Occurrence of narwhals (*Monodon monoceros*) and white whales (*Delphinapterus leucas*) in East Greenland

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Dietz, R., Heide-Jørgensen, M. P., Born E. W. & Glahder C. M. 1994. Occurrence of narwhals (*Monodon monoceros*) and white whales (*Delphinapterus leucas*) in East Greenland. – Meddr Grønland, Biosci. 39: 69–86. Copenhagen 1994-04-22.

Narwhals (*Monodon monoceros*) have been observed along the east coast of Greenland from Umiiviip Kangertiva (64°10'N, 41°W) to Kilen (81°N, 13°W). The fjord complexes of Sermilik, Kangerlussuaq and Scoresby Sund are important inshore summering areas. Narwhals occur in these fjords from ice breakup in May-July until new ice forms in September–November. Narwhals also occur at the entrances to these fjords during winter. Historical information from whalers indicates that narwhals are present in the pack ice of the Greenland Sea between May and September. Narwhals are believed to be widely scattered in the pack ice between eastern Greenland and Svalbard during winter, and the narwhals in this area may comprise a single population. During the period 1981 to 1990 the catch of narwhals in eastern Greenland has averaged at least about 80 animals per year. White whales *(Delphinapterus leucas)* are rare and only occasionally caught in eastern Greenland. The general absence of white whales in this area is probably due to a combination of severe ice conditions along the East Greenland coast and a general lack of suitable shallow-water habitat.

Key words:
Narwhal, *Monodon monoceros*, white whale, beluga, *Delphinapterus leucas*, distribution, migrations, food, gestation period, catch, East Greenland.

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Introduction

Huge masses of heavy polar pack ice are transported year-round south along the east coast of Greenland by the East Greenland Current. This ice makes living conditions in this area harsh for both humans and wildlife. Access to the coast is difficult, and as a result there are vast unpopulated areas in eastern Greenland. Nowadays small groups of Inuit live only in the Ammassalik (66°N) and Scoresby Sund (Kangertiitivaq, 70°30'N) areas of southeastern and eastern Greenland. North of Scoresby Sund the coast is unpopulated except for a few people who live year-round at the weather stations at Daneborg (74°20'N) and Danmarkshavn (77°N). Few observations of wildlife have been recorded in eastern Greenland outside the populated areas. Most of the available information has come from English and Scottish whalers navigating the Greenland Sea in search of bowhead whales (*Balaena mysticetus*), early European explorers, Danish and Norwegian trappers living in northeastern Greenland during the first half of the 20th Century, and some recent expeditions which have operated primarily during summer.

Observations of narwhals (*Monodon monoceros*) and white whales (*Delphinapterus leucas*) in the East Greenland area have been reviewed by Winge (1902) and Dietz *et al.* (1985). In a summary of observations of narwhals in the "Norwegian High Arctic" Gjertz (1991) included information on narwhals in the Greenland Sea east of 5°W.

Based on a variety of sources, we summarize the occurrence of narwhals along the coast of eastern Greenland by region from south to north. Offshore observations of narwhals in the Greenland Sea and Fram Strait (between eastern Greenland and Svalbard) are presented separately. We also describe a few observations of feeding and the birth period of narwhals in eastern Greenland, and we summarize the available data on narwhal catches. Finally we review the few records of occurrence and catch of white whales in eastern Greenland.

Materials and methods

Titles of publications dealing with narwhals and other marine mammals in eastern Greenland and in the Greenland Sea area were compiled from the libraries at the Scott Polar Research Institute (Cambridge, UK), Museum of Tromsø and Library of Tromsø, Norwegian Polar Research Institute (Oslo), Arctic Institute (Copenhagen) and Greenland Fisheries Research Institute (Copenhagen). Published works containing information on marine mammals were selected based on the title or on our knowledge of the merits of the author(s). These publications were obtained from the libraries of the University of Copenhagen, the Royal Danish Veterinary Agricultural University, the Royal Danish Library and the Danish National Archives.

Information was extracted from unpublished Ittoqqortoormiit (the settlement of Scoresbysund) journals for the period 1925–1940 held at the National Archives. Recent information concerning narwhals was obtained from interviews with the residents of Scoresby Sund municipality carried out in August 1983 (Born 1983), and hunters in the same area in August 1990 (Mosbech 1990). An extensive series of interviews to obtain information on wildlife was conducted in Kangerlussuaq in summer 1991 (Glahder 1992). During August-September 1991 narwhals were observed opportunistically from r/v *Thetis* and a helicopter operating in the Greenland Sea between 70°N and 80°N and from 10°W to 25°W (Søder 1991). During the cruise of r/v *Polarstern* extensive helicopter surveys were conducted between 27 May and 18 June 1993 over the pack ice between 79°00'N (Norske Øen) and 81°58'N (Kap Ringkøbing) and between 10°30'W and 21°20'W. Observations of narwhals made during these surveys are included here (Born unpubl. data). Sporadic observations of narwhals and white whales made by various expeditions visiting East Greenland have also been included in this study.

Results

Coastal observations of narwhals

Coastal observations of narwhals are presented in Tables 1 and 2 a,b,c and Figs 1–3. Areas with numerous observations are cross-hatched in the figures.

The southernmost record of narwhals in East Greenland is from Umiiviip Kangertiva (Gyldenløves Fjord; 64°11'N, 41°W) in early July 1982 (Table 1, Fig. 1). Although narwhals occur along the entire coast between Ammassalik and Scoresby Sund, they are particularly abundant in Sermilik, Kangertitsivaq and Kangerlussuaq fjords (Fig. 1).

Narwhals occur frequently in the Tasiilaq (Ammassalik) area, where they are caught between February and December (Fig. 8; Winge 1902, Holm & Petersen 1921, Chapman 1932). Historically they were caught primarily in Sermilik Fjord (Mikkelsen & Sveistrup 1944) and further north in Kangertiitivatsiaq (Holm & Petersen 1921, Chapman 1934). According to Holm (1887) narwhals were taken in all seasons at Kialineq, Ammassalik municipality.

Narwhals reportedly occur at Kangerlussuaq yearround (Holm & Garde 1889, Pedersen 1931), and Kangerlussuaq has been cited as an important summering area (Amdrup 1902, Mikkelsen 1933, Degerbøl 1935, Iversen 1936, Mikkelsen & Sveistrup 1944). Narwhals certainly occur in this fjord complex from the time when the fjord ice breaks up in May until the newly forming ice forces them offshore into Denmark Strait in October–

Table 1. Observations of narwhals south of Scoresby Sund presented from south to north. Numbers refer to Fig. 1.

Obs.	Locality	Day	Month	Year	Remarks	Reference
1	Umiiviip kangertiva	Primo	July	1982	2–3 seen in leads in the fast ice	Sivertsen pers. comm.
2	Kangertiitivatsiaq	Primo	July	1933	1 "white" female with a calf and two dark animals seen	Chapman 1934
		Primo	Aug.	1933	17 seen in the fjord	*Ibid.*
3	Langø	18	Aug.	1980	5–6 observed	Andersen 1982
4	Aggas Ø	15	Aug.	1980	3–4 observed	*Ibid.*
5	Denmark Strait	21	Oct.	1923	1 seen	Bistrup 1924
6	Mikis Fjord			1991	Present in open-water season	Glahder 1992
7	J. C. Jacobsens Fjord			1991	Present in open-water season	*Ibid.*
		6–8	Aug.	1980	Two pods of 3–5 seen	Andersen 1982
8	Rybjerg Fjord			1991	Present in open-water season	Glahder 1992
9	Søkongen Ø			1991	Present in open-water season	*Ibid.*
10	Kap Beaupré	23–24	July	1980	5–8 narwhals seen	Andersen 1982
11	Turner Sund	27	July	1900	Some seen	Jensen 1909
		Ultimo	July	1990	About 30 shot	Mosbech 1990
		2–7	Aug.	1990	About 20 shot	*Ibid.*
12	Steward Ø	14	July	1974	2 observed	Meltofte 1974
13	South of Kap Brewster	5	Oct.	1922	1 shot	Isachsen 1925

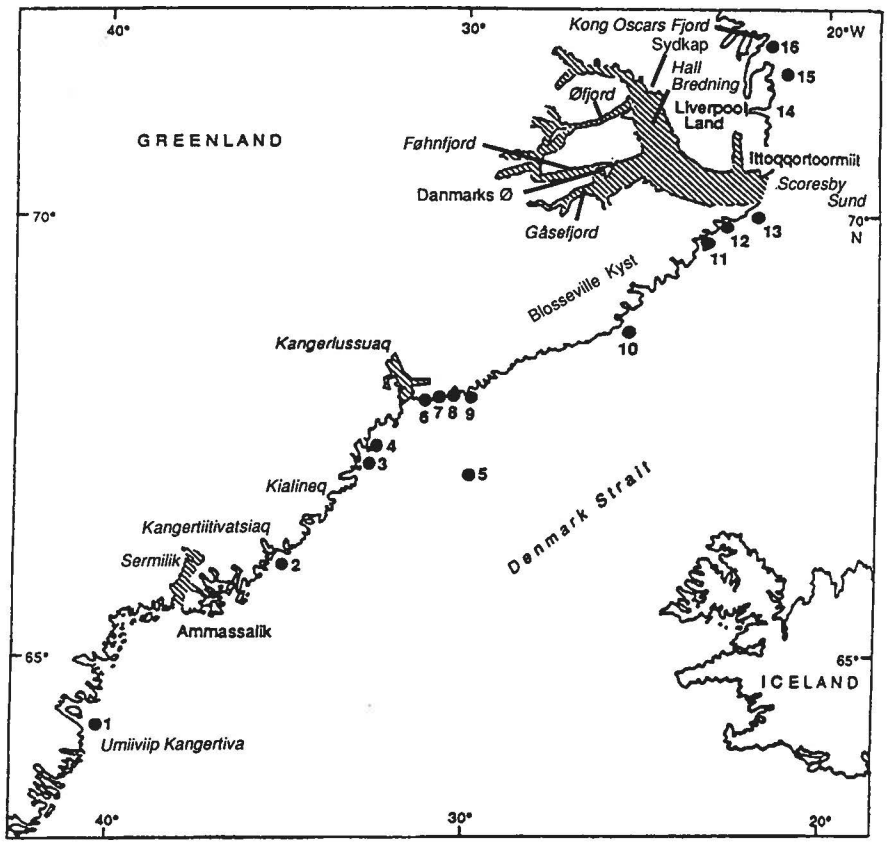

Fig. 1. Coastal observations of narwhals between Umiiviip Kangertiva and Kong Oscars Fjord. The numbers refer to sightings presented in Tables 1 and 2a. Cross-hatched areas indicate fjords where narwhals occur regularly during the open-water season.

