerlussuaq and along the outer coasts from July to October. As harp seals sink in July and August in particular, most are shot in autumn in numbers of 5-10 per hunter. Individual hunters have shot between 30 and 40 harp seals per year. The annual catch of bearded seals, hooded seals and harp seals in Kangerlussuaq in the present can be estimated at 10-25 animals per hunter. With 5-10 active hunters at the hunters' village an estimated 50-200 seals are killed per year. According to Siegstad (1989) approximately 75 and 100 seals were caught in 1966/67 and 67/68 respectively. According to the catch lists (Anon. 1966-70; Anon. 1966-71) an average of twelve harp seals per year were caught from 1966 to 1970, with a range of 0-29. Harp seals are seen from Nordre Aputiteeq and northeast along the coast to the mouth of Kangerlussuaq, on to J. C. Jacobsen Fjord, and opposite the hunters' village and Kraemer Ø (Fig. 42). Most of the harp seals are seen from Nordre Aputiteeq to Kap Deichmann. On the whole, most of the harp seals seen are immature individuals.

In the Ammassalik area harp seals are seen in July and again in September (Holm & Petersen 1921). During the 1970s an average of 174 harp seals were caught in the area per year (Dietz et al. 1985). Kangerlussuaq is an area in which a large number of harp seals are found according to Pedersen (1930), Degerbøl (1937) and Mikkelsen & Sveistrup (1944) and they are especially abundant in the autumn (Pedersen 1931). In Scoresby Sund the first flocks of harp seals, especially young seals, arrive in August. When the ice forms, most of the harp seals move away from the area, although some individuals are seen at the edge of the ice up until February (Born 1983). Born (1983) estimated that the annual catch in Scoresby Sund at the beginning of the 1980s was between 100 and 200 animals.

Harbour seal (*Phoca vitulina*)

Harbour seals had not been seen in Kangerlussuaq by any of the hunters interviewed. One hunter had heard that there were many in Uttental Sund in the 1940s. One hunter had only seen harbour seals at Skjoldungen (63°23'N; 41°18'W) and Timmiarmiit (62°32'N; 42°13'W), which are in the southern part of East Greenland. According to the catch lists (Anon. 1966-71) one harbour seal was caught in Kangerlussuaq in 1970.

In Scoresby Sund harbour seals are seldom seen (Pedersen 1930). However, this information, and more recent information from 1974, are said to be ambiguous (Born 1983).

Whales

Apart from narwhals, which have already been described in detail, relatively few whales are seen in the Kangerlussuaq area, and none of these whales were hunted. Minke whales are seen relatively often, while there has been only one sighting of a sperm whale (*Physeter macrocephalus*) and one possible sighting of a killer whale (*Orchinus orca*). Although no bowhead whales (*Balaena mysticetus*) have been seen in the area, one hunter said that some were seen in 1939 or 1940, when a group of people travelled by umiak (a big skin boat rowed by the Eskimo women) from Ammassalik to Kulusuk. The hunters were also asked about sightings of humpback whales (*Megaptera novaeangliae*), blue whales (*Balaenoptera musculus*), fin whales (*Balaenoptera physalus*) and sei whales (*Balaenoptera borealis*) (see Appendix 2). White whales (*Delphinapterus leucas*) were seen in Kangerlussuaq in August 1932 (Iversen 1936), and according to the catch lists (Anon. 1966-71), one white whale was caught in Kangerlussuaq in 1970.

Minke whale (*Balaenoptera acutorostrata*)

There are reports of at least eight minke whales. The location of the sighting was given for seven of these (Fig. 43). The eighth minke whale was sighted some distance off the mouth of Kangerlussuaq. The year of observation was given for five of the sightings, with one sighting per year in 1968, 1986, 1987, 1988, and 1987/88. Four of the minke whales for which the month of sighting was given were seen in September. So far, minke whales have not been hunted, partly because the hunters are not interested. One minke whale at Amdrup Pynt was not hunted because there was too much ice.

Minke whales appear in the Ammassalik area after the ice breaks up (Holm & Pedersen 1921) and they are normally seen and hunted. At the mouth of Scoresby

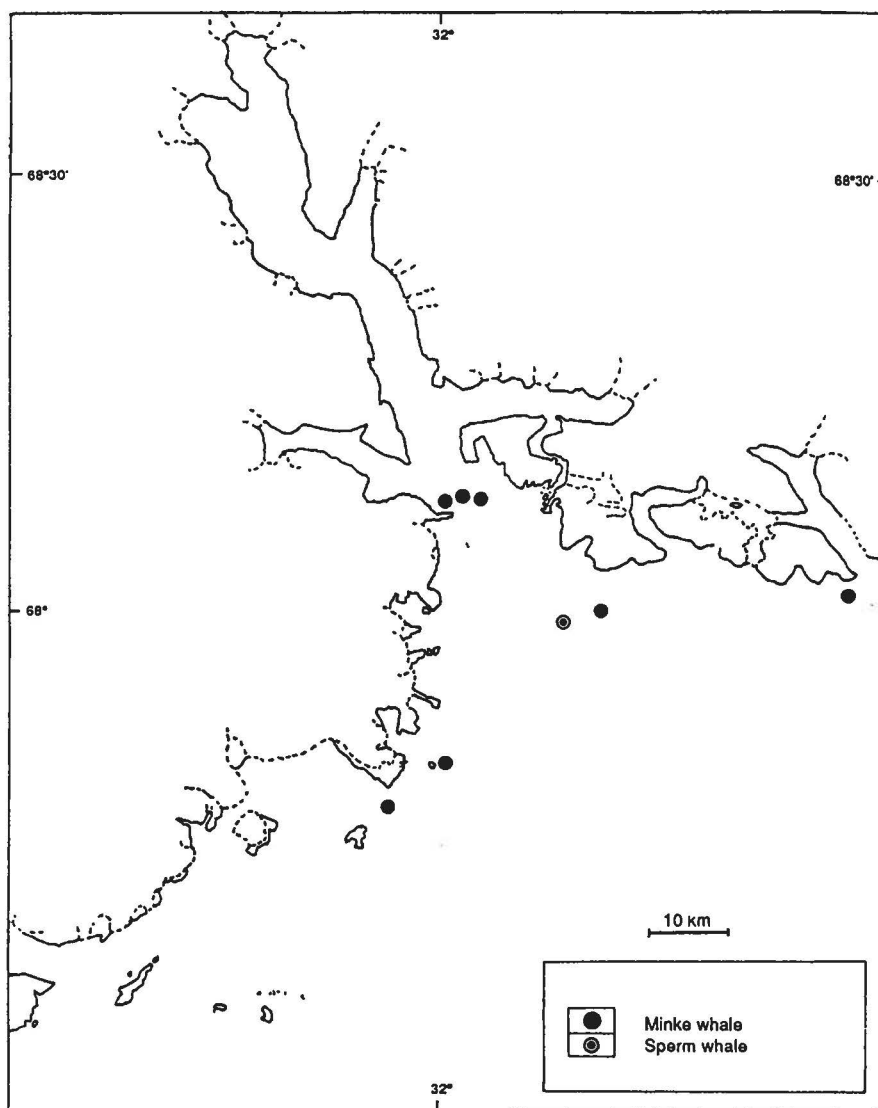


Fig. 43. Minke whale and sperm whale sightings in the Kangerlussuaq area in August and September.

Sund minke whales occur from June until the ice begins to form in October. The importance of minke whales to hunters in Scoresbysund increased at the beginning of the 1980s (Born 1983), and from 1984 to 1986 eight were caught annually (Sandell & Sandell 1991).

