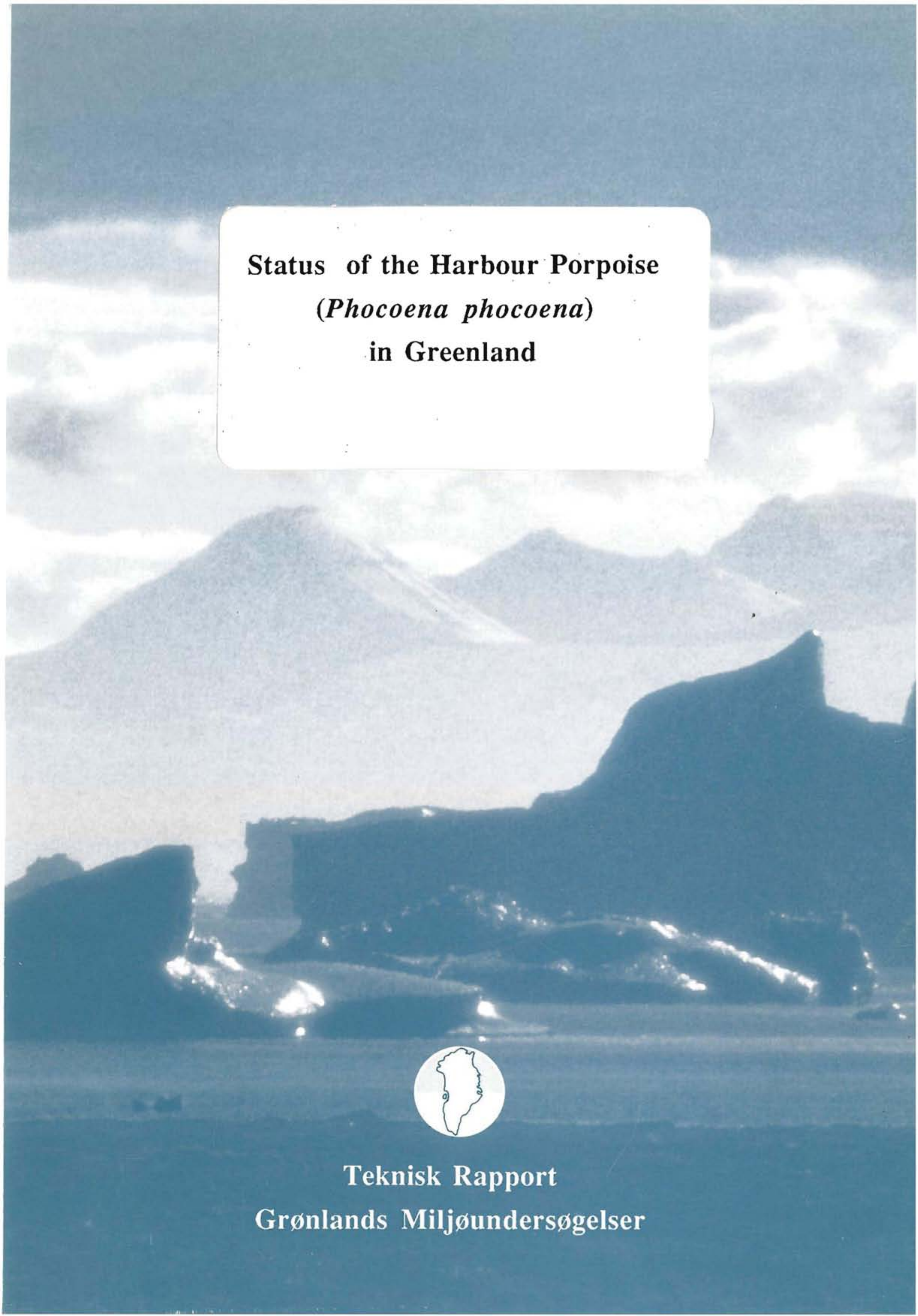

Status of the Harbour Porpoise (*Phocoena phocoena*) in Greenland

Teknisk Rapport

Grønlands Miljøundersøgelser

Grønlands Miljøundersøgelser (GM) vurderer virkningerne på miljøet af efterforskning og udnyttelse af mineralske råstoffer og vandkraft i Grønland. I forbindelse med råstofprojekter undersøger GM de miljømæssige forhold og medvirker ved råstofforvaltningens behandling af projekterne. GM udfører undersøgelser af, hvordan påvirkningen af miljøet kan begrænses, og overvåger påvirkningen. GM udfører desuden egne mere forskningsmæssige undersøgelser, som er af betydning for vurderingen af de miljømæssige forhold ved de konkrete projekter.

Grønlands Miljøundersøgelser er en sektorforskningsinstitution med 16 medarbejdere uddannet som biologer, kemikere, laboranter og kontorpersonale. Institutionen har adgang til et undersøgelsesskib stationeret i Nuuk.

Sammen med Grønlands Geologiske Undersøgelse og Grønlands Forundersøgelser bistår GM Råstofforvaltningen for Grønland ved forvaltningen af mineralske råstoffer, kulbrinter og vandkraft. Efterforskning og udnyttelse heraf er et fælles anliggende mellem den danske regering og det grønlandske hjemmestyre.

GRØNLANDS MILJØUNDERSØGELSER

TAGENSVEJ 135, 4.sal, DK-2200 KØBENHAVN N, DANMARK, Tlf: 35 82 14 15, Fax: 35 82 14 20

10.4

Status of the Harbour Porpoise (*Phocoena phocoena*) in Greenland

Prepared by

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Reference:
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Greenland Environmental Research Institute, Technical Report: 27 pp.

