

# Meddelelser om Grønland

Historical and present distribution, abundance and exploitation of Atlantic walrus (*Odobenus rosmarus rosmarus* L.) in eastern Greenland

*Erik W. Born, Rune Dietz, Mads Peter Heide-Jørgensen and Lars Øivind Knutsen*



**Bioscience**

**46 • 1997**

ISSN 0106-1054  
ISBN 87-90369-15-7



Historical and present  
distribution, abundance and  
exploitation of Atlantic walruses  
(*Odobenus rosmarus rosmarus* L.)  
in eastern Greenland

*Erik W. Born, Rune Dietz,  
Mads Peter Heide-Jørgensen  
and Lars Øivind Knutsen*

## Meddelelser om Grønland

The series *Meddelelser om Grønland* was started in 1879 and has since then published results from all fields of research in Greenland. In 1979 it was split into three separate series:

*Geoscience*  
*Bioscience*  
*Man & Society*

The series should be registered as *Meddelelser om Grønland, Geoscience (Bioscience, Man & Society)* followed by the number of the paper. Example: *Meddr Grønland, Geosci. 1, 1979.*

The new series are issued by Kommissionen for Videnskabelige Undersøgelser i Grønland (The Commission for Scientific Research in Greenland).

### Correspondence

All correspondence and manuscripts should be sent to:

The Secretary  
Kommissionen for Videnskabelige Undersøgelser i Grønland  
Danish Polar Center  
Strandgade 100 H  
DK-1401 Copenhagen K

Questions concerning subscription to all three series should be directed to the agent.

### Agent

Geografforlaget, Fruerhøjvej 43, DK-5464 Brenderup.  
Tel.: +45 63 44 16 83. Fax: +45 63 44 16 97.  
e-mail: go@geografforlaget.dk

## Meddelelser om Grønland, Bioscience

*Meddelelser om Grønland, Bioscience* invites papers that contribute significantly to studies of flora and fauna in Greenland and of ecological problems pertaining to all Greenland environments. Papers primarily concerned with other areas in the Arctic or Atlantic region may be accepted, if the work actually covers Greenland or is of direct importance to continued research in Greenland. Papers dealing with environmental problems and other borderline studies may be referred to any of the series *Geoscience, Bioscience, or Man & Society* according to emphasis and editorial policy.

### Scientific editor – Zoology

G. Høpner Petersen, Zoological Museum, Universitetsparken 15, DK-2100 Copenhagen Ø. Telephone +45 35 32 10 82

### Scientific editor – Botany

Gert Steen Mogensen, Botanical Museum, Gothersgade 130; DK-1123 Copenhagen K, Telephone +45 35 32 22 00

This volume is edited by G. Høpner Petersen

### Instructions to authors.

See page 3 of cover

© 1997 Kommissionen for Videnskabelige Undersøgelser i Grønland. All rights reserved. No part of this publication may be reproduced in any form without the written permission of the copyright owner.

Accepted May 1997  
ISSN 0106-1054  
ISBN 87-90369-15-7

# Contents

Introduction .....	5	Sex and age composition .....	31
Materials and methods .....	6	Wintering areas .....	32
Review of information from literature and other sources .....	6	Migrations and offshore observations .....	34
Recent ship-based and aerial surveys .....	7	Catch .....	35
Identification by use of natural marks .....	8	Catches by European sealers and trappers .....	35
Age estimation .....	8	The catch of walruses by Greenlanders .....	39
Estimation of historical population size .....	8	Estimation of present population size .....	41
Results .....	9	Estimation of historical population size .....	41
Seasonal distribution of coastal observations of walruses .....	9	Regulations .....	42
Distribution before 1950 .....	9	Foraging and foraging areas .....	43
Coastal observations south of Kangertittivaq (Scoresby Sund; approximately 70° N) .....	9	Discussion .....	44
The Kangertittivaq (Scoresby Sund) area .....	11	Distribution .....	44
The areas between Kangertittivaq and Dove Bugt (70° to 77° N) .....	12	Migrations and offshore observations .....	45
The areas north of Dove Bugt (north of approximately 77° N) .....	19	Identification by use of natural marks .....	46
Distribution after 1950 .....	20	Catches and catch composition .....	46
Coastal observations south of Kangertittivaq (Scoresby Sund) .....	20	Estimation of present population size .....	47
The Kangertittivaq (Scoresby Sund) area .....	20	Estimation of historical population size .....	48
The areas between Kangertittivaq and Dove Bugt (70° to 77° N) .....	20	Foraging and foraging areas .....	49
The Lille Snenæs haulout .....	23	Acknowledgements .....	49
The areas north of Dove Bugt (north of approximately 77°N) .....	30	References .....	51
		Appendix 1: List of unpublished sources held at Arctic Institute (Copenhagen) and Norwegian Polar Institute (Oslo) which were searched for information on walruses in eastern Greenland ...	59
		Appendix 2: Coastal observations of walruses in East Greenland, 1889-1994 .....	61





# Historical and present distribution, abundance and exploitation of Atlantic walrus (*Odobenus rosmarus rosmarus* L.) in eastern Greenland

ERIK W. BORN, RUNE DIETZ, MADP PETER HEIDE-JØRGENSEN and LARS ØIVIND KNUTSEN

Born E.W., Dietz R., Heide-Jørgensen M.P. & Knutsen, L.Ø. 1997. Historical and present distribution, abundance and exploitation of Atlantic walrus (*Odobenus rosmarus rosmarus* L.) in eastern Greenland – Meddr Grønland, Biosci. 46: 73 pp. Copenhagen 1997-12-01.

The status of the Atlantic walrus (*Odobenus rosmarus rosmarus* L.) in eastern Greenland is reviewed on the basis of several historical and recent sources of information on distribution, numbers and catch. Walrus occur in small groups along the east coast of Greenland from approximately 63° N to approximately 81° N. Their largest abundance is, however, north of approximately 73° 30' N. The sexes are generally segregated during summer: During August and September, about 50 males are found at each of two terrestrial haulouts Sandøen (74° 15' N) and Lille Snenæs (76° 52' N). Movement of walrus that could be identified from natural marks indicates that there is a connection between the two groups. During summer, the majority of mature females and subadults of both sexes are distributed further north, between about 80° N and about 81° N. Walrus winter in the Northeast Water Polynya, in leads and cracks in the offshore pack ice in the Fram Strait and Greenland Sea between about 78° N and about 81° N, further south in smaller recurring polynyas, and in the shear zone between fast ice and the pack ice along the east coast of Greenland. Although a connection between walrus in eastern Greenland and Svalbard has been demonstrated, the extent to which the eastern Greenland population is geographically isolated from groups further east has not been determined. A total kill of about 1680 walrus (including walrus killed-but-lost) by European sealers and hunters between 1889 and 1955 severely reduced the walrus population in eastern Greenland. Back-calculations based on estimates of the present population size of between 500 and 1000 walrus indicate that this population numbered between 700 and 1900 individuals in 1889, and most likely about 900 individuals. It is estimated that Greenlanders removed 20 to 30 walrus (primarily males) annually during the 1980s and 1990s (23% killed-but lost animals included). This appears to be a sustainable catch.

## Key words:

Atlantic walrus, *Odobenus rosmarus*, distribution, migrations, catch, East Greenland.

Erik W. Born and Mads P. Heide-Jørgensen, Greenland Institute of Natural Resources, c/o National Environmental Research Institute, Department of Arctic Environment, Tagensvej 135, DK-2200 Copenhagen N, Denmark. Rune Dietz, National Environmental Research Institute, Department of Arctic Environment, Tagensvej 135, DK-2200 Copenhagen N, Denmark. Lars Ø. Knutsen, Lóa, 71494 Kopparberg, Sweden.

## Introduction

Inuit living in small groups along the east coast of Greenland traditionally hunted Atlantic walrus (*Odobenus rosmarus rosmarus* L.) for subsistence (e.g. Thostrup 1911, Mathiassen 1933, Sandell & Sandell 1991), however this catch was presumably small. In 1889, a Norwegian sealer penetrated the heavy pack ice in the Greenland Sea and made a large catch of walrus in north-eastern Greenland (Knudsen 1889). This marked the start of an era of walrus hunting in this area primarily by Norwegian sealers, followed later by Norwegian and Danish hunters and trappers operating in Northeast Greenland until 1960 (e.g. Jennov 1945a, Mikkelsen 1994). These hunting activities severely depleted the walrus population in eastern Greenland (e.g. Jennov 1945a).

Walrus are still hunted by the Inuit (e.g. Born 1983, Sandell & Sandell 1991, Glahder 1995) who now live permanently only in the Tasiilaq (Ammassalik) and Ittoqqortoormiit (Scoresbysund) areas (Fig. 1).

Information about walrus in eastern Greenland is generally sparse. Huge masses of pack ice drifting southward along the east coast of Greenland make access to the coast difficult. Much of the available information about wildlife in these areas comes from English, Scottish and Norwegian whalers and sealers, early European explorers, (for a review of early exploration of eastern Greenland cf. e.g. Amdrup 1913, Koch 1945, Higgins 1989), Danish and Norwegian trappers (cf. Mikkelsen 1994), Danish military and weather station personnel (e.g. Fischer 1982, 1983), and some recent expeditions which have operated in eastern

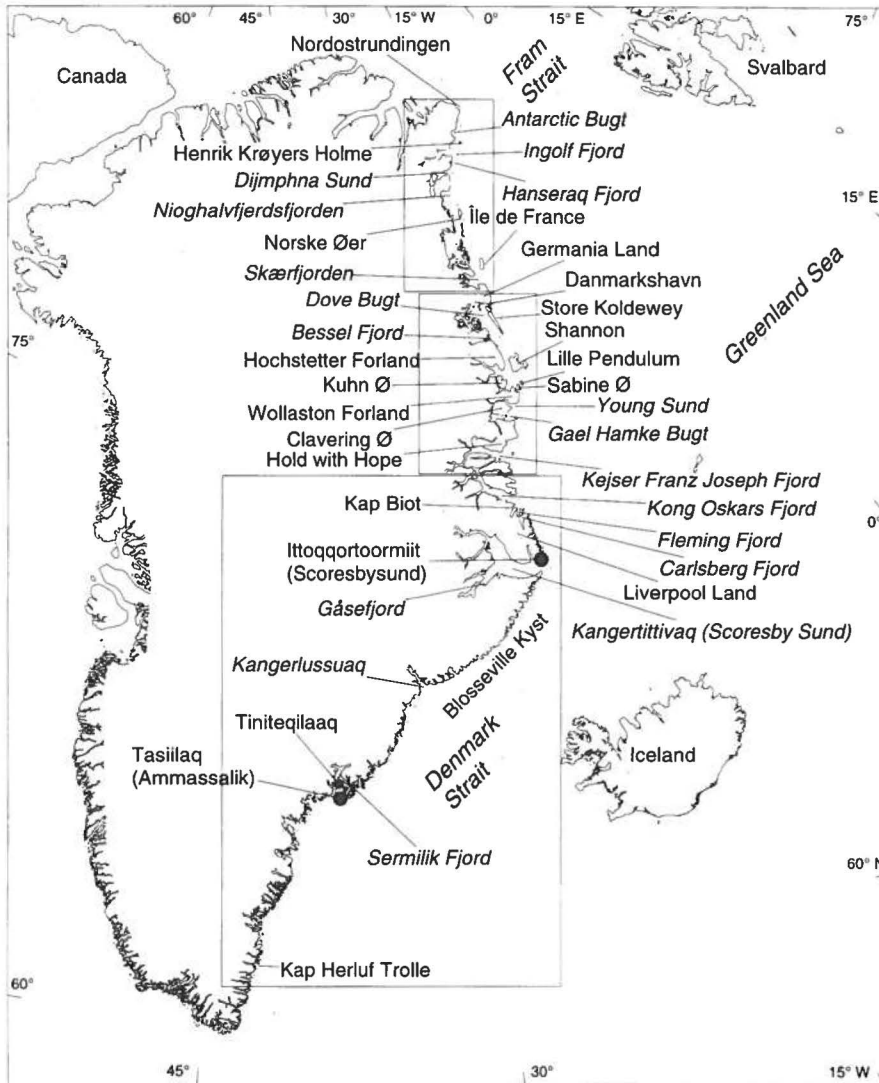


Fig. 1: Places mentioned in the text. Inserts show delineations used for description of distribution of walruses in eastern Greenland.

Greenland primarily during summer (e.g. Andersen 1984).

Some observations of walruses in eastern Greenland were summarized by Winge (1902) and Dietz *et al.* (1985). Maagaard (1990) presented some published observations of walruses in the Dove Bugt area (approx. 76°-77° N) in 1985-1989. Research from 1989-1991 was primarily aimed at providing information about walrus migrations in northeastern Greenland and adjacent areas (Born & Knutsen 1992, Born & Gjertz 1993). Recent expeditions with ice breaking vessels in the Greenland Sea and Fram Strait areas have provided new information about the occurrence of walruses in eastern Greenland from areas and during seasons where information was limited.

Despite its protection north of Scoresby Sund (Kangerittivaq; Kangersuttuaq, Sandell & Sandell 1991:7) since 1950 (Anon. 1950, 1956), there are indications that the

population of walruses in eastern Greenland is still small. An up-to-date evaluation of its present status is essential.

The following is a review of the status of the Atlantic walrus in eastern Greenland on the basis of several historical and recent sources of information on distribution, numbers and catch.

## Materials and methods

### Review of information from literature and other sources

During a literature survey conducted in 1985, titles of publications dealing with walruses and other marine mammals in eastern Greenland and in the Greenland Sea

area were compiled from the libraries at Scott Polar Research Institute (Cambridge), the Museum of Tromsø and the Library of Tromsø, Norwegian Polar Institute (Oslo), Arctic Institute (Copenhagen) and Greenland Fisheries Research Institute (Copenhagen). Published sources containing information on marine mammals were selected according to the title or based on knowledge of the merits of the authors. 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 (Rigsarkivet). Information was also extracted from unpublished Ittoqqortoormiit (the settlement of Scoresbysund) journals for the period 1925-1940, held at the Danish National Archives (Dietz *et al.* 1985).

In 1994 and 1995, unpublished Danish and Norwegian hunters' journals and other unpublished material held in the archives of the Arctic Institute (Copenhagen) and Norwegian Polar Institute (Oslo) were searched for information about walruses. Journals and other materials included in this survey are listed in Appendix 1.

Recent information was obtained from interviews with residents of the fjord of Kangerlussuaq (Tasiilaq municipality) in 1991 (Glahder 1992, 1995) and in the Ittoqqortoormiit municipality in 1983 and 1990 (Born 1983, Mosbech 1990). Information about catches in recent years was obtained from the Department of Fishery, Hunting and Agriculture (Greenland Home Rule, Nuuk) and Jonas Brønlund (Ittoqqortoormiit/Scoresbysund).

The administrative areas Tasiilaq (Ammassalik) and Ittoqqortoormiit (Scoresbysund) are referred to in the text. The municipality of Tasiilaq encompasses the area between the southern tip of Greenland and the entrance to Kangerlussuaq at 68° N. The southern and northern borders of the municipality of Ittoqqortoormiit are at the entrance to Kangerlussuaq and at Kap Biot in Fleming Fjord, respectively (Anon. 1985); Fig. 1.

Observations made by various expeditions visiting eastern Greenland during the period 1985-1994 have also been included in this study. An effort was also made to contact residents of the Tasiilaq and Ittoqqortoormiit municipalities, members of various expeditions, and military personnel operating in eastern Greenland to collect additional unpublished information on observations of walruses.

## Recent ship-based and aerial surveys

Observations of marine wildlife were made from the Danish naval vessel *Thetis* which operated in the Greenland Sea between 70° N and 80° N and from 10° W to 25° W during August-September 1991 (Søder 1991), and between 64° 24' N and 78° 28' N and 09° 09' W and 24° 12' W in August-September 1994 (Petersen 1994); (Fig. 2). In 1991 walruses were also observed opportunistically from a helicopter operating from this vessel (*Ibid.*).

In connection with land-based studies of walruses at

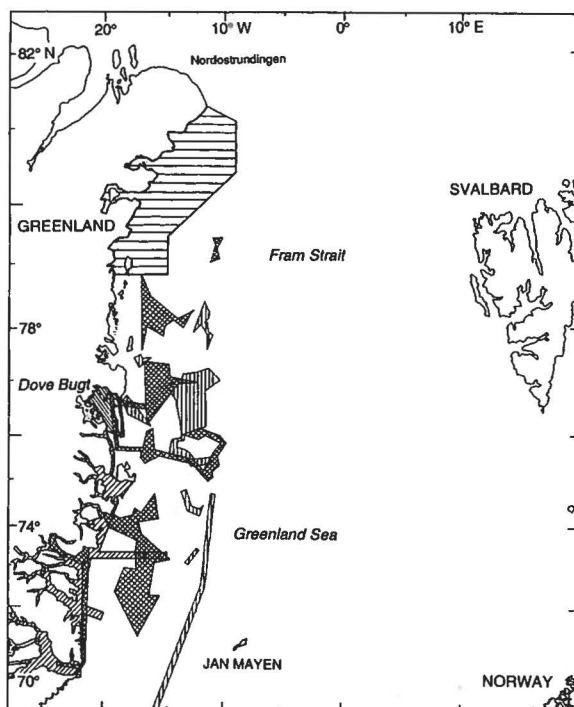


Fig. 2: Areas covered during ship- and helicopter based surveys for walruses and other marine mammals 1989, 1991, 1993 and 1994.

- ▧: aerial reconnaissance in Dove Bugt, 18 August 1989.
- ▨: naval vessel *Thetis*, 8 August-30 September 1991.
- ▩: research vessel *Polarstern*, 27 May-18 June 1993.
- : *Thetis*, 17 August-8 September 1994.
- ▬: *Polarstern*, 22 August-25 September 1994.

For cruise track in 1989 cf. Born & Knutsen (1990a,b). Detailed cruise tracks of *Thetis* are shown in Søder (1991) and Petersen (1994); those of *Polarstern* are given in Anon. (1994a) and Hubberten (1995).

the Lille Snenæs haulout in Dove Bugt in August 1989 (Born & Knutsen 1992), an aerial reconnaissance survey along the coast in the Dove Bugt area was conducted between 4 p.m. and 7 p.m. on 18 August in order to determine the distribution and number of walruses (Born & Knutsen 1990a; Fig. 2). The survey was carried out using a Hughes 500 helicopter where the target altitude and air-speed were 600 feet (ca. 185 m) and 100 knots (ca. 185 km/h), respectively. Two observers were positioned in the right co-pilot's seat and in the left rear seat.

During the ARK IX/2 cruise of RV *Polarstern* a total of 40.5 hours of aerial reconnaissance surveys (B105 helicopter) along the coast and over the pack ice between 78° 52' N (Norske Øer) and 81° 25' N and about 9° W and 21° 20' W were conducted between 27 May and 18 June 1993 (Fig. 2). During these surveys, which were flown at an altitude of 600 feet (ca. 185 m) and a target air speed of 90 knots (ca. 167 km/h), all observations of marine mammals including walruses were recorded by the front left and the rear right observer. During the same

period, additional extensive aerial surveys serving other research purposes were carried out in the same area. During these flights the pilots and researchers looked for various forms of wildlife including walrus (Born & Thomassen 1994). During *Polarstern's* ARK X/2 cruise in 1994 a total of 44.5 hours were used for aerial surveys between 22 August and 25 September. The coastal areas between approximately 76° 20' N (southern Dove Bugt) and approximately 70° 00' N (Gåsefjord), and between 17° 15' W and 29° 00' W were surveyed (Fig. 2). During these surveys, which involved the same type of aircraft, air speed varied between 90 and 100 knots (ca. 167 km/h to ca. 185 km/h); and target altitude varied between 200 and 300 feet (ca. 60 and ca. 90 m) (Born *et al.* 1995a). In 1993 and 1994, observations of marine mammals were made regularly from *Polarstern's* crow's nest (25 m a.s.l.). Observations of walrus made during these ship and helicopter based surveys are also included here.