Table 2a. Observations of narwhals north of Scoresby Sund presented from south to north. Numbers refer to Figs. 1 and 2.

Obs.	Locality	Day	Month	Year	Remarks	Reference
14	Storfjorden	20	Sep.	1985	Several seen inside and off this fjord	Born unpubl.
15	Northern Liverpool Land	Ultimo	July	1899	Some seen	Nathorst 1900
		Ultimo	Aug.	–	6–8 seen. A 4 m long female shot	Giæver 1944
16	Entrance to Carlsberg Fjord	1	Sep.	1900	2 dark and 1 very light one seen	Jensen 1909
17	In Alpefjord			1931	Many present during summer	Boyd 1935
18	Segelsällskapets Fjord			1931	Many present during summer	*Ibid.*
19	Narhvalsundet	22	Aug.	1899	One pod seen	Nathorst 1900
20	Ella Ø			1934	Single animal killed by Inuit	Pedersen 1942
		10	Aug.	1984	2 seen	Born unpubl.
21	In Kjerulf Fjord			1933	Many seen	Boyd 1935
22	Entrance to Kjerulf Fjord		Summer	1931	Many seen	*Ibid.*
23	Franz Joseph Fjord		Summer	1931	Many seen	*Ibid.*
24	Nordfjord		Sep.	1950	A deal whale found	Johnsen 1953
25	Kap Giesecke	20	July	1899	Some seen	Nathorst 1900
26	Eastern part of Franz Joseph Fjord			1931–1939	A few observed regularly	Pedersen 1942
27	Foster Bugt	13	Aug.	1922	Some seen	Isachsen 1922
28	Mackenzie Bugt	27	July	1891	Some seen	Giæver 1937
29	Myggbukta	2	Oct.	1936	A pod seen in a lead, 3 shot	Røstad 1960
30	Godthåbsgolfen	Ultimo	July	1889	Some pods. One animal with a 10 ft tusk	Knudsen 1890
31	In the river estuary in Dødemandsbugten	Primo	July	1932	About 25 observed	Larsen 1934
32	Dødemandsbugten				1 shot	Malmquist 1955
33	Eastern part of Dødemandsbugten	23	Aug.	1984	5 seen	Andersen 1984
34	Gael Hamkes Bugt			1933	A young narwhal observed	Pedersen 1942

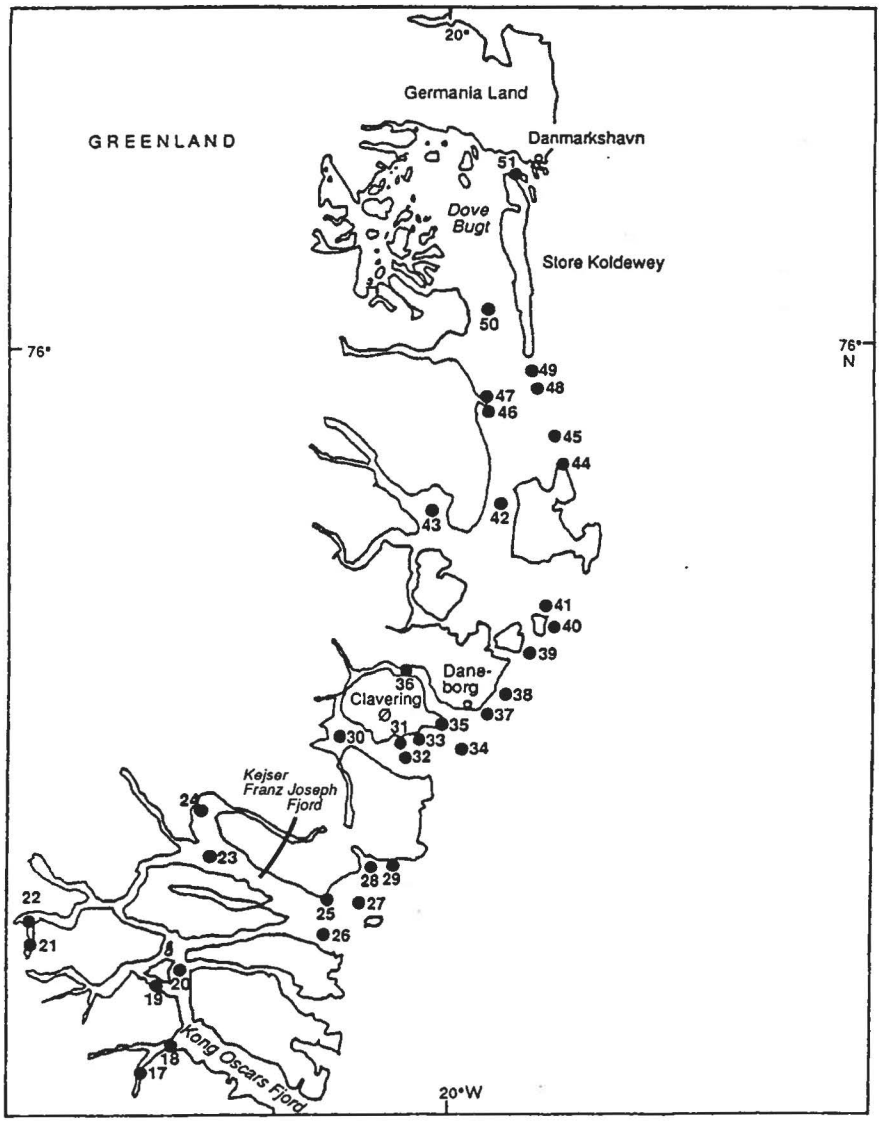

Fig. 2. Coastal observations of narwhals between Kong Oscars Fjord and Germania Land. The numbers refer to sightings presented in Table 2a and 2b.

November. During summer narwhals also occur in Mikis Fjord, J. C. Jacobsen Fjord and Ryberg Fjord, and further north at Søkongen Ø (Glahder 1992, Fig.1, Table 1).

Narwhals were observed in Scoresby Sund by Scoresby (1823) in August 1822, and Bay (1896) found that they occurred regularly in the fjord. Narwhals migrated into the fjord complex during summer and left in September (Ryder 1895). When the "Ryder Expedition" wintered at Danmarks Ø the first narwhals were observed on 21 July 1893, two days after the ice broke up (*ibid.*). In July narwhals migrated into Scoresby Sund in groups consisting of 15–20 animals (Mikkelsen & Sveistrup 1944). Reports of narwhals became more regular after 1925, when the settlement of Ittoqqortoormiit was established at the entrance of Scoresby Sund. Many narwhals were observed in the entrance to Scoresby Sund during the mild winter of 1925–26, especially in December, January, February and May (Petersen 1926). In late February 1928 and 1929 large herds were observed along the ice edge at the entrance to Scoresby Sund and near Liverpool Land. They remained there until they were able to penetrate Scoresby Sund after the ice broke up in mid-July. Narwhals remained at the entrance to the fjord until new ice formed in October (Pedersen 1931).

Narwhals are still observed in Scoresby Sund from February until the formation of new ice, usually between mid-September and mid-October (Sølberg 1980, Born 1983, Dietz *et al.* 1985, Sandell & Sandell 1991, Larsen *et al.* 1994). They can be observed at the mouth of Scoresby Sund until December (*e.g.* Dietz *et al.* 1985). Based on systematic aerial surveys conducted in September, Larsen *et al.* (1994) made point estimates of 300 and

Table 2b. Observations of narwhals north of Scoresby Sund presented from south to north. Numbers refer to Fig. 2.