Greenland Environmental Research Institute
May 1995

CONTENTS

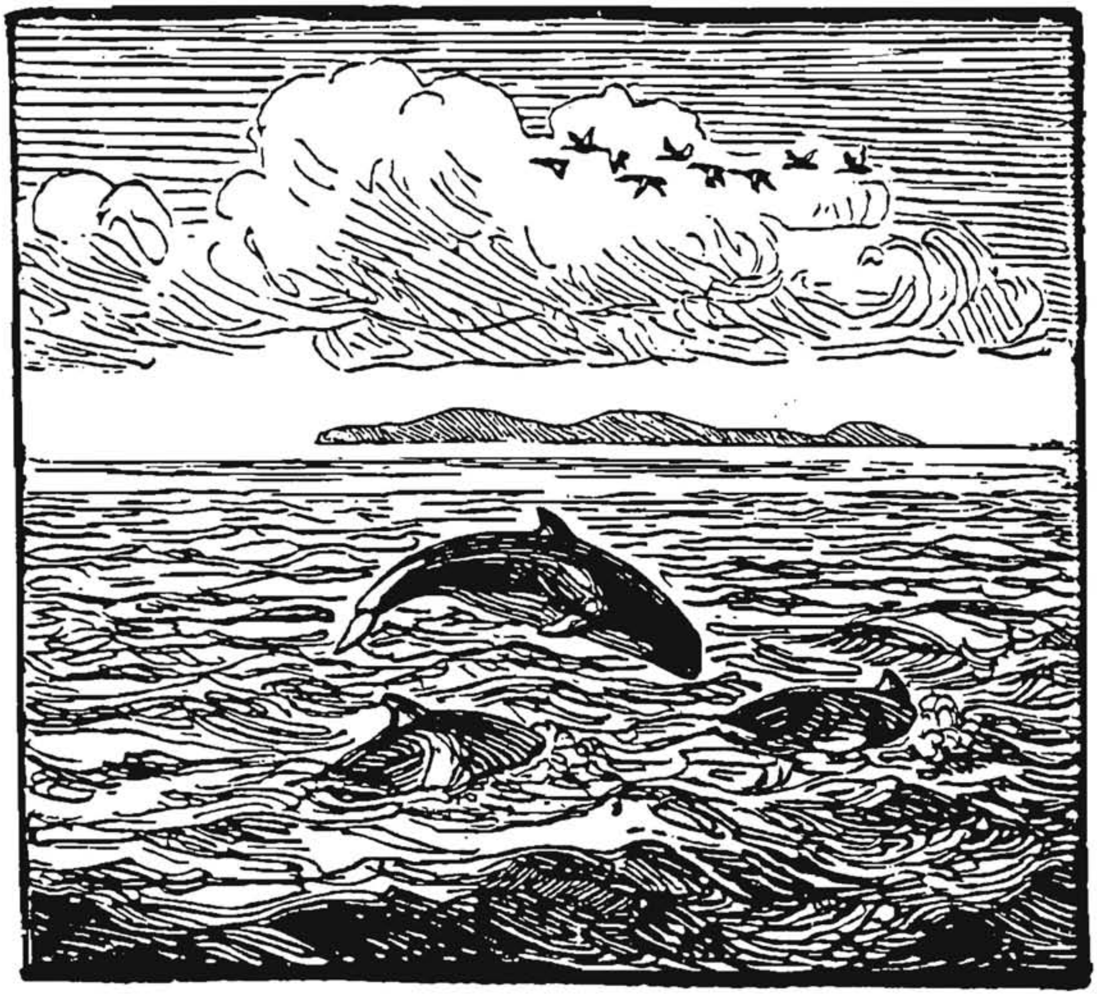

Figure 1. Breaching harbour porpoises and seabirds. Wood carving by Johannes Larsen 1926.

Photo of seal and harbour porpoise, shot in the back. Nanortalik 24 September 1988.

1. ABSTRACT

The harbour porpoise (*Phocoena phocoena*), the smallest cetacean in Greenland, is widely distributed from Ammassalik on the east coast of Greenland, all the way round south Greenland to Avanersuaq in Northwest Greenland. The main distribution lies between Sisimiut and Paamiut in Central West Greenland. Catch statistics from 1900-1993 indicate an annual take of 700 harbour porpoises, ranging from 134 to 1531 animals. A decline in the reported catch has been recorded during the last 10 years. Whether this reflects a trend in the population or difference in the reporting effort is unknown. Harbour porpoises are mainly caught between April and November, with a peak during June to October. There are no indications to date that environmental issues such as organochlorines, heavy metals, oil or noise until date have constituted any threat to harbour porpoises in Greenland. No reports of ice entrapments of harbour porpoises have yet been made in Greenland, as is the case for e.g. white whales and narwhals on the westcoast of Greenland. Five fish species, crustaceans and squids has been found in stomach contents of harbour porpoises in Greenland waters. Information from the North Sea have shown, that the harbour porpoise is an opportunistic feeder, and therefore can adapt to fluctuations in the abundance of their prey items. Disease patterns of harbour porpoise have not been studied in Greenland and incidents of mass mortality has never been recorded. Killer whales constitute as much of a threat to harbour porpoises as to any other marine mammal. However, killer whales are sparse in Greenland waters.

In Greenland no reliable figures on stock size are available at present, and a monitoring program is seriously needed if the ecological impact of the catch should be evaluated.

2. INTRODUCTION

Greenlandic and Danish authorities announced a hydrocarbon exploration licensing round for areas off West Greenland south of 66°N in April 1992. In connection with this licensing process, Boertmann *et al.* (1992) reviewed biological data in relation to oil spill sensitivity mapping, and identified data gaps. One of the gaps identified was the lack of information in relation to the distribution and abundance of harbour porpoise (*Phocoena phocoena*). The present report has been prepared to at least partially fill this gap.

The harbour porpoise (Fig. 1) has a circumpolar distribution in the northern hemisphere from 15°N (Cape Verde Islands, Gaskin 1984) to 74°N (this study). Historically, harbour porpoises