To some extent, the areas covered during the surveys from *Polarstern* in 1994 geographically supplemented those covered by *Thetis*.

In 1950 walrus were protected inside their core distribution area north of Kangertittivaq (Anon. 1950, Anon. 1956). In 1974 they received further protection when the National Park in North and Northeast Greenland was established (Vibe 1973, Anon. 1976, 1987). The distribution and abundance of walrus may theoretically have changed as a result of this protection. Therefore, information about occurrence of walrus in eastern Greenland is reviewed for the period prior to and after 1950, respectively.

If not stated specifically, observation numbers given in the text (Obs. no. NN) refer to Appendix 2.

## Identification by use of natural marks

In the periods 29 July to 25 August 1989, and 30 July to 23 August 1990, observations were made at the terrestrial walrus haulout at Lille Snenæs (ca. 76° 52' N, 19° 38' W) on the north coast of Dove Bugt (Fig. 1). While the main purpose of this work was to instrument walrus with satellite-linked radio transmitters (Born & Knutsen 1992), a secondary aim was to determine whether natural marks could be used for individual identification, and thereby provide information on movements and haul-out patterns.

During the field work, sketches were drawn of individuals that could be identified from their natural marks. High quality photos of as many walrus as possible were taken systematically at close range with 300 mm telephoto lens for matching with walrus photographed in other years or/and in other areas by other personnel. Walrus were systematically photographed on Lille Snenæs in August 1989 and 1990 with the purpose of obtaining photos for identification (L.Ø. Knutsen & E.W. Born). Similarly, walrus hauled out on Sandøen (ca. 74° 15' N, 20° 09' W) in Young Sund were photographed in August

1991 (R. Søder) and in August 1994 (E.W. Born). The present study of natural marks also includes photos taken opportunistically by other researchers, tourists and station personnel in the period 1982 to 1995.

Photos were allocated to three categories for analysis: 1) high quality "master reference photos" taken from a frontal view, 2) high quality "supplementary ID-photos" taken from other angles, and 3) "match photos" for which the only criterion was that a "match" with a photo from category 1 or 2 was possible.

A combination of natural marks was used for identification and matching with other photos. Characteristics used for identification were: 1) individual shape and relative size and position of the tusks, 2) patterns of wear on the tusks and breakage of the tips, 3) size, position and pattern of longitudinal dark cracks and lines in the ivory, 4) patterns of skin tubercles in the neck and thorax region, 5) patterns of lightly pigmented scars, and 6) wrinkles on the forehead and neck.

The presence at the beach of Lille Snenæs of walrus which could be individually identified (*i.e.* marked animals) and the daily total number of walrus (*i.e.* the sample) on the beach were used to calculate an estimate of the total number of animals using the beach each day (Petersen-Lincoln index; *e.g.* Caughley 1977) in August 1989 and 1990. In this way, daily "population" estimates were calculated throughout the study period. The 95% CI of the slope of the regression of these estimates on time was used for indicating the uncertainty associated with the estimates of maximum numbers in August 1989 and 1990.

## Age estimation

Ages of 18 walrus sampled from the Inuit subsistence catch in the Kangertittivaq area between 1988 and 1993 were estimated by counting incremental layers in the cementum of 200 µm thick longitudinal sections prepared from lower molariform teeth, as described by Mansfield (1958).

Approximate ages of walrus on the island of Sandøen and at Lille Snenæs were obtained by comparing the estimates of external tusk lengths of hauled out individuals with data on age specific tusk growth in walrus in north-western Greenland (Born, unpublished data).

## Estimation of historical population size

An estimate of the historical abundance of walrus in eastern Greenland was determined, *i.e.* abundance prior to significant hunting mortality, which is assumed to be equivalent to the equilibrium population size (*i.e.* carrying capacity). Since no detailed information about age and sex structure of the catch of walrus in eastern Greenland was available, a simple extrapolation method



previously applied to cetacean (*e.g.* Breiwick *et al.* 1981, Breiwick & Mitchell 1983, Smith 1983, Wade 1993) and seal populations (*e.g.* Heide-Jørgensen & Härkönen 1988) was used. This method, which requires estimates of present population size, total removals and maximum net recruitment rate, uses the recursive relationship (Breiwick & Mitchell 1983):

$$(1) \quad N_{t+1} = (N_t - K_t) (1 - M) + R_t$$

where gross recruitment  $R_t = r_t N_t$ ,

$r_t$  being the recruitment rate in season  $t$

$$(2) \quad r_t = M + [1 - (N_t/N_h)^z](r_0 - M)$$

$M$  = natural mortality rate

$r_0 - M$  = maximum net recruitment rate

$N_t$  = population size at the beginning of season  $t$

$N_h$  = initial population size (start of 1889 season)

$K_t$  = number of animals killed in season  $t$

$z$  = density-dependent exponent

Equation (1) was solved iteratively for  $N_h$  by specifying the 1995 population size, natural mortality rate and maximum net recruitment rate.

We used the following data and parameters for calculating historical population size:

1995 population level	500, 1000
Natural mortality rate ( $M$ )	0.02, 0.05
Maximum net recruitment rate ( $r_0 - M$ )	0.02, 0.07
Density-dependent exponent ( $z$ )	2.39, 5.04

The coefficient  $z$  was set at 2.39 and 5.04. These values are widely used for long-lived mammals and correspond to population sizes at which MSY (maximum sustainable yield) occurs at 60% and 70% of the initial population size (carrying capacity), respectively (*e.g.* Anon. 1986, Eberhardt 1992).

## Results

### Seasonal distribution of coastal observations of walrus

A total of 594 coastal observations of walrus were collected of which 540 had information relative to month of observation (Appendix 2; Tables 2-5, 8-9; later). Walrus have been observed in all months except January in areas inhabited by Greenlanders (*i.e.* southeastern Greenland including Kangertittivaq/Scoresby Sund). There is a peak in observations from July-September, during which about 60% of the observations have been made (Table 1). In the coastal areas from Kangertittivaq to Dove Bugt (*i.e.* including Bessel Fjord; Appendix 2), where European hunters operated until 1960 (see later), walrus have been observed all year round with a peak between May and August (83% of the observations). Dove Bugt is an inshore summering area where walrus can only occur after the fast ice breaks up; thus about 77% of the observations have been recorded during the open water season in August-September. Walrus have been observed along the coast north of Dove Bugt in the period March-August.

### Distribution before 1950

#### Coastal observations south of Kangertittivaq (Scoresby Sund; approximately 70° N)

The southernmost recorded observation of walrus in eastern Greenland prior to 1950 was made on 25 April 1870 by the wrecked crew of *Hansa* off the coast at approximately 63° N (Obs. no. 2); Fig. 3.

Historical information indicates that walrus have always been scarce south of the entrance to Kangertittivaq (Scoresby Sund). For example walrus bones were only sparsely represented in excavations of early Inuit settlements in Ammassalik and Sermilik fjords (Mathiassen

Table 1. Distribution by region and month of coastal observations of walrus in eastern Greenland, 1870-1995.

		J	F	M	A	M	J	J	A	S	O	N	D
South of Kangertittivaq/ Scoresby Sund	A	0	1	2	6	9	8	13	22	19	7	1	1
	B	0	100	50	83	100	75	69	59	95	100	100	100
From Kangertittivaq to south of Dove Bugt	A	1	1	1	5	36	31	62	54	13	8	6	2
	B	100	100	100	100	100	87	63	31	62	100	100	100
Dove Bugt	A	0	0	0	0	1	4	31	82	38	0	0	0
	B	0	0	0	0	0	100	81	73	97	0	0	0
North of Dove Bugt	A	0	0	2	5	3	18	33	14	0	0	0	0
	B	0	0	0	0	0	0	0	7	0	0	0	0

A = Total number (indicences) of observations by month.

B = % of A made near settlements and stations etc. by people living permanently in eastern Greenland, and by wintering parties.

1933:110). However, walrus were rarely seen in the Tasiilaq area (e.g. Holm 1887, Poulsen 1900, Jensen 1909, Petersen, 1957), where it was claimed they were more common earlier (Holm & Petersen 1921, Pedersen 1942, 1951). Pedersen (1930) stated that walrus were resident ("beheimatet" *sic!*) along the entire coast between Tasiilaq and Kangerlussuaq, but that they were rare in the vicinity of the town of Ammassalik. Pedersen (1942), however, later claimed that only stragglers visited the areas south of Kangerlittivaq. According to Mikkelsen & Sveistrup (1944:139) "some" walrus were stationary in the Tasiilaq area during the pre-colonization period (*i.e.* prior to 1894), whereas they rarely occurred there following colonization.

There are few recorded observations of walrus along Kialiip Kialia (Blosseville Kyst) between Kangerlussuaq and Kangerlittivaq. Severe ice conditions made it difficult for whalers, sealers and early explorers to gain ac-

cess to this stretch of coast (e.g. Amdrup 1913, Koch 1945). The entire east coast of Greenland was not navigated during the 17th and 18th centuries, and there are no records of ships having visited northeastern Greenland until 1822 when William Scoresby Jr. explored the coast between approximately 69° N and 75° N (Scoresby 1823, Koch 1945:290).

Small groups of walrus were regularly observed in the vicinity of Sulussugutikajik (Steward Ø) in August (year not stated) (Madsen 1900). However, the northern parts of Kialiip Kialia were not visited regularly until after 1924/25, when the entrance to Kangerlittivaq was repopulated by a group of Inuit from the Tasiilaq area (e.g. Mikkelsen & Sveistrup 1944). Around mid March 1928, walrus were observed in several places along the coast between Kangikajik (Kap Brewster) and Henry Land; a large herd was observed at a breathing hole in the ice in the vicinity of Sulussugutikajik (Fig. 3; Obs. no. 18).

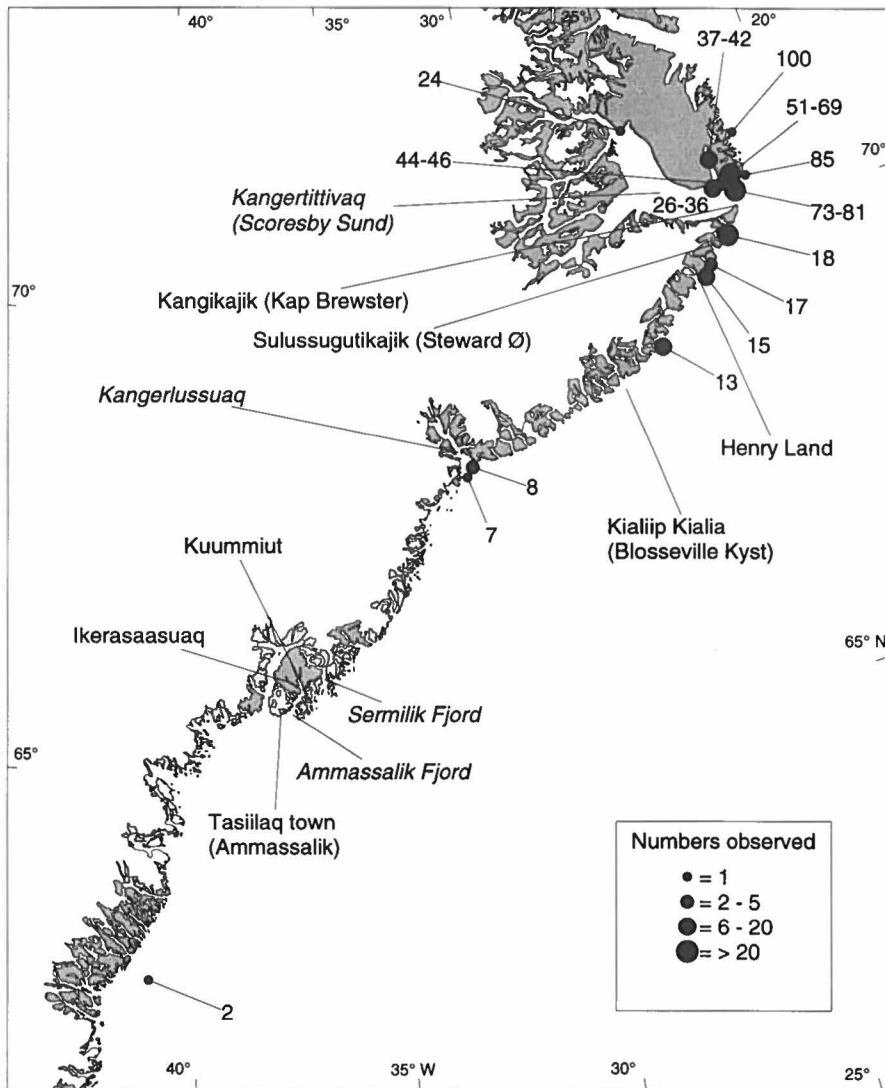
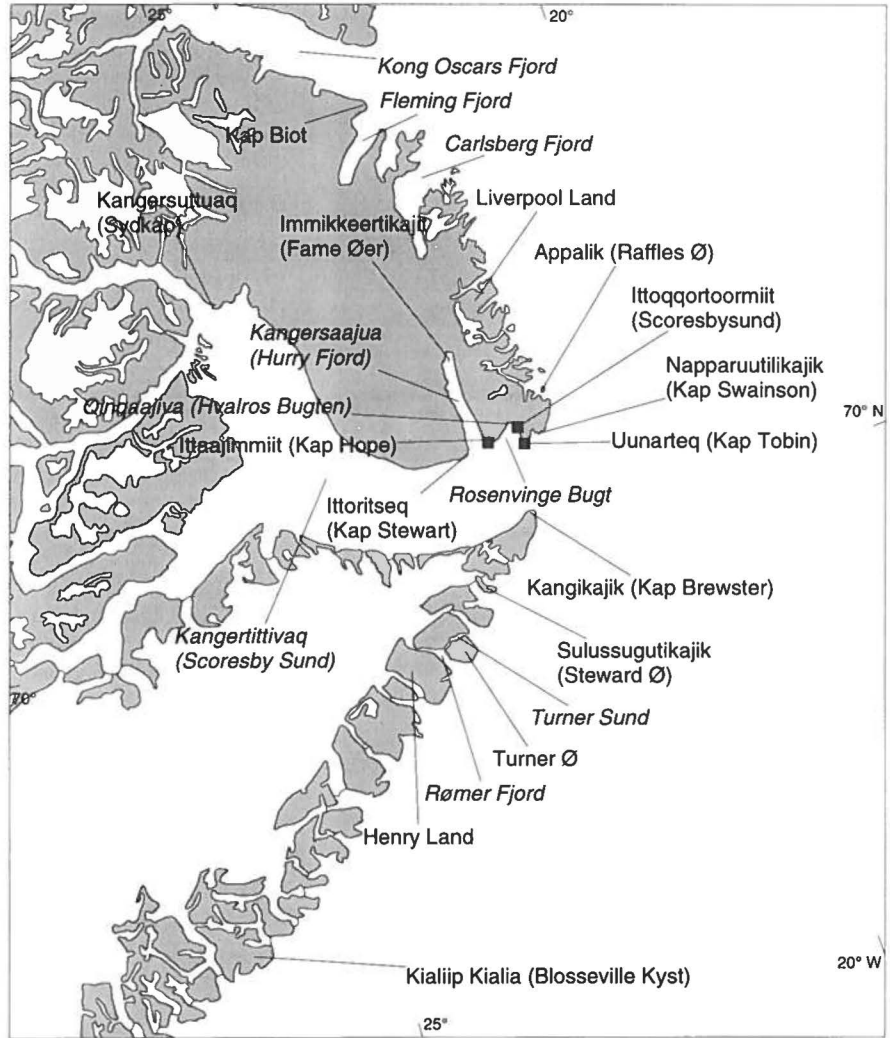


Fig. 3: Distribution of observations of walrus in southern East Greenland before 1950. Numbers refer to Appendix 2.

Fig. 4: Places in the Kangertittivaq (Scoresby Sund) area mentioned in the text.



### The Kangertittivaq (Scoresby Sund) area

Scoresby (1823:335) noted that: “All along this coast, where we touched [*i.e.* eastern Greenland between approximately 69° 30' N and 71° N], the fewness of the animals [*i.e.* all animals], was remarkable”; and during his visit to the entrance to Kangertittivaq in late July 1822, Scoresby did not observe walrus. However, walrus were observed there in the 1890s (Bay 1894, Nathorst 1900. Obs. no. 37-38), and in the 1920s they occurred regularly at the entrance to Kangertittivaq.

When the settlement of Ittoqqortoormiit (Scoresby-sund) was established in 1924/25, walrus are reported to have hauled out on Immikkeertikajik (Fame Øer) in Kangersaaajua (Hurry Fjord), and in Qingaajiva (Hvalros Bugten); Figs 4 and 5. In 1924 seven walrus were seen in Kangersaaajua between 10 and 23 September (Rasmussen 1925) after the Norwegian sealer *Quest* had visited the area and shot “quite a few” (Isachsen 1925). Mikkel-sen (1924) reported observing a total of 169 walrus in

Kangersaaajua and at the entrance to Kangertittivaq between 24 July and 28 August 1924. The walrus usually occurred singly or in pairs, although small groups were also observed. According to Pedersen (1934), the walrus groups consisted of individuals of both sexes and all age categories including females with one-year-old calves, but never newborns. In 1924 the largest number observed on one occasion was about 27 individuals hauled out on the beach in Qingaajiva in August (Munck 1924, Bengtsson 1927, Høegh 1931, Pedersen 1926, 1934, 1942; Fig. 6).