Obs.	Locality	Day	Month	Year	Remarks	Reference
35	Kap Breusing	20	Aug.	1984	3 seen	Andersen 1984
36	Zachenberg Bugt			1947	A pod seen	Johnsen 1953
				1948	One taken in salmon net	*Ibid.*
37	Kap Borlace Warren				Some seen	Giæver 1930, 1937
38	Wollaston Forland	14	Aug.	1975	30–40 observed	Meltofte 1975
39	Sabine Ø				Some seen	Peters 1874
40	Pendulum Ø	6	July	1899	1 seen	Nathorst 1900
41	Hochstetter Bugt, south	17	Aug.	1984	16 seen	Andersen 1984
42	Shannon Sund	28	Aug.	1991	Female with young	Søder 1991
		28	Aug.	1991	Female with young	*Ibid.*
		28	Aug.	1991	4 seen	*Ibid.*
43	Peters Bugt			1933	Some seen	Pedersen 1942
		31	Aug.	1991	13 seen	Søder 1991
44	Kap Børgen, Shannon	12	Aug.	1984	6 seen	Andersen 1984
		28	Aug.	1991	Two pods of five seen	Søder 1991
45	Between Shannon and Store Koldewey	1	Oct.	1909	Many observed	Mikkelsen 1914
		11	Aug.	1984	36–40 seen	Andersen 1984
		10	Aug.	1984	75–80 seen	*Ibid.*
46	Roseneath Bugt	12	Aug.	1938	A subadult seen	Pedersen 1942
47	Off Haystack	16	Sep.	1991	2 seen	Søder 1991
48	South of Store Koldewey	15	Aug.	1938	2 adult seen	Pedersen 1942
49	Kap Alf Trolle	16	Sep.	1991	A total of 10 seen. 3 with tusks	Søder 1991
50	Southern part of Dove Bugt		Aug.	1938	Some seen	Pedersen 1942
		31	Aug.	1991	Three pods with a total of 21 seen	Søder 1991
51	Between Store and Lille Koldewey	10	July	1984	20–25 seen. Some with tusks	Knud Fischer, pers. comm.

Table 2c. Observations of narwhals north of Scoresby Sund presented from south to north. Numbers refer to Fig. 3.

Obs.	Locality	Day	Month	Year	Remarks	Reference
52	Skærfjorden		July	1925	Many seen	Isachsen & Isachsen 1932
53	SW of Kap St. Jacques, Ile de France	27	July	1989	30–50 seen in pods of 2–10 along ice edge	Andreasen 1988
		12	Aug.	1989	80 seen in pods of 4–8 animals heading south along ice edge	Peter Brandt. pers. comm.
54	Northeast of Ile de France	23	Aug.	1991	Several observed with tusks	Søder 1991
55	About 75 km east of Norske Øer	24	July	1984	13 seen	Andersen 1984
56	79°09'N 15°24'W	18	Jun.	1993	A total of 37 narwhals (both sexes and all age groups except neonates) seen heading south. Observed in a 500 m wide lead between fast ice and pack ice	Born, unpubl.
57	50 km east of 79-fjorden	23	July	1984	Pods, with a total of 19 animals seen	Andersen 1984
58	79°32'N 15°57'W	9	Jun.	1993	About 150 seen	Axel Bochert, pers. comm.
	79°32'N 15°57'W	9	Jun.	1993	7 adult males seen heading N about 10 m from fast ice edge	Born, unpubl.
59	5 km E of Kap H. N. Andersen	11	Jun.	1993	1 adult (no tusk) seen heading north	*Ibid.*
60	Kap H. N. Andersen	11	Jun.	1993	60 observed (both sexes and all age groups except neonates). Within 100–200 m from fast-ice edge. All heading south	*Ibid.*
61	Ice edge at Dijmphna Sund	17	Jun.	1993	About 40 seen along fast-ice edge	Jette Østergaard, pers. comm.
62	Mallemukfjeldet	21	July	1984	14 seen	Born, unpubl.
63	80°20'N 14°55'W	15	Jun.	1993	1 adult (no tusk) seen in 9/10 ice	*Ibid.*
64	10 km E of Eskimonæsset	30	May	1993	1 adult male seen in 9/10 pack ice	*Ibid.*
65	5 km E of Eskimonæsset	30	May	1993	5+3 adult males seen heading S in lead in 9/10 pack ice	Born, unpubl.
66	Few km N of Eskimonæsset	29	May	1993	5+4 seen (3 with tusks) along ice edge	René Ramseier, pers. comm.
67	Henrik Krøyers Holme	22	July	1992	2 seen	Reinhardt Møbjerg pers. comm.
68	Kilen, south	16	July	1984	2 seen	Andersen 1984

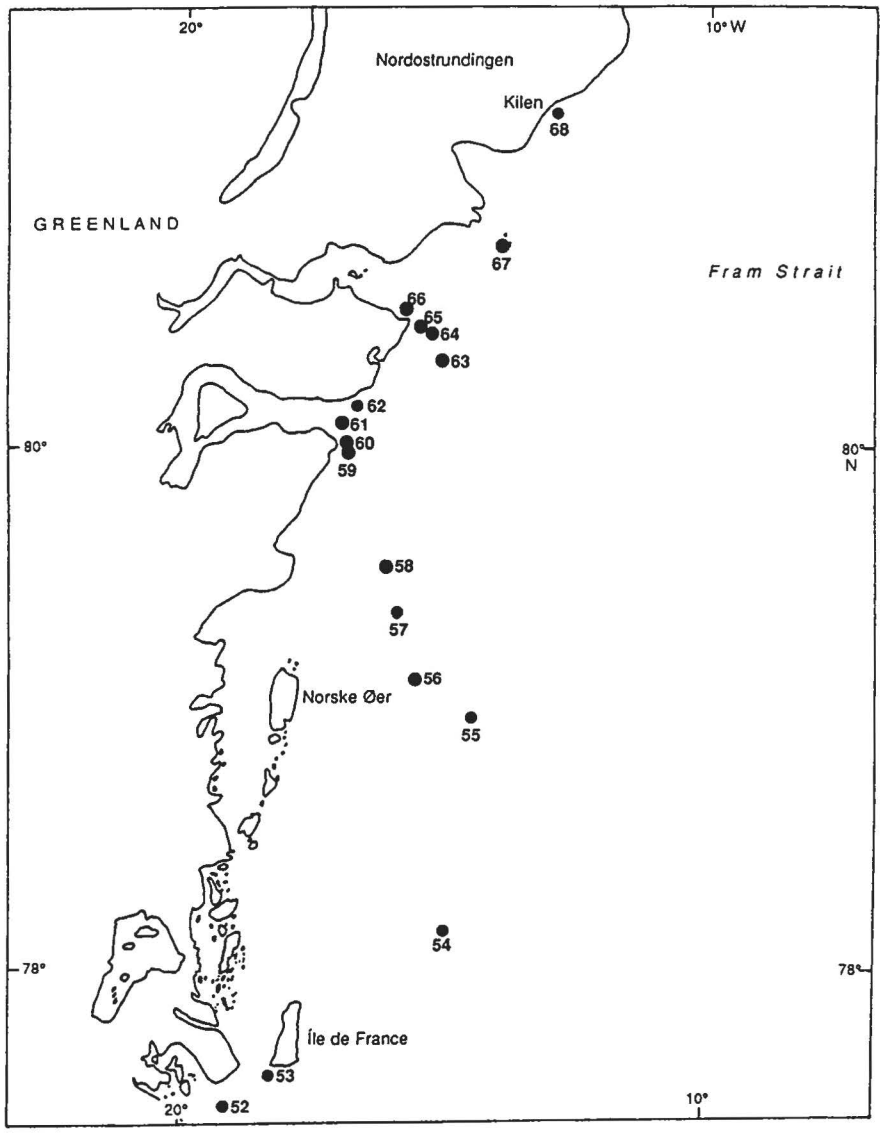

Fig. 3. Coastal observations of narwhals between Germania Land and Nordostrundingen. The numbers refer to sightings presented in Table 2c.

102 narwhals in 1983 and 1984, respectively. The estimates covered the visible part (*i.e.* they were not corrected for submerged animals) of the population of narwhals in the entire fjord complex including Hall Bredning, Øfjord, Føhnfjord and Gåsefjord. The difference was ascribed to either low survey precision, due to the clumped distribution of narwhals in this fjord or the fact that new ice prevailed in the inner regions of Scoresby Sund in 1984, causing a substantial proportion of the whales to leave the fjord by the time of the survey (*ibid.*). In February 1991 numerous narwhals were seen along the ice edge in Scoresby Sund (Knudsen *in litt.*).

North of Scoresby Sund narwhals have been observed at the entrances to most of the fjords between Kong Oscars Fjord and Germania Land (Fig. 2 and Tables 2a-c). They have been observed in the heads of the fjords between Kong Oscars Fjord and Kejser Franz Joseph Fjord, and also in the fjords around Clavering Ø (Fig. 2). The first recorded sighting of narwhals at the Danmarkshavn Station was in 1984, when narwhals were observed in a lead between the mainland and the northern coast of Store Koldewey (Knud Fisher pers. comm.). During a kayak expedition from Nordostrundingen south to Scoresby Sund in 1984 (7 July-6 September) a total of 146 narwhals were observed by Andersen (1984) along the coast between Danmarkshavn and Scoresby Sund (Figs 2–3, Tables 2a-c). No narwhals were observed by the "Danmarks-Expedition" in Dove Bugt (Johansen 1910), and our survey indicates that narwhals rarely, if ever, occur in this relatively shallow bay. There are few

Table 3. Offshore observations of narwhals in the Greenland Sea and Fram Strait. The numbers refer to Fig. 4.