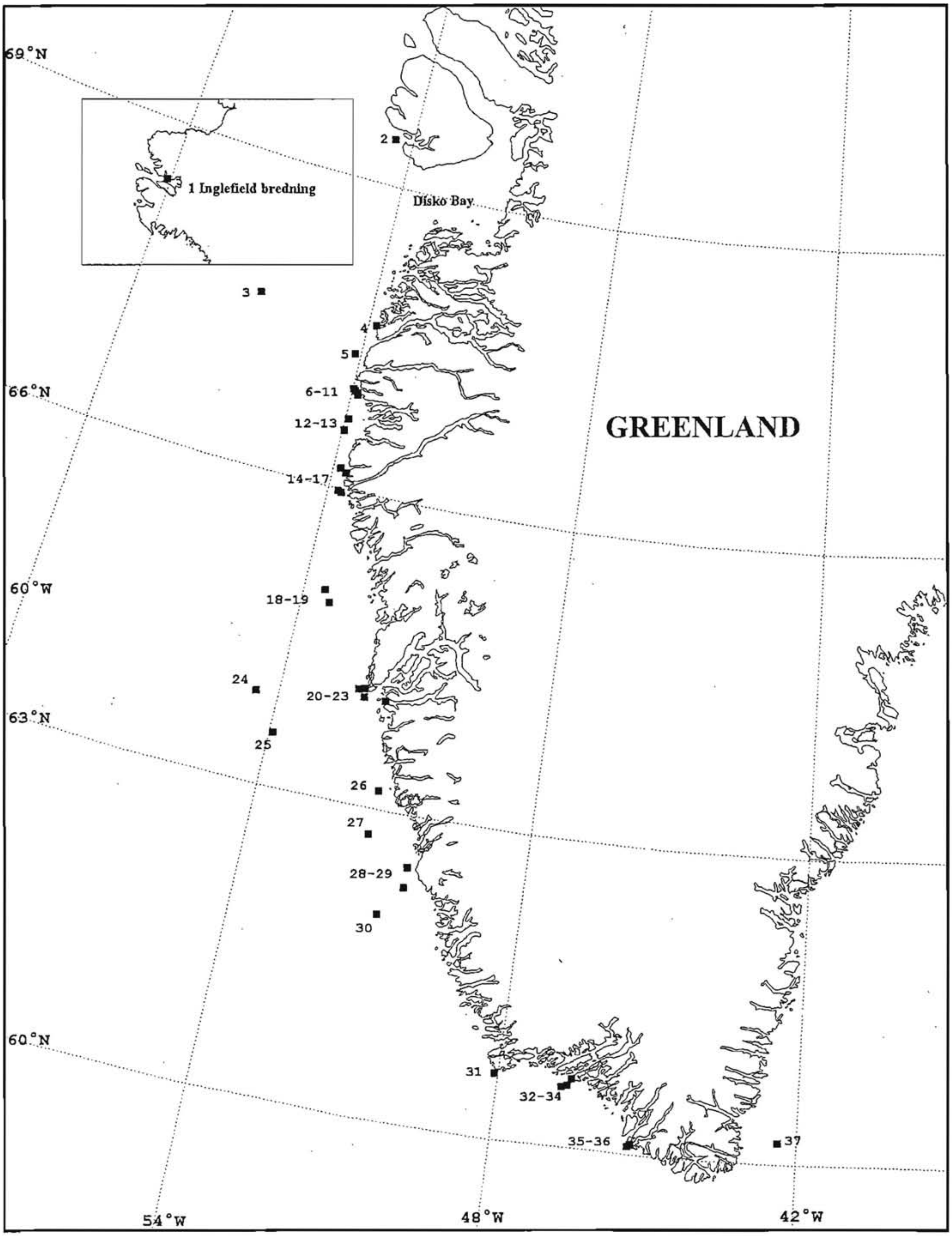

Fig. 2. Map of observations of harbour porpoises in Greenland.

in Greenland ranged from Ammassalik, on the east coast, south to Kap Farvel, and north to Upernavik on the west coast of Greenland (Oldendow 1935). Harbour porpoises are hunted all over Greenland. The meat, skin (mattak) and intestines are consumed by both humans and dogs, and is highly desired for the good taste (Fabricius 1929).

There has been increasing international interest and concern about the status of the harbour porpoise throughout its distribution in recent years due to the extensive bycatch and directed hunt (International Whaling Commission 1994).

This paper reports on the historic exploitation of harbour porpoises, and provides a review of the present knowledge of this species in Greenland waters. Published and unpublished records of observations and catches from the 20th century have been reviewed.

4. DISTRIBUTION

The harbour porpoise is common both offshore, inshore and in the fjords in Greenland (Jensen 1928a,b, Kapel 1975). It occurs mostly alone or in small groups. The mean pod size for observations in Greenland is 2.1 (S.D.=2.48, range=1-15, n=36) (Table 1). The main distribution extends from Sisimiut (Holsteinsborg) to Paamiut (Frederikshåb), with fewer animals seen and caught in the northern and southern municipalities. Only stragglers are seen in East Greenland and North Greenland (Vibe 1971).

Table 1. List of observations of harbour porpoises in Greenland.

No	Latitude	Longitude	Date	Comments	Reference
1	74°30N	66°45W	08.15.1985	1 observed in a narwhal pod (ship)	Filmed by Lars Åby in 1985
2	69°27N	54°30W	09.11.1986	1 seen outside Nipisat (ship)	Heide-Jørgensen 1986
3	67°40N	56°52W	07.15.1983	3 observed (ship)	Anon. 1983
4	67°38N	53°47W	06.26.1992	3 near the islands Simiutanguit (ship)	Mosbech & Boertmann 1992
5	67°19N	54°08W	09.04.1988	1 observed (ship)	Ornis Consult 1988
6	66°58N	53°55W	09.04.1988	15 observed (ship)	Ornis Consult 1988
7	66°58N	53°55W	09.04.1988	2 observed (ship)	Ornis Consult 1988
8	66°59N	53°58W	09.10.1988	3 observed (ship)	Ornis Consult 1988
9	66°59N	53°58W	09.10.1988	3 observed (ship)	Ornis Consult 1988
10	66°57N	53°50W	09.10.1988	2 observed (ship)	Ornis Consult 1988
11	66°56N	53°50W	08.22.1977	3 observed (ship)	Biokon ApS 1977

12	66°41N	53°55W	09.10.1988	1 observed (ship)	Ornis Consult 1988
13	66°34N	53°57W	09.10.1988	1 observed (ship)	Ornis Consult 1988
14	66°10N	53°40W	06.29.1992	1 seen inside Satunguit islands (ship)	Mosbech &Boertmann 1992
15	66°12N	53°49W	07.28.1992	1 observed (plane)	Larsen 1992
16	65°59N	53°45W	08.07.1992	1 swimming under 5 seagulls Plane)	Larsen 1992
17	65°58N	53°40W	08.07.1992	1 swimming under 2 seagulls (plane)	Larsen 1992
18	65°00N	53°30W	10.08.1993	4 observed (ship)	Bortmann & Mosbech unpubl.
19	64°53N	53°21W	07.08.1992	1 observed (ship)	Anon. 1983
20	64°09N	52°09W	08.06.1992	1 observed (plane)	Larsen 1992
21	64°08N	52°16W	08.06.1992	1 observed (plane)	Larsen 1992
22	64°04N	52°07W	09.27.1988	1 observed (ship)	Ornis Consult 1988
23	64°04N	51°38W	10.25.1977	6 observed (ship)	Anon. 1981
24	63°54N	54°30W	08.06.1992	1 swimming under 20 seagulls (plane)	Larsen 1992
25	63°32N	53°55W	08.06.1992	2 swimming under 8 seagulls (plane)	Larsen 1992
26	63°11N	51°24W	10.10.1993	3 observed (ship)	Bortmann & Mosbech unpubl.
27	62°45N	51°26W	09.30.1988	1 observed (ship)	Ornis Consult 1988
28	62°30N	50°30W	08.02.1987	1 observed (plane)	Larsen 1989
29	62°30N	50°30W	07.15.1992	Several porpoises observed (ship)	J. Rosing pers. comm.
30	62°00N	50°57W	08.04.1987	2 observed, mother and calf (plane)	Larsen 1989
31	60°41N	46°32W	08.31.1988	1 observed (ship)	Ornis Consult 1988
32	60°39N	48°04W	08.31.1988	1 observed (ship)	Ornis Consult 1988
33	60°37N	46°36W	08.31.1988	1 observed (ship)	Ornis Consult 1988
34	60°36N	46°43W	08.31.1988	1 observed (ship)	Ornis Consult 1988
35	60°06N	45°15W	10.03.1988	2 observed (ship)	Ornis Consult 1988
36	60°05N	45°18W	10.03.1988	2 observed (ship)	Ornis Consult 1988
37	60°13N	42°22W	09.19.1992	1 observed (ship)	Glahder & Petersen 1992

3.1 Occurrence by season

All observations and the majority of catches were recorded from May to November (Table 1, Figs. 2, 3). From these and other records, it is believed that harbour porpoises leave the Greenlandic coast in late fall and return in the spring. Eschricht (1849) stated that harbour porpoise leave the Greenlandic coast in November and arrived again by the end of April. However, animals have reportedly been seen in December during mild winters.