The last observation of walrus in 1924 was made on 13 October, and they were not observed again until 8 July 1925 (Pedersen 1926). During the comparatively mild winter of 1925/26, however, the last kill of a walrus was made at Ittaajimmiit (Kap Hope) on 4 December. The next kill was made as early as 3 February 1926 at Napparuutilikajik (Kap Swainson) (*Ibid.*). This indicates that walrus wintered at – or close to – the entrance to Kangertittivaq when ice conditions were favorable, whereas

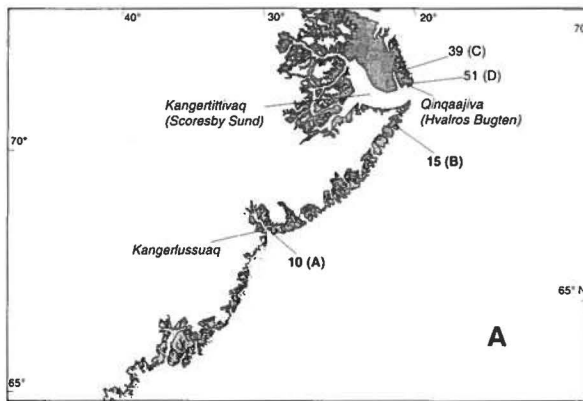
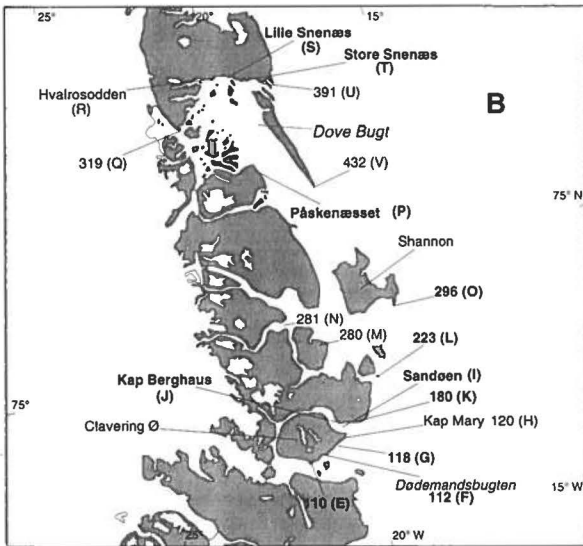
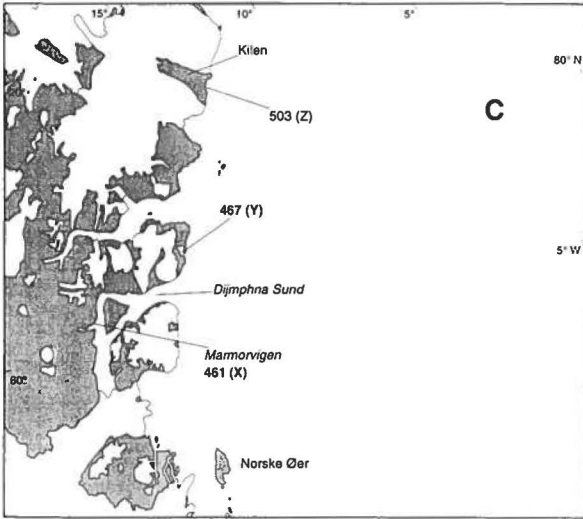


Fig. 5: Places where walrus have been observed on land in eastern Greenland. Before 1950: normal; after 1950: bold. Identification codes (numbers and letters) refer to Appendix 2.

they had to retreat to more “remote” areas when ice conditions became severe.

During 1925 and 1926, 70 walrus were killed in the Kangerfittivaq area. During the following three years, however, the catches dropped dramatically (Pedersen 1930, Mikkelsen & Sveistrup 1944; see The catch of walrus by Greenlanders). During these latter years the majority of walrus observed while hauling out on ice floes at the northern coasts of the entrance to Kangerfittivaq during summer (usually in August) were adult males (Pedersen 1930). The terrestrial haulout in Qingaajiva (Hvalros Bugten) was clearly abandoned; and the decline in catch and observations indicates that a local group of walrus had been severely depleted in numbers. Alternatively, the walrus may have learned to avoid the area due to the hunting. Koch (1928) suggested that the walrus became scarce near the settlements at the entrance to Kangerfittivaq because they avoided the smoke and fumes from the coal-heated houses. The fact that walrus could still be observed not far from the entrance to Kangerfittivaq favors the hypothesis that they learned to avoid the inhabited areas. For example, during March 1928, Pedersen (1930) observed walrus in several places between Henry Land and Kangikajik (Kap Brewster) on northern Kialiip Kialia (Blosseville Kyst). On one occasion a large group (“einer grössere Familie” *sic!* a large family) was seen near Sulussugutikajik (Steward Ø) where they maintained breathing holes in the ice (*Ibid*: 390).

Petersen (1957) reported that a walrus had been shot at Kangersuttuaq (Sydkap, 25°10' W; Fig. 3, Obs. no. 24) in 1934. Otherwise, walrus apparently rarely penetrated west of Kangersaajua (Hurry Fjord) into Kangerfittivaq.

### The areas between Kangerfittivaq and Dove Bugt (70° to 77° N)

There are few recorded observations of walrus along the coast of Liverpool Land and in the fjord complex of Kong Oscars Fjord and Keiser Franz Joseph Fjord (Figs 3 and 7), despite the fact that there were many hunting stations situated in these areas (*cf.* Mikkelsen 1994). Bivalve communities including walrus food items, such as *Mya truncata*, are found in some places along the coasts, however, the productivity of these communities has been reported to be low (Thorson 1933, Spärck 1933).

Few observations have been reported from the Myggbukta-Foster Bugt area at the Hold with Hope promontory (Fig. 7). Bang (1944) stated that walrus were rare in this area.

Large catches in 1889 and during the following decades suggest that the Clavering Ø – Young Sund area was an important walrus ground (Obs. no. 109-193; Fig. 7). Walrus have been observed on land at Kap Mary, Kap Berghaus and Sandøen (Fig. 5 B). In some years they were observed in the Young Sund area as early as



Fig. 6: Walrus that were scared into the water in August 1924 at the haulout in Qingaa-jiva (Hvalros Bugten) close to where the settlement of Ittoq-qortoormiit was established in 1924/25. If four animals near the ice in the background are included, a total of 24 animals can be seen on this photo. According to Pedersen (1951) the animal in the center (front) was the only adult female in the group. Adult males can be seen (right) along with another walrus which appears to be an adult female (arrow). Furthermore the group consisted of subadults and one (< one year?) and two year old calves. To our knowledge this is the only existing photo of a mixed group of walrus from eastern Greenland. Photo: A. Pedersen.



March-April, however they usually did not appear until May. During June-July, they penetrated into Young Sund as ice break-up progressed (Drastrup 1932, Tolløfsen 1932-33, 1933-34, Hanken 1934-37).

In July 1889 the Norwegian sealer *Hekla* caught as many as 170 walrus in Young Sund; of these more than 100 were killed on land at a place referred to as "Heklas Hvalrosnæs" [*i.e.* *Hekla's* walrus cape] (Table 2). In 1922 numerous walrus bones left on the beach allowed the Danish trapper H.L. Jensen to identify the site of this kill as Kap Berghaus (Jensen 1922-23). Danish and Norwegian trappers also referred to this walrus haulout as Sandodden, Sandhøjene and Hvalrosodden (Table 2). In 1898, about 134 walrus were killed in the Young Sund area (including Kap Berghaus), and, based on cases where information on location is less exact (Table 2. Obs. no. 4-5), it is likely that substantial numbers of walrus were killed on this haulout until at least 1901. In 1927 many walrus were observed on land at a place which, according to the description in Karlsbak (1927-28; Table 2. Obs. no. 10), was probably Kap Berghaus. This is presumably also the site where the sealer *Fangstmand* caught many walrus that same year (Table 8, p. 36). Although there are some observations of limited numbers in the mid-1930s (Table 2. Obs. no. 13-17), walrus appeared to have abandoned this site in the late 1930s (?) due to hunting. They were not observed again at Kap Berghaus until 1987 (Table 2. Obs. no. 18).

A few walrus were seen in the Young Sund area in 1922-1923 when a Danish hunting station was established about 4-5 km north of the walrus haulout at Kap Berghaus (see Mikkelsen 1994). However, in a letter to Jenov, Jensen (1928) wrote: "... considerable numbers of walrus are found, particularly south and east of Clavering [Island] .... Especially Sandodden [*i.e.* Kap Berghaus] is a good walrus place, which is proven by the large numbers

of bones". Larsen (1934) stated that walrus still occurred regularly in Dødemandsbugten on the southeastern coast of Clavering Ø in 1932. However, Poulsen (1938-39) only saw walrus in these areas on one occasion in 1938-39. Hence, there are some indications that walrus had already become severely depleted in the area by the end of the 1930s. Jenov, who traveled through the walrus inshore summering grounds between approximately 74° and 77° N (Journals A265-130 through 143; Appendix 1) nearly every year in the period 1933-1954, made only few observations of walrus after 1933. Koch (1953:27), who also had many years of experience of traveling in eastern Greenland, commented upon this significant depletion: "About 25 years ago large herds of walrus could be met with in many places, for example at the entrance to Scoresby Sund, near Clavering Ø and near Danmarkshavn. The walrus have now, due to an increasing number of humans, almost disappeared".

Nowadays walrus haul out on Sandøen [*i.e.* Sand Island], which is situated about 1.5 km south of Kap Berghaus (Table 2). However, it is difficult to determine from the historical data whether walrus used this haulout when Europeans first visited these areas. The first indication of Sandøen being a regularly used haulout is from 1923, when Jensen (1922-23) stated that there were in fact *no* walrus there on 11 July (Table 2). Despite observations of walrus in the vicinity of the island (Appendix 2, Obs. no. 127, 132-33; and Table 2, Obs. no. 21-23), the first clear statement about walrus hauling out on Sandøen is from 1980 (Table 2. Obs. no. 24).

According to reports from trappers, walrus were frequently observed in the Kap Herschell – Kap Borlase Warren area at the entrance to Young Sund during the 1920s and until the mid-1930s (Obs. no. 139-193) where they were also observed to be feeding (*e.g.* Hanken, 1934-37).

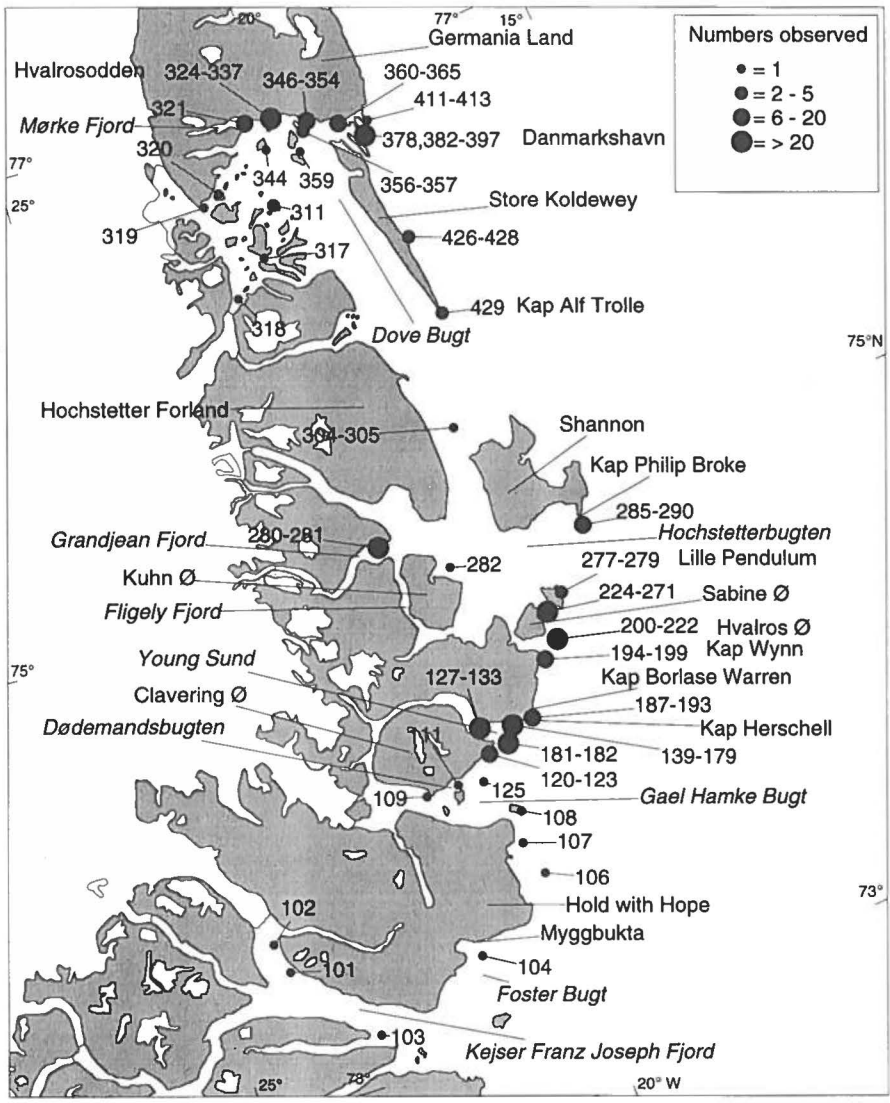


Fig. 7: Distribution of observations of walruses in the central parts of East Greenland before 1950. Numbers refer to Appendix 2.

Various observations (e.g. Southwell 1899, Orvin 1934, Pedersen 1942) indicate that the majority of the walruses which occurred in the Young Sund area during summer were males.

Herds were sometimes seen on the ice (e.g. Obs. no. 159-160). One of the most notable observations was made in 1932 by Emkjær (1944a): "26 May we saw a huge ice floe drifting into the fjord, on it was a very large herd of walruses, we never obtained an exact number despite the fact that we studied it for two days through binoculars, we estimated the herd to number ca. 100 animals, however, when we got close to it on the third day there were two more herds that we had not detected because of a several meter tall ridge along the edge of the floe, we fastened the boats there and shot 26 before they could enter the water, on this ice floe there may have been about 200 walruses, when we were flensing we saw many large and small herds on drifting floes further out in the fjord".

These herds, which may have numbered more than 300 individuals in total, represent the largest concentration of walruses ever recorded in eastern Greenland.

There are several historical observations of walruses, including both sexes and all age classes (except newborns), at Kap Wynn, Sabine Ø, Hvalros Ø and the island of Lille Pendulum (Obs. no. 194-279; Fig. 7). They have also been observed during winter in these areas (e.g. Obs. no. 194-197). The presence of many cracks and leads in the ice, and the fact that the ice frequently breaks up during winter and spring (e.g. Koch 1945, Mikkelsen 1994) makes the area favorable for wintering. Furthermore, there is often open water and light ice conditions during winter at Hochstetterbugten (e.g. Koch 1945:70; see Fig. 22, p. 33). These are also areas where walruses have been observed on several occasions, sometimes while foraging (Obs. no. 285-290).

Walruses were apparently common in the Kuhn Ø area

Table 2. Information on walrus observed at or near the haulouts Kap Berghaus between 1889 and 1994 – locality “J” (alias Sandodden, Sandhøjene, Hvalrosodden) and Sandøen – locality “I” – in Young Sund (Fig. 5 B). Legend: – indicates same entry as above; a dot indicates that data are not available.

Obs. no.	Locality	Day	Month	Year	Observation	Source	
1-J	Kap Berghaus	16	7	1889	100 shot on land at “Heklas Hvalrosnæs”	Knudsen	1889,1890
2	“Tyrolerfjorden”-	17	7	1889	Some shot [site?]	<i>Ibid.</i>	
3	Sandøen area	29	7	1889	Some shot [site?]	<i>Ibid.</i>	
4	–	.	.	1898	64 shot by <i>Anna</i>	Anon.	1932
5	–	medio	6	1898	70 shot in mid June in “East Greenland” at ca. 74° N by <i>Polar Star</i> . “Fine old animals” [site?]	Southwell	1899
6	–	.	7-8	1901	46 shot on sand bank [ <i>i.e.</i> perhaps Kap Berghaus] by <i>Spitsbergen</i>	Isachsen & Isachsen	1932
7	–	.	8	1922	3 walrus on land (two of these were killed, 1 lost). 4 were seen according to Emkjær (1944a) and Jennov (1945a,b)	Jensen	1922a,b,
					Many walrus bones from earlier [ <i>i.e.</i> Norwegian] kills		1922-23
8	–	2	8	1922	1 shot on land [site?]	Mikkelsen	1994
9	–	11	7	1923	3 walrus attempted to haul out on Hvalrosodden [Sandodden]; they left, and 2 were killed later on the ice	Jensen	1922-23
10	–	28	7	1927	“Go from Sabine Ø south to Claveringfjorden [ <i>i.e.</i> Young Sund] and far into this. Saw a lot of walrus on land. No time for hunting. Go east again to K. Herschell”	Karlsbak	1927-28
11	–	.	.	1927	Quite a few shot by <i>Fangstmand</i> [some on land]	Isachsen & Isachsen	1932
12	–	.	.	1929	Some shot by <i>Veslekari</i> [site?]	<i>Ibid.</i>	
13	–	21	7	1933	4 observed off the station. Of these 2 were shot at Sandhøjene; both lost	Jennov	1933
14	–	23	7	1933	Shot a 320 cm long male on Sandhøjene	<i>Ibid.</i>	
15	–	4	8	1933	2 got close; of these 1 made attempts to haul out on land (year uncertain: 1936?).	Jennov	1933,1945a,b
16	–	.	.	1935	4 shot on an ice floe. Frequently walrus were foraging in this area. After they were shot at while hauling out close to the cabin, they did not return	Hansen	1944
17	–	.	.	1935	“Quite a few” on land	Jennov	1945a,b
18	–	.	.	1987	Four walrus hauled out on beach of a small point at the entrance to Young Sund [Kap Berghaus?]	U. Vedel pers. comm.	1989
19	–	.	8	1994	4 hauled out on beach	T. Rasmussen pers. comm.	1994
20-I	Sandøen	10	7	1923	No walrus on the island	Jensen	1922-23
21	–	.	.	1929-31	Walrus seen several times in the water at Sandøen. They did not haul out there	Emkjær	1944a
22	–	1	8	1948	No walrus on the island	Jennov	1948
23	–	17	8	1976	None on Sandøen	Meltofte	1976
24	–	16	8	1980	3 walrus on land	Halliday & Higgs	1980
25	–	.	8	1983	20-30 on land in early August	Granholt pers. comm.	1985
26	–	.	.	1987	In 1987 to 1989, 15-20 walrus on land on Sandøen. Often about 10 males occupied the southern tip whereas smaller animals hauled out on the northern tip	U. Vedel pers. comm.	1989
27	–	1	8	1988	7 on land	K. Secher <i>in litt.</i>	1988
28	–	18	8	1988	6-8 on land	<i>Ibid.</i>	
29	–	23	7	1989	12 on land on southern tip of Sandøen (Fig. 12, top)	T. H. Andersen <i>in litt.</i>	1991
30	–	23	7	1989	9 on land on west coast of Sandøen (Fig.12, bottom)	<i>Ibid.</i>	
31	–	26	7	1989	40 hauled out	R. Winter pers. comm.	1989
32	–	20	6	1991	47 on land plus some in the water	Sirius via Søder	1991
33	–	26	7	1991	A calf with no visible tusks, and another calf with external tusk length of ca. 5 cm	<i>Ibid.</i>	
34	–	13	8	1991	10 on the beach	Søder	1991
35	–	27	8	1994	Drag marks left by 3 walrus ca. 25 m from the coast on NW part of Sandøen	This study	
36	–	10	8	1994	28 walrus hauled out	F. Ploug Nielsen pers. comm.	1994
37	–	28	8	1994	21 on Sandøen, and 2 hauled out on floes few km to the west	This study	

Table 3. Observations of walrus on the Hvalrosodden haulout between 1906 and 1967 – locality “R” – in northwestern Dove Bugt (Fig. 5 B). Legend: – indicates same entry as above; a dot indicates that data are not available.

Obs. no.	Day	Month	Year	Observation	Source	
1-R	20	8	1906	11-12 shot on land 20 according to Johansen (1910)	Amdrup Friis	1913 1925
2	.	8	1907	2 shot	Amdrup	1913
3	16	8	1912	2 adult males on the beach, 3 in the water at Hvalrosodden (Lakseelv)	Koch	1913:30
4	21	8	1912	7 on beach of Hvalrosodden	<i>Ibid.</i> :32	
5	20	8	1919	2 ad. walrus shot on land at the point near Lakseelv	Jensen	1919
6	8	8	1939	3 according to Larsen (1941-42) 6 walrus haul out for a short period of time. Jennov (1945a,b), who used Hennings as a source, wrote 1941	Hennings	1941
7	.	8	1967	2 on the beach at the Hvalrosodden Fangststation	A. Nielsen <i>vide</i> Maagaard	1990

where in 1889 about 80 and 16 were killed on land, presumably in two different places (Knudsen 1889, 1890. Obs. no. 280-281). Knudsen did not give exact positions of these sites, which according to Jennov (1945a) were probably situated at the northern part of Fligely Fjord, or at the entrance to Grandjean Fjord. After having inspected the area in 1948, Jennov (1948) concluded that at least one of the kill sites was at the entrance to Grandjean Fjord where “there had undoubtedly been a walrus haulout a little east of Ullaelven” (75°07' N, 21° 05' W). However, he did not give any further details about the site.