Obs. no.	Positions N (degr./ min.)	W/E (degr./ min.)	Day	Month	Year	Remarks	Reference
1	73°30'	12°00'W			1875	Many seen on Southern Whaling Ground	Gray 1929
2	79°00'	02°00'W	25	May	1877	Many seen heading NNW	Gray 1931
3	74°00'	14°00'W	28	June	1885	Many seen (1 with two tusks)	Gray 1933
4	75°01'	00°42'W	2	May	1886	One seen	Gray 1887
5	79°57'	04°20'E	18	May	1886	Many seen	*Ibid.*
6	79°24'	02°02'E	28	May	1886	Hundreds seen	*Ibid.*
7	78°50'	01°16'E	8	June	1886	Mothers with young commonly seen	*Ibid.*
8	79°29'	04°12'E	13	June	1886	Several seen	*Ibid.*
9	78°50'	00°00'E	19	June	1886	Several seen	*Ibid.*
10	78°28'	00°52'E	21	June	1886	Hundred seen. Abundance of *Calanus finmarchius*	*Ibid.*
11	73°26'	15°16'W	4	July	1886	Many seen	*Ibid.*
12	73°21'	14°59'W	5	July	1886	Several with young seen	*Ibid.*
13	75°05'	05°15'W	26	July	1886	Some seen	*Ibid.*
14	80°00'	05°00'E	27	May	1887	Many seen heading NE	Gray 1931
15	79°50'	05°15'E	15	May	1888	Many seen	Gray 1889
16	80°00'	05°00'E	19	May	1888	Many seen heading NE	Gray 1931
17	75°14'	09°28'W	28	May	1888	Many seen	Gray 1889
18	74°37'	11°00'W	1	July	1888	Many seen, one caught with a foetus	*Ibid.*
19	74°40'	12°00'W	5	July	1888	Narwhal caught with a foetus	*Ibid.*
20	74°49'	10°30'W	22	July	1888	One shot	*Ibid.*
21	74°43'	11°30'W	24	July	1888	Many poods observed including females with newborn	*Ibid.*
22	78°34'	00°10'W	6	Aug.	1888	Many seen heading NW	*Ibid.*
23	73°41'	15°00'W	12	Aug.	1888	Many males seen	*Ibid.*
24	72°00'	19°00'W	6	Aug.	1895	Some seen	Gray 1931
25	73°40'	15°00'W	25	July	1869	Several observed	Payer 1877
26	76°30'	05°00'W	24	June	1909	1 seen	Kmunke 1910
27	71°50'	21°00'W	31	Aug.	1907	A female with total length of 412 cm caught	Leverkus 1909
28	73°30'	18°00'W	15	Aug.	1907	1 seen	*Ibid.*
29	80°45'	05°45'E	20	Apr.	1979	Narwhals and bowhead whale seen	Christian Vibe pers. comm.
30	82°00'	00°24'W	23	Apr.	1979	4 seen	Christian Vibe pers. comm.
31	82°41'	16°14'E	17	Apr.	1982	20–30 seen in a lead	Kristoffersen 1982
32	83°00'	12°00'E	17	May	1896	Some seen	*Fram* obs. cited in Gray 1931
33	78°30'	01°34'W	5	May	1874	Great numbers seen migrating north	*Eclipse & Hope* obs. cited in Gray 1931
34	72°00'	17°00'W	20	July	1898	Some seen going northeast	*Active* obs. cited in Gray 1931
35	74°00'	15°00'W	16	June	1899	Some seen going northeast	*Ibid.*
36	74°00'	12°00'W	27	July	1873	Some seen going northeast	*Mazinthien* obs. cited in Gray 1931

records of narwhals occurring north of Danmarkshavn. However the waters along the entire coastal stretch are seldom navigated. In August 1984 Andersen (1984) observed a total of 48 narwhals between Nordostrundingen and Norske Øer (Fig. 3, Table 2c). In July and August 1989 an estimated 50–80 narwhals were observed twice along the southwestern coast of Île de France (Andreasen 1989, Peter Brandt pers. comm.). Between 29 May and 17 June 1993 groups of narwhals were observed several times between Norske Øer and Eskimonæsset (Fig. 3, Table 2c). On 9 June 1993 an estimated 150 narwhals were seen (no. 58; Table 2c). The majority of the whales occurred along the edge of the land-fastice (Born unpubl. data).

Narwhal bones uncovered in Eskimo ruins in Independence Fjord, Peary Land (north of Nordostrundingen), show that narwhals have occurred along this coast, but do not indicate their current presence (Knuth 1952).

Offshore observations of narwhals

Narwhals were observed by bowhead whalers in the Greenland Sea and Fram Strait. Narwhals and bowhead whales occurred in the same regions of the Greenland Sea (Scoresby 1980, Gray 1931). In fact the observation of narwhals was regarded as an indication of the presence of bowheads in an area (Gray 1931). The bowhead whalers most often initiated their hunting west of Svalbard at about 80°N or even further north in April-May. During June they followed the edge of the pack ice in a southwesterly direction until the hunt was terminated in August at about 70°N, off the coast of Liverpool Land in East Greenland (*ibid.*).

Observations of narwhals in the Greenland Sea and Fram Strait made from whaling and expedition ships, whose routes are not known in detail, are plotted on Fig. 4

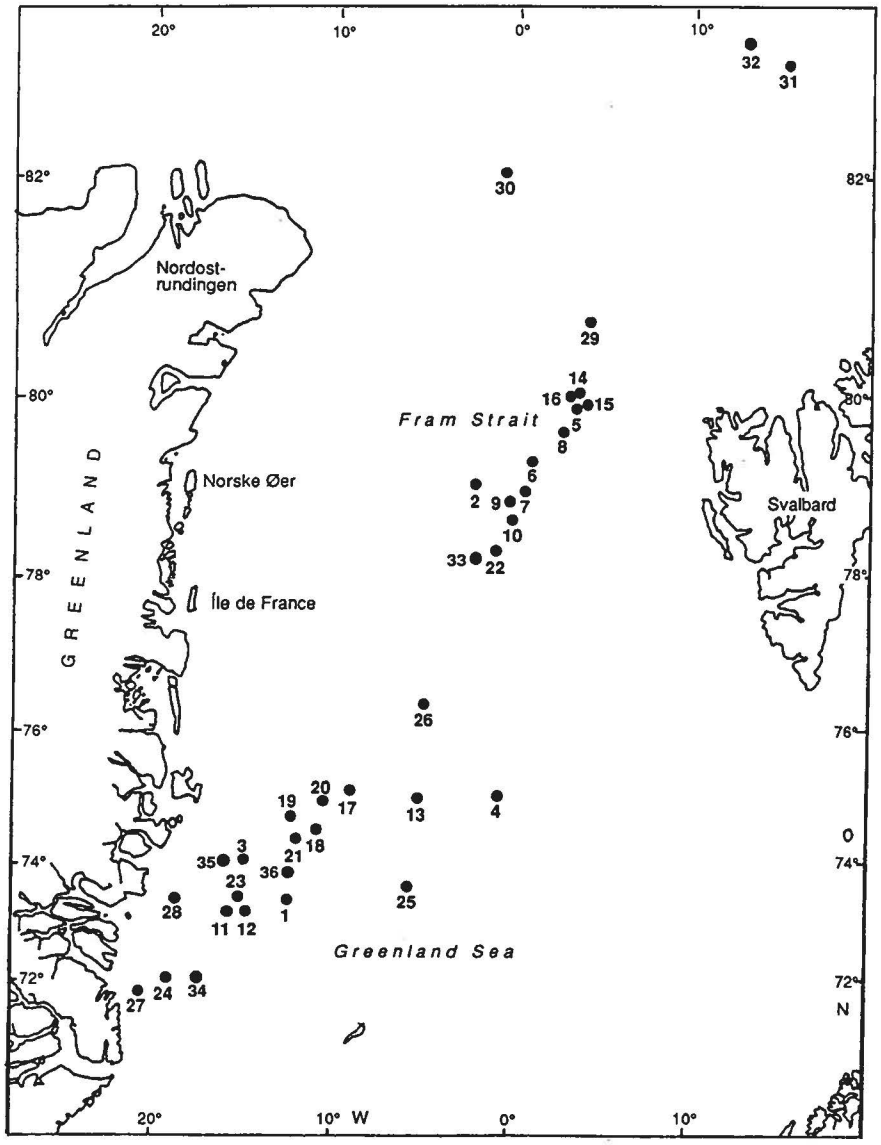

Fig. 4. Offshore observations of narwhals in the Greenland Sea and Fram Strait. The numbers refer to sightings presented in Table 3.

and listed in Table 3. The observations made on 17 April at 82°41'N, 16°14'E (no. 31; Table 3) and on 21 October at 67°N, 67°W (no. 5; Table 1) represent the earliest and the latest offshore observations of narwhals in this area. Two whaling logbooks in particular (Livingstone-Learmonth 1888, Kinnear 1907) give precise information on narwhals in the Greenland Sea (Figs. 5 and 6). Narwhals were usually encountered in groups of 5–6 at the "Northern Whaling Ground", between 78°N and 80°N west of Svalbard (Kinnear 1907).

The miscellaneous observations in Figs. 4–6 confirm the findings of Gray (1931), that the narwhals concentrated in two areas: the "Northern Whaling Ground", where they were found in May-June, and the "Southern Whaling Ground" (off the coast of eastern Greenland between 71°N and 75°N), where they were observed in July-August (see Fig. 6).