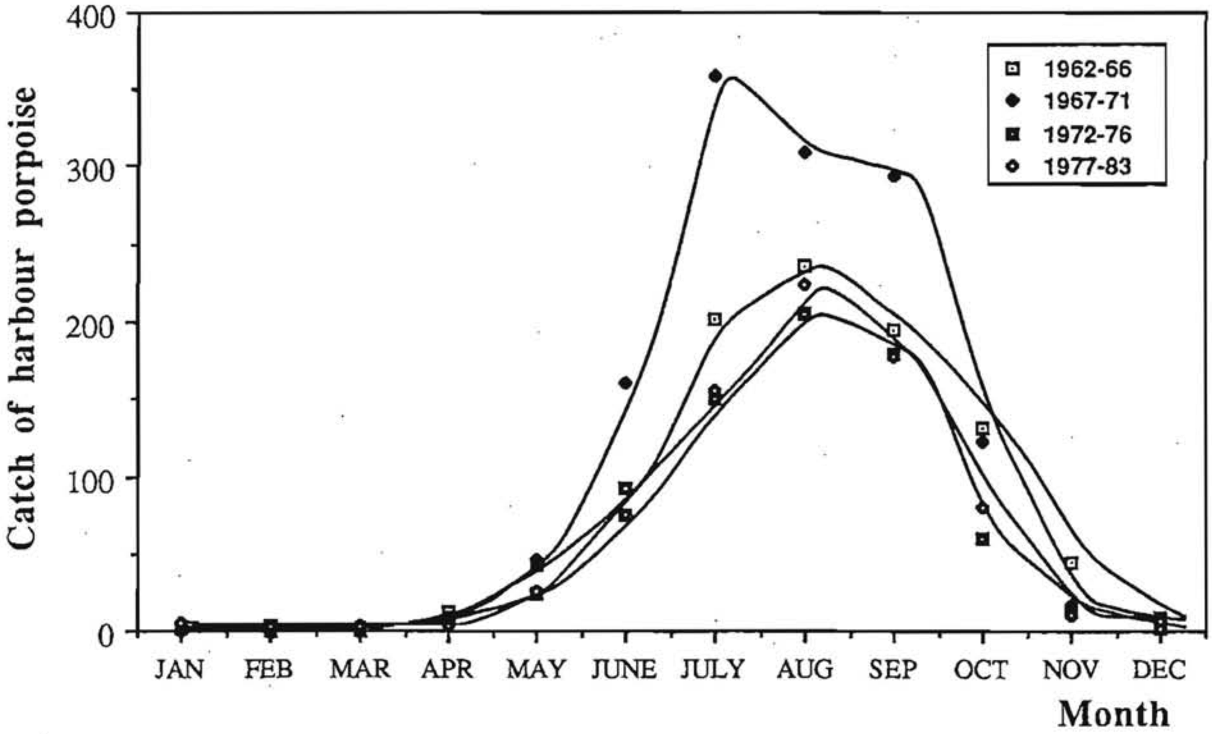

Fig. 3. The reported catches of harbour porpoises (Pooled for the whole Greenland), by month, in five years intervals, based on information from Hunters' Lists of Game (HLG 1962-1983).

3.2 Occurrence by area

3.2.1 North Greenland

North Greenland consists of three municipalities: Avanersuaq, Upernavik and Uummannaq. According to the Hunters' Lists of Game, 25 harbour porpoises were caught in 1976 in the northern most settlement of Avanersuaq. This is likely to be a printing error, as the only definite observation of harbour porpoise in Avanersuaq occurred in Inglefield Bredning in August 1985 (filmed by Lars Åby 1985), when one animal was filmed in company with a group of narwhals. Harbour porpoises are rarely seen in Upernavik and Uummannaq

(Bertelsen *et al.* 1921). Catch statistics reveal an annual average take of one to two animal in the two municipalities combined since 1950 (Fig. 5). The highest catch recorded in Upernavik was nine harbour porpoises in 1956 (HLG (Hunters' Lists of Game) 1900-1993).

3.2.2 Disko Bay

This area includes the following settlements: Aasiaat, Qasigiaanguit, Ilulissat and Qeqertarsuaq. Harbour porpoises are widespread in the Disko Bay during summer, but only occur in low numbers (Osterman & Porsild 1921a,b; Porsild 1921; Osterman *et al.* 1921). During the 1960s and mid 1970s about 100 porpoises were caught annually in Aasiaat, while about 30 animals were caught in each of the remaining cities. In the following 10 years about 25 harbour porpoises were taken in each of the four settlements. Very few records of porpoise catches were recorded in this area from 1986-93 (Fig. 6), although this may be due to a decrease in the reporting effort (HLG 1900-1993).

3.2.3 Central West Greenland

Four municipalities are included in this area; Kangaatsiaq, Sisimiut, Maniitsoq and Nuuk. The area has the highest catches of harbour porpoises in Greenland and account for the overall trend (Fig. 4, 7), with the largest catches taken in Maniitsoq and Nuuk. In August 1988-89 Kinze (1990b) collected samples from 84 harbour porpoises. He reported that harbour porpoises were frequent in the area around Nuuk and Maniitsoq. Harbour porpoises are a main target of hunting in Maniitsoq, while in Nuuk hunting is more random (Kinze 1989a). The HLG (1900-1993) reveals that a steady level of about 20 harbour porpoises were taken in Kangaatsiaq between the mid 1950s and the mid 1980s. A steady decrease in the catch from Sisimiut is evident, where the annual average of 130 in the late 1950s dropped to about 50 animals in the early 1980s (HLG 1900-1993). An annual average of about 200 harbour porpoises were caught per year in Nuuk from the 1950s to 1980. From 1982 to 1987, only about 100 animals were taken annually. A different catch trend is evident in Maniitsoq, where about 300 harbour porpoises were taken annually in the 1950s to 1966. In the following five years the catch increased to an average of 700 animals. This period was followed by an annual catch of 200 porpoises from 1972 to 1977, whereafter the catch increased to about 500 over the following 10 years in Maniitsoq. According to the catch statistics, Nuuk had the largest catches of harbour porpoises in Greenland before the second world war, while after the war Maniitsoq had the largest catches (HLG 1900-1993).