The few observations indicate that walrus were rare along the eastern coast of Hochstetter Forland (Fig. 7).

Walrus were hunted in the Dove Bugt area as early as 1905, when the Norwegian sealer *Severn* caught 22 at Danmarkshavn (Grøhdahl 1914 *vide* Sæther 1936; Table 8, p. 36).

In August 1906, “Danmark Ekspeditionen” found wal-

ruses in Dove Bugt (e.g. Amdrup 1913), where they were reported to occur regularly from about late July until a new layer of solid ice formed in late September – mid October (Pedersen 1942, Jennov 1945a). Walrus have mainly been observed in the northern parts of the bay (Obs. no. 311-365; Fig. 7). It was also claimed that the tributary Mørke Fjord was a “good” walrus area (Jennov 1933). Walrus were seen in herds of up to 20 at Hvalrosodden (“Walrus spit”), where about 10 were seen on land in August 1906 (Friis 1909,1925, Johansen 1910; Table 3). A total of 23 walrus were killed in northern Dove Bugt the same year to provide dog food for the “Danmark Ekspeditionen”. According to Amdrup (1913), 11-12 of these animals were killed on Hvalrosodden. The following summer only few walrus were observed at Hvalrosodden (Johansen 1910), and they apparently avoided the site after the kill. However, this may also have been a response to heavier ice conditions in Dove



Fig. 8: Adult male walrus at the haulout of Lille Snææs (Dove Bugt) in August 1933 (Pedersen 1934). This haulout was discovered by trappers in 1933 when a total of 48 walrus were found there (see text). Photo: A. Pedersen. Copyright: Arktisk Institut, Copenhagen.



Bugt during the summer of 1907 (*Ibid.*). In 1907 a total of six walrus were taken by the expedition in the Dove Bugt area, whereas in 1908 only one was killed (Amdrup 1913). When Hvalrosodden was visited again in August 1912, seven walrus were observed hauled out there (Koch 1913; Table 3). From 1919 until the 1950s, Danish trappers operated in Dove Bugt from hunting installations which were mainly situated on the northern coast of the bay. A hunting station established at Hvalrosodden was used in the periods 1919-1924, 1932-1941 and 1959-60 (Mikkelsen 1994). During these periods there were some occasions where walrus were observed near Hvalrosodden and in northern Dove Bugt (Obs. no. 324-337). However, they were only seen on land at Hvalrosodden in 1919 and 1939 (Table 3), indicating that the walrus normally avoided this haulout due to hunting activities and general disturbance.

In 1933 Danish trappers discovered a haulout on the beach of Lille Snenæs (76°52' N, 19°38' W), about 10 km east of Hvalrosodden (Jennov 1933, 1945a, Pedersen 1942). According to Pedersen (1942, 1951) this haulout

was only used by males during the molt. On 13 August 1933, 48 males hauled out on Lille Snenæs. In 1933 and 1939 walrus were killed on land at Lille Snenæs (Table 4; Fig. 8).

There are several observations of walrus from the vicinity of the "Danmark Havn" (Danmarkshavn) station at the northern entrance to Dove Bugt (Obs. no. 378, 382-397), where walrus have also been seen on land (Obs. no. 391). Relatively large herds were observed in this area in September 1933 and 1934 (Obs. no. 388, 391).

According to Anon. (1938a), the number of walrus in northeastern Greenland had decreased substantially during the few years preceding, and only few remained in the Shannon and Dove Bugt areas and along the coast north of Germania Land (Fig. 1). Pedersen (1942) estimated that in July 1933 the group of walrus occurring in the Dove Bugt area numbered at least 70 animals. However, Hansen & Jennov (year not stated) referred to observations of 50 at Lille Snenæs and additional 50-70 in northern Dove Bugt between Mørke Fjord and Dan-

Table 4. Observations of walrus on land at Lille Snenæs – locality "S" – between 1933 and 1995 (Fig. 5 B). For years where observations have been made on more than one occasion only the maximum count is given. Legend: – indicates a gap in the series of years; a dot indicates that data are not available.

Obs. no	Day	Month	Year	Number	Source	
1	13	8	1933	48 (3 of these killed on land) 50	Jennov Kristoffersen	1933, 1945a,b 1969
2	.	8	1939	20 (6 of these killed on land)	Hennings	1941
3	.	.	1941	20	Jennov Kristoffersen	1945a,b 1969
4	1	9	1952	2	Fischer	1982
5	1	8	1954	1	<i>Ibid.</i>	
6	23	7	1967	2	<i>Ibid.</i>	
7	31	8	1969	19	<i>Ibid.</i>	
8	31	8	1970	19	<i>Ibid.</i>	
9	26	7	1971	18	<i>Ibid.</i>	
10	23	8	1972	26	<i>Ibid.</i>	
11	23	8	1973	8	<i>Ibid.</i>	
12	1	9	1974	26	Meltofte	1976
13	19	8	1975	17	<i>Ibid.</i>	
14	16	9	1979	15	Fischer	1982
15	9	9	1980	43	<i>Ibid.</i>	
16	15	8	1981	25	<i>Ibid.</i>	
17	26	9	1982	22	<i>Ibid.</i>	
18	1	8	1983	0	<i>Ibid.</i>	
19	3	8	1984	10	<i>Ibid.</i>	
20	2	9	1986	25	Maagaard	1990
21	19	9	1987	19	<i>Ibid.</i>	
22	12	9	1988	28	<i>Ibid.</i>	
23	22	8	1989	23	Born & Knutsen	1990b
24	12	8	1990	45	Born & Knutsen	1990c
25	29	8	1991	23	Søder	1991
26	6	8	1994	5	F. Ploug Nielsen pers. comm.	1994
27	29	8	1995	15-20	H. Oerter <i>in litt.</i>	1995

markshavn in 1933 (Obs. no. 327, and Table 4). Pedersen (1942) estimated that not more than 30 walrus were found in the Dove Bugt area during the summer of 1938 and suggested that the reason for this depletion was that the animals avoided the area because of hunting activities during the preceding years.

Apparently, walrus also occurred regularly along the east coast of the island of Store Koldewey, where they have been reported to haul out on land at Kap Alf Trolle

(Obs. no. 429, Figs 5B, 7). According to Jennov (1959) groups ("bestande" *sic!*; "populations") of walrus regularly occurred along the western coast of Store Koldewey south of Trækpasset (76° 34' N), and at some small islands (Nørre Sundby Ø) north of Godfred Hansens Ø (about 76° 25' N, 20° 30' W) in western Dove Bugt. Although not stated directly, the wording in Jennov (*Ibid.*) indicates that sometimes walrus also hauled out at these places.

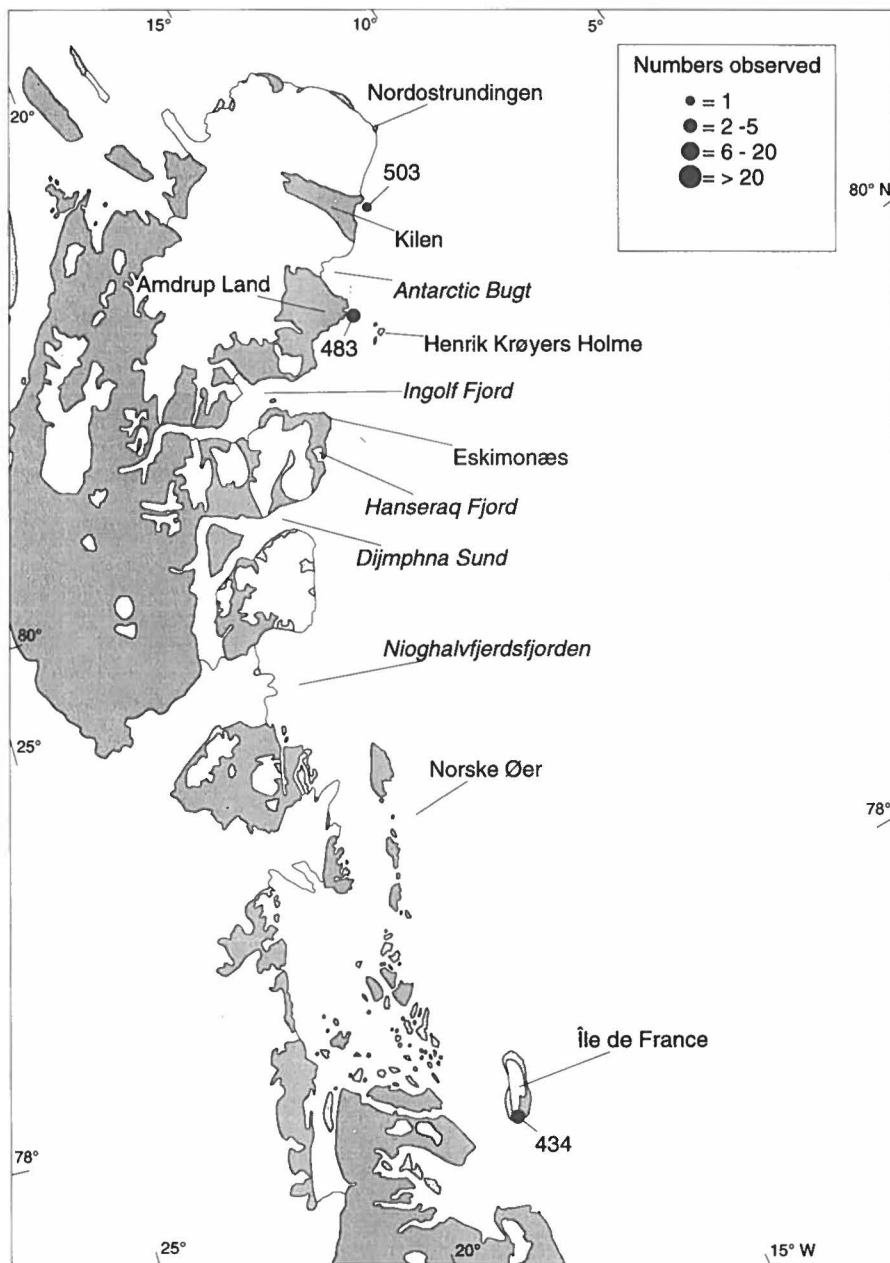


Fig. 9: Distribution of observations of walrus in north-eastern Greenland before 1950. Numbers refer to Appendix 2.

The areas north of Dove Bugt (north of approximately 77° N)

There are few historical observations of walrus north of Dove Bugt. Not until 1907 were the first observations of walrus recorded from these areas (e.g. Trolle 1908, Johansen 1910, Amdrup 1913; Fig. 9). Judging from the topography and findings of walrus bones, Thostrup (1911: 208) suggested that Eskimonæs (80° 26' N, 15° 48' W) was a terrestrial haulout. The northernmost observation before 1950 was made at Kilen on 6 June 1907 (Obs. no. 503; Fig. 9).

Remains of walrus at Inuit sites (e.g. Thostrup 1911, Andreasen 1995, 1997) in the Northeast Water area (between approximately 79° 30' and 81° 30' N; e.g. Koch 1945, Böhm *et al.* 1997) indicates that this polynya has

been a walrus habitat for millennia. Walrus bones from Paleo-eskimo sites on Amdrup Land date back to at least 400-800 BC (Andreasen 1997) indicating that walrus were of importance in the diet of the Independence II people.

Few walrus bones have been found in the Jørgen Brønlund Fjord area (approx. 82° 10' N, 30° 11' W). The bones date back to 1400-1900 years BP and presumably originate from the same animal, which may have entered the fjord this far north during a period of less severe ice conditions than today (Bennike in press). Small artifacts made of walrus tusks found in Inuit ruins in Jørgen Brønlund Fjord (approx. 82° 08' N, 30° 00' W) and in eastern Peary Land (Knuth 1965, 1968, 1981) were probably brought to the area (Eigil Knuth, pers. comm. 1995, Bennike in press).

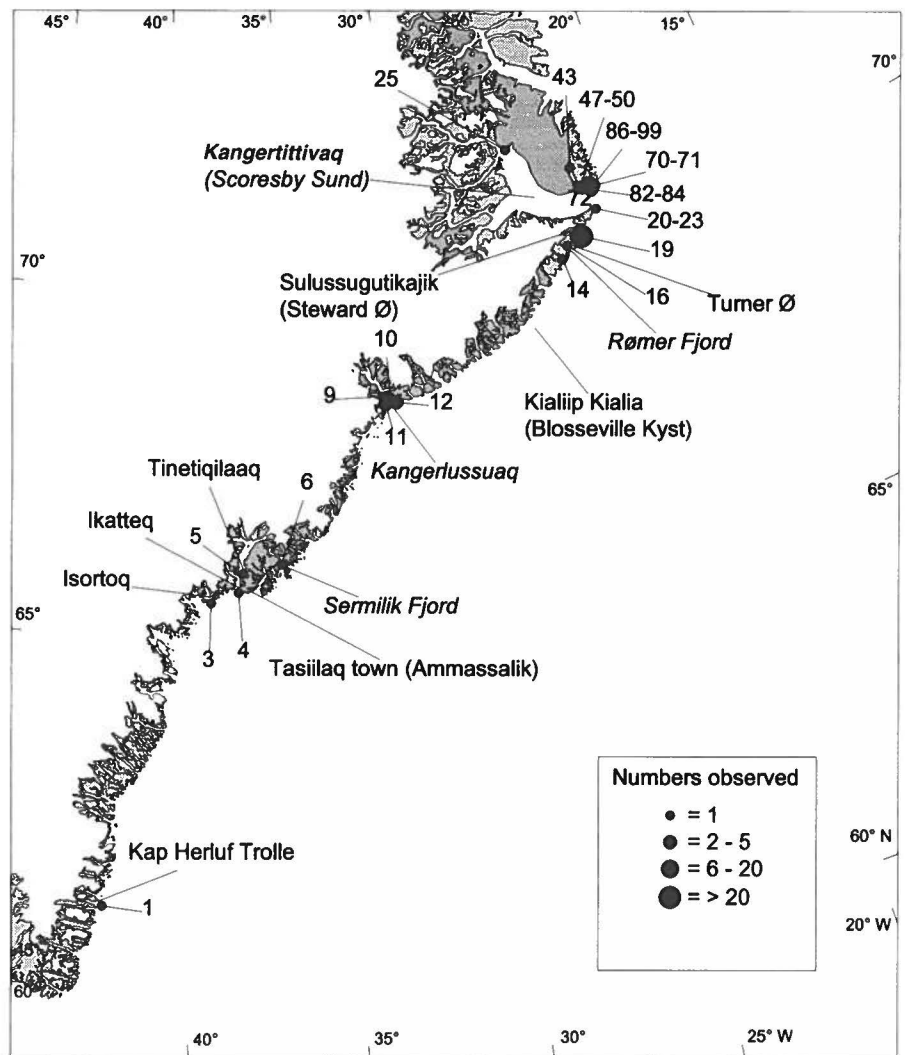


Fig. 10: Distribution of observations of walrus in southern East Greenland after 1950. Numbers refer to Appendix 2.

## Distribution after 1950

### Coastal observations south of Kangertittivaq (Scoresby Sund)

Walrus are occasional visitors in the Tasiilaq (Ammassalik) area (Nooter 1972/73, Robert-Lamblin 1986). Old hunters reported, however, that walrus were more plentiful in the past (Robert-Lamblin 1986).

The southernmost observation of a walrus after 1950 recorded during the present study was at Kap Herluf Trolle (61° 10' N; Obs. no. 1; Fig. 10).

During an interview survey conducted in 1988 in the Tasiilaq municipality, hunters explained that walrus were usually observed between June and August. They seemed to appear more often at Isortoq than at other places (Helle Siegstad pers. comm. 1994). Catch records indicate that although walrus may be caught at all times of the year in this area, they appear to occur more frequently between June and November (Fig. 27, p. 39).

During an interview survey in the Kangerlussuaq area in 1991, Glahder (1992, 1995) obtained information regarding 20 occasions where walrus had either been observed or shot between 1951 and 1992. Although they had been seen in this area during winter, the majority of observations were made between July and October.

In 1966, when hunters from Tasiilaq resumed their habit of staying in the Kangerlussuaq area for longer periods of time, a small group of walrus hauled out on the beach where the settlement of Ittaasiarteq (Skærgård boplads; approximately 68° 07' N) was established (Glahder 1992, 1995; Obs. no. 10; Fig. 5 A). In 1970 (or 1971) a single walrus hauled out on the beach near the same settlement (Christian Glahder, pers. comm. 1994).

A comparison of the seasonal distribution of the catch at Kangertittivaq, and in the Kangerlussuaq and Tasiilaq areas (Figs 27 and 28, p. 39) indicates that walrus occur later in the season in southern areas, suggesting that walrus south of Kialiip Kialia (Blosseville Kyst) are mainly stragglers, traveling south along the coast during the open water period.

According to Inuit living in the Kangertittivaq area, walrus are frequently seen along the northern part of Kialiip Kialia, particularly during spring (Born 1983). In recent times, walrus have been observed in the Rømer Fjord, Turner Ø and Sulussugutikajik (Steward Ø) area (Obs. no. 14, 16, 19). This may be related to the fact that there is often open water along the edge of the fast ice on the northern part of Kialiip Kialia (Fig. 22, p. 33), where shallow water banks with walrus food items are found (Ockelmann 1958, Born 1983, Sandell & Sandell 1991).

### The Kangertittivaq (Scoresby Sund) area

Although walrus can occur at the entrance of Kangertittivaq in all seasons, they are usually observed from ear-

ly spring until July (Born 1983, Sandell & Sandell 1991; Fig. 10) along the coast between Napparuutiligajik (Kap Swainson) and Uunarteq (Kap Tobin) (Born 1983, Jens Thygesen, pers. comm. 1988) where there is shallow water with suitable food items (e.g. Ockelmann 1958). Although "on one occasion recently" a walrus was shot at Kangersutuaq (Sydkap) (Sandell & Sandell 1991), walrus usually do not penetrate west of Ittoritseq (Kap Stewart) at the entrance to Kangersaajua (Hurry Fjord).

At the entrance to Kangertittivaq, walrus occur either singly or in groups of two to four. The majority of these are adult males – although subadults and females with young (except newborns) are sometimes killed (Jens Thygesen, pers. comm. 1988). Walrus often arrive in this area during spring and summer while hauled out on ice floes drifting in the south-flowing current. The walrus are frequently seen swimming northward (*Ibid.*). It is therefore likely that walrus at Kangertittivaq are mainly stragglers from further north.

Although a walrus was shot on the beach in Qingaajiva (Hvalros Bugten) in early September 1991 (Jonas Brønlund *in litt.* 1994), the major differences between the beginning of this century and the present times are that walrus no longer haul out on land in these areas and apparently no longer penetrate into Kangersaajua (Hurry Fjord).