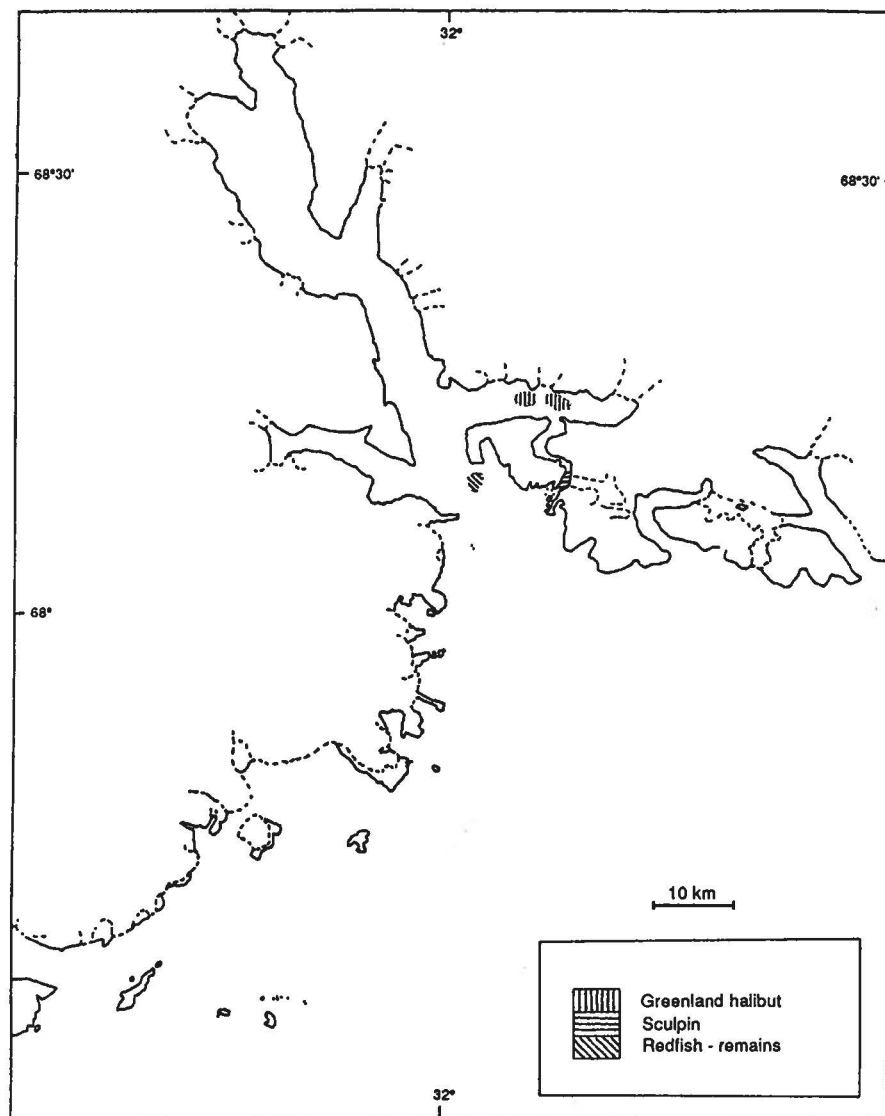
Sperm whale (*Physeter macrocephalus*)

A sperm whale was seen at the mouth of Kangerlussuaq in August 1987 (Fig. 43). It was not hunted because it was too big.

Fish

There is generally speaking no fishing in the Kangerlussuaq area, partly because the area is so rich in marine animals and partly because it is believed that there are only a few fish. Sculpins and, in the last few years, Greenland halibut, are almost the only fish species that are caught in the area. Yet a few polar cod and spotted wolffish are caught in Kangerlussuaq. Fish are also seen in the stomachs of seals, narwhals and polar bears. The hunters were asked about the catch of Atlantic cod (*Gadus morhua*), Greenland cod (*Gadus ogac*), Arctic cod (*Arctogadus glacialis*) and lumpfish (*Cyclopterus lumpus*) (see Appendix 2), but none of these fish are caught in the area. Atlantic cod have been found in the stomach of a ringed seal. Few fish other

Fig. 44. Areas within the Kangerlussuaq area where Greenland halibut and sculpins are caught, and where remains of redfish were observed.



than four species of sculpin were caught with nets and long lines in Uttental Sund, Kangerlussuaq and Miki Fjord in connection with the biological background study in August 1990 (Glahder 1990). The sculpin species constituted more than 90% of the catch. The fish species in the area are described below.

Arctic char (*Salvelinus alpinus*)

None of the hunters had caught Arctic char, but many had heard of Arctic char in Sødalen and at the head of Miki Fjord. In a film about Aputiteeq, fishermen were looking for Arctic char at Vandfaldsdalen and Sødalen, both of which run out into Miki Fjord. According to the hunters Arctic char is eaten by the polar bear.

Three large anadromous (migrating) chars (35 to 44 cm in length and 520 to 1070 g in weight) were caught in Miki Fjord opposite Vandfaldsdalen during the biological background study in August 1990 (Glahder 1990). The 28th July 1991 over thirty young Arctic char with parr marks were observed in the river in Sødalen between the landing strip and the head of Miki Fjord. The fish were between 5 and 12 cm in length. In addition more than ten young fish (about 2 cm in length) were seen. In the lakes north of the Sødalen airstrip, Degerbøl & Møhl-Hansen (1935) watched red-throated divers catching Arctic char approximately 10 cm in length.

Capelin (*Mallotus villosus*)

The hunters had occasionally seen capelin in the stomachs of ringed seals, especially in winter. Capelin is called ammassaq in the East Greenland language, and has given rise to the name of the town Ammassalik, the place (-lik) where there are capelin (Gessain 1970).

During the research cruise in August 1990 two capelin were caught (12-14 cm in length) in Miki Fjord (Glahder 1990).

Greenland halibut (*Reinhardtius hippoglossoides*)

Greenland halibut were first caught by the hunters in the area in 1988, and since then relatively few have been caught, possibly not more than ten. Greenland halibut are only caught in Watkins Fjord. They are caught in the winter using a long line and jig. Jigging for Greenland halibut has been attempted at Kap Deichmann, but without success. Greenland halibut are often found in the stomachs of narwhals and some small Greenland halibut have also been seen in the stomach of a ringed seal.

Spotted wolffish (*Anarchichas minor*)

The hunters have seen or heard of spotted wolffish in Kangerlussuaq.

Polar cod (*Boreogadus saida*)

Only a few polar cod are caught in the Kangerlussuaq region. Many hunters have found polar cod in the stomachs of ringed seals - usually only small fish.

Seven small polar cod (11 to 23 cm in length) were caught in Uttental Sund during the research cruise in August 1990, and one 23 cm in length was caught in Miki Fjord (Glahder 1990).

Redfish (*Sebastes* sp, probably *mentella*)

Attempts had been made to catch redfish, but without success, as the fjord was too deep. Redfish had only been seen at Jagtlejren on Kraemer Ø, where what was probably the remains of a ringed seal meal were washed ashore. Small redfish are often seen in the stomachs of narwhals, and the remains of redfish were seen in a ringed seal breathing hole.

Herring (*Clupea harengus*)

Two herrings were caught in Miki Fjord (18-20 cm in length) during the research cruise in August 1990 (Glahder 1990).

Sculpin species (*Myoxocephalus*, *Cottunculus* and *Triglops* species)

Sculpin are only caught occasionally, and are apparently only eaten by older people. Two young hunters did not like sculpin because there were too many bones in them.

160 sculpins were caught during the research cruise in August 1990. They were of four different species. The most common species caught (71 individuals) was the four-horned sculpin (*Myoxocephalus quadricornis*) (Glahder 1990).

Greenland shark (*Somniosus microcephalus*)

Greenland shark are only occasionally caught. One was caught, for example, south of Kraemer Ø. The Greenland shark can be a problem in connection with the net hunting of seals, because it can eat the seals and maul the nets. The meat of Greenland shark is dried to avoid toxicity, and is used for dog food. In former days sharks were caught in winter, the huge liver was used for lamp oil, and the dried meat for dog food or human food in periods of hunger (Gessain 1970).

Two Greenland sharks were caught with long lines in Miki Fjord during the research cruise in August 1990 (Glahder 1990).