3.2.4 South Greenland

Four municipalities are included in this area: Paamiut, Narsaq, Qaqortoq and Nanortalik. According to the catch statistics the only place where harbour porpoises are caught in large numbers in South Greenland is Paamiut. Approximately 70 animals have been taken annually in this area over the past 20 years which contributes to the major bulk of the annual take (Fig. 8). Only few harbour porpoises are taken in the more southern municipalities. Five animals are caught per year in Narsaq and Qaqortoq, while only three animals on average are caught in Nanortalik.

3.2.5 East Greenland

Harbour porpoises are rarely seen in the two East Greenland municipalities: Ittoqqortoormiit and Ammassalik. Pedersen (1930) reported two possible observations in Ittoqqortoormiit; July 1927 and in August 1892. In 1984, one harbour porpoise was recorded in the catch statistics (HLG 1900-1993). This is the only catch ever recorded in this municipality. The harbour porpoise appears as a rare guest in Ammassalik in years with minimal ice coverage (Holm & Petersen 1921). In 1986 142 harbour porpoises were recorded in the Ammassalik catch statistics. This figure is most likely a printing error due to the extreme value, and has therefore been excluded from this study. Besides this figure, only nine animals has been recorded in this area, with a maximum of six animals in 1964 (Fig. 9).

4. POPULATION STRUCTURE

Knowledge of the harbour porpoise population distribution is important to assess the impact of hunting and bycatches in any particular area. Several studies have attempted to separate harbour porpoises into populations and sub-populations (*e.g.* Kinze 1985, Yurick & Gaskin 1987, Amano & Miyazaki 1992, Andersen 1993). A population is defined as being a group of animals genetically isolated from other groups, where there is no mingling with other groups during the mating season. This definition can only be verified by thorough genetic studies, which is only in its preliminary state for harbour porpoises (*e.g.* Andersen 1993; Walton 1995). Harbour porpoise samples from West Greenland, western Canada, Holland and inner Danish waters were analysed in a preliminary genetic study by isozyme electrophoresis (Andersen 1993). All were shown to be significantly different from each other, except for porpoises from West Greenland and the inner Danish waters, which were found to have similar allele frequencies. However, it is very unlikely that the same genetic group could persist within such geographically distant areas. Consequently, populations can be roughly separated by differences in morphology, reproduction, parasitic burden and contaminant levels or by telemetry or geographical barriers. From morphological comparisons of skulls, Yurick & Gaskin (1987) found significant differences between harbour porpoises from the eastern Pacific, western Atlantic, and the eastern Atlantic. Similarly, Amano & Miyazaki (1992) found significant differences between the eastern and western Pacific and the Atlantic, but no differences were found within the Atlantic, which may be ascribed to a small sample size. Six smaller more or less isolated groups (subpopulations) were suggested to exist in the northwestern Atlantic based on geographical separation (Gaskin 1984). These are; one along the west coast of Greenland, one along the east coast of Greenland, one along Eastern Newfoundland and Western Davis Strait, one in the Gulf and Estuary of the St. Lawrence river, one along the coast from Nova Scotia to North Carolina, and finally one around Iceland and the Faeroe Islands.

Harbour porpoises in Greenland give birth to their young in the beginning of July, while this takes place one month earlier in the Bay of Fundy, Canada (Kinze *et al.* 1990). This supports the supposition that harbour porpoises in Greenland are reproductively separate from other known populations. Differences in the parasitic burden between Greenlandic porpoises and other areas also indicates that the stocks are separated (Kinze 1989c).

5. HUNTING

Since the first settlements, the harbour porpoise has been hunted without regulations in Greenland (Hammer 1921). It has been hunted like seals with riffles, harpoons or caught in nets from all kind of boats (Birket-Smith 1924, Kapel 1982). Because of its scattered distribution and small pod size, harbour porpoises are mostly taken as a bycatch during hunt or fishery for other species. However, during the past years the decreasing number of several mammals and latest the hunting band for reindeer, may have increased the hunting pressure on the harbour porpoise.

5.1 Catch statistics

The official catch statistics (HLG 1900-1993) for harbour porpoises in Greenland dating back to 1900, is based on a unique reporting system, where all hunters and fishermen are required to report their catches every year. The statistics are likely to be biased to an unknown extent due to the cultural and technical revolution, and the changes in effort over the years (Kapel 1983). However, it provides a minimum estimate of the catch, but caution must be taken when analysing the data for population trends. The Ministry of Greenland have tried, for some years, to correct for animals caught but not reported (Kapel 1983). We believe that any estimates based on these statistics would only increase the above mentioned biases and therefore be of little value. For this reason the modified statistics were not used in this study.