### The areas between Kangertittivaq and Dove Bugt (70° to 77° N)

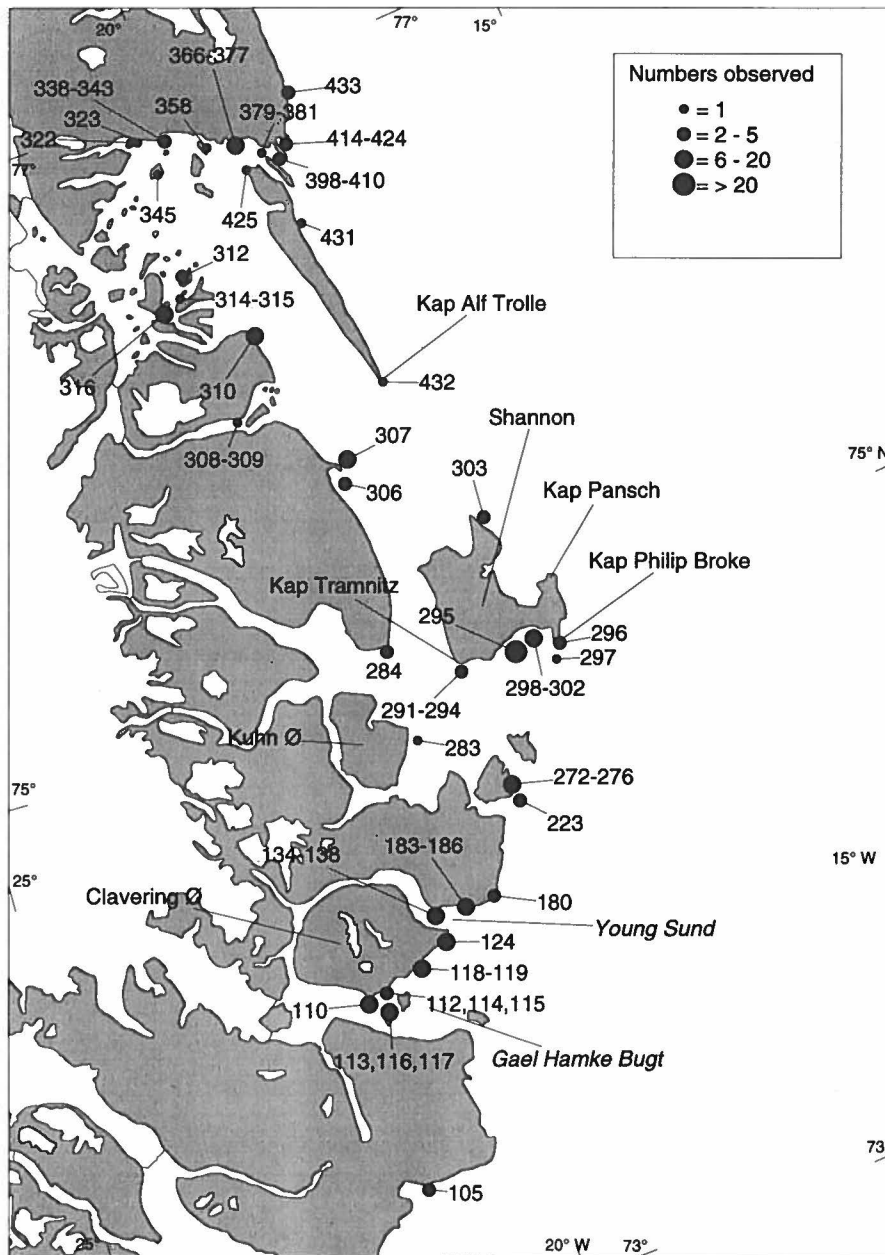
No walrus were observed during extensive ship-based and aerial reconnaissance surveys conducted along the coast of Liverpool Land and in the areas between Liverpool Land and Hold with Hope in the period from 29 August to 17 September 1994 (this study).

Recent observations confirm that the Clavering Ø – Young Sund – Gael Hamke Bugt area is an important walrus habitat where animals have been observed between April and November (Fig. 11).

Hauled out walrus have been observed on the south-eastern coast of Clavering Ø (Eskimonæs; Obs. no. 110), Dødemandsbugten (112), Basaltkap (118) (Figs. 5B and 11). However, neither walrus nor drag marks on the sandy beaches were observed when this coast was surveyed from a helicopter on 29 August 1994 (this study).

Walrus had apparently become very scarce in the Young Sund area due to exploitation (this study). When Génsbøl (1978) observed a group close to Sandøen on 18 July 1964 (Obs. no. 134), he was told by personnel at the Daneborg military station that the walrus had reappeared in this area only few years earlier (Benny Génsbøl pers. comm. 1995). Although walrus were observed on the beach at Kap Berghaus (Table 2. Obs. no. 18-19) in 1987 and 1994, they nowadays only haul out regularly on Sandøen (Table 2). Since at least the early 1980s, a group of up to perhaps 50 animals (Table 2. Obs. no. 32) have hauled out on the southern point of this island. Walrus

Fig. 11: Distribution of observations of walrus in the central parts of East Greenland after 1950. Numbers refer to Appendix 2.



have also been observed on land on the west coast of Sandøen (Fig. 12). The annual maximum counts (Table 2) indicate an increase in the number of walrus using this haulout during the period 1980-1994. Data were not available to allow for an adjustment of the annual maximum number for variations in observation effort (*e.g.* number of days of observation per year). An unweighted regression of the natural logarithm of annual maximum number observed (*i.e.* exponential growth assumed) by year indicated an annual increase of about 15% in the number of walrus using Sandøen. This increase was, however, not sta-

tistically significant ( $F=4.011, P>0.05, R=0.667, DF=1/5$ ).

There is only one documented observation of a female in the areas between Kangertittivaq and Dove Bugt (Obs. no. 186; Fig. 13). This supports the historical information which indicates that females and young are rare in these areas during summer. Sandøen is apparently a haulout used only by males. In 1991 walrus were hauled out on Sandøen as early as 9 June (Søder 1991). They are usually first observed there during July and August. On 28 August 1994, 21 males were hauled out on the southern tip of the island (Table 2). Judging from the length of their

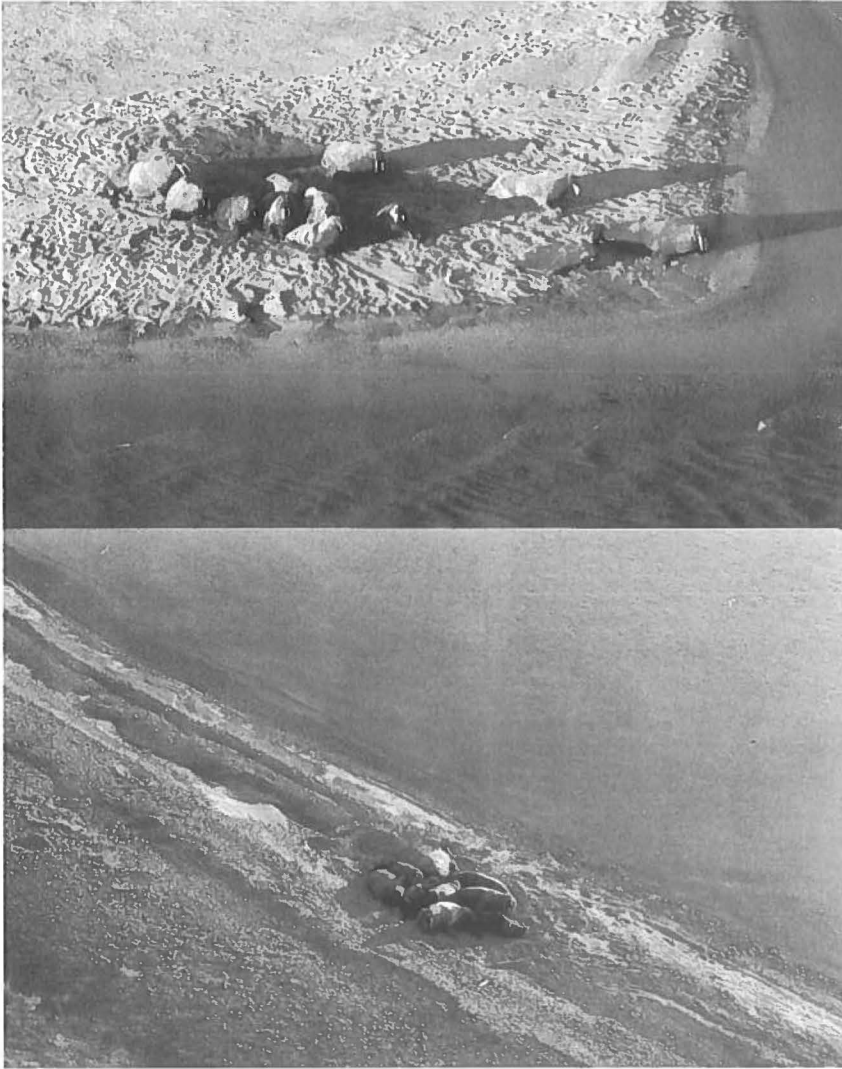


Fig. 12: Groups of walrus hauled out on the southern tip (top) and on the western coast (bottom) of Sandøen in Young Sund, 23 July 1989 (Observations 29 and 30 in Table 2). Photo: Kort- og Matrikelstyrelsen, Copenhagen.

tusks, seven of these animals were more than 15 years of age, five were between 10 and 15 years, five were between 5 and 10 years and two were 2-3 years old (two undetermined). In addition, two large males (> 15 years of age) were hauled out on ice floes about two km west of the island (this study).

Recent observations confirm that Hochstetterbugten is still a walrus habitat. In 1984 Andersen (1984) observed 40-50 walrus in this area and four on land at Kap Philip Broke (Obs. no. 295-296). Walrus were observed off the south coast of Shannon on several occasions in August 1994 (Obs. no. 298-302). No signs of walrus were observed during an aerial reconnaissance along the south shore of Shannon between Kap Tramnitz and Kap Pansch on 22 August 1994 (this study).

Only one observation of a walrus has been recorded from Kuhn Ø since 1950 (Obs. no. 283), and only few

observations have been reported along the east coast of Hochstetter Forland. No walrus were observed during an aerial reconnaissance along the west coast of Fligely Fjord, the entrance to Grandjean Fjord, the east coast of Kuhn Ø, and the east coast of Ad. S. Jensen Land and Hochstetter Forland on 22 and 24 August 1994 (Fig. 7; this study).

Larsen (1951) reported a remarkable observation at Hochstetter Forland on 17 November 1951. Two walrus were lying on completely solid fast ice in Rosenearth Bugt (Obs. no. 306). Apparently, the emaciated animals had been stranded on the ice when leads and cracks froze solid (see also Mikkelsen 1994:233).

Walrus occur regularly in Dove Bugt, particularly in the northern parts (Fig. 11; Tables 3-5). A total of four walrus was seen during the aerial reconnaissance of Dove Bugt on 18 August 1989. Except for one animal observed





Fig. 13: Female walrus have rarely been recorded south of about 79° N in eastern Greenland. An adult female with what appears to be a one year old calf was photographed in Young Sund in July 1989. Judging from the length of the tusks this female was 8-10 years old. Photo: E. Villadsen.

along the northeast coast of Store Koldewey, these walrus were seen in northern Dove Bugt. All were single adults hauled out on small ice pans in < 20% ice cover. During the same period 16 walrus were sighted at the Lille Snenæs haulout (Born & Knutsen 1990b, this study).

Observations of walrus feces on the beach of Kap Alf Trolle in 1984 (Store Koldewey. Obs. no. 432), and re-locations of walrus equipped with satellite-linked radio transmitters (Born & Knutsen 1990b, 1992), indicate that they also haul out on the beach at Påskenæsset (locality "P"; Fig. 5 B), and at southern Store Koldewey (432-V; Fig. 5 B).

## The Lille Snenæs haulout

It appears that Lille Snenæs is the only terrestrial haulout site which is used regularly today in Dove Bugt (Table 4; Fig. 14). Since 1969 a few walrus have occasionally been seen on Store Snenæs, about 10 km east of Lille Snenæs (Table 5). Walrus penetrate to Lille Snenæs from offshore areas, following cracks and leads in the fast ice around mid July. In 1989 walrus were first observed hauled out on land on 29 July. However, they were observed in the shore lead at Lille Snenæs on 14 July. On 11 and 13 July 1990 four and five walrus, respectively, were hauled out on the ice off Lille Snenæs (This study). Drag marks in the sand indicated that they had hauled out onto the beach prior to our arrival on the 30 July (*Ibid.*). Tracking of adult male walrus equipped with satellite-linked radio transmitters at Lille Snenæs indicated that the walrus used this haulout until 19 September in 1989, and until 5 October in 1990, before moving offshore into the Greenland Sea (Born & Knutsen 1992). This is consistent with Kristoffersen's (1969) statement

that the walrus retreat offshore to areas with drift ice when the fast ice is formed in Dove Bugt.

Between 29 July and 25 August 1989 only adult male walrus occurred at Lille Snenæs. Tusk lengths indicated that they were all older than 10 years of age, with the exception of one 3-4 year old (tusk length: < 10 cm). Between 30 July and 23 August 1990 few subadult walrus (external tusk length: 12-15 cm) were seen among the adult males hauled out on the beach. Between 12 and 15 August 1990, one adult female (tusk length: 35 cm) with a calf, approx. one year old, appeared at Lille Snenæs. However they were never seen to haul out on the beach.

A total of 44 individuals photographed at Lille Snenæs were categorized as identifiable with certainty (Table 6). The photographic documentation from Lille Snenæs was particularly good in 1989 and 1990. Of 18 walrus catalogued in 1989, 13 were re-identified from photos taken at the same site in 1990 (Table 6). Of 28 animals registered there in 1990, seven were re-identified from photos taken in 1991. Six out of seven animals categorized as identifiable from photos taken at Lille Snenæs in 1988 have been re-identified there over two or more subsequent years. Furthermore, two individuals photographed in 1990 were matched with walrus on photos taken at Lille Snenæs in 1982 and 1986 (Table 6; Figs 15 and 16). Thus the registration of individual walrus with natural marks indicates that the group of walrus that uses Lille Snenæs shows strong site fidelity.

Photo-identification has also demonstrated a connection between walrus from Lille Snenæs and those found in the Clavering Ø – Young Sund area. Walrus "BG", which was photographed in August 1987 on Lille Snenæs, was re-identified from a photo taken at Eskimo-

Table 5. Observations of walrus at Store Snenæs – locality "T" – between 1969 and 1988 (Fig. 5 B). For years where observations have been made on more than one occasion only the maximum count is given. Legend: – indicates a gap in the series of years.

Obs. no	Day	Month	Year	Number	Source
1	7	7	1969	3	Fischer 1982
	–				
2	27	7	1971	1	<i>Ibid.</i>
3	7	8	1972	1	<i>Ibid.</i>
4	7	8	1973	4	<i>Ibid.</i>
5	11	9	1974	3	<i>Ibid.</i>
6	31	7	1975	1	Meltofte 1976
7	19	6	1976	1	Fischer 1982
8	23	7	1977	6	<i>Ibid.</i>
9	21	7	1978	4	<i>Ibid.</i>
10	23	7	1979	3	<i>Ibid.</i>
11	18	8	1980	2	<i>Ibid.</i>
12	25	8	1981	4	<i>Ibid.</i>
13	28	8	1982	5	<i>Ibid.</i>
	–				
14	5	8	1984	4	Andersen 1984
15	14	8	1985	1	Maagaard 1990
	–				
16	23	8	1988	3	<i>Ibid.</i>



Fig. 14: Walrus on the haul-out Lille Snenæs in Dove Bugt. Ice sometimes blocked the beaches preventing the walrus from hauling out during August 1989 (top; 23 August 1989). During August 1990, ice was absent in Dove Bugt (bottom) and in contrast to the situation in August 1989, the walrus also hauled out on the eastern shore of Lille Snenæs (11 August 1990). Nordre and Sydlige Orienterings Øer (top and bottom) and Store Koldevey are seen in the background. Photos: E.W. Born.



næs (south coast of Clavering Ø) on 29 July 1989 (Fig. 17). Walrus "AU" which was photographed on Lille Snenæs in 1990 was re-identified from photos taken on Sandøen in 1991 (Table 6; Fig. 18). So far, none of the walrus initially photographed at Sandøen have been re-identified at Lille Snenæs.

Both in 1989 and 1990, the daily maximum number of walrus on Lille Snenæs increased during August (only days with undisturbed conditions included; 1989:  $Y = 0.290X + 7.660$ ,  $R=0.63$ ,  $F=6.716$ ,  $DF = 1/10$ ,  $P<0.05$ ; 1990:  $Y = 1.106X + 4.735$ ,  $R=0.50$ ,  $F=5.669$ ,  $DF=1/17$ ,  $P<0.05$ ); (Fig. 19). Maximum numbers counted were 23 on 22 August 1989 and 45 on 12 August 1990. However,

the group using the haulout during the two seasons was larger than the number of animals present on the beach at any one time. Based on the presence of individually identified walrus on the beach, the total number using Lille Snenæs in August was calculated (see Materials and methods) to be 46 (95% CI 40-52 animals) in 1989 and 52 (95% CI 40-64 animals) in 1990.

In August 1989, when floes of ice in Dove Bugt offered an alternative haul out platform (Born & Knutsen 1990b), the maximum number of walrus seen on Lille Snenæs at any one time was only 50% of the number actually using the beach during the same period. However, in August 1990, when there was no ice in Dove Bugt, about 87% of

Table 6. List of individually identified walruses, area and year of registration and re-identification, and characters used for identification. Legend: L = first identified at Lille Snænes, S = in the Young Sund – Clavering Ø area; ? = questionable identification. Angle = relative angle between the tusks (based on comparison of internal distance at base relative to that between the tips; D = diverging, C = converging, P = parallel). Shape = shape of each tusk seen from a frontal view ( () = concave, )( = convex; II = straight). - = area not covered by photo-documentation. Length = external tusk length estimated from photos.