Migrations

Narwhals and bowheads were thought to migrate together. Whalers observed that narwhals arrived from southwest in spring from their presumed wintering grounds between Iceland and Kap Farvel (Nunap Issua) on the southern tip of Greenland. In May-June narwhals migrated in a northeasterly direction into dense pack ice (Gray 1931). Observations of narwhals at several local-

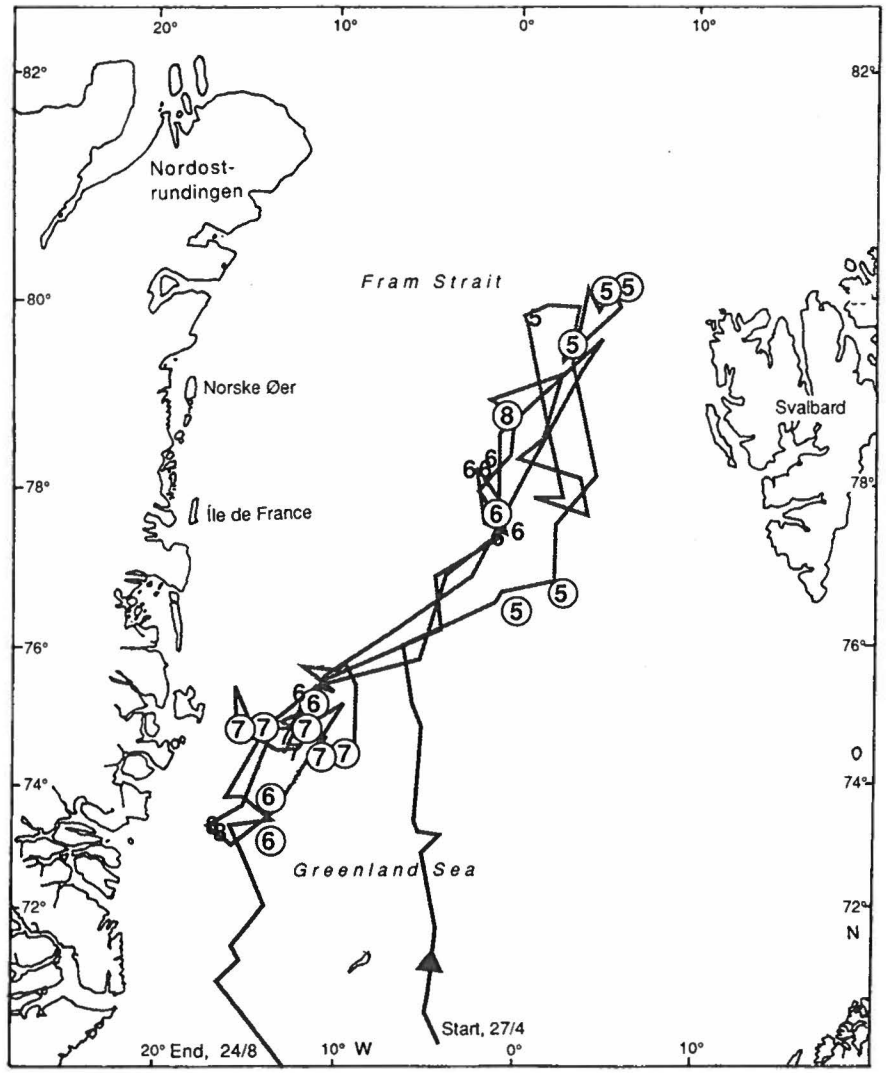

Fig. 5. Offshore observations of narwhals in the Greenland Sea and Fram Strait. The observations were made from S.S. *Eclipse* from 27 April to 24 August 1888 (Livingstone-Learmonth 1888). Numbers indicate the month of observation. Circles indicate "groups"; no circles indicate solitaries. Lines indicate the sailing route.

ities in the Polar Basin suggest a continuous distribution north of 80°N (Nansen 1897, Rutilevskii 1958, Vibe 1981, Belikov *et al.* 1984, Belikov 1988). From the observations reported in this study the observations of narwhals migrating northwest at the "Northern Whaling Ground" (Gray 1931), and findings of remains of narwhals in Eskimo ruins, it appears that narwhals also summer along the coast of Northeast Greenland. However a survey of wildlife observations in North Greenland revealed no sightings of narwhals along the nothern coast of Greenland between Nordostrundingen and Humboldt Gletscher (Northwestern Greenland; Dietz & Andersen 1984). The possibility of a connection between narwhals in East and West Greenland, and dispersal farther north across the Polar Basin, is indicated by several observations of narwhals north of 84°N which are shown in Table 4 and Fig. 7 (*e.g.* Nansen 1897, Rutilevskii 1958, Belikov *et al.* 1984, Belikov 1988). Narwhals that were observed on the "Southern Whaling Ground" were thought to have migrated southwest from the "Northern Whaling Ground" (Gray 1931).

Food

The information obtained during the interview survey in 1991 indicates that the main food of narwhals in Kangerlussuaq is cephalopods and Greenland halibut (*Reinhardtius hippoglossoides).* Redfish *(Sebastes* sp.) and crustaceans are eaten to a lesser extent (Glahder 1992).

The narwhals in Scoresby Sund in August-October feed on polar cod (*Boreogadus saida),* Greenland halibut, crustaceans (Pedersen 1930, Born 1983) and cephalopods (Isachsen 1925).

Gray (1887, 1889, 1929) found cephalopods (*Gonatus*

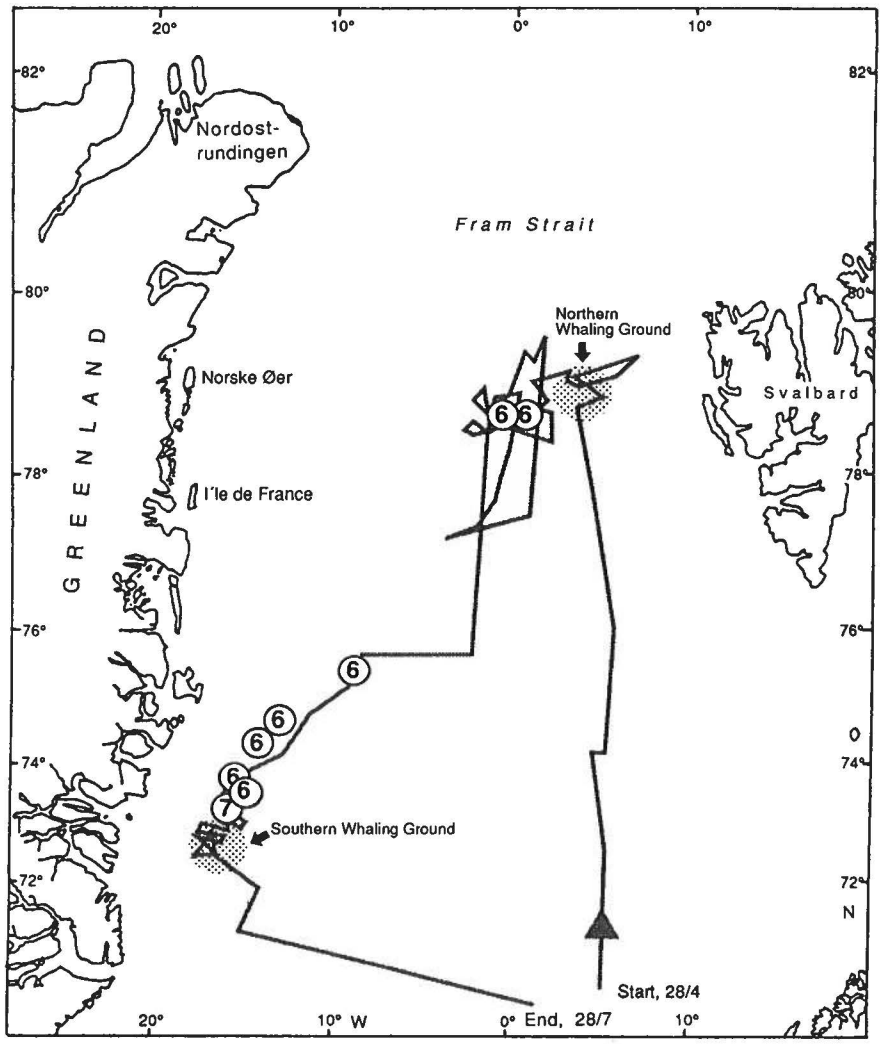

Fig. 6. Offshore observations of narwhals in the Greenland Sea and Fram Strait. The observations were made from S.Y. *Scotia* from 28 April to 28 July 1907 (Kinnear 1907). Numbers indicate the month of observation. Circles indicate "groups"; no circles indicate solitaries. The stippled areas indicate large concentrations. Lines indicate the sailing route.

fabricii) and decapods *(Pasiphaea tarda, Hymenodora glacialis)* in the stomachs of six narwhals caught at the Southern Whaling Ground in July-August. According to Gray (1931), the narwhals feed mainly on cephalopods. Manby (1822) reported finding cephalopods and crustaceans in narwhal stomachs. One narwhal caught in the Greenland Sea had flatfish (Heterosomata), cod (Gadidae) and rays *(Raia batis)* in its stomach (Scoresby 1823).

Gestation period

Eales (1950) presented length data on three narwhal foetuses from the Courtauld Expedition to Kangerlussuaq in 1935–36. A female foetus from 29 May was 13.7 cm long, a foetus from 28 June measured 15.0 cm and a male foetus from 28 July was 28.0 cm. Glahder (1992) interviewed hunters in Kangerlussuaq, who had observed both foetuses (small and large) and calves from May to August. In this area a full-term foetus had been observed in June, and on 18 July a 150 cm foetus was recorded, but small foetuses could also be seen in July. In August, near-term foetuses as well as a 30–40 cm long foetus have been observed in Kangerlussuaq (Glahder 1992).

The earliest observations of narwhals with calves were on 8 June and 5 July on the "Northern and Southern Whaling Grounds", respectively (Gray 1887). On the "Southern Whaling Ground", Kinnear (1907) observed a narwhal with a newborn on 15 July. In this area, Gray (1931) observed many pods of narwhals with newborn, one narwhal had a 19 cm long foetus. In the same area narwhals were caught with 150 and 155 cm long foetuses on 1 and 5 July, respectively (Gray 1889). Manby (1822) observed a narwhal with a suckling calf on 20 July, but he

Table 4. Observations of narwhals in the Polar Basin. The numbers refer to Fig. 7.