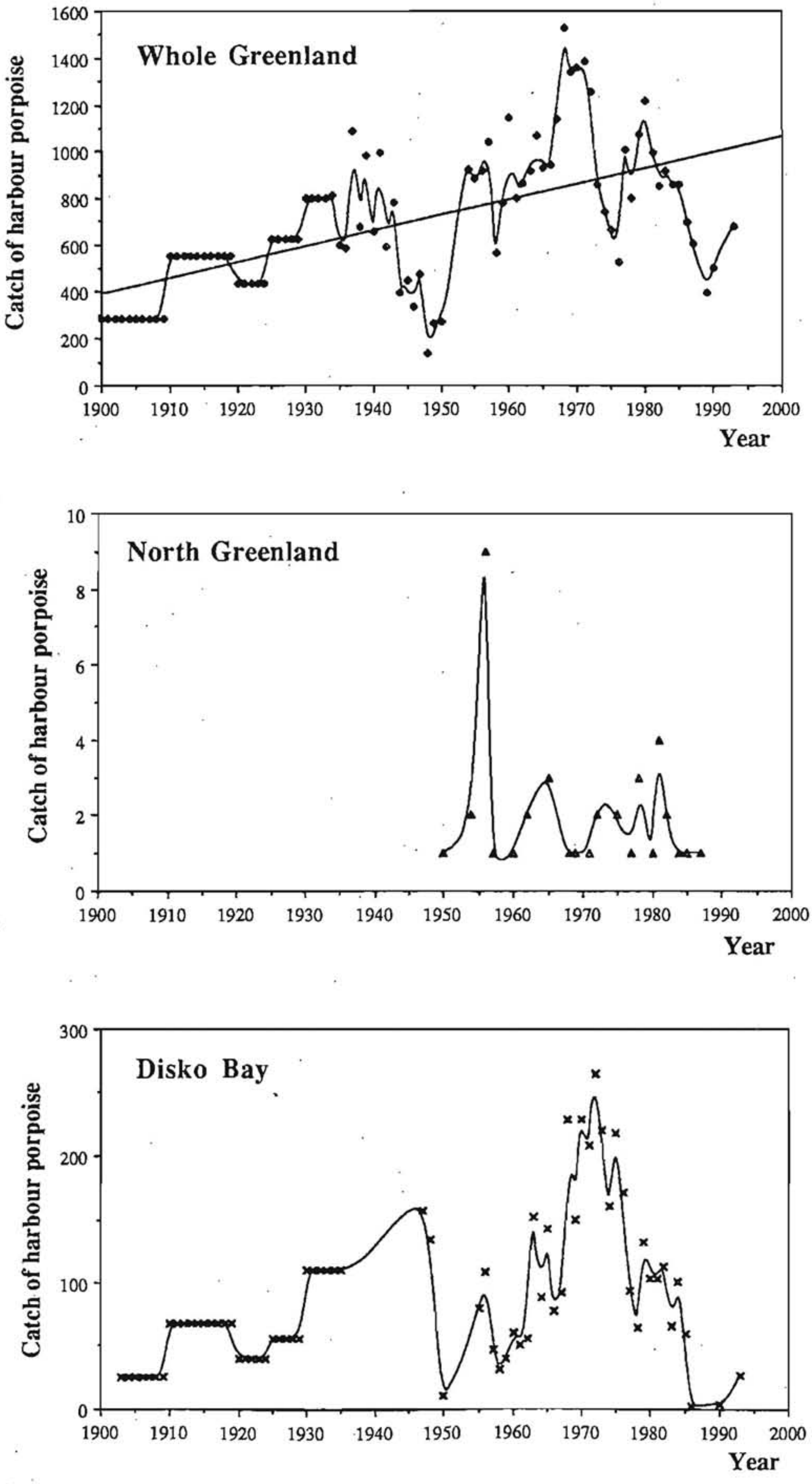

Fig. 4-6. The catch of harbour porpoises for whole Greenland, North Greenland, Disko Bay, respectively. Information is based on the Hunters' Lists of Game 1900-1993 (HLG 1900-1993).

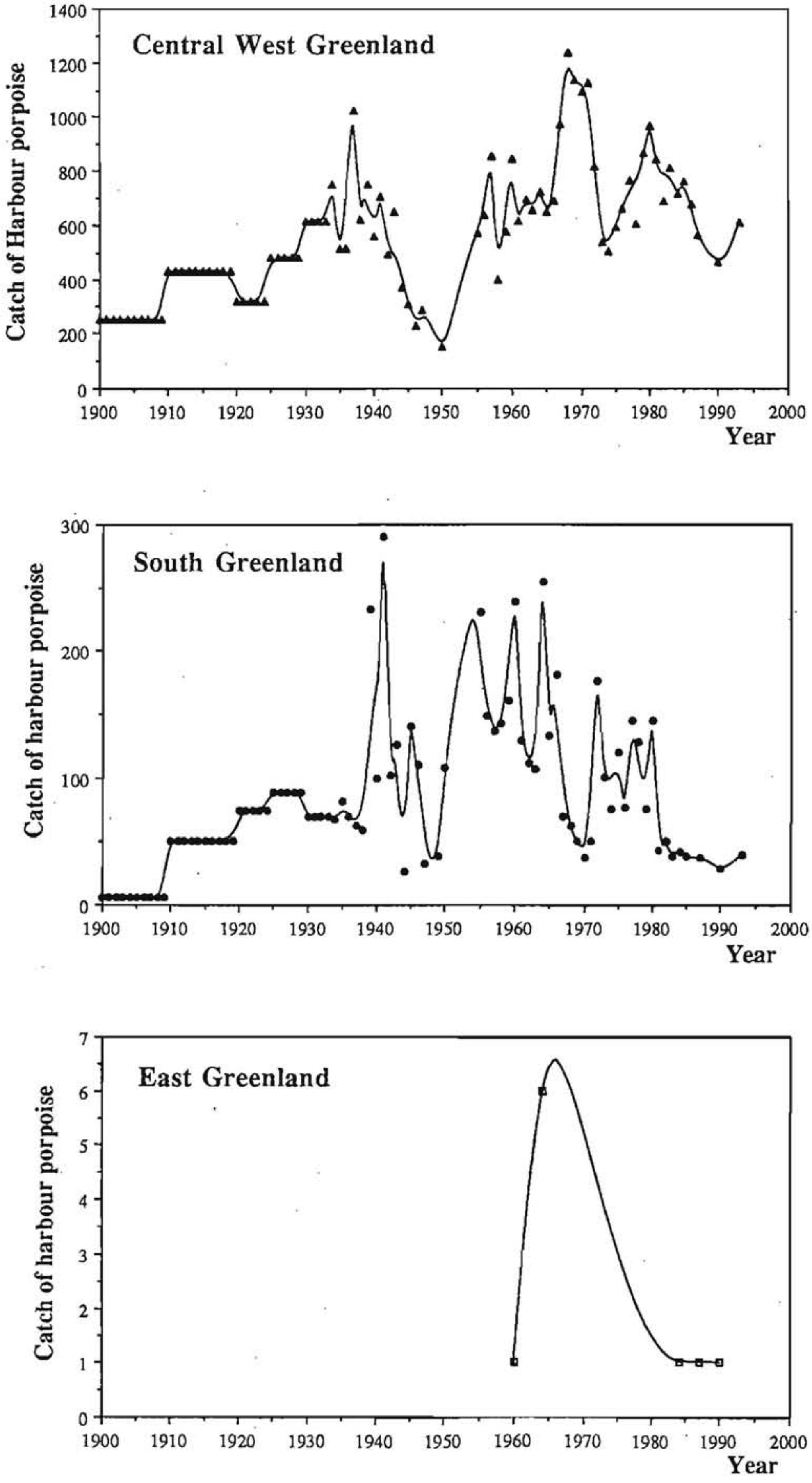

Fig. 7-9. The catch of harbour porpoises for Central West Greenland, South Greenland and East Greenland, respectively. Information is based on the Hunters' Lists of Game 1900-1993 (HLG 1900-1993).

Figures 4-9 shows the total catch from 1900-1993, divided into the following areas: whole Greenland, North Greenland, Disko Bay, Central West Greenland, South Greenland and East Greenland. For this century an overall increase in the catch is seen for the whole of Greenland. However, this trend covers up individual variations between years. In North and East Greenland a few harbour porpoises are caught in some years. For Disko Bay, Central West Greenland and South Greenland a decline in the reported catch occurred during and after the second world war, probably due to a lack of fuel for boats and less reporting effort. This decline was followed by an increase through the 1960s, reaching the maximum for this century in the early 1970s. This increase may be attributed to the bycatch of porpoises in the growing driftnet salmon fishery along West Greenland conducted by both national and international fishing fleets. Only bycatch figures from the national fishing vessels are recorded in the Hunters' Lists of Games (HLG 1900-93, Kapel 1977). Since the early 1980s a decline in the catch for all municipalities has been observed. Since the hunting effort has not been reduced, the decline reflects either the population trend or a decreasing reporting effort.