ID code	Year of registration and re-identification								Tusk characteristics						Other characters used for identification
	82	86	87	88	89	90	91	Angle	Shape	Damage		Length (cm)			
										R	L	R	L		
AH					L	L	S	-	-	x	x	5	7	Old. Both teeth damaged	
BE					L	L		-	-			38	38	Teeth different shape in lateral view	
BC						L		-	-			30?	30?	Many scars on thorax	
AR					L			-	?	x		0	20	Young with few tubercles	
AT				L		L	L	D	()		x	30	30	Dark skin with many scars and tubercles	
AI					L	L	?	D	()	x		43	43	Teeth very diverging	
BB						L		D	()			43	46	Many tubercles	
AQ		L				L		D	)(	x	x	29	31	Dark lines in tusk cementum	
BZ							L	D	I()			36	35		
AG				L		L	?	D	II	x		32	32	Furrows in neck, tubercles	
BG			L			S		D	II			33	35	Scars, skin furrows, lines in tusk cementum	
BO							L	D	II			33	31		
BJ					L		L	D	II		x	35	35	Crack on side of tip of L. tooth	
AB						L		D	II	x	x	35	30	Many tubercles. Teeth worn	
BH			L					D	II	x	x	35	33	Dentine visible L. tooth; slender teeth	
BQ							L	D	II			36	36	Light scar on muzzle, L.	
AD			L		L	L		D	II		x	37	25	Twisted left tooth	
BL						L	L	D	II			38	38	Light scar on nose, L.	
BW							L	D	II			38	40	Scars on nose, R., and muzzle, L. and R.	
AJ			L			L		D	II			40	40	Tubercles and scars on R. side	
BS					L	L		D	II			40	40	Furrows in neck	
AY				L		L	L	D	II	x		40	45	One tooth twisted. Tubercles	
AS			?		L	L		D	II	x	x	40	34	Worn teeth; breakage	
AN				L	L	L	L	D	II		x	42	34	Deep groves on teeth. Few tubercles	
BF			L		L			D	II			45	45	One furrow on neck	
BU							L	C	)(			18	19	Scars on nose, R., and muzzle, L. and R.	
AL			L		L			P	()	x		39	39	Teeth twisted. Smooth skin	
BP							L	P	()			40	42	Scars on nose, R., and muzzle, R.	
AK					L	L	?	P	()?	x	x	38	35	Many tubercles. One big tubercle on L. side	
BK						L	L	P	()			-	-		
AC	?	?			L			P	II	x		2	35		
AU					?	L	S	P	II	x		5	48	Tusk breakage and lines in cementum	
AO	L			L	L	L		P	II		x	34	37	Furrows in back head	
AP					L	L	L	P	II	x	x	34	37		
AE			?		L	L		P	II		x	35	18	Tubercles	
AV					L	L		P	II	x		35	42		
BA			L	L				P	II	x	x	35	38	Dentine visible on R. tusk	
BD						L	?	P	II			37	37	Pointed teeth	
AF						L		P	II			37	37		
BM						L	L	P	II			38	38	Scars on nose, R. and L., and muzzle, L.	
BI			L					P	II		x	40	36	Wrinkles on neck and in back head	
BR							L	P	II			40	40	Scars on nose, R. and L., and muzzle, R. and L.	
AA	?			L	L	L		P	II		x	45	0	Wrinkles and tubercles	
AX						L		P	-			38	38		

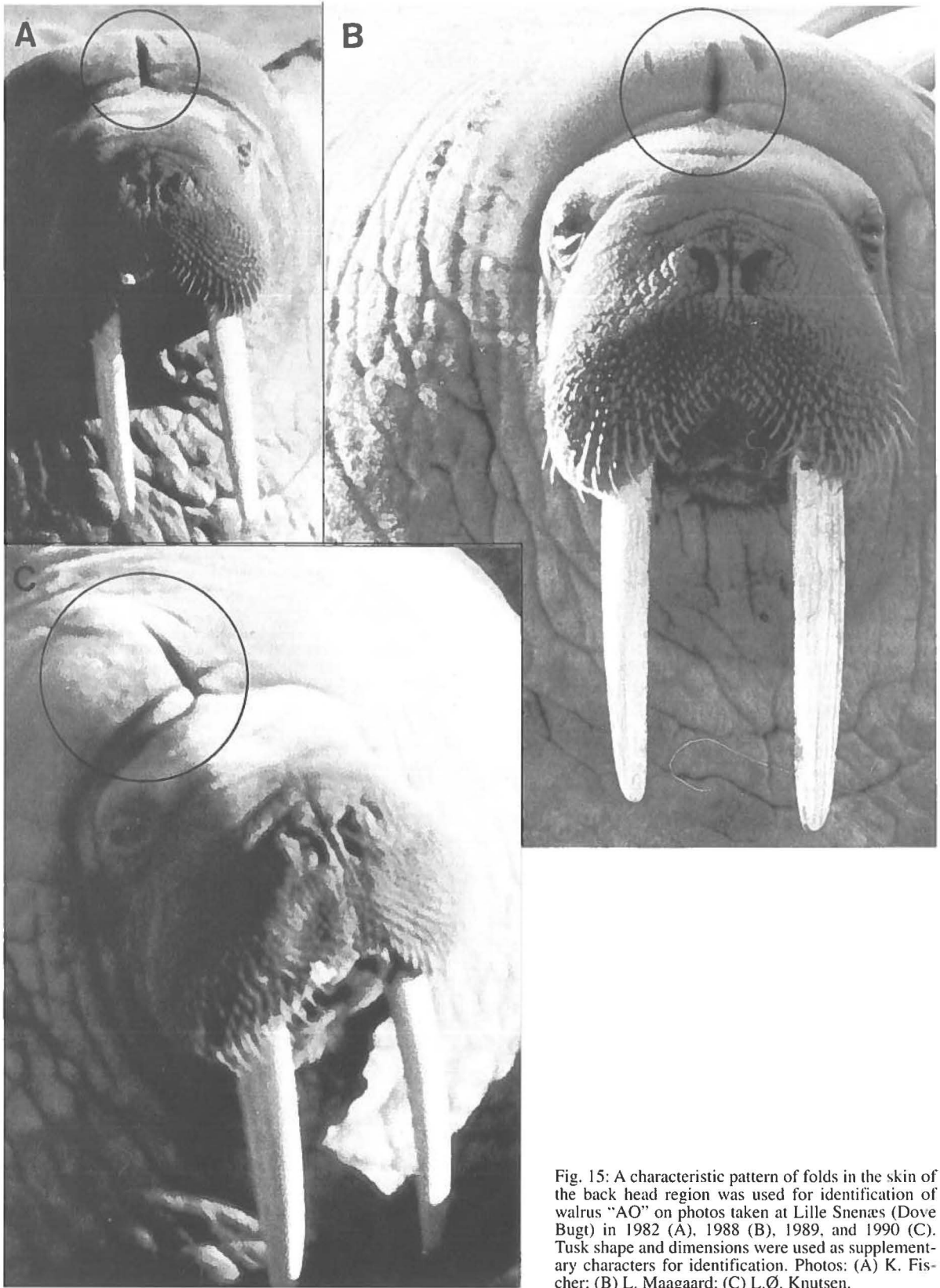
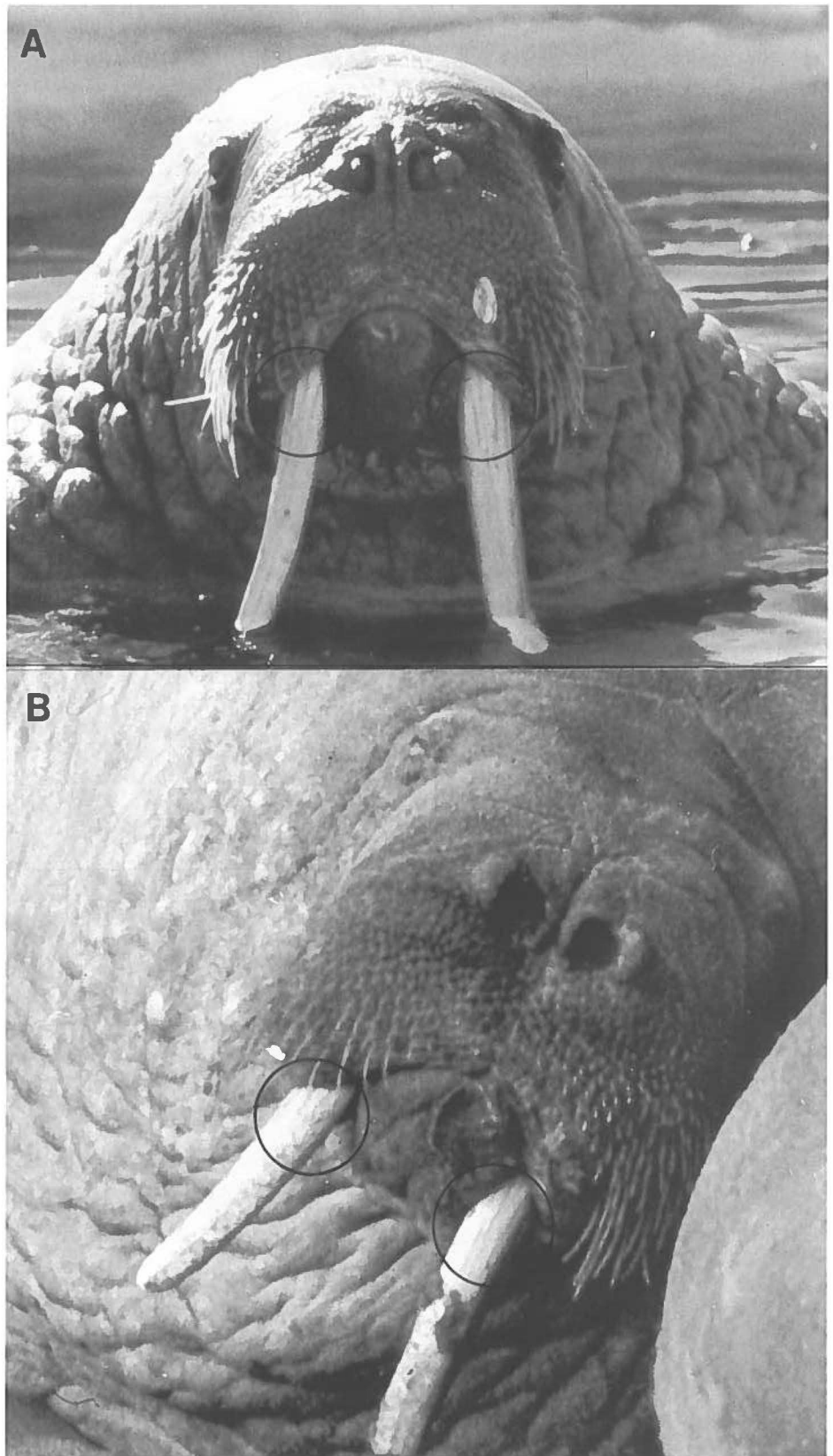


Fig. 15: A characteristic pattern of folds in the skin of the back head region was used for identification of walrus "AO" on photos taken at Lille Snæs (Dove Bugt) in 1982 (A), 1988 (B), 1989, and 1990 (C). Tusk shape and dimensions were used as supplementary characters for identification. Photos: (A) K. Fischer; (B) L. Maagaard; (C) L.Ø. Knutsen.



Fig. 16: Walrus "AQ" was identified on photos taken at Lille Snenæs (Dove Bugt) in 1986 (A) and 1990 (B). The shape of the tusks and the patterns of dark lines in the cementum of both tusks near the gum line were used for the identification. Photos: (A) M. Forchhammer; (B) L.Ø. Knutsen.



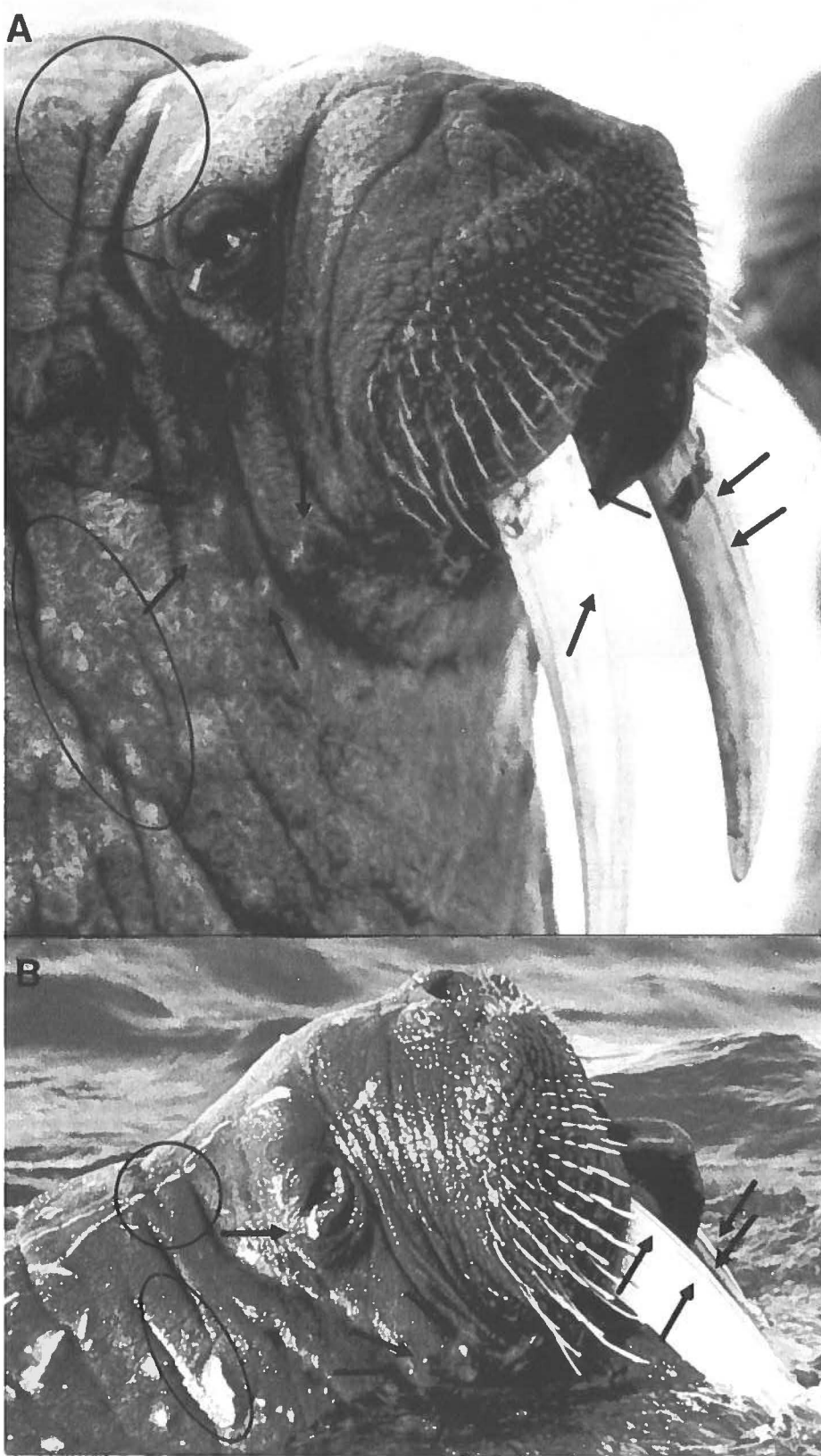


Fig. 17: Walrus "BG" was identified on photos taken on Lille Snenæs (Dove Bugt) in 1987 (A) and off Eskimonæs (southern Clavering Ø) in 1989 (B). Scars, skin folds and dark lines in the cementum of both tusks were used for the identification. Photos: (A) L. Maagaard; (B) M. Elander.



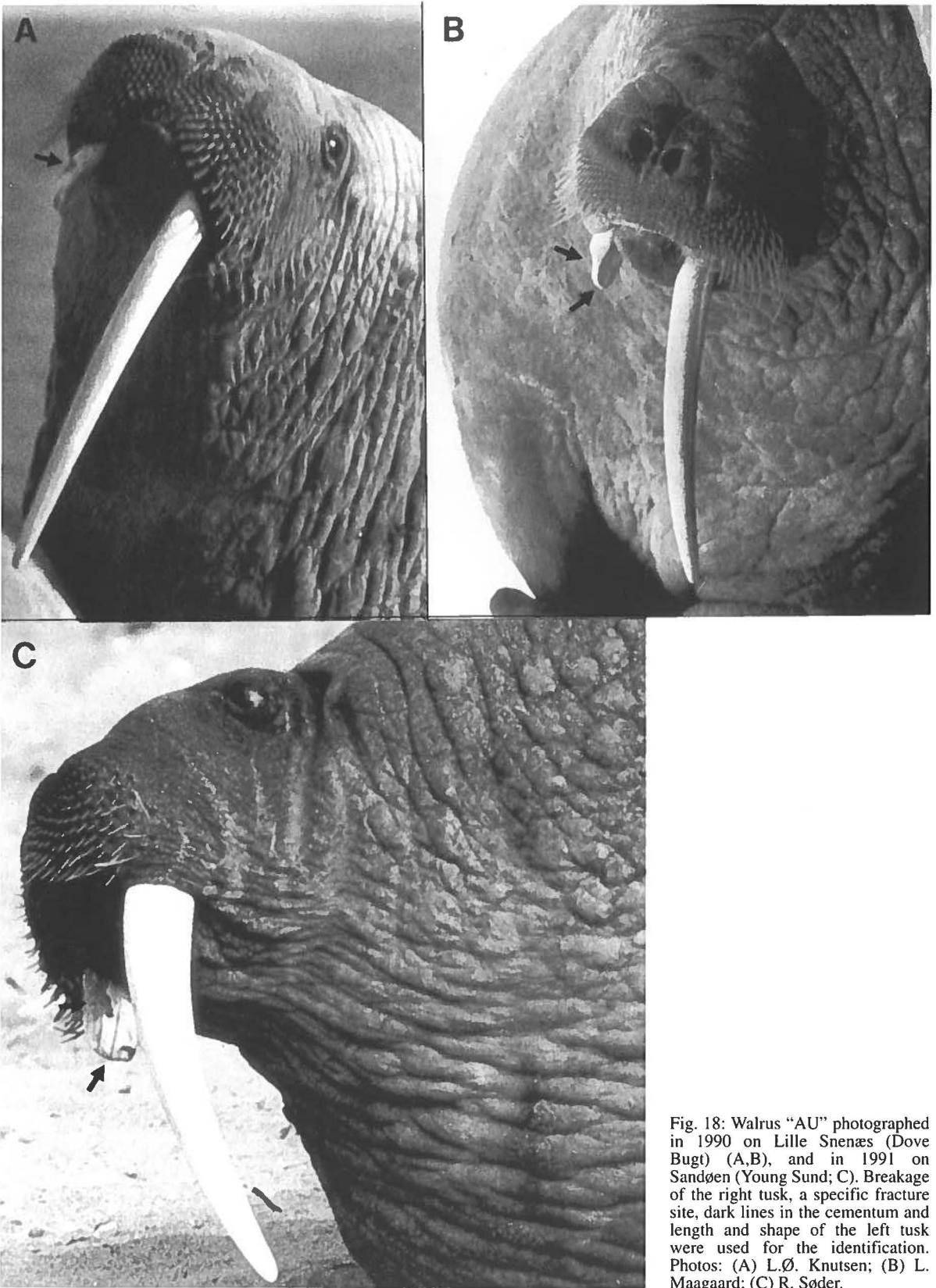


Fig. 18: Walrus "AU" photographed in 1990 on Lille Snenæs (Dove Bugt) (A,B), and in 1991 on Sandøen (Young Sund; C). Breakage of the right tusk, a specific fracture site, dark lines in the cementum and length and shape of the left tusk were used for the identification. Photos: (A) L.Ø. Knutsen; (B) L. Maagaard; (C) R. Søder.

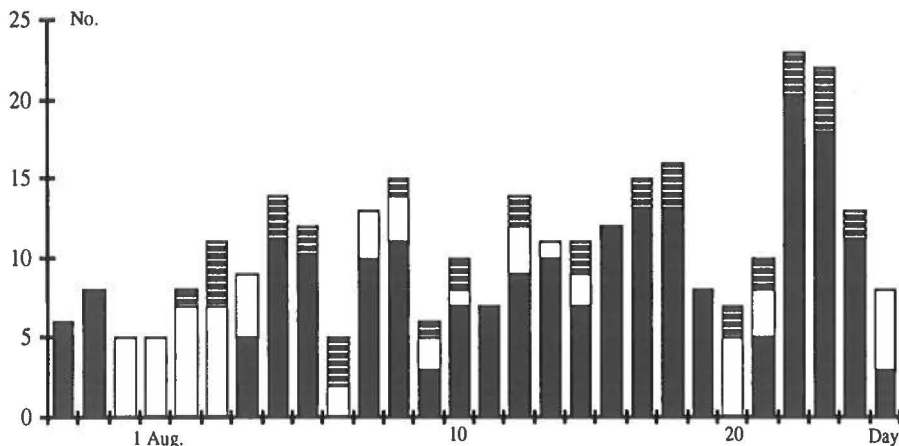
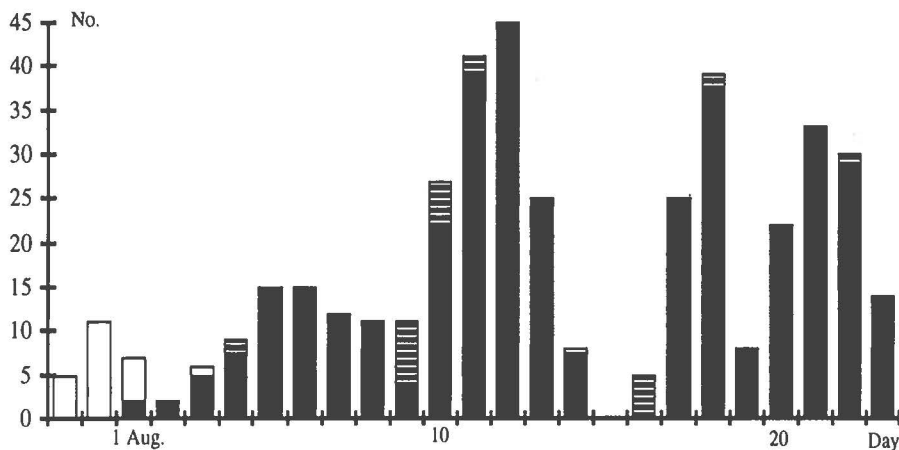


Fig. 19: Maximum daily counts of walrus at Lille Snænæs (Dove Bugt) between 29 July and 25 August 1989 (top) and between 30 July and 23 August 1990 (bottom). During the period 31 July-3 August 1989 ice hummocks blocked access to the southern beach where the walrus preferred to haul out in 1989. Strong winds during 14-16 August 1990 forced the walrus to leave the beach. Black columns = numbers on land; hatched = in water; white = on ice.



the total number of animals using Lille Snænæs hauled out during the "peak day" (Born & Knutsen 1997).