Obs. no.	Positions N (degr./ min.)	W/E (degr./ min.)	Day	Month	Year	Remarks	Reference
1	82°00'	00°24'W	23	Apr.	1979	4 seen	Christian Vibe pers. comm.
2	82°41'	16°14'E	17	Apr.	1982	20–30 seen in a lead	Kristoffersen 1982
3	83°00'	12°00'E	17	May	1896	Some seen	Nansen 1897
4	81°00'	20°00'E	?	Apr.	1980	1 seen in 1/10 ice cover	Belikov *et al.* 1984
5	84°25'	73°00'W	30	July	1956	A single one stayed for 5 days	Ice drift station Northpole-5, cited in Rutilevskii 1958
6	84°40'	69°08'E	19	Sep.	1956	Snoring heard, presumably from narwhals	Ice drift station Northpole-5, cited in Rutilevskii 1958
7	84°42'	72°22'W	26	June	1956	A single one stayed here for 5 days	Ice drift station Northpole-5, cited in Rutilevskii 1958
8	79°13'	169°08'W	7	Aug.	1950	3 seen	Ice drift station Northpole-5, cited in Rutilevskii 1958
9	80°55'	45°40'E	?	Apr.	1971	4 seen in shore ice polynia	Belikow *et al.* 1984
10	81°00'*	52°00'E	?	?	1970s	6 seen in open water of British Canal Strait	Belikow 1988
11	81°00'	55°00'E*	?	?	1950s	10 seen open water near Franz Josef Land	Belikow 1988
12	81°30'*	50°00'E*	?	Apr.	1980	2 seen in opening between ice	Belikov *et al.* 1984
13	82°00'*	59°00'E*	?	?	1983	6 seen 25 km north of Rudolf Island	Belikov 1988
14	83°49'	13°20'E	17	May	1896	5 seen	Nansen 1897
15	83°23'	64°09'E	18	May	1895	Snoring heard	Nansen 1897
16	83°28'	64°07'E	17	May	1895	2 seen, snoring heard, probably many in the area	Nansen 1897
17	82°24'	66°10'E	30	May	1895	Pod observed	Nansen 1897
18	82°20'	65°53'E	5	June	1895	Some heard	Nansen 1897
19	84°32'	80°20'E	22	June	1895	7–8 observed	Nansen 1897
20	84°40'	74°19'E	2	July	1895	The polynia was swarming with narwhals	Nansen 1897
21	84°53'	78°42'E	6	Sep.	1895	Playing narwhals were seen	Nansen 1897
22	82°28'	136°26'E	17	Aug.	1938	Some observed	*G Sedov* observation, cited in Rutilevskii 1958
23	82°10'	136°18'E	13	Aug.	1938	3 observed, one was light-coloured	*G Sedov* observation, cited in Rutilevskii 1958
24	82°04'	136°50'E	11	Aug.	1938	4 seen	*G Sedov* observation, cited in Rutilevskii 1958
25	82°00'	137°03'E	8	Aug.	1938	Some observed	*G Sedov* observation, cited in Rutilevskii 1958
26	82°01'	136°52'E	7	Aug.	1938	3 seen	*G Sedov* observation, cited in Rutilevskii 1958
27	81°51'	136°38'E	29	July	1938	3 seen	*G Sedov* observation, cited in Rutilevskii 1958
28	81°19'	137°20'E	4	July	1938	A big animal seen swimming in the polynia	*G Sedov* observation, cited in Rutilevskii 1958
29	81°17'	138°07'E	30	June	1938	7 seen	*Malygin* observation, cited in Rutilevskii 1958
30	76°00'*	165°00'E*	?	?	1970s	8 seen in 20–30 m wide lead	Belikov *et al.* 1984

*Approximate position representing observations in an area.

did not mention the location. These scattered observations suggest that the gestation period lasts between May and July the following year. The peak of births probably occurs in late July.

Catch of narwhals in eastern Greenland

Narwhal hunting was important for the survival of early Inuit in eastern Greenland (Sandell & Sandell 1991) The catch of narwhals appears to have less importance for the modern Inuit communities in East Greenland. The narwhal catch in the Tasiilaq (Ammassalik) municipality between 1954 and 1990 is based on the Hunters' Lists of Game (HLG 1955–1990) and other sources (Table 5a). During the last decade (1981–1990), the catch in this area has averaged about 50 narwhals per year (Table 5a). The hunting period, which extends from February until December, peaks in July-September (Fig. 8). Kangerlussuaq is the most important narwhal hunting area in southeastern Greenland. Interviews with hunters in the Kangerlussuaq area in 1991 indicated that during the period 1951–1991 the average annual catch in this area was 20–30 narwhals (Glahder 1992). In the period 1986–1991, when the information was particularly precise, an average of 24

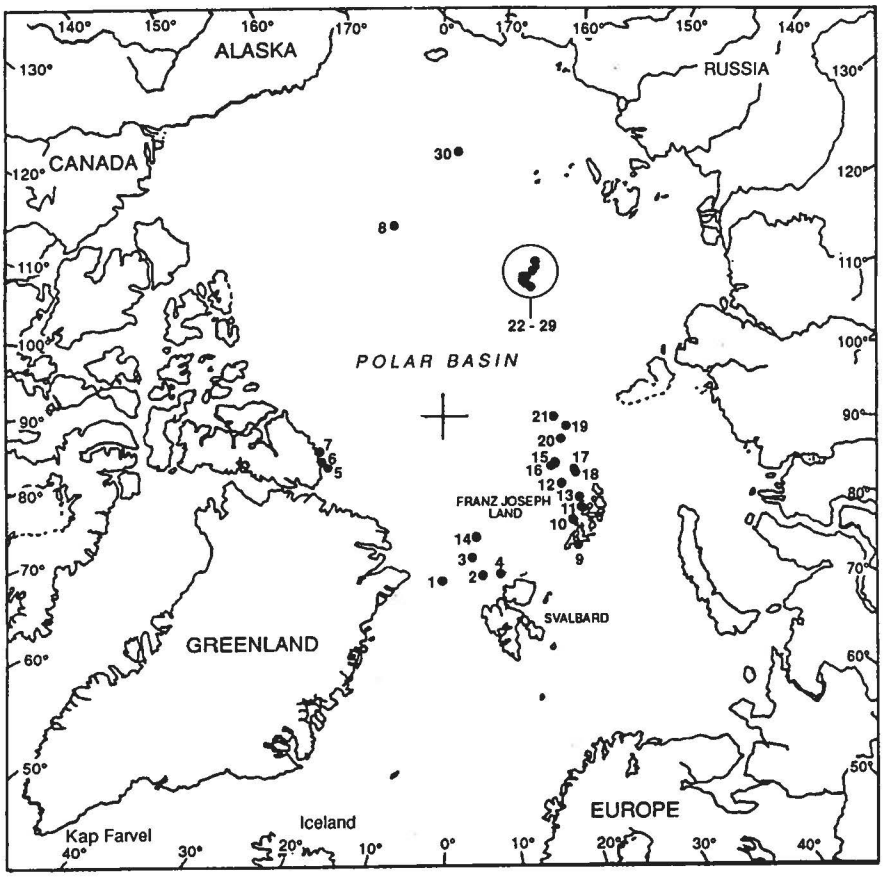

Fig. 7. Observations of narwhals in the Polar Basin. The numbers refer to sightings presented in Table 4.

narwhals (range: 11–44) were caught annually. In Kangerlussuaq narwhals are hunted between May and November with a peak in July (Fig. 9). The whales are either harpooned from kayaks, or shot from skiffs with outboard engines. Sometimes the narwhals are chased into shallow waters where they are shot. After they have sunk they are retrieved with a hook. In some cases the whales are shot from land or taken in nets. Of 81 narwhals caught in Kangerlussuaq for which sex was stated, about 56% were males and 44% females (Glahder 1992).

Narwhals are caught at the entrance to Scoresby Sund between April and July. They are shot either from the ice edge or from skiffs. Between August and October some have been shot inshore as far west as Sydkap (Born 1983; Fig. 1). This area, which was one of the best hunting grounds, has not been used for many years (Sandell & Sandell 1991). During their emigration in fall, narwhals are driven into shallow water and shot. Kayaks and harpoons have not been used to hunt narwhals in Scoresby Sund since the early 1970's (Born 1983). Some hunters have resumed the use of harpoons to catch narwhals in particular at Steward Ø (Sandell & Sandell 1991). Since 1984, narwhals were also caught in nets (Sandell & Sandell 1991). This method of hunting ceased, however, because many narwhals were believed to leave the area once a few animals had been netted (Mosbech 1990). Based on interviews with the hunters in this region in 1983, Born (1983) estimated that the annual narwhal catch in the Scoresby Sund area was 10–20 animals, and the mean reported catch during 1981–1990 was 27 (HLG). According to information obtained from hunters in 1990, narwhals are no longer hunted far west in Scoresby Sund, at Sydkap and Danmarks Ø during the open-water season. Instead, they are caught primarily at Turner Ø and Steward Ø on the Blosseville Kyst in July–August (Fig. 1, nos. 11–12; Table 1). In 1989 and 1990, an estimated 70–80 narwhals were caught in these areas (Jonas Brønlund pers. comm., Mosbech 1990). The reason for this apparent change in the distribution of narwhals and in hunting practice is unclear. The seasonal distribution of the catch in Scoresby Sund, according to HLG, is shown in Fig. 10.