The only study trying to asses the bycatch in commercial fishery was carried out in 1972, when observers onboard 8 non-greenlandic salmon driftnet vessels recorded all catches (Lear & Christensen 1975). Large numbers of seabirds, harbour porpoises and seals were included in the bycatch. An estimated 1400 harbour porpoises were caught in the non-greenlandic driftnet fishery in 1972. If this figure is added to the greenlandic catch in 1972 (1258 animals), a minimum estimate of 2658 harbour porpoises can be derived. Christensen & Lear (1977) point out that the great variability in effort and fishing gear makes it impossible to give a reliable estimate of the harbour porpoise bycatch in driftnet fishery for other years. The large scale driftnet fishery for salmon ceased during 1972-76 (Kapel 1983).

6. POTENTIAL TO WITHSTAND EXPLOITATION

Population parameters are important for determining the impact of exploitation, but they have proven to be very difficult to estimate for cetaceans (Reilly & Barlow 1986). To assess rates of population increase, several parameters are needed, such as; age-specific reproductive rates, age-specific survival rates, natural mortality rates, and incidental mortality rates. In harbour porpoise populations, late maturation and a short life span provides a natural limitation to population increase. Harbour porpoises therefore have a very limited ability to withstand incidental mortality (Woodley & Read 1991).

In Greenland, male harbour porpoises become sexually mature at about three years of age and females at about four (Kinze *et al.* 1990). From observations of marked harbour porpoises, females are known to be capable of giving birth to a calf every year (Klinowska 1991). The maximum life span of harbour porpoise in Greenland was found to be 11 years for males and 9 years for males (Kinze *et al.* 1990). From an examination of 84 specimens the sex ratio of females and males was found to be close to 1:2 (Kinze *et al.* 1990), however, the sex ratio for harbour porpoises is generally considered to be 1:1. The biological data mentioned above give very little potential for population increase. However, Read & Gaskin (1990) reported an increasing maternal investment in a population exposed to exploitation. Although, this population was also subjected to an increase in food availability, which is known to positively affect reproductive parameters.

It has been recommended that the annual removals from cetacean populations are kept below half of the maximum population increase rate (Anon 1993). According to the calculations made by Reijnders (1992), this recommendation would imply that 1 to 3 % of the harbour porpoise populations could be exploited. The International Whaling Commission states that bycatch of cetaceans should be maintained at maximum 1-2% of the population size. Applying these recommedations to the 1972 catch figures, the Greenland population should be between 90 000 and 270 000 harbour porpoises to withstand the hunt and bycatch. The average minimum catch of 700 harbour porpoises per year in this century, could be maintained at a population level of about 23 000-70 000 whales.

7. OTHER THREATS TO THE POPULATION

Several things can affect the harbour porpoise population, besides the directed catch and the bycatch in commercial fishing gear. Some of these will be reviewed in the following sections.

7.1 Environmental threats

The Environmental threats which cause the most concern in marine ecosystem are organochlorines, heavy metals, oil and underwater noise.

7.1.1 Organochlorines

Organochlorines which are stable, they accumulate in fat and are known to be concentrated throughout food chains reaching the predators such as seals, whales and polar bears at the highest trophic level. Experiments have shown reproductive failure in harbour seals and minks given PCB (*e.g.* Reijnders 1986, Kihlström *et al.* 1992). Levels above 50-70 ppm of PCB has been suggested to have a negative effect on the reproduction rate and the immune system in seals. It has been postulated that the reduced stock of Baltic seals and porpoises is due to PCB concentrations (Otterlind 1976, Helle 1989, Olsson *et al.* 1992). In addition increased skull and bone lesions were observed in grey seals in the Baltic from 1950 to 1985. This coincides with the increased levels of DDT and PCB found in the Baltic biota (Bergman *et al.* 1992). PCB pollution started after the second world war, became severe in the 1960s and peaked in the 1970s (Bergman *et al.* 1992, Blomquist *et al.* 1992). No analyses have been carried out on harbour porpoises from Greenland waters, although samples were collected in 1988-89. However, organochlorine levels are, in general, lower in Arctic waters compared with lower latitudes.

7.1.2 Heavy metals

Cadmium, mercury, zinc, copper and selenium have been analysed in muscle, skin, liver and kidney from harbour porpoises from West Greenland (Paludan-Müller *et al.* 1993). Cadmium levels from Greenland were found to be more than ten times higher than in harbour porpoises from European waters, while mercury levels were equal to or up to four times lower (Paludan-Müller *et al.* 1993). In the Bay of Fundy, Canada the level of mercury were twice as high as the level in harbour porpoises from Greenland (Gaskin *et al.* 1979). Both mercury and cadmium were shown to accumulate with age in harbour porpoise, but metal content do not reach a level that can cause a health risk to the whales (Paludan-Müller *et al.* 1993, Aguilar & Borrell 1994). Both cadmium and mercury levels in Greenland harbour porpoises exceed the Danish standard limits for metals in food (Anon 1985). Levels of selenium in greenlandic harbour porpoise revealed extremely high levels, higher than in any other tissue or species analysed in the Greenland marine environment (Paludan-Müller *et al.* 1993).

7.1.3 Oil

The effects of oil on cetaceans are less well known than they are on pinnipeds. Oil has not been proven to cause mortality in cetaceans (Richardson *et al.* 1989). The fact that cetaceans rely on a layer of blubber to minimize heat loss in cold water, means that oiling is unlikely to have serious thermal consequences, even if oil does adhere to the skin. The grounding of Exxon Valdez caused the release of 40 million litres of crude oil into Prince Williams Sound, Alaska, a habitat for several marine mammal species. Large numbers of seals, were observed swimming in the slick, and 47 fatalities were reported from three species. The disapperence of 14 killer whales from a resident pod in Prince William Sound led Dalheim & Matkin (1993) to conclude that the whales died from either a combination of the Exxon Valdez oil spill, natural causes or as a result of interactions with fisheries. In the weeks immidiately following the oil spill harbour seals in the area were reported to be sick, lethargic or unusually tame. Later examinations of 19 dead seals from the area showed debilitating lesions in the brains of many of these (Frost & Lowry 1993). If inhalation can cause death in seals, the same may also be true for whales.

7.1.4 Noise

The effect of noise on whales has been reviewed by a number of authors e.g Richardson *et al.* (1989) and Davis *et al.* (1991). The physical presence of structures used by industry is not likely to affect marine mammals. However, the noise from human activities associated with these structures may be important. The noise produced by aircrafts flying over toothed whales may force the animals to dive or turn away, but their sensitivity seems to vary depending on their activity (*e.g.* feeding, suckling, migrating), and the effects appear to be transient. Toothed whales show some tolerance to noise emmited from ships and boats, but may react over distances of several kilometres or more when confined by ice or shallow water, or when they associate approaching vessels with harassment. Although noise from seismic exploration is more intense than that from other non-explosive sources, it is transient in nature and, therefore, will not mask marine mammal communication. The limited knowledge available suggests that stationary activities (*e.g.* dredging, oil drilling and production) often have less effect on marine mammals than do moving sources of sound such as aircrafts and ships, and that the few species of marine mammals studied, reacted only when the noise levels exceeded some threshold level well above the ambient level (Richardson *et al.* 1989, Davis *et al.* 1991). No information is available on how harbour porpoises react to disturbance in Arctic waters. Harbour porpoises are often seen close to vessels, which indicates that this species is more tolerant of noise than are belugas and narwhals for example.