Birds

In the interview-study the hunters were asked about the use of fifteen species of birds, and the hunters themselves added another two species (see Appendix 2). Besides those already on the list, an additional sixteen bird species were added. These species were observed in 1932 (Degerbøl & Møhl-Hansen 1935), 1933 (Hørring 1939), 1980 (Andersen 1981), 1990 (Glahder 1990) and 1991 during this interview-study. Only four of the bird species included on this list occur in large numbers: fulmar, eider, ivory gull and black guillemot. And only four species of birds are hunted, and of these only the eider and the black guillemot are of any importance, while the pink-footed goose and barnacle goose are seldom hunted. The different species of birds that occur in the area are described below.

Photo 21. Pink-footed geese.



Red-throated diver (*Gavia stellata*)

Red-throated divers are seen in the area but are few in number. A single individual was seen in Uttental Sund during the research cruise in August 1990. One red-throated diver was seen in Miki Fjord, while another was found drowned in one of our fishing nets in Miki Fjord (Glahder 1990).

One pair with two young were catching Arctic char in the lakes at Sødalen on 23rd August 1932 (Degerbøl & Møhl-Hansen 1935).

Great northern diver (*Gavia immer*)

Few great northern divers are seen in the area. Some were seen, for example, at the mouth of Kangerlussuaq. Two great northern divers were seen at the head of Miki Fjord in August 1990 during the research cruise (Glahder 1990) and two were seen in Skærgårds Bugt in July 1991.

Fulmar (*Fulmarus glacialis*)

Fulmars are frequently seen in Kangerlussuaq, especially in September and October. During the research cruise in August 1990, 10-15 fulmars were seen in Kangerlussuaq (opposite the mouth of Amdrup Fjord) and another 10-15 were seen at the mouth of Miki Fjord (Glahder 1990). In July 1991, about ten fulmars were seen in Kangerlussuaq, opposite Skærgården.

Fulmars were sporadically observed in Kangerlussuaq in 1932; otherwise they were only seen off the coast (Degerbøl & Møhl-Hansen 1935).

Pink-footed goose and barnacle goose (*Anser brachyrhynchus* and *Branta leucopsis*)

When questioned about these two species, the hunters talked about geese in general. It is possible that only the pink-footed goose is seen, but it is also possible that barnacle geese appear in the area during their spring and autumn migration. Geese are seen in May and in the summer, migrating north. It was also mentioned that they come in the summer and that they nest in Sødalen (Fig. 45). The hunters shoot few geese. T. Nielsen (1992, GGU, pers. comm.) both heard and saw barnacle geese at the head of Miki Fjord. On the 16th August 1990, during the research cruise, 16 pink-footed geese were seen flying into Miki Fjord from a great height. On 17th August, 2-300 pink-footed geese were disturbed at the delta at Sødalen. Footprints were found there, and also in the delta at Vandfaldsdalen (Glahder 1990).

One adult and three young pink-footed geese were killed in Miki Fjord on 6th August 1932 (Degerbøl & Møhl-Hansen 1935; Degerbøl 1937), and in Sødalen, north of Miki Fjord, three pinkfeet were foraging on 22nd August 1932 (Degerbøl & Møhl-Hansen 1935). Three flocks of pink-footed goose numbering 20-30 individuals were observed in J. C. Jacobsen Fjord on 7th August 1980 (Andersen 1981).

Brent goose (*Branta bernicla*)

One adult, subspecies *Hrota*, was shot in Miki Fjord on 7th September 1933; it was probably migrating south (Hørring 1939).

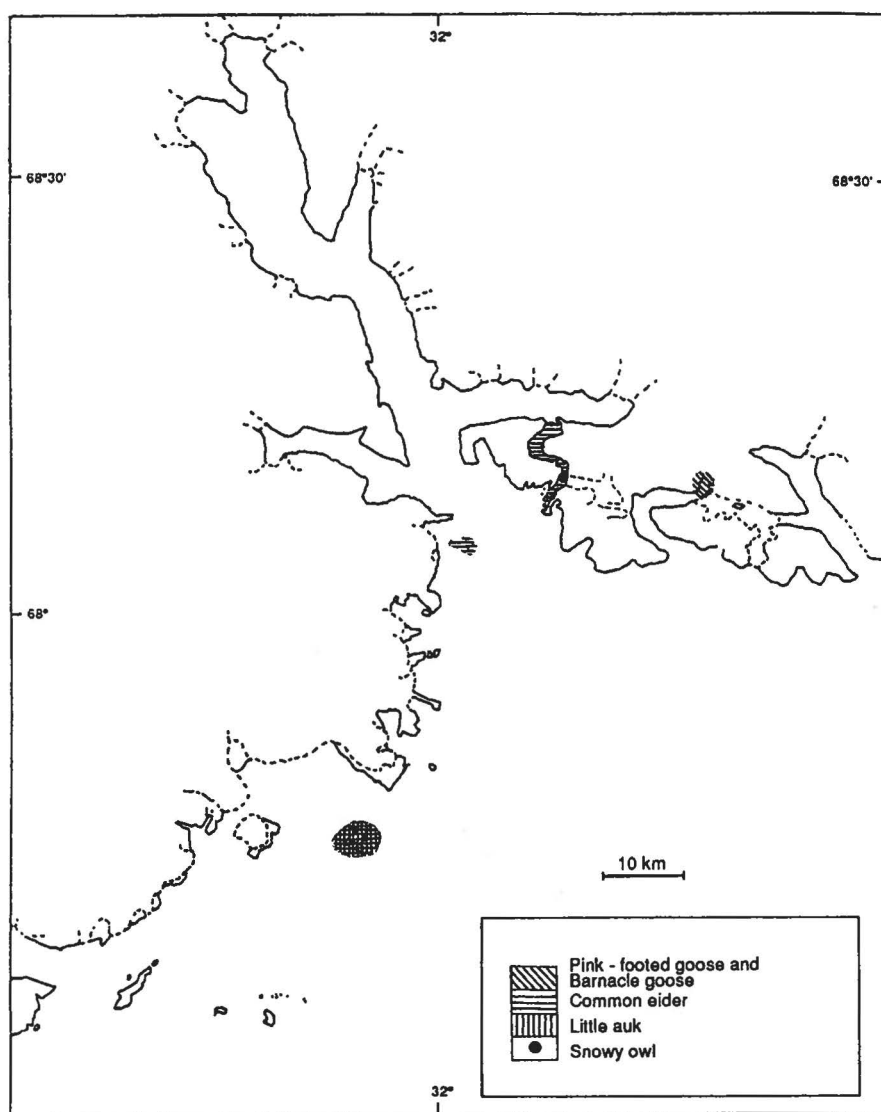


Fig. 45. Areas within the Kangerlussuaq area where some birds species have been observed.

Eider (*Somateria mollissima*)

Many eiders are seen in the Kangerlussuaq area in summer. Eiders breed at Sortskær south of Amdrup Pynt, and at Nordre Aputiteeq (Fig. 45). 65 were seen in Uttental Sund during the research cruise in August 1990 (Glahder 1990). The hunters shoot and eat a number of eiders and they are mainly shot before the narwhals are hunted. About forty male and two female eiders were observed opposite Skærgårdshalvø in July 1991.

Large flocks of adult females with their young were seen in both Kangerlussuaq and Miki Fjord on 4th-20th August 1932 (Degerbøl & Møhl-Hansen 1935).

King eider (*Somateria spectabilis*)

King eiders are seldom seen in Kangerlussuaq, and only if a lot of eiders are present.

Long-tailed duck (*Clangula hyemalis*)

Some long-tailed ducks have been seen near Nordre Aputiteeq.

In the middle of Kangerlussuaq a flock of twelve long-tailed ducks, adults with their young, was observed on 14th August 1932 (Degerbøl & Møhl-Hansen 1935).

Photo 22. Gyrfalcon.



Gyrfalcon (*Falco rusticolus*)

Gyrfalcon are seen occasionally, most frequently in the summer. Both white and grey phases are seen in the area.