This somewhat heterogeneous information shows that between 1955 and 1990 the total catch of narwhals in eastern Greenland has averaged 41 animals per year, ranging from 0 to 158 animals in one year (see Tables 5a,b). The data show a significant increasing trend in the catch, but this trend is mainly explained by large catches in 1981, 1982, 1989 and 1990 and the increased figures from interviews during later years. Glahder (1992) de-

Table 5a. Hunting statistics on narwhals (N) and white whales (W) from Tasiilaq (Ammassalik) municipality (HLG 1954–1990).

Year	Skjold-ungen	Kanger-lussuaq	Imarsi-vik	Isor-toq	Tinite-qilaq	Umig-tuars-suit	Ikka-teq	Akor-miaq	Kulu-suk	Kuu-miut	Sermi-liaq	Kap Dan	Am-massa-lik	Tasiilaq Estimate	Tasiilaq Total
	N/W	N/W	N/W	N/W	N/W	N/W	N/W	N/W	N/W	N/W	N/W	N/W	N/W	N/W	N/W
1955		1/–			5/–										6/–
1956	–/1		–/1												–/2
1957							1/–				4/–				5/–
1958					1/–										1/–
1959					4/1	2/2					3/–				9/3
1960					1/–						1/–	–/1			2/1
1961					3/–						1/–				4/–
1962					3/–							–/1			3/1
1963					12/–					1/–	5/–	1/–	2/–		21/1
1964															
1965															
1966		42 (66*)/–									1/–				43(67*)/–
1967		20/–													20/–
1968		29/–									1/–				30/–
1969		16/–			1/–										17/–
1970		6 (23**)/1			9/–						15/–				30(47**)/1
1971		(11–12**)/–								3/1	7/–			11/1	21(33**)/1
1972		(4–5**)/–			8/–					1/9	1/–			10/9	20(25**)/18
1973		(9–12**)/–			4/–					2/2					6(18**)/2
1974		(7**)/–			13/1					6/4	4/–			10/2	33(40**)/7
1975					1/–					1/–					2/–
1976									1/–	3/1	4/–				8/1
1977					3/–					10/1	4/–				14/1
1978													1/–		1/–
1979		(13**)/–		4/–	1/–					1/–				1/–	7(20**)/–
1980				4/–	24/–				5/–	16/–					49/–
1981				2/–	9/–		1/–		2/–	4/–			4/–	106/–	128/–
1982				36/–	8/–					2/–			2/–	36/–	84/–
1983					8/–						3/–			1/–	12/–
1984															
1985														21/–	21/–
1986		(22**)/–		1/3	2/–				2/–	3/–				132/12	42(63**)/15
1987		(21**)/–		1/75	7/–				–/1	3/–	1/–		30/–		19/–
1988		(11**)/–													(11**)/–
1989					13/–					6/–					19/–
1990		(44**)/–			3/–					26/–	15/–				44(88**)/–

*Interviews in 1988 (Siegstad 1989). **Interviews in 1991 (Glahder 1992).

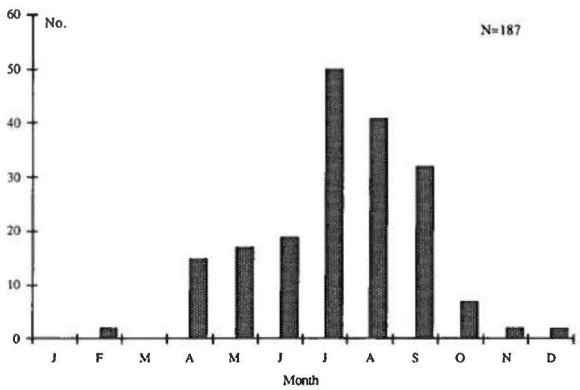

Fig. 8. Seasonal distribution of the narwhal catch in Tasiilaq municipality (excluding the Kangerlussuaq area, Fig. 9) between 1974 and 1983 (Source: Hunters' Lists of Game).

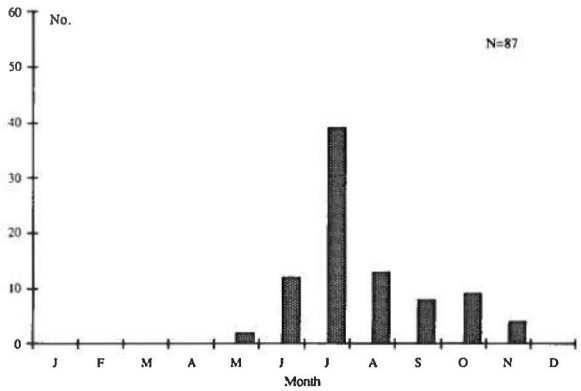

Fig. 9. Seasonal distribution of the narwhal catch in the Kangerlussuaq area (municipality of Tasiilaq) between 1967 and 1991 (Source: Glahder 1992)

Table 5b. Hunting statistics on narwhals (N) and white whales (W) from Scoresbysund and total East Greenland (HLG 1954–1990).

Year	Ittoqqortoormiit Scoresbysund N/W	Pikiullit N/W	Kap Brewster N/W	Sydkap N/W	Itaijivi Kap Hope N/W	Unarteq Kap Tobin N/W	Scoresbysund Estimate N/W	Scoresbysund Total N/W	East Greenland Total N/W
1955	8/–			8/–		2/–		18/–	24/–
1956	3/–		3/–		4/1			10/1	10/3
1957	4/–		3/–		1/–	1/–		9/–	14/–
1958	7/–			16/–	1/–	4/–		28/–	29/–
1959	13/–				–/2	4/–		17/2	26/5
1960					50/–	4/–		54/–	56/1
1961	7/–				1/–	4/–		12/–	16/1
1962									3/1
1963							8/–	8/–	29/1
1964							8/–	8/–	8/–
1965	–/5							–/5	–/5
1966	2/1							2/1	45(69*)/1
1967									20/–
1968									30/–
1969					6/–			6/–	23/–
1970	6/2							6/2	36(53**)/3
1971		1/–			4/–			5/–	26(38**)/1
1972	1/–							1/–	21(26**)/18
1973					4/–			4/1	10(22**)/3
1974	2/–					–/1		2/1	35(42**)/8
1975	1/–					1/–		2/–	4/–
1976	1/–							1/–	9/1
1977	4/–				1/–			5/–	19/1
1978	1/–							1/–	2/–
1979							10/–	10/–	17(30**)/–
1980							10/–	10/–	59/5
1981							15/–	15/–	143/–
1982					10/–		15/–	25/–	109/–
1983	2/–					12/–	29/–	43/–	55/–
1984	50/15							50/15	50/15
1985	28/–							28/–	49/–
1986									42(63**)/15
1987									19/–
1988	(ca. 40 #)/–							(ca. 40#)/–	(ca. 51**#)/–
1989	1 (ca. 70 #)/–							1 (ca. 70 #)/–	20 (ca. 89 #)/–
1990	(ca. 70 #)/–							(ca. 70 #)/–	44 (ca. 158**#)/–

*Interviews in 1988 (Siegstad 1989). **Interviews in 1991 (Glahder 1992). #=caught at Steward Ø and Turner Ø (Mosbech 1990).

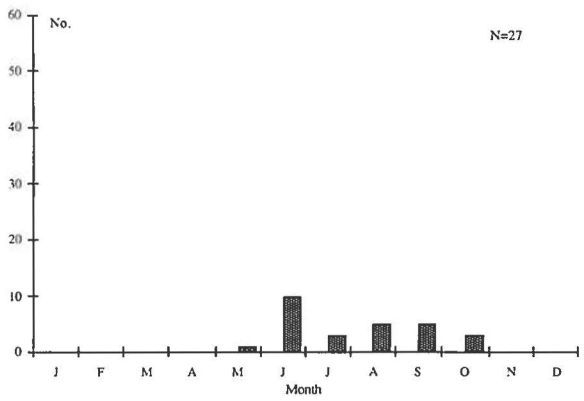

Fig. 10. Seasonal distribution of the narwhal catch in Ittoqqortoormiit (Scoresbysund) municipality between 1974 and 1983 (Source: Hunters' Lists of Game).

scribed the narwhal catch as ranging between 40 and 60 animals per year, based upon nearly the same data. We conclude that during the period 1981 to 1990 the total catch of narwhals in eastern Greenland has averaged at least about 80 animals per year. The number of whales killed but lost is not well documented. However, during the open-water hunts, losses are substantial in some cases (Glahder 1992).

The narwhal's skin (mattak) is traded to the Greenland Trade Department (KNI) for 50 Dkr per kg (approximately 8 US dollars, Heide-Jørgensen 1994). A substantial proportion of the mattak is given to family. Most of the meat is dried for human consumption. Some meat is also used for feeding sled dogs (Born 1983, Sandell & Sandell 1991, Glahder 1992). The tusks are traded to KNI for approximately 725 Dkr per kg (Ca. 121 US dollars, Reeves & Heide-Jørgensen 1994). Some ivory is used for handicrafts and for making tools such as harpoons (Glahder 1992). In 1990, a total of 19 narwhal tusks were traded to KNI in Scoresbysund (R.v.d. Pedersen pers.