Based on two seasons of sporadic observations primarily centered around Lille Snænæs, Maagaard (1990) suggested that between 40 and 80 walrus could be found in northern Dove Bugt during summer.

Between 1952 and 1995 the number of walrus hauling out on Lille Snænæs increased significantly (Table 4). A regression of logarithmic transformed ( $\ln$ ) observations by year, weighted for number of observation days per year, indicated an annual increase of 4.8% (95% CI 2.2 – 7.5%) in the number of walrus occurring on Lille Snænæs ( $\ln Y = -0.7869X + 0.04693 * \text{Year} - 1000$ ;  $R = 0.619$ ,  $DF = 1/21$ ). This increase was statistically significant ( $F = 13.077$ ,  $P < 0.05$ ). The number of walrus hauling out on Lille Snænæs in 1995, as predicted by the regression, was 39 (95% CI 27-56).

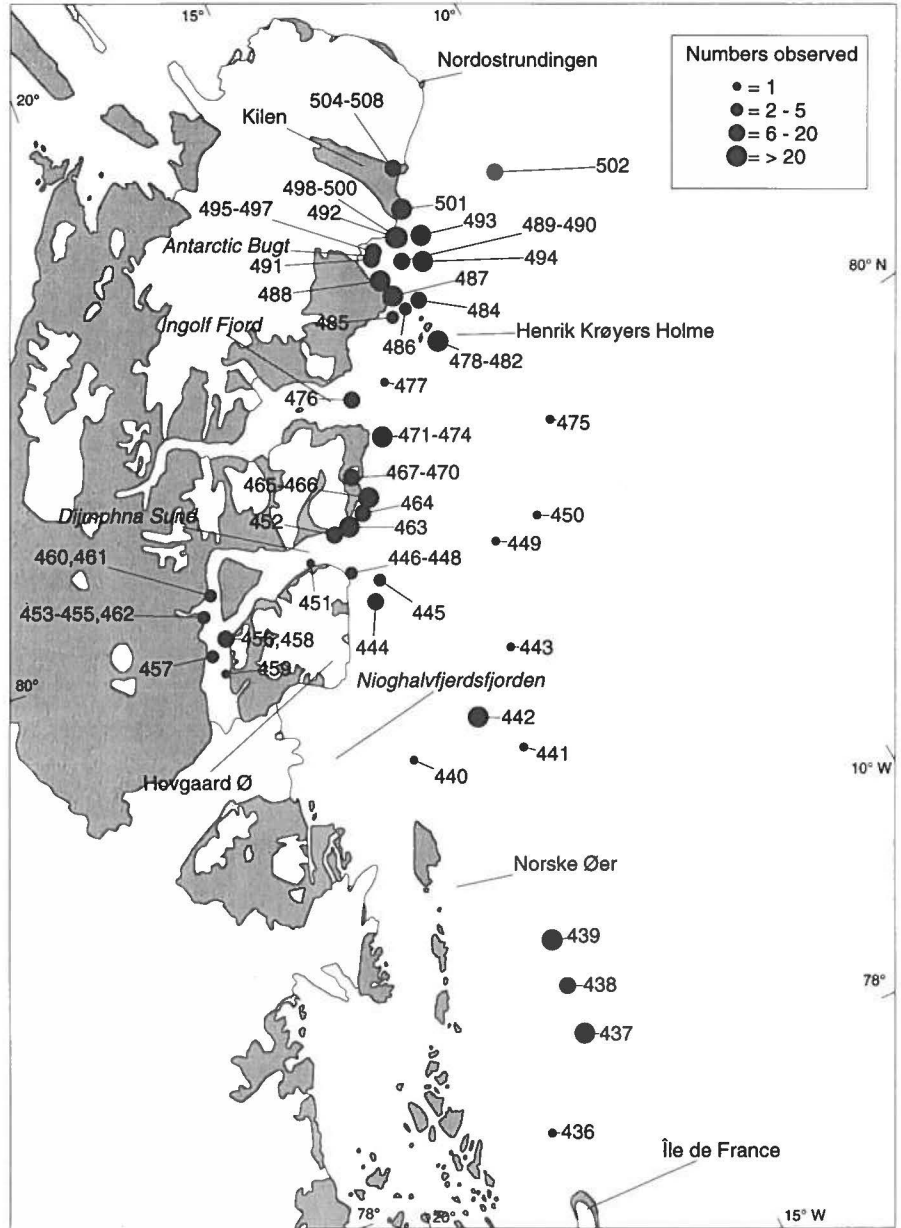
A similar regression carried out with data from Store Snænæs (Table 5) indicated an annual increase of about 4.9% per year. This relationship was, however, not statistically significant ( $F = 1.696$ ,  $P > 0.05$ ,  $R = 0.366$ ,  $DF = 1/11$ ).

### The areas north of Dove Bugt (north of approximately 77° N)

In recent years, walrus have been observed on several occasions in areas north of Dove Bugt. Of a total of 76 coastal observations between 1879 and 1994 have been recorded north of 77° N (Appendix 2); about 90% of these are post-1984. Of a total of 16 offshore observations north of 77° N, 63% were made after 1984 (Table 7). In particular, many of the observations were made north of approximately 80° N (Fig. 20). An extensive sheet of fast ice and consolidated multi-year pack ice in the Nioghalvfjærdsfjorden (79-Fjorden) area (*cf.* for example Schneider & Budeús 1994, 1997) between Île de France and approximately 79° 30' N apparently prevents the walrus from getting close to the coast during certain years. Observations at the head of Dijnphna Sund in July and early August 1989 showed that walrus also use in-shore areas after the fast ice breaks up (Obs. no. 453-462).

The 75 observations for which month was stated were

Fig. 20: Distribution of observations of walrus in northeastern Greenland after 1950. Numbers refer to Appendix 2.



made between March and August; 87% were from the period June-August (Table 1).

North of Dove Bugt walrus have been observed hauled out on land at Marmorvigen in Dijnphna Sund (Obs. no. 461) and in Hanseraq Fjord (Obs. no. 467). Feces on the beach at Kilen indicates that they also haul out there (Fig. 5 C). On 3 June 1993 a group of about 80 walrus hauled out at the edge of the fast ice in Antarctic Bugt (80° 57' N, 13° 52' W; Obs. no. 498; Fig. 21). This is the largest group of walrus recorded in eastern Greenland since 1932.

### Sex and age composition

A sexual segregation of adult walrus outside the mating season has been observed in many areas (e.g. Fay 1982, Gjertz & Wiig 1995).

Johansen (1910) stated that in northeastern Greenland, males occurred in groups of up to 10, including both older and younger individuals. Females were encountered singly and, apparently, much less often. Freuchen (1921) hypothesized that females were likely to be found in remote areas north of Dove Bugt. Although both males and fe-



Fig. 21: A group of about 80 walrus hauled out at the edge of the fast ice in Antarctic Bugt ( $80^{\circ} 57' N$ ,  $13^{\circ} 52' W$ ) on 3 June 1993 (Appendix 2. Obs. no. 498). Only adult females, subadults and calves were identified. Fecal staining (left) indicated that the area is used for foraging. Photo: J. Thomassen.

males of all age classes occurred at the entrance to Kangerittivaq in the 1920s (Pedersen 1926, 1934, 1942), and the fact that Pedersen (1934) reported a catch of a pregnant female from this area, Pedersen (1942) noted that only few female walrus have been observed in eastern Greenland. This information suggests that females generally occurred further north than males in eastern Greenland.

In this study, reliable information on the occurrence of the two sexes was available from two types of sources: (1) notes by Danish and Norwegian trappers who had determined the sexes of killed animals and (2) records of experienced observers during walrus surveys.

Information from trappers operating between approximately  $74^{\circ}$  and approximately  $77^{\circ} N$  was available for 245 walrus (Appendix 2). Of these, 29.8% were recorded as being males and 2.5% as females, while for the remaining 67.7% sex was not stated. Twenty per cent were classified as adults, 1.6% as subadults and 1.6% as dependent calves (< two years old); the remainder were not classified according to age.

It was only possible to document a total of 18 observations of females. Half of these were from the northern parts of the area – *i.e.* around Danmarkshavn.

Recent observations support Freuchen's (1921) hypothesis that female walrus are mainly distributed north of  $77^{\circ} N$ . For example, in August 1980 a female with a calf was observed in Hanseraq Fjord (approx.  $80^{\circ} 16' N$ ; Obs. no. 468); in June 1991 three adult females with newborns were seen in the same general area (Obs. no. 489). During aerial surveys in May-June 1993, more than half of the walrus observed in the Northeast Water area were adult females with subadults and calves. Of a total of 148 walrus observed, 38 were identified as adults (3 M, 14 F, 21 not identified to sex). One, five and two were identified as 0-, 1 – and 2-year-old calves, re-

spectively. Among those not classified according to sex and age was the above mentioned group of about 80 walrus in Antarctic Bugt. Judged from a distance of about 100 m this group appeared to consist mainly of adult females, subadults and calves. Blood on the ice near a small calf indicated that it had recently been born (this study). During an aerial reconnaissance from Nordost-rundingen to Eskimonæs on the afternoon of 25 July 1993, 17 out of a total of 92 walrus observed were recorded as “pups” (Tahon & Vens 1994:118; on p. 116 a total of 93 is given).

Hence, it appears that outside the breeding season adult male walrus are mainly distributed south of approximately  $77^{\circ} N$ , whereas females and most subadults occur north of  $77^{\circ} N$ . This conclusion is also supported by considering the sex composition of the catch in the Kangerittivaq area (see p. 40). Adult males equipped with satellite-linked radio transmitters occurred in the Northeast Water area during February (*i.e.* during parts of the mating season) (Born & Knutsen 1992) where females presumably occur for the major part of the year.

## Wintering areas

Walrus are only capable of breaking up through ice of up to about 20 cm thick, and have to retreat to other areas if the ice becomes thicker (Fay 1982). Therefore polynyas and flaw leads with predictable open water or light ice conditions in areas with access to benthic invertebrate food generally comprise important walrus wintering grounds (*e.g.* Vibe 1950, Stirling *et al.* 1981, Born *et al.* 1995c). Furthermore walrus prey facultatively on seals – in particular on young ringed seals (*Phoca hispida*; *e.g.*



Fig. 22: Typical maximal extension of winter ice cover in eastern Greenland between approximately 68° and approximately 82° N. Areas with significant recurring polynyas are indicated: (1) The northern parts of Kialiip Kialia (Blosseville Kyst), (2) the entrance to Kangertittivaq (Scoresby Sund), (3) the Gael Hamke Bugt area, (4) the Wollaston Forland – Sabine Ø – Hvalros Ø – Lille Pendulum area, (5) Hochstetterbugten, (6) at Store Koldewey, (7) Île de France, and (8) the Northeast Water off the coast between Dijmphna Sund and Nordostrundingen. NOAA thermal infra-red satellite imagery, 16 March 1994 (source: Danish Meteorological Institute, Copenhagen).

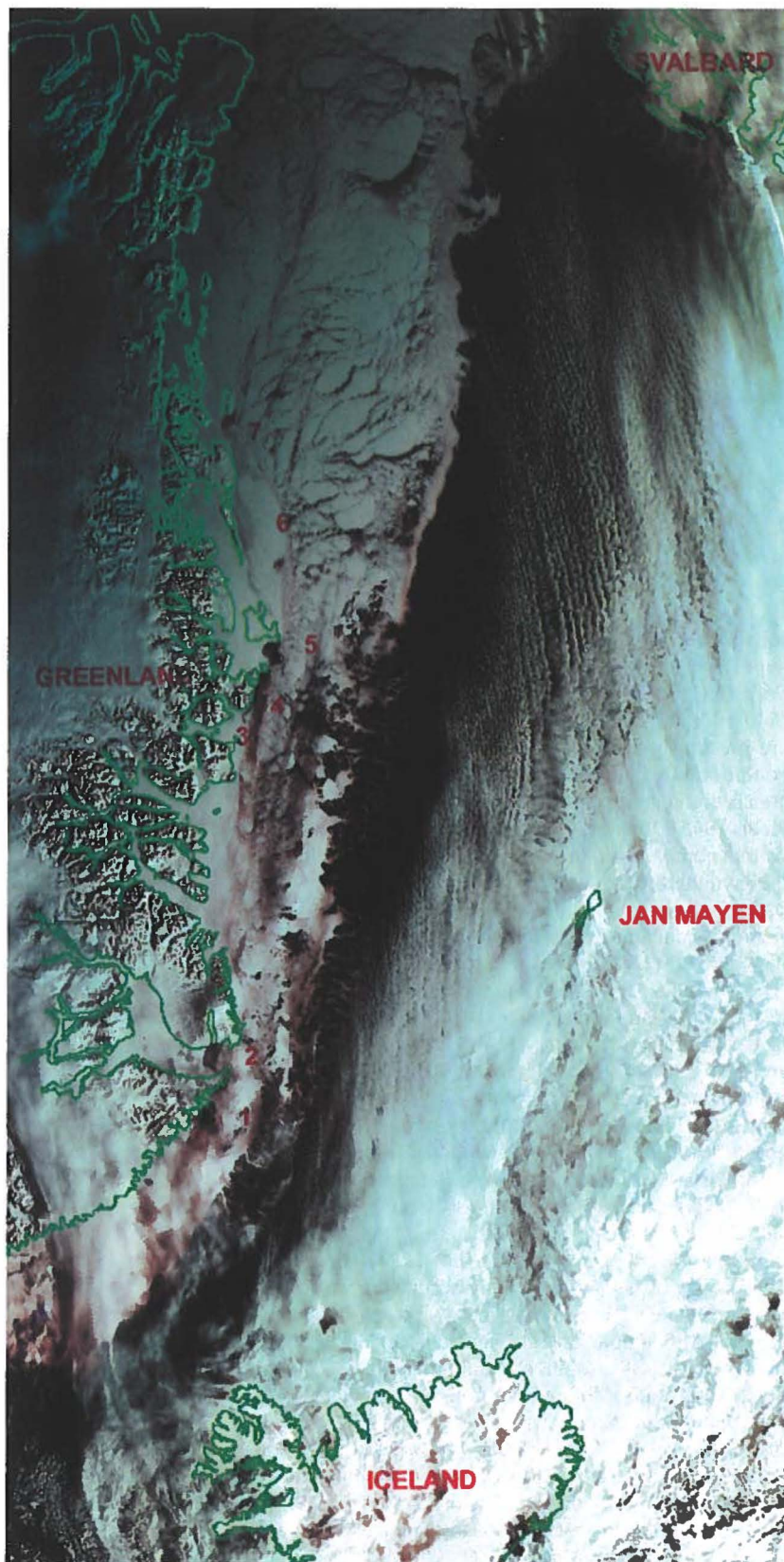




Fig. 23: An adult male walrus hauled out on 3 June 1993 on dense fast ice in Antarctic Bugt (80° 56' N, 14° 04' W) (Appendix 2. Obs. no. 495). This animal, which was hauled out about 100 m from the water, had numerous bleeding scars and was relatively emaciated indicating that it recently had participated in mating. Several adult females were observed in the same area. Photo: J. Thomassen.

Johansen 1910, Lowry & Fay 1984) – which often occur in polynya areas (e.g. Pedersen 1942, Stirling *et al.* 1981). Walrus mate in winter (late January – April) (e.g. Mansfield 1966, Fay 1982, Born 1990), so recurring polynyas are presumably also important as breeding grounds. Ice conditions are generally severe in eastern Greenland. The area is dominated by the cold East Greenland Current (e.g. Koch 1945). It is therefore likely that the survival of the walrus population in this area depends to a large extent on the availability of polynyas and persistent flaw lead systems during winter (see also Anon. 1995).

Significant recurring polynyas are found in the following places: (1) The northern parts of Kialiip Kialia (Blosseville Kyst), (2) the entrance to Kangertittivaq, (3) in the Gael Hamke Bugt area, (4) along Wollaston Forland and in the Sabine Ø – Hvalros Ø – Lille Pendulum area, (5) in Hochstetterbugten and at southern Shannon, (6) at eastern and southern Store Koldewey, (7) at southern Île de France and (8) in the Northeast Water off the coast between Dijnphna Sund and Nordostrundingen (Mikkelsen 1922, Amdrup 1913, Pedersen 1942, Koch 1945, Mikkelsen 1994, Nielsen & Valeur 1994; Fig. 22). The extent of these polynyas varies from year to year, and they may be connected via the flaw lead system (Koch 1945). Few observations of walrus have been reported between October and April when winter ice conditions prevail. Although a few individuals occur during winter in the flaw leads south of Kialiip Kialia (Blosseville Kyst) (this study), the observations in Appendix 2 indicate that the majority winters in the polynya areas north of Kialiip Kialia.

An observation of walrus in a small polynya near Ålborghus (SW Dove Bugt; Obs no. 316) in May 1974 indicates that they sometimes also winter in small areas with semi-permanent open water.

The Northeast Water at Nordostrundingen is the largest polynya in eastern Greenland. Small areas and leads of open water are present in this area all year round. However, the “summer polynya” usually opens gradually from early May to early July, reaching its maximum extension (59 000 – 124 000 km<sup>2</sup>) by August – September. The polynya closes again between mid September to mid October when the formation of new ice is rapid (Böhm *et al.* 1997, Minnett *et al.* 1997).

Recent observations support Pedersen’s (1942) suggestion that the Northeast Water was a walrus wintering area. Tracking of adult males equipped with satellite-linked radio transmitters in the Dove Bugt area in 1989 and 1990, revealed that adult males were present in the Northeast Water area and in the pack ice over the edge of the continental shelf between about 73° N and about 81° N during winter (Born & Knutsen 1992).

Only a few adult males were observed in the Northeast Water area during the aerial surveys in May-June 1993 (Fig. 23). However, the surveys were conducted after the mating period, and it is therefore likely that most males may have already migrated south to their summering areas.

## Migrations and offshore observations

Studies of movement of walrus equipped with satellite-linked radio transmitters (Born & Knutsen 1992) support Pedersen’s (1934) suggestion that walrus made local migrations from Dove Bugt north to Nordostrundingen and south to Shannon.