Ptarmigan (*Lagopus mutus*)

Ptarmigan are seen in the area all through the year, but are few in number. Only one hunter had shot ptarmigan. Many ptarmigans were reported from Sødalen in 1990 (Glahder 1990).

Ptarmigan were relatively common in Kangerlussuaq in July 1932, and frequently small broods of 6-8 young birds were seen (Degerbøl & Møhl-Hansen 1935).

Ringed plover (*Charadrius hiaticula*)

Eight old and fifteen young ringed plovers were seen at the head of Miki Fjord in August 1990 (Glahder 1990). In July 1991, one ringed plover was seen at Skærgårdshalvø, and a pair with two chicks was seen in Sødalen.

At the head of Miki Fjord small flocks of ringed plover, both adult and young, were seen in July and August 1932 and 1933; some of the young birds had been bred in the area (Degerbøl & Møhl-Hansen 1935; Hørring 1939).

Knot (*Calidris canutus*)

Five knots in summer phase were observed in July 1991. One of them had an aluminium ring on its right leg.

Knot were fairly numerous in Miki Fjord in August 1932 and 1933 (Degerbøl & Møhl-Hansen 1935; Hørring 1939).

Sanderling (*Calidris alba*)

During the background study in 1990, six sanderlings in winter phase were seen at the head of Miki Fjord (Glahder 1990).

Sanderling were common on the banks in Miki Fjord in August 1932 and 1933 (Degerbøl & Møhl-Hansen 1935; Hørring 1939).

Purple sandpiper (*Calidris maritima*)

Five birds were seen among other waders in Miki Fjord on 31st August 1932 (Degerbøl & Møhl-Hansen 1935).

Dunlin (*Calidris alpina*)

One dunlin was seen at Skærgårdshalvø in July 1991.

Flocks of up to twenty, both adult and young, were seen in Miki Fjord in August 1932; most birds were seen early in August and none were seen after 20th August (Degerbøl & Møhl-Hansen 1935).

Turnstone (*Arenaria interpres*)

During the research cruise in 1990, seven young turnstones were seen in Uttental Sund on 11th August (Glahder 1990). Another eight were seen in connection

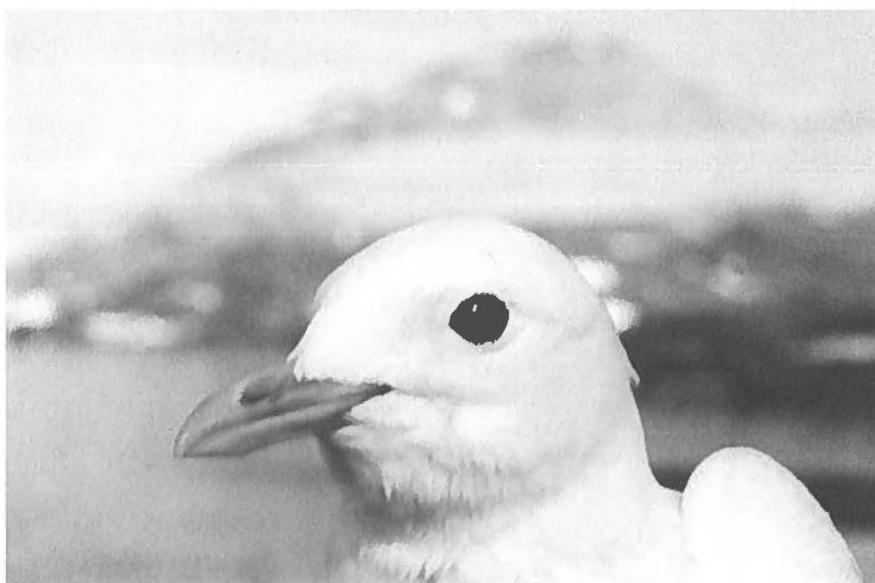


Photo 23. Ivory gull.

with the interview-study in July 1991 in full summer phase.

Migrating turnstones were common in Kangerlussuaq and in Miki Fjord in both 1932 and 1933 (Degerbøl & Møhl-Hansen 1935; Hørring 1939).

Red-necked phalarope (*Phalaropus lobatus*)

Two red-necked phalaropes were observed among other waders in Miki Fjord on 31st August 1932 (Degerbøl & Møhl-Hansen 1935).

Long-tailed skua (*Stercorarius longicaudus*)

A few long-tailed skuas were fishing like terns at the head of Miki Fjord in August 1932 (Degerbøl & Møhl-Hansen 1935).

Black-headed gull (*Larus ridibundus*)

One adult black-headed gull was seen together with the ivory gulls (see photo 23) in July 1991 at the hunters' village. This was the second sighting of this bird in South East Greenland (Boertmann 1994).

Glaucous gull (*Larus hyperboreus*)

The hunters had seen many in the area, and 5-10 glaucous gulls were seen at Skærgården in July 1991.

Degerbøl & Møhl-Hansen (1935) stated that the glaucous gull was a common bird in the area.

Kittiwake (*Rissa tridactyla*)

One hunter had seen a few in the area. During the background study in 1990, 40 kittiwakes were seen in Miki Fjord, most of them young birds (Glahder 1990).

Kittiwake were very common in the interior of Kangerlussuaq in 1932 (Degerbøl & Møhl-Hansen 1935).

Ivory gull (*Pagophila eburnea*)

A number of ivory gulls had been seen in the area, particularly around the hunters' village, where they come to eat dried meat and blubber. The hunters had seen some young birds in spring and some from August to October. The hunters do not hunt ivory gull. In August 1990, twenty adult birds were seen at the mouth of Kangerlussuaq and up to Bagnæsset (Glahder 1990). In 1991 approximately 75 adult birds were counted at the hunters' village.

Ivory gulls were common along the Blosseville coast, and it was only in Kangerlussuaq that they were seen inside the fjord (Degerbøl & Møhl-Hansen 1935).

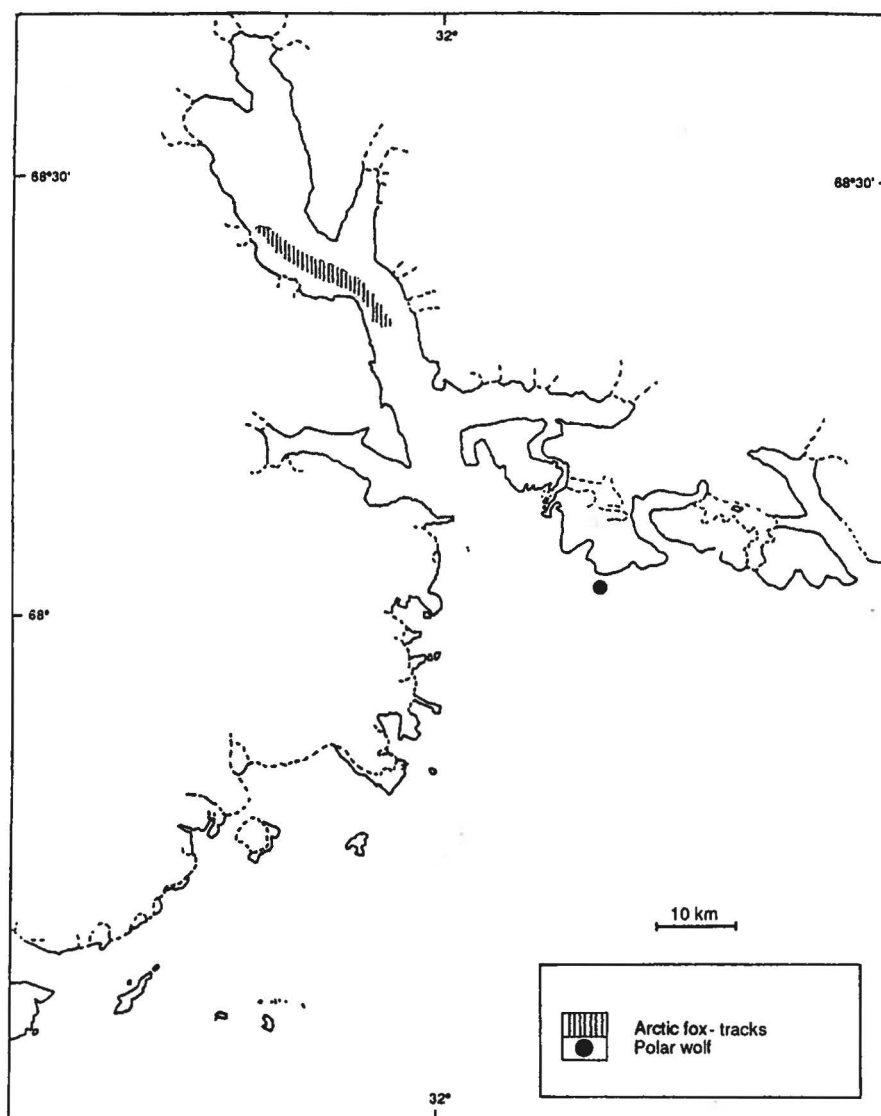
Arctic tern (*Sterna paradisaea*)