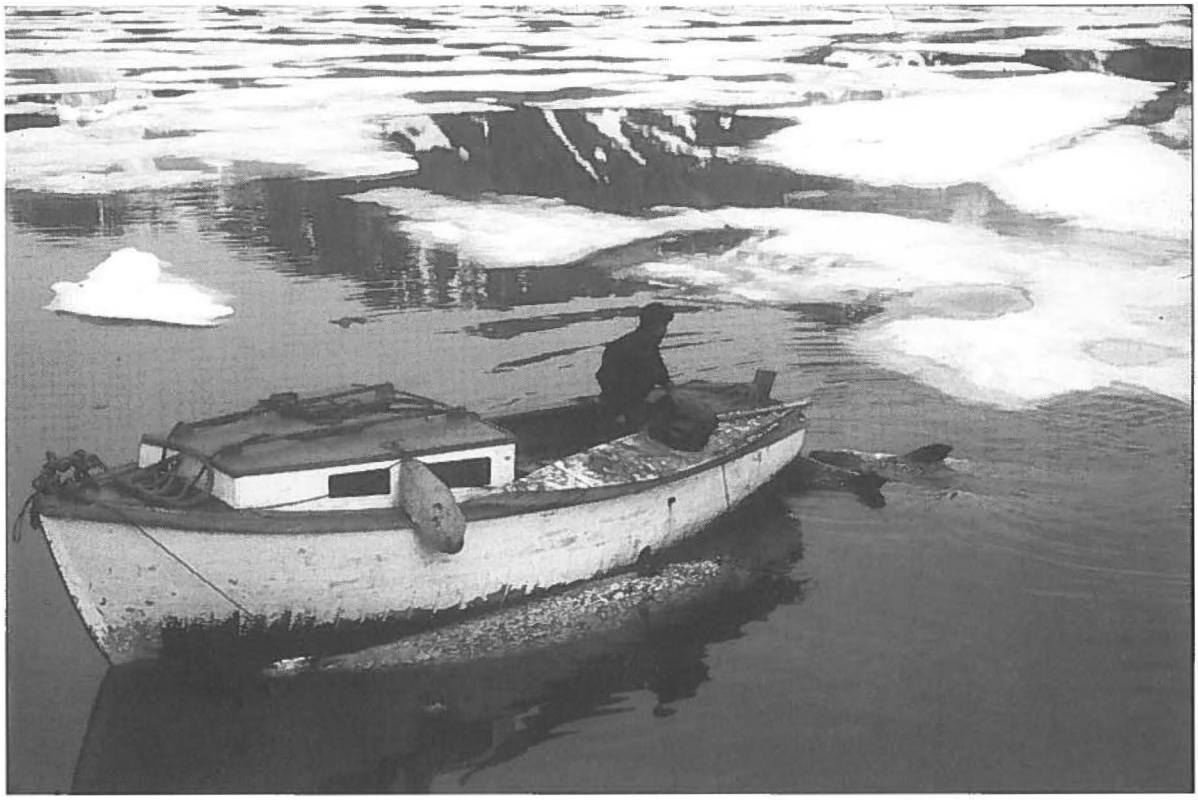

Fig. 11. Four narwhals taken from kayak being towed by a small fishing vessel in Kangerlussuaq, late July 1991. Photo: C.M. Glahder.

comm.). In 1989 and 1990, KNI in Scoresbysund bought 1884 kg of mattak.

Occurrence and catch of white whales in eastern Greenland

In eastern Greenland white whales occur far less frequently than narwhals. Few observations of white whales have been reported in eastern Greenland in the May-August period. Holm and Petersen (1921) wrote that white whales were seen and caught occasionally in the Ammassalik area, whereas Mikkelsen and Sveistrup (1944) mentioned that they were seldom taken and had no significance in the hunting economy. A few white whales are listed in the catch statistics from this municipality (see Table 5a), but all recent reports are believed to be erroneous (Jakob Sivertsen pers. comm.). Iversen (1936) saw white whales in August 1932 in Kangerlussuaq.

In Scoresby Sund scattered observations of white whales have been recorded (*e.g.* Nathorst 1900, Mikkelsen 1925, Meltofte 1974). Sølberg (1980) stated that herds of 5–10 animals were seen in some years. In the hunting statistics (Table 5b) between 4 and 15 animals are listed within decades (HLG 1954–1990). Born (1983) presented similar figures from the 1960s and 1970s, but Sandell & Sandell (1991) could not verify these statistics. North of Scoresby Sund only a single observation of a small pod was made in the middle of August 1900 in Kejser Franz Joseph Fjord (Kolthoff 1901, 1903). White whales have been observed in late June in the Greenland Sea between eastern Greenland and Svalbard (Kolthoff 1903, Kinnear 1907).

Discussion

Our assessment of the narwhal's occurrence off East Greenland is based on observations made over a long period of time. Moreover the sources that we reviewed vary greatly in detail and precision. Although we merely summarize where and when narwhals have occurred in the past, we believe that this summary provides a good general idea of their present-day occurrence. As Gjertz (1991) concluded for the Svalbard area, there is no evidence of changes in narwhal distribution and abundance in the Greenland Sea and Fram Strait.

In the western part of their range narwhals occur primarily in deep-water areas (*e.g.* McLaren & Davis 1983,

Koski & Davis 1994). They spend the winter in Davis Strait and Baffin Bay, widely distributed in the closed pack ice in deep water. They summer in deep fjords of the Canadian and West Greenland High Arctic (*e.g.* Born *et al.* 1994, Richard *et al.* 1994).

Any account of narwhal distribution in East Greenland waters reflects the nature of the observation platform, particularly in the days when vessels were limited to sail power for penetrating the pack ice in the Greenland Sea. It is thus not surprising that the majority of observations of narwhals during the 19th and early 20th centuries are from the eastern fringes of the pack ice in the Greenland Sea. Only a few narwhals have been observed during expeditions with ice-breaking research vessels navigating the pack ice in the East Greenland and Svalbard areas during summer (Ugland & Ree 1983, Søder 1991, this study). Even these observations were not made from the ships but from accompanying helicopters.

Narwhals have been observed in the pack ice as early as April, but otherwise there are few observations in the pack ice during winter months. By analogy with the situation in Davis Strait and Baffin Bay, it seems likely that narwhals move far into the pack ice of the Greenland Sea during winter. This inference is supported by several observations at the entrance to Scoresby Sund, where narwhals have been seen in February, and by a catch of 16 narwhals in Sermilik Fjord in April 1992 (Jakob Sivertsen pers. comm.). Narwhals probably occur throughout the year in the pack ice of the Greenland Sea and Fram Strait. During summer some narwhals migrate into the East Greenland fjords, particularly Sermilik, Kangerlussuaq and Scoresby Sund. Other narwhals migrate to areas northeast of the Svalbard archipelago. In East Greenland narwhals are frequently seen as far south as 66°N during summer, whereas in West Greenland they are rarely seen south of 70°N between June and October. Generally, the distribution of narwhals and white whales is mutually exclusive at all seasons. The summering and wintering areas differ in time and space, suggesting that competition for a common food supply is avoided by spatial segregation (Sergeant 1979). Where narwhals and white whales occur sympatrically they apparently reduce competition by feeding at different water depths (Mitchell 1983). Narwhals probably feed at a great range of depths (*e.g.* Hay & Mansfield 1989) and occur during winter (*e.g.* Koski & Davis 1994) and summer (*e.g.* Born *et al.* 1994) in areas with deep waters. White whales to a greater extent feed bathypelagically and prefer areas with less deep waters (*e.g.* Sergeant 1979, Kingsley *et al.* 1994, Smith *et al.* 1994). The striking scarcity of narwhals in the Svalbard area is puzzling. Although a substantial part of the surrounding water is less than 100 m deep several fjords are between 200 and 400 m deep, and the major food items of narwhals are available in Svalbard waters (Ian Gjertz pers. comm.). It therefore remains unclear why narwhals do not summer around Svalbard.

In offshore areas of the Greenland Sea, narwhals feed mainly on squid (*Gonatus sp.*) and decapods, which occur primarily in areas with deep waters. After break-up of the fjord ice, narwhals penetrate the deep fjords of eastern Greenland, where the main food is cephalopods, Greenland halibut, redfish, polar cod and crustaceans (Isachsen 1925, Pedersen 1930, Born 1983, Glahder 1992). This summer diet is generally consistent with that of narwhals in Canadian and West Greenland waters (Vibe 1950, Finley & Gibb 1982, Hay & Mansfield 1989, Heide-Jørgensen *et al.* 1994). The scattered observations from East Greenland suggesting that gestation lasts from May to July are in agreement with published results cited by Hay & Mansfield (1989), who gave 15.3 months as an estimate for narwhals off northern Baffin Island. Best & Fisher (1974) estimated the gestation period to be only 14 months for western Greenland and eastern Canada. The peak of births seems to occur in late July in East Greenland, which again is consistent with the Canadian findings (Hay & Mansfield 1989, Koski & Davis 1994).

Observations of white whales in the Greenland Sea between eastern Greenland and Svalbard in June suggest that whales from the two areas belong to a single population. Few white whales have been observed during recent times south of 65°N in West Greenland, and it is therefore unlikely that the few white whales seen in East Greenland come from West Greenland. The white whales appearing in East Greenland from time to time are probably stragglers from the Svalbard population. In Davis Strait and Baffin Bay white whales tend to winter in coastal areas with less dense ice cover than those areas inhabited by narwhals (*e.g.* Heide-Jørgensen *et al.* 1993, Koski & Davis 1994) . We therefore hypothesize that white whales are rare in eastern Greenland because of the limited availability of suitable habitat. This is in contrast to the situation at Svalbard where white whales are relatively common (Gjertz & Wiig 1994) and narwhals are quite rare (Gjertz 1991). White whales are presumably deterred from dispersing westward from Svalbard because to do so they would need to cross areas with deep water and penetrate dense pack ice.

Acknowledgements

We thank the people who have provided us with their unpublished observations on narwhals and white whales. The translation of the Russian literature by C. O. Nielsen and the useful criticism provided by R. R. Reeves and two anonymous reviewers is gratefully acknowledged.

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