7.2 Ice entrapments

Ice entrapments and deaths of large numbers of harbour porpoises have been reported in Denmark by Johansen (1929) and Bondesen (1977). Mass mortalities brought about by ice entrapments may have long-term consequences for the population of harbour porpoise, as is believed to be the case for white whale and narwhal populations in Greenland (Siegstad & Heide-Jørgensen 1994). However, no records on ice entrapments of harbour porpoises have yet been made in Greenland.

7.3 Food availability

Of 18 stomachs samples taken in Maniitsoq in July 1988, all were found to contain remnants of capelin (*Mallotus villosus*). Greenland halibut (*Reinhardtius hippoglossoides*), Norway haddock (*Sebastes marinus*) and unidentified codfish (*Gadidae sp.*) were present in 28%, 11%

and 5.5% of the stomach samples respectively (Kinze 1989a,b,c). Squids (*Gonatus fabricii*) and longtailed decapods (*Sclerocrangon ferox*) were found in 11% and 5.5% of the stomachs (*Ibid.*). Kinze (1990b) found similar food items in the stomachs of 20 porpoises sampled in August 1989. Capelin were found in all of the stomachs, greenland halibut were found in 45%, sculpin (*Icelus bicornis*) in 10% and squid in 10% (Kinze 1990).

Studies of harbour porpoise stomach contents from northern Europe have revealed of a large variety of prey species including 33 fish species, polychaetes and squids. In general, the harbour porpoise seems to be a opportunistic feeder. However, it has a high rate of metabolism and might depend on fish species with high lipid content such as herring, mackerel and eel. Harbour porpoises always swallow fish in one piece. They are not capable of biting a fish into pieces due to their small teeth, which can only be used to hold prey. Prey size is therefore limited by the size of the porpoise and the shape of the prey. The average prey size is about 25 cm long.

7.4 Disease

Mass mortalities of marine mammals caused by viruses and biological toxins have been reported on several occasions and are a potential threat to all populations. 750 bottle-nosed dolphins (*Tursiops truncatus*) washed ashore on the southeast coast of United States during 1987-88. These deaths were probably caused by toxic dinoflagellates (St. Aubin 1991). In 1988 a morbillivirus, phocine distemper virus, caused the death of some 17,000 harbour seals (*Phoca vitulina*) in northern Europe (Dietz *et al.* 1989, Heide-Jørgensen *et al.* 1993). Morbillivirus were also isolated in stranded harbour porpoises from the northern Irish coast during the outbreak of the seal epizootic, but no mass mortality was detected (Visser & Osterhaus 1991). The same, or a related morbillivirus, is believed to have caused the death of several thousand striped dolphins (*Stenella coeruleoalba*) in Mediterranean waters in 1990 (Aguilar & Raga 1991, Visser & Osterhaus 1991). No mass mortalities have been recorded in Arctic waters, however, antibody titers of morbillivirus (distemper virus) has been found in ringed seals and harp seals from Greenland waters (Dietz *et al.* 1989). Fourteen different viruses have been shown to infect marine mammals (Visser & Osterhaus 1991).

7.5 Predation by killer whales

Killer whales (*Orcinus orca*) are widely distributed in Greenland, although the only occur in small numbers. In Greenland, killer whales are known to feed on almost all species of marine mammals, however fish and squids have also been found in their stomachs (Heide-Jørgensen 1988). A stomach analyse of a killer whale found floating in Kattegat in 1861 revealed remnants of 14 seals and 13 harbour porpoises (Bondesen 1977).

8. DISCUSSION

The harbour porpoise is still common along the coasts of Greenland from May-November, with its main distribution along Central West Greenland. Catch statistics reveal an annual take of 700 animals from 1900-1993. This is the largest number caught for any cetacean in Greenland, which suggest that the harbour porpoise is the most common cetacean in Greenland. However, a decline in the catch was evident in all districts during the past 10 years. Whether this reflects a trend in the abundance of harbour porpoises is unknown.

The harbour porpoise is generally considered to be a coastal species (*e.g.* Vibe 1990). This may not be true in Greenland, where several observations were made beyond the continental shelf (Table 1). Christensen & Lear (1977) reported a bycatch of two animals in the middle of the Davis Strait, in late September 1972. This suggests that the harbour porpoise is capable of reaching other geographically isolated populations in Canada or Iceland. However, there are several indications from genetic, morphological, reproductional and parasitic studies that point to the fact that harbour porpoises in Greenland belong to a separate stock, and must be treated so until other have been proved.

There are no indications to date that environmental issues such as organochlorines, heavy metals, oil or noise have constituted any threat to harbour porpoises in Greenland. Organochlorines are not used in Greenland. Theories have been proposed regarding the transportation of volatile and semi volatile compounds. These compounds will volatilise from temperate environments where they are both produced and used, and then recondense in colder areas (the global fractionation theory). However, the levels are generally lower than further south, and have not reached levels likely to cause disease patterns. Heavy metal contamination is in general high in Arctic waters, but are likely to originate from natural background sources (Dietz *et al.* 1995). No major oil spills have occurred in Greenland waters and no whale mortalities have been proven to be caused by oil anywhere. No information is available on how harbour porpoises react to disturbance in Arctic waters, however harbour porpoises in Danish waters have been reported to flee from motorboats (*e.g.* Amundin & Amundin 1973). No records have yet been made on ice entrapments of harbour porpoises in Greenland. Examination of stomach contents of harbour porpoise from Maniitsoq have shown that at least five fish species, crustaceans and squids are among the preferred prey items. Information from other areas of the North Sea reveal that the harbour porpoise is an opportunistic feeder, and therefore can adapt to fluctuations in the abundance of prey items. Disease patterns of harbour porpoise have not been studied in Greenland, and incidents of mass mortalities have never been recorded. Such observations have not been made for seals either, although antibody titers from the distemper virus have been documented among ringed seals and harp seals. Killer whales constitute no greater threat to harbour porpoises than to other marine mammals. The limited number of killer whales in Greenland waters compared to the high numbers of other marine mammals species makes the Greenland marine environment relative safe from predation.

In conclusion, there does not appear to be any major factors affecting the population other than the direct hunting and possibly the bycatch of commercial fisheries. No estimates of abundance exist for harbour porpoises in Greenland. Such estimates are crucial if the effects of the catch rate are to be evaluated and any form of management applied.

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