In Kangerlussuaq adult Arctic terns with their young were seen sitting close together on some icebergs (Degerbøl & Møhl-Hansen 1935). One big colony was discovered on Patuulaajivit by Andersen (1981).

Brünnich's guillemot (*Uria lomvia*)

One of the hunters had seen a few guillemots, probably Brünnich's guillemots. One skin of an adult Brünnich's

Fig. 46. Observations of Arctic fox and polar wolf in the Kangerlussuaq area.



guillemot, shot in Miki Fjord on 30th August 1933, was examined by Hørring (1939).

Black guillemot (*Cephus grylle*)

The hunters see many guillemots, some of which they shoot and eat. During the research cruise in August 1990, 25-50 guillemots were seen in Kangerlussuaq and 100-200 were seen around Hængefjeldet and at the mouth of Miki Fjord. It is highly likely that they breed in the latter area (Glahder 1990).

Degerbøl & Møhl-Hansen (1935) stated that the black guillemot was the most common of all birds along the Blossville coast down to Kangerlussuaq, and Pedersen (1931, in Hørring 1939) stated that it was a frequent breeding bird at Kangerlussuaq.

Little auk (*Alle alle*)

Many little auks are seen at Nordre Aputiteeq, but the hunters did not know whether this was their breeding area. Some were seen in autumn.

A large number sheltered from a storm in Miki Fjord on 1st September 1932 (Degerbøl & Møhl-Hansen 1935).

Snowy owl (*Nyctea scandiaca*)

A few snowy owls have been seen in the area. In the summer of 1973 or 1974 one hunter saw two young snowy owls hunting black guillemots in Uttental Sund. Another hunter said that snowy owls live on black guillemots and ptarmigans.

Raven (*Corvus corax*)

One raven was seen during the background study in 1990 (Glahder 1990), and another three were seen at Skærgårdshalvø in July 1991. T. Nielsen (1992, GGU, pers. comm.) saw up to five ravens at one time in the Kangerlussuaq area.

Ravens were relatively common in Kangerlussuaq in 1932, when three or four were seen at the same time (Degerbøl & Møhl-Hansen 1935).

Wheatear, common redpoll and snow bunting (*Oenanthe oenanthe*, *Carduelis flammea* and *Plectrophenax nivalis*)

Only a few individuals of these three passerine species were seen during the background study in 1990 (Glahder 1990). In addition, three male snow buntings sang at Skærgårdshalvø July 1991.

In 1932 a small number of individuals of these three species were seen (Degerbøl & Møhl-Hansen 1935).

Arctic redpoll (*Carduelis hornemanni*)

Small flocks were observed in 1932 by Degerbøl & Møhl-Hansen (1935).

Land mammals

Only Arctic foxes are seen frequently in the Kangerlussuaq area. Few of them are shot. As for other land mammals in the area, a polar wolf was seen on one occasion, while alpine hare (*Lepus arcticus*) and caribou (*Rangifer tarandus*) were not seen at all.

Arctic fox (*Alopex lagopus*)

Most of the hunters stated there are many Arctic foxes in the area, although some of the hunters had only seen footprints of Arctic foxes at the head of Kangerlussuaq and at Søkongen Ø. It is the general opinion that where there are polar bears, there are Arctic foxes. Only a few foxes are shot. The skins can be used for gloves and caps for girls. In August 1990, one Arctic fox was sighted on a number of occasions at the base camp at Sødalen (Glahder 1990).

Three Arctic foxes were seen in Miki Fjord in 1932 and the same expedition also found fox-traps set by the Eskimos (Degerbøl 1937).

Polar wolf (*Canis lupus*)

One of the hunters knew of a hunter who had seen a polar wolf at Hængefjeldet in 1986. Apparently the wolf had followed some polar bears and eaten the remains of their kill. Wolves had disappeared from East Greenland by the end of the 1930s, but in the 1980s they migrated back to the area they previously occupied, which is a little farther south than the mouth of Scoresby Sund (Dawes et al. 1986). So the polar wolf that was seen in Kangerlussuaq represents the southernmost sighting of wolves in East Greenland.

Conclusion

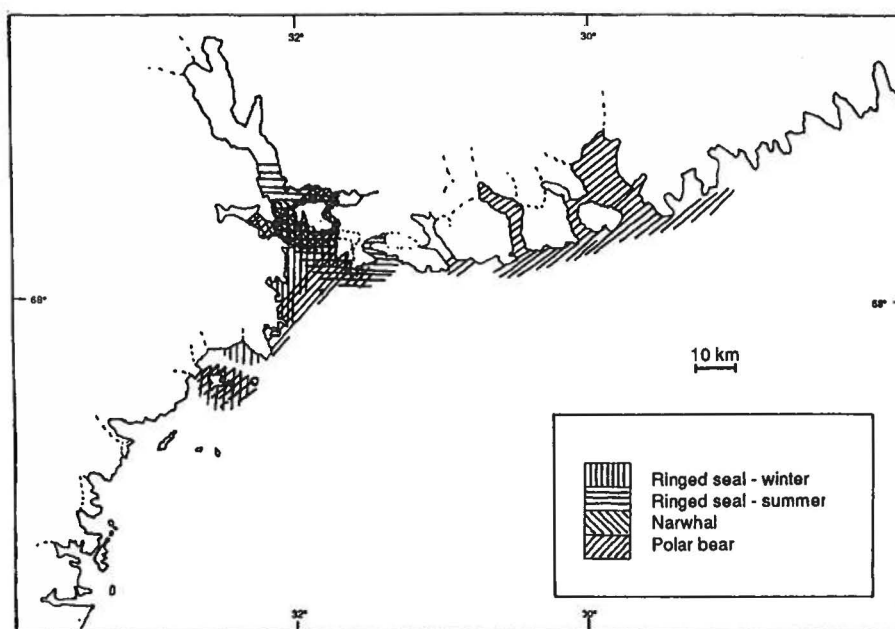
Kangerlussuaq is one of the largest fjords in East Greenland. It is an ice fjord extending about 100 km from the ice-cap to the coast through steep mountains and active glaciers. Along the coast the East Greenland Current carries large quantities of ice from the Polar Sea. Off Kangerlussuaq, in the Danmark Stræde, the cold and nutritious East Greenland Current meets with a branch of the warmer Irminger Current and with the Greenland-Iceland ridge. The result is an upwelling of nutritious, warm water which give rise to a rich source of phytoplankton food for the animals in the food chain.

Marine mammals are very numerous in the Kangerlussuaq region. Ringed seal are seen everywhere all year round, while bearded, hooded and harp seal, as well as narwhal, are common from early summer to autumn. Polar bear are also common most of the year, but more scattered in the region. Walrus and minke whale are more scarce, with only a few individuals seen every year. The only land mammal seen frequently is the Arctic fox, and of birds, only fulmar, eider, ivory gull and black guillemot are seen in any great number.

Hunters were probably living in the Kangerlussuaq region some 4000 years ago, and building sites give evidence of settlements in different places in the region from the 15th to the 19th century. In recent years hunters have wintered in Kangerlussuaq in 1935/1936, from 1946 to 1948, and permanently from 1966 until today, apart from the years 1980-1986.

There is hunting all year round in the Kangerlussuaq region and as far southwest as Agga Ø, approximately 120 km from the hunters' village, and to the north east as far as Kap Vedel, approximately 200 km from the village. The most important hunting area stretches from the middle of Kangerlussuaq, a little north of Watkins Fjord, south to the mouth of Kangerlussuaq, which is defined by a line from Kap Edvard Holm to Kap Hammer. The area includes most of Watkins Fjord and Amdrup Fjord, and all of Uttental Sund. Additional important hunting areas are around Nordre Aputiteeq and Fladø, and around Søkongen Ø, including Ryberg

Fig. 47. The most important areas in the Kangerlussuaq region for hunting ringed seal, narwhal and polar bear.



Fjord slightly west of Søkongen Ø (Fig. 47). By far the most important animals hunted are ringed seal, narwhal and polar bear. On average a hunter catches 200 ringed seals in a season. With 5-10 hunters present at the village, 1000-2000 ringed seals are caught in a single season. On average 20-30 narwhals and 25-35 polar bears are caught per season. Of the other marine mammals, a total of 50-200 are caught per season. These include bearded seal, hooded seal and harp seal; in addition, an average of one walrus is caught per season. Whales are few in number; the minke whale is seen frequently but not hunted. The hunters catch fish, especially Greenland halibut, and birds, especially eider and black guillemot. Of land mammals only the Arctic fox is shot, and only in small numbers.

The Kangerlussuaq region has been of great interest to geologists since the 1930s, but it was not until 1986 that exploration for gold, platinum and palladium was initiated. The hunters in the Kangerlussuaq region have gained some experience of the impact on the hunted animals of this mineral exploration, as well as the impact of other activities, e.g. the weather station at Aputiteeq, the Kulusuk air base, research vessels and their own motorboats and dinghies with outboard motors.

Most often, the disturbances cause local problems, making the animals move away from the area for some time. This is seen with ringed seals and narwhals disturbed by ships, motorboats, low-flying helicopters and diamond drilling on land. With the polar bear there is perhaps a more regional impact, caused by the various activities in the mouth of Kangerlussuaq.

This interview-study collected much information, especially on the marine mammals and their distribution over the year in the Kangerlussuaq region. Knowledge of the hunters' exploitation of the marine mammals in the region at different times of the year has also been extended by this study.

This information, in combination with other work like studies of the effects of mineral resource activity on Arctic marine mammals will make it possible to regulate future mineral exploration and exploitation in the Kangerlussuaq region, and to avoid or minimise possible conflicts of interest between the mining industry, the hunters and the hunted animals.

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1976. He therefore speaks the East Greenland dialect fluently. Thanks to his experience as a schoolteacher in East Greenland, Niels Grann was already acquainted with many of the people visited and interviewed. This was of great significance for the implementation of this study.

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Appendix 1

Names of animals referred to in the paper in English, Latin, East Greenlandic, Danish.

Ringed seal	<i>Phoca hispida</i>	Miigattak	Ringsæl
Bearded seal	<i>Erignatus barbatus</i>	Anneq	Remmesæl
Hooded seal	<i>Cystophora cristata</i>	Niiniarteq	Klapmyds
Harp seal	<i>Phagophilus groenlandicus</i>	Nalanginnaq	Grønlandssæl
Harbour seal	<i>Phoca vitulina</i>	Qittalivag	Spættet sæl
Walrus	<i>Odobenus rosmarus</i>	Aaveq	Hvalros
Narwhal	<i>Monodon monoceros</i>	Qialivag	Narhval
White whale	<i>Delphinapterus leucas</i>	Qialivarnaq	Hvidhval
Minke whale	<i>Balaenoptera acutorostrata</i>	Tigaanguttik	Vågehval
Fin whale	<i>Balaenoptera physalus</i>	Arpeq/Tunnulik	Finhval
Sei whale	<i>Balaenoptera borealis</i>	Tunnuttit ilaat (?)	Sejhval
Blue whale	<i>Balaenoptera musculus</i>	Tunnulik	Blåhval
Humpback whale	<i>Megaptera novaeangliae</i>	Qipoqqaq	Pukkelhval
Bowhead whale	<i>Balaena mysticetus</i>	Arpeq	Grønlandshval
Sperm whale	<i>Physeter macrocephalus</i>	Arpeq neqqisilitti-vagajik kigutilissuaq	Kaskelot
Killer whale	<i>Orchinus orca</i>	Napaatilik	Spækhugger
Arctic char	<i>Salvelinus alpinus</i>	Kaporniarngaq	Fjeldørred
Capelin	<i>Mallotus villosus</i>	Ammassaq	Lodde/Ammassat
Greenland halibut	<i>Reinhardtius hippoglossoides</i>	Qalarngalik	Hellefisk
Spotted wolffish	<i>Anarchichas minor</i>	Qeerngaq	Plettet havkat
Polar cod	<i>Boreogadus saida</i>		Polartorsk
Arctic cod	<i>Arctogadus glacialis</i>		Istorsk
Greenland cod	<i>Gadus ogac</i>	Uuvaq	Uvak
Atlantic cod	<i>Gadus morhua</i>	Aalisakkat	Torsk
Redfish	<i>Sebastes sp</i>	Suluppaavaq	Rødfisk
Herring	<i>Clupea harengus</i>		Sild
Lumpfish	<i>Cyclopterus lumpus</i>	Niisa	Stenbider
Four-horned sculpin	<i>Myoxocephalus quadricornis</i>	Qivaareq	Hornulk
Greenland shark	<i>Somniosus microcephalus</i>	Niialingaq	Grønlandshaj/havkal
Red-throated diver	<i>Gavia stellata</i>	Qaqqaqqaq	Rødstrubet lom
Great northern diver	<i>Gavia immer</i>	Qartiimoortoq	Islom
Fulmar	<i>Fulmarus glacialis</i>	Qarattuk	Mallemuk
Pink-footed goose	<i>Anser brachyrhynchus</i>	Siggukitsoq-sikkigitseq	Kortnæbbet gås
Barnacle goose	<i>Branta leucopsis</i>		Bramgås
Brent goose	<i>Branta bernicla</i>		Knortegås
Eider	<i>Somateria mollissima</i>	Maleersartaq	Ederfugl
King eider	<i>Somateria spectabilis</i>	Qingaliqialik	Kongeederfugl
Long-tailed duck	<i>Clangula hyemalis</i>	Alleq-atleq	Havlit
Gyrfalcon	<i>Falco rusticolus</i>	Nappaligitseq	Jagtfalk
Ptarmigan	<i>Lagopus mutus</i>	Nagalarngaq	Fjeldrype
Ringed plover	<i>Charadrius hiaticula</i>		Stor præstekrave
Knot	<i>Calidris canutus</i>		Islandsk ryle
Sanderling	<i>Calidris alba</i>		Sandløber
Purple sandpiper	<i>Calidris maritima</i>		Sortgrå ryle
Dunlin	<i>Calidris alpina</i>		Almindelig ryle
Turnstone	<i>Arenaria interpres</i>		Stenvender
Red-necked phalarope	<i>Phalaropus lobatus</i>		Odinshane

Long-tailed skua	<i>Stercorarius longicaudus</i>		Lille kjove
Black headed gull	<i>Larus ridibundus</i>		Hættemåge
Glaucous gull	<i>Larus hyperboreus</i>	Quseeq	Gråmåge
Kittiwake	<i>Rissa tridactyla</i>	Taalaqqaq	Ride
Ivory gull	<i>Pagophila eburnea</i>	Quseerngaajik	Ismåge
Arctic tern	<i>Sterna paradisaea</i>	Imeqqilaalaq	Havterne
Brünnich's guillemot	<i>Uria lomvia</i>	Saarnngittiit/-ttik	Polarlomvie
Black guillemot	<i>Cepphus grylle</i>	Noorniarngaq	Tejst
Little auk	<i>Alle alle</i>	Kutsuulaq	Søkonge
Snowy owl	<i>Nyctea scandiaca</i>	Kiialik	Sneugle
Raven	<i>Corvus corax</i>		Ravn
Wheatear	<i>Oenanthe oenanthe</i>		Stenpikker
Common redpoll	<i>Carduelis flammea</i>		Gråsisken
Arctic redpoll	<i>Carduelis hornemanni</i>		Hvidsisken
Snow bunting	<i>Plectrophenax nivalis</i>		Snespurv
Polar bear	<i>Ursus maritimus</i>	Naneq	Isbjørn
Polar wolf	<i>Canis lupus</i>	Amarngoq	Polarulv
Arctic fox	<i>Alopex lagopus</i>	Oritsernaq	Polarræv
Caribou	<i>Rangifer tarandus</i>	Tuttoq	Rensdyr
Alpine hare	<i>Lepus arcticus</i>	Ugaleq	Arktisk snehare

Appendix 2

Questionnaire 1, General

Hunter:

- 0 Date of interview, name, occupation, address, size of family, children, adults.

The use of Kangerlussuaq:

In which periods have you been in Kangerlussuaq?

- 1 During winter (date of arrival and departure)
- 2 During summer (date of arrival and departure)
- 3 How many people were present in those periods?
- 4 What were the names of the hunters who were with you?
- 5 Do you know of hunters who may have been up here earlier (during winter/summer)?
- 6 Why do you come here?
- 7 Do you keep a hunting diary?

Mining activities:

- 8 What does it mean that the mining company is here?
- 9 Do you think hunting will be affected if a mine is established in Kangerlussuaq?
- 10 Will you continue to come here if a mine is established?
- 11 Advantages/disadvantages of a mine

Ice:

- 12 Where and when is there fast ice?
- 13 Where is the ice edge during winter?
- 14 Does the fast ice often break up with the "piteraq"?
- 15 Are there always a lot of icebergs?
- 16 What routes do you take during your sledge journeys (map)?
- 17 Where are the places where there are currents under the ice (map)?

Questionnaire 2, Narwhal

Catch:

- 1 Did you hunt narwhal in 1990/1991?
- 2 Where (map)?
- 3 How many?
- 4 When?
- 5 Sex?
- 6 Age?
- 7 How many whales were there in the flock (sex, age)?
- 8 Were any of the other whales shot, and if so by whom (name)?
- 9 Who was with you (names)?
- 10 Have you hunted narwhals in the past (the questions above asked again)?
- 11 Have you seen any narwhals that were not shot (most of the questions above asked again)?
- 12 Were any of the narwhals you shot subsequently lost (sank, escaped)?
- 13 How many narwhals were shot in total in 1990/1991?
- 14 How many narwhals were shot in total in the past?

Hunting trips:

- 15 Where did you go hunting in 1990/1991?
- 16 How many times and when?
- 17 Describe the journey and observation posts (map)?
- 18 How many hunters accompanied you on the hunting trip?
- 19 Why did you choose these observation posts?

Hunting methods:

- 20 How was the hunt carried out (motorboat, kayak, harpooned-shot, shot-harpooned, shot-hooked, other)?
- 21 Do you hunt more or less whales than in the past?

Migratory routes:

- 22 The whales you hunted, did you notice the direction they were moving?
- 23 The whales you saw (did not shoot), did you notice the direction they were moving?
- 24 Do the whales always migrate along the same routes?

Other behaviour:

- 25 In what months do foetuses appear in the females?
- 26 How big is the foetus (when)?
- 27 Nutrition (stomach contents)?

Trade:

- 28 How many tusks did you take in 1990/1991?
- 29 Size, value?
- 30 Males with two tusks?
- 31 Females with tusks?
- 32 Mattak - sale, quality, value, storage?
- 33 I would like to buy mattak for analyses

Disturbances, the mining company and hunting:

- 34 Disturbances - have you observed any disturbance in relation to helicopters, ships and rubber dinghies?
- 35 Other influences of mining activities?
- 36 Disturbances from your motorboat?
- 37 If yes, at what distance?
- 38 What does it mean for your hunting?

Questionnaire 3, Polar bear

Catch:

- 1 Did you hunt polar bear in 1990/1991?
- 2 Where (map)?
- 3 How many?
- 4 When?
- 5 Sex?
- 6 Age?
- 7 Was the bear together with other bears?
- 8 If yes - what was the family composition (number of cubs of 0, one and two years of age)?
- 9 Were any of the other bears shot, and if so by whom (name)?
- 10 Who was with you (names)?
- 11 Have you hunted polar bears in the past (the questions above asked again)?
- 12 Have you ever shot a tagged bear (tag colour, number, location of tag, tattooed number in the upper lip, satellite transmitter (neck band))?
- 13 Do you know of anybody who has shot a marked bear (name and address)?
- 14 Have you seen any polar bears that were not shot (most of the questions above asked again)?
- 15 How many polar bears were shot in total in 1990/1991?
- 16 How many polar bears were shot in total in the past?

Hunting trips:

- 17 Where did you go hunting in 1990/1991?
- 18 How many times and when?
- 19 Describe the route (map)
- 20 How many hunters accompanied you on the hunting trip?
- 21 How many sledges?
- 22 How many dogs?
- 23 Why did you choose this route?
- 24 Do other hunters (from Scoresbysund - Søndre Aputiteeq) shoot bears here?

Hunting methods:

- 25 How was the hunt carried out (tracking, dogs, the weapon)?
- 26 Did you hunt more or less polar bears than in the past?

Migratory routes:

- 27 The bears you shot, in what direction were they walking?
- 28 Where have you seen bear tracks?
- 29 Which direction were they going and at what time of the year?
- 30 Which sex?
- 31 Are there fixed migratory routes (map)?
- 32 Have you seen any small bear tracks, where, in what month?
- 33 Where do you think the polar bears migrate to during summer (outside Kangerlussuaq)?

Dens:

- 34 Have you seen maternity dens - where (map)?
- 35 How many and when?
- 36 Size?
- 37 Location in the terrain?
- 38 Have you seen other dens?
- 39 Do you know of anybody who has seen dens (questions above and name of person)?
- 40 Do you know of any dens/denning areas outside Kangerlussuaq?

Other behaviour:

- 41 Mating or mating behaviour (possibly tracks which suggest this)?
- 42 Where and when?
- 43 Nutrition (stomach contents, observations of hunting bears)?

Trade:

- 44 What do you use the hides for (trousers, sale)?
- 45 How many hides used to make trousers are sold (who buy the hides)?
- 46 At what price?

The mining company:

- 47 Disturbances?
- 48 Are the polar bears attracted by the mining company (e.g. to waste)?

Questionnaire 4, Ringed seal

Catch:

- 1 How many did you shoot in 1990/1991?
- 2 Where (the approximate number of different places (map))?
- 3 When?
- 4 How many were shot in 1990/1991?
- 5 How many were shot in the past?
- 6 How many were shot in total in 1990/1991 and in the past?
- 7 Have you shot any tagged seals (tag colour, number, location)?
- 8 Do you know of any hunters who have shot tagged seals (name and address)?
- 9 When do you catch males in the rutting season?

Hunting trips:

- 10 Where is the best place to hunt in summer - why?
- 11 Where is the best place to hunt in winter - why?

Hunting methods:

- 12 Nets:
 - Where are the nets set (map)?
 - Precisely which places (headlands, icebergs, cracks in the ice)
 - When?
 - How many nets?
 - How many seals per net?
- 13 Ice edge:
 - Where, how, how many, when?
 - How many are lost?
- 14 Ice floes:
 - Where, how, how many, when?
 - How many are lost?
- 15 Breathing hole:
 - Where, how, how many, when?
 - How many are lost?
- 16 Do you hunt more or less seals than in the past?

Migratory routes:

- 17 Where do the young and adult seals migrate during summer?
- 18 Are there fixed routes the seals follow (do they come close to the headlands, islands, etc.)

Breeding lairs:

- 19 Have you seen breeding lairs - where (map)?
- 20 How many and when?
- 21 Location in the terrain?
- 22 Do you know of anybody who has seen breeding lairs (questions above and name of person)
- 23 Have you seen lairs that have been broken by polar bears?
- 24 How many, where and when?

Other behaviour:

- 25 When do the seals moult (qatsimalit)?
- 26 When do you see most of the seals moulting?
- 27 Nutrition (stomach contents)?

Trade:

- 28 How many skins can you sell in 1990/1991?
- 29 In the past?
- 30 What is the selling price per skin?

The mining company:

- 31 Disturbances (helicopters, skidoos, rubber dinghies, ships)?

Questionnaire 5, Marine mammals, birds, fish, land mammals

Which other animals do you hunt (see the list below)

Which of them is most important?

When and how many have you hunted (H), seen (S)

1991 1990 1989 1988 1987 1986 1985

- 1 Walrus, aaveq
- 2 Bearded seal, anneq
- 3 Hooded seal, niiniarteq
- 4 Harp seal, nalanginnaq
- 5 Harbour seal, qittalivaq

- 6 Humpback whale, qipoqqaq
- 7 Blue whale, tunnulik
- 8 Fin whale, arpeq/tunnulik
- 9 Sei whale, tunnuttit ilaat (?)
- 10 Minke whale, tigaanguttik
- 11 Sperm whale, arpeq neqqisilittivagajik kigutilissuaq
- 12 Bowhead whale, arpeq
- 13 White whale, qialivarnaq

- 14 Great northern diver, qartiimoortoq
- 15 Fulmar, qarattuk
- 16 Glaucous gull, quseeq
- 17 Kittiwake, taalaqqaq
- 18 Ivory gull, quseerngaajik
- 19 Brünnich's guillemot, saarnngittiit/-ttik
- 20 Little auk, kutsuulaq
- 21 Pink-footed goose, siggukitsaq-sikkigitseq
- 22 Barnacle goose, ?
- 23 Long-tailed duck, alleq-atleq
- 24 Eider, maleersartaq
- 25 King eider, qingaliqialik
- 26 Ptarmigan, nagalarnga
- 27 Gyrfalcon, nappaligitseq
- 28 Snowy owl, kiialik

- 29 Arctic char, kaporniarnga
- 30 Greenland halibut, qalarngalik
- 31 Spotted wolffish, qeerngaq
- 32 Arctic cod, ?
- 33 Greenland cod, uuvaq
- 34 Polar cod, ?
- 35 Atlantic cod, aalisakkat
- 36 Lumpfish, niisa
- 37 Sculpin, qivaareq

- 38 Arctic fox, oritsernaq
- 39 Alpine hare, ugaleq
- 40 Caribou, tuttoq
- 41 Polar wolf, amarngoq

Time (whole min.)		Time period (whole min.)		
Surface	Underwater	Surface	Underwater	
10.06 - 10.07	10.03 - 10.06		3	<u>Flock B</u> C. 10 individuals <u>Surface:</u> $\bar{x} = 0,7 \text{ min.}$ $s = 0,4 \text{ min.}$ <u>Underwater:</u> $\bar{y} = 3,4 \text{ min.}$ $s = 1,5 \text{ min.}$
10.11 - 10.12	10.07 - 10.11	1	4	
? - 10.26	10.12 - ?	1	?	
10.29 - 10.30	10.26 - 10.29	?	3	
10.31 - 10.31	10.30 - 10.31	1	1	
10.35 - 10.36	10.31 - 10.35	0	4	
10.37 - 10.37	10.36 - 10.37	1	1	
10.42 - 10.42	10.37 - 10.42	0	5	
10.44 - 10.44	10.42 - 10.44	0	2	
10.49 - 10.49	10.44 - 10.49	0	5	
10.54 - 10.55	10.49 - 10.54	0	5	
10.58 - 10.59	10.55 - 10.58	1	3	
11.04 - 11.05	10.59 - 11.04	1	5	
		1		
? - 10.08	10.02 - ?		?	<u>Flock A</u> C. 12 individuals
? - 10.16	10.08 - ?	?	?	
? - 10.23	10.16 - ?	?	?	
10.28 - 10.29	10.23 - 10.28	?	5	
? - 10.45	10.29 - ?	1	?	
10.53 - 10.53	10.45 - 10.53	?	8	
? - 11.05	10.53 - ?	0	?	
		?		
12.50 - 12.50	12.50 - 12.56	0	6	<u>Flock A</u> C. 10 individuals 15-20 individuals from 1.52 p.m. <u>Surface:</u> $\bar{x} = 0,9 \text{ min.}$ $s = 2,0 \text{ min.}$ <u>Underwater:</u> $\bar{y} = 4,6 \text{ min.}$ $s = 2,0 \text{ min.}$
12.56 - 12.57	12.57 - 13.03	1	6	
13.03 - 13.04	13.04 - 13.06	1	2	
13.06 - 13.07	13.07 - 13.10	1	3	
13.10 - 13.11	13.11 - 13.18	1	7	
13.18 - 13.19	13.19 - 13.24	1	5	
13.24 - 13.25	13.25 - 13.26	1	1	
13.26 - 13.26	13.26 - 13.30	0	4	
13.30 - 13.31	13.31 - 13.37	1	6	
13.37 - 13.38	13.38 - 13.44	1	6	
13.44 - 13.45		1		
12.52 - 12.53	12.53 - 12.58	1	5	
12.58 - 12.59	12.59 - 13.07	1	8	
13.07 - 13.08	13.08 - ?	1		
13.31 - 13.32		1		
Separated into two flocks				
13.38 - 13.39	13.39 - 13.44	1	5	
13.44 - 13.45	13.45	1		
Combined data:	<u>Surface (N=31):</u> $\bar{x} = 0,8 \text{ min.}$ $s = 0,3 \text{ min.}$		<u>Underwater (N=27):</u> $\bar{y} = 4,4 \text{ min.}$ $s = 2.0 \text{ min.}$	

Appendix 3

Observations of the diving rhythm of narwhal flocks in search of food at Kap Deichmann - Den Lave Pynt, 28.7.1991.

The narwhal flock was monitored from an observation post located west of Kap Deichmann approximately 500 m above sea level. The narwhals were 5-6 km from the observation post. The narwhals were observed with Nikon 10X40 binoculars and the diving time was recorded to the nearest minute with a wrist watch. Time 0 represents a period of 0-30 secs., Time 1 = 30-90 secs., Time 2 = 90-150 secs., etc. In order to calculate the mean and variance of a single diving period, the mid-point of each time interval was used, i.e. for Time 0, 15 secs. was used, 1 : 60 secs., 2 : 120 secs., etc. "?" indicates that the flock had probably been up and down a number of times without being observed. In the table the means and variances are given in minutes to one decimal place. Since the basis for recording the diving rhythm was minutes, the values for the mean and variance should be viewed with some caution (e.g. the numbers stated could be reported such that the feeding narwhals on average were under water a little more than four minutes and on the surface for about one minute, and that the ratio was approximately 5:1 mins.).

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Two copies of the manuscript, each complete with illustrations, tables, captions, etc. should be sent to the Secretary, Kommissionen for videnskabelige Undersøgelser i Grønland. Manuscripts will be forwarded to referees for evaluation. Authors will be notified as quickly as possible of acceptance, rejection or desired alterations. The final decision on these matters rests with the editor.

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Tarling, D. H. 1967. The palaeomagnetic properties of some Tertiary lavas from East Greenland. - Earth and Planetary Science Letters 3: 81–88.

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