Walrus have been observed offshore in the Fram Strait and the Greenland Sea on a number of occasions. Gray (1927) stated: “Although the walrus is usually



Table 7. Offshore observations of walrus in the Greenland Sea and Fram Strait between 1863 and 1992 – presented from south to north (Fig. 24). · = no information.

Obs.	Day	Month	Year	Locality	Remarks	Source
1*	primo	5	1863	Jan Mayen	1 seen	Quennerstedt 1868
2	26	7	1876	70° 50' N-21° 00' W	1 walrus	Gray 1933
3	3	7	1907	73° 04' N-16° 00' W	1	Kinnear 1907
4	22	6	1887	73° 28' N-16° 08' W	1	Gray 1933, 1942
5	·	7	1888	75° 20' N-08° 58' W	1 adult	Joiris & Tahon 1992
6	7	5	1883	76° 10' N-10° 00' W	1	Gray 1929
7	4	7	1892	76° 00' N-00° 00' W	1	Anon. 1884-1910
8	23	6	1988	76° 40' N-02° 05' W	1 adult	Joiris 1991
9	·	8	1992	76° 50' N-06° 00' W	1 subadult	Kristensen & Kristensen 1993
10	·	8	1992	77° 15' N-11° 30' W	1 subadult	<i>Ibid.</i>
11	6	7	1879	78° 00' N-03° 00' W	1	Gray 1927, 1929
12	29	5	1891	78° 10' N-00° 15' W	1	Gray 1933
13	25	5	1993	79° 08' N-05° 48' W	1 adult	This study
14	21	5	1888	79° 16' N-04° 46' E	1	Livingstone-Learmonth 1888
15	31	7	1984	79° 36' N-08° 12' W	1	I. Gjertz pers. comm. 1994
16	26	5	1897	79° 40' N-02° 10' E	1	Gray 1933
17	·	4	1977	79° 50' N-12° 00' W	4	Vibe 1981
18	15	5	1888	79° 50' N-05° 15' W	1	Gray 1929, 1889 Livingstone-Learmonth 1888
19	7	8	1992	80° 16' N-08° 40' W	1	Kristensen & Kristensen 1993
20	16	6	1993	80° 31' N-10° 57' W	1 two-year old	This study
21	6	8	1992	80° 36' N-07° 56' W	1 three-year-old female	Kristensen & Kristensen 1993
22	25	7	1984	80° 38' N-09° 29' W	1 adult male	I. Gjertz pers. comm. 1994
23	4	8	1992	80° 44' N-08° 50' W	1 subadult	Kristensen & Kristensen 1993
24	25	8	1984	80° 46' N-08° 32' W	2	Dietz 1984
25	·	8	1992	80° 50' N-08° 45' W	1 subadult	Kristensen & Kristensen 1993

\* On 14 february 1997, a male walrus was shot on land on Jan Mayen (I. Gjertz, pers. comm 1997).



found near land subsisting on shell-fish it finds at the bottom, it is also on rare occasions found among the drift ice in deep water, far from land, subsisting on seals and other mammals". Gray (*Ibid.*), who presented observations of walrus made offshore by British whalers during the last decades of the 19th century, also wrote that "during Scoresby's time [*i.e.* early 19th century] straggling walrus were apparently more frequently seen by whalers on the so-called 'whaling banks' between Greenland and Spitsbergen".

The offshore observations summarized in Table 7 and Fig. 24 indicate that a connection exists between walrus in eastern Greenland and those in the Svalbard region.

## Catch

### Catches by European sealers and trappers

European sealers, hunters and trappers caught walrus in eastern Greenland between 1889 and the 1950s. In 1889 the Norwegian sealing captain Ragnvald Knudsen reached the coast of central eastern Greenland (Knudsen 1889). This occurred during a period in which, according

Fig. 24: Offshore observations of walrus in the Fram Strait and Greenland Sea, 1863-1993. Numbers refer to observation number in Table 7.

Table 8. Number of walrus caught by European sealing vessels between Kangertittivaq (Scoresby Sund) and Dove Bugt, 1889-1939.

Vessel	Year	Number	Locality	Source	
<i>Hekla</i>	1889	267	Kap Berghaus Gael Hamke Bugt Hvalrosøen, Kuhn Ø	Knudsen Giæver Jennov	1889, 1890 1937 1945a,b
<i>Frena</i>	1897	13	No information <sup>1)</sup>	Anon.	1898-1913
<i>Avance</i>	1897	10	No information	<i>Ibid.</i>	
<i>Anna</i>	1898	64	Kap Berghaus	Anon. Jennov	1932 1945a,b
<i>Polar Star</i>	1898	70	Clavering Ø	Southwell	1899
<i>Diana</i>	1899	57	No information	Anon.	1898-1913
<i>Søstrene</i>	1899	13	Between Clavering Ø and Kejser Franz Joseph Fjord	Anon. Jennov	1932 1945a,b
<i>Balaena</i>	1899	4	Shot at Hvalros Ø	Nathorst	1900
<i>Spitsbergen</i>	1899	15	Vicinity of Shannon and Clavering Ø	Anon. Jennov	1932 1945a,b
<i>Søstrene</i>	1900	32	No information	Anon.	1898-1913
<i>Cecilie Malene</i>	1900	10	No information	<i>Ibid.</i>	
<i>Spitsbergen</i>	1901	46	"Clavering Fjord" [ <i>i.e.</i> Young Sund]; "on a sand bank"	Isachsen & Isachsen	1932
<i>Minna</i>	1900/06	20-40 per year	Eastern coast of Greenland	Anon. Jennov	1932 1945a,b
<i>Laura</i>	1903	4	No information	Anon.	1898-1913
<i>Wild Flower</i>	1903	5	No information	<i>Ibid.</i>	
<i>Anna</i>	1903	14	No information	<i>Ibid.</i>	
<i>Unknown</i>	1903/08	77	"Said to be have been caught" in NE Greenland	Lønø	1972:204
<i>Laura</i>	1904	1	No information	Anon.	1898-1913
<i>Johannes Bakke</i>	1904	2	No information	<i>Ibid.</i>	
<i>Lykkens Prøve</i>	1904	7	No information	<i>Ibid.</i>	
<i>Severn</i>	1905	22	Danmarkshavn	Grødahl <i>vide</i> Sæther	1914 1936
	1906	"few"		Isachsen & Isachsen	1932
<i>Laura</i>	1909	4	Jackson Ø	Kmunke	1910
<i>Aurora</i>	1912	2	No information	Anon.	1898-1913
<i>Polara</i>	1919	5	Between Kap Hold with Hope and Kap Bismarck	Anon. Jennov	1932 1945a,b
<i>Johanna</i>	1919	16	Between Clavering Ø and Shannon	Anon. Jennov	1932 1945a,b
<i>Schjelderup</i>	1922	"a few"	"Clavering Fjord"	Isachsen & Isachsen	1932
<i>Jopeter</i>	1922	1	Hvalros Ø		
<i>Quest</i>	1923	?	Hurry Fjord	<i>Ibid.</i>	
<i>Hanseat</i>	1925	11	Eastern coast of Greenland	<i>Ibid.</i> Jennov	1945a,b 1932
<i>Heimland</i>	1926	2	Davy Sund-Sabine Ø	Anon. Isachsen & Isachsen	1932
<i>Fangstmand</i>	1927	58	Between Clavering Ø and Shannon; majority taken at Sandodden [ <i>i.e.</i> Kap Berghaus]	Anon. Isachsen & Isachsen Andresen	1932 1932 1927-29
<i>Sælbarden</i>	1928		No catch by sealers	<i>Ibid.</i>	
<i>Kap Flora</i>	1929		"some"; between Shan- non and Scoresby Sund	Anon. Jennov	1932 1945a,b
<i>Veslekari</i>	1927/29	9	Between Clavering Ø and Sabine Ø	Isachsen & Isachsen	1932
<i>Veslekari</i>	1929	"some"	Between Clavering Ø and Sabine Ø	<i>Ibid.</i>	
<i>Quest</i>	1937	7(8)	Young Sund At Kap Mary (Fig. 25)	Hansen Knutsen	1944 1992
<i>Polarbjørn</i>	1939	1	Young Sund?	Lønø	1964

<sup>1)</sup> No information: Area of operation given in "Norsk Fiskeritidende" as either "Vestisen" (the West Ice; *i.e.* the Greenland Sea area) or "Østgrønland" (*i.e.* eastern Greenland).

Fig. 25: A group of four adult male walrus killed in the vicinity of Kap Mary (eastern Clavering Ø) in May 1937 by personnel from the sealing vessel *Quest* (captain Schjelderup). Hansen (1944) refers to a total of 7(8) being killed (Appendix 2. Obs. no. 131). Left to right: E. Halvorsen (?), count G. Micard and G. Eriksen. Photo: probably Captain L. Schjelderup (Will C. Knutsen's collection).



to Vibe (1967), the pack ice was relatively loose and moved relatively quickly along the coast of eastern Greenland. Vibe (*Ibid.*) referred to this period as “the drift-ice pulsation stage” (ca. 1860 to ca. 1910). During his trip in 1889 Knudsen caught 267 walrus, of which the majority were likely to have been killed on land (Knudsen 1889, 1890, Giæver 1937, Jennov 1945a,b). The Inuit population living in northeastern Greenland disappeared presumably not long after 1823, when they were seen for the last time by Commander D.C. Clavering (Clavering 1830). The Norwegian sealer therefore stumbled across pristine hunting grounds along the northeastern Greenland coast. Knudsen’s operation opened an era of commercial hunting in the area, and during the following decades several sealing and whaling vessels caught walrus in eastern Greenland (Table 8). During the period 1889-1922, Norwegian vessels were able to reach the coasts of northeastern Greenland at least 89 times; 37 of these trips were made in the period 1900-1906 (Isachsen 1922, Krogh 1932). According to Higgins (1989), Norwegian ships visited the coasts of northeastern Greenland on at least 142 occasions during the period 1889-1931.

These hunting expeditions in the coastal waters of

eastern Greenland usually supplemented offshore sealing operations primarily for harp (*Phoca groenlandica*) and hooded seals (*Cystophora cristata*) (e.g. Krogh 1932). Walrus, which were caught for their blubber, hide and ivory (e.g. Knudsen 1889, Anon. 1898-1913, Lønø 1972), were mainly taken in the areas around Clavering Ø and in the vicinity of Shannon (e.g. Isachsen & Isachsen 1932; Fig. 25). Apparently, a large proportion of the killing was carried out on terrestrial haulout sites.

Between 1908 and 1960, Norwegian and Danish trappers wintered in the areas between Carlsberg Fjord (71° 45' N) and Skærfjorden (77° 30' N). However, in the period 1909-1922, Norwegian trappers did not winter in northeastern Greenland (Giæver 1939). There were a total of 534 “person-winterings” with an average of 14 persons per winter between 1908 and 1960 (range: 3-31 persons/winter; Mikkelsen 1994). This hunting activity, which was most intensive between about 1930 and 1952, peaked in the 1930s. The main game was Arctic fox (*Alopex lagopus*). The trappers usually hunted muskoxen (*Ovibos moschatus*) to provide food for their dogs, which were used for transportation along the trap line. Walrus were sometimes killed for the same purpose (e.g. Mikkelsen 1994). The hides were salted (Anon.

year not stated, Jennov 1930-31, Madsen 1989) and exported together with blubber, tusks, skulls and penis bones (Jennov 1930-31, Anon. 1920, 1921, Andresen 1930-31, Sørensen 1953-54, Madsen 1989). Around 1950 walrus hides had a value of 3 Danish kroner per kg (Sørensen 1953-54).

To facilitate killing and flensing, the Norwegian and Danish trappers usually shot walrus that were hauled out on ice or on land (e.g. Jennov 1933, Hennings 1936-41; Fig. 26). Walrus hunted at sea were frequently lost despite the fact that they were usually harpooned (e.g. Nielsen 1919-21, Anon. 1929-31, Dalskov 1938-39, Jensen 1938-39, Hennings 1939-40). Sometimes when a walrus was lost, the trappers would continue to search for a number of days, hoping that it would return to the surface after becoming bloated (e.g. Jennov 1933).

There was no information available regarding losses resulting from the walrus hunting by vessel and sealers. On many occasions the killing was apparently carried out at terrestrial haulouts (this study). The hunters tried to kill the walrus while they were hauled out, however at least some of the animals often escaped and fled into the water



Fig. 26: Danish trappers preparing to butcher adult male walrus near Hvalrosodden (Dove Bugt) in the summer of 1934 (year uncertain). Walrus were often killed on the ice or land to make the butchering easier. Walrus that died in the water were usually towed into shallow water to be butchered at low tide. The hunters are (top from left to right): Kristian Jensen, H.V. Nielsen and Finn Kristoffersen. Bottom: Finn Kristoffersen and H.V. Nielsen (pers. comm. Peter Schmidt Mikkelsen 1994). Photos: Presumably Poul Poulsen.

(Knudsen 1889). It is therefore reasonable to assume that a relatively large number of walrus may have escaped mortally wounded. Therefore the crude loss rate of 20% suggested by Chapskii (1936) and Gjertz *in litt.* (1997) for this kind of hunting is considered to be reasonable. The crude loss rate estimated from data in Appendix 2 for the catch by the Norwegian and Danish trappers operating between Kangertittivaq and Dove Bugt is about 9% (22 reported lost of 245 struck). However, this must be regarded as an absolute minimum estimate because losses were not stated in many of the sources cited in Appendix 2. When based on information extracted from journals which are particularly specific and detailed also about the hunt and losses, the overall loss rate is estimated to be as high as 26.5% (18 lost of 68 struck) (Nielsen 1919-21, Jensen, H.L. 1922-23, Anon. 1929-31, Tolløfsen 1932-33, 1933-34, Dalskov 1938-39, Jensen, C. 1938-39).

Walrus catch statistics from eastern Greenland are generally incomplete. In this study (Table 8 and Appendix 2) we were able to document the catch of a total of 1131 walrus (exclusive of loss) by foreigners between 1889 and 1951; of these, all except eight were caught before 1940. A total of 940 animals were taken primarily by Norwegian vessels (Table 8); 95 and 96 were landed by Norwegian and Danish trappers, respectively. Jennov (1945a,b), who had a substantial knowledge about the activities of trappers hunting in eastern Greenland, estimated that more than 1000 walrus had been killed over a period of 40-50 years from 1889. The majority were taken during the first half of this period (*Ibid.*). According to Jennov (1945a,b), hunters operating for the hunting company "Østgrønlandsk Kompagni" (later re-organized as the holding company "A/S Nanok") caught 48 walrus between 1919 and 1924. He estimated that Norwegian trappers did not take more than 150 animals between 1926 and 1939, and that trappers employed by "Nanok" caught 60-70 animals during the period 1929-39. This study was only able to document catches of 28, 86 and 41 walrus for these three periods, respectively. However, if Jennov's figures are accepted, a minimum estimate of the total number of walrus landed during the period 1889-1939 is about 1231.

To our knowledge there are no records of the number of walrus killed during the period 1940-1956, when walrus were finally officially protected in areas of north-eastern Greenland where European hunters and trappers operated. A rough estimate of the number killed during this period can be derived if one assumes that at least one walrus was killed per year (for dog food and trophies) at each of the hunting stations situated close to walrus habitats between Hold with Hope (approx. 73° 45' N) and Mørke Fjord (approx. 76° 50' N) during this period. A total of 17 different stations situated in walrus areas were manned at this time, although the number varied between one and nine per year (mean = 4.8 station per year; cf. Mikkelsen 1994:67). Thus, it is estimated that a total of about 80 walrus were killed during the period 1940-1955.

Overall it is estimated that 1311 walrus were landed between 1889 and 1955. If "operation-specific" losses are included (20% for vessel catches; 26.5% for trappers), a total of about 1680 walrus were killed by non-residents before 1956. During the same period Greenlanders further south landed an estimated 170 walrus, corresponding to 221 walrus if losses are included (see p. 41).

### The catch of walrus by Greenlanders

Walrus were traditionally taken by the Inuit of eastern Greenland (e.g. Scoresby 1820, Thostrup 1911, Mathiasen 1933, Sandell & Sandell 1991, Andreassen 1997). Scoresby (1820:333-334) described the finding of a walrus which had been recently killed by Greenlanders: "A Bremen whaler found a dead sea-horse [walrus], in the summer of 1820, within sight of the east coast of Greenland, in the latitude of 73°, in which there were two harpoons, such as are used by the Esquimaux ... From the

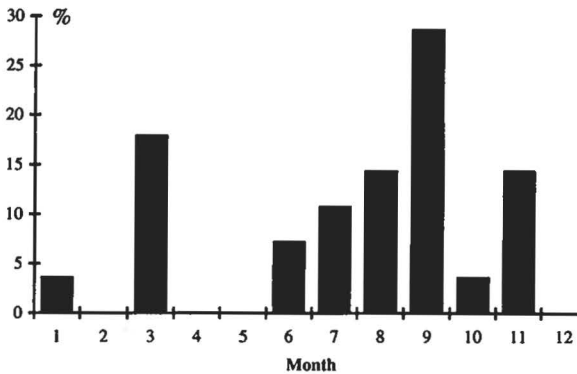


Fig. 27: Distribution by month of the catch of walrus (1950-1983) in the Tasiilaq (Ammassalik) municipality (N = 28; source: Anon. 1954-1987).

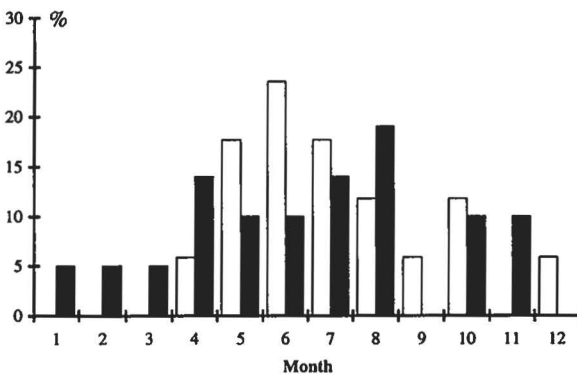


Fig. 28: Distribution by month of the catch of walrus in the Ittoqqortoormiit (Scoresbysund) municipality. Black column = catch (N = 21) reported in Anon. (1954-1987). White columns = catch (N=17) sampled during this study (1988-1994).

Table 9. Catch of walrus in the Ittoqqortoormiit (Scoresbysund) municipality, 1925-1994. Legend: - = indicates a gap in the series of years. (.) = no information available.

Year	Number	Source
1925/26	70	Pedersen 1926; Mikkelsen & Sveistrup 1944
1926/27	10	<i>Ibid.</i>
1927/28	6	<i>Ibid.</i>
1928/29	2	<i>Ibid.</i>
1929/30	3	Høegh 1931
1931	2	<i>Ibid.</i>
-	-	-
1934/35	3	Petersen 1957
-	-	-
1947/48	4	Statistics of "Nanok"; Mikkelsen 1956
1948/49	2	<i>Ibid.</i>
1949/50	3	<i>Ibid.</i>
-	-	-
1954/55	2	Anon. 1954 ... 1987
1955/56	13	<i>Ibid.</i>
1956/57	3	<i>Ibid.</i>
1957/58	1	<i>Ibid.</i>
1958/59	2	<i>Ibid.</i>
1959/60	2	<i>Ibid.</i>
1960/61	1	<i>Ibid.</i>
1961-1963	(.)	<i>Ibid.</i>
1964/65	1	<i>Ibid.</i>
1966-1971	1	<i>Ibid.</i>
1972	1	<i>Ibid.</i>
1973	1	<i>Ibid.</i>
1974	(.)	<i>Ibid.</i>
1975	5	<i>Ibid.</i>
1976	(.)	<i>Ibid.</i>
1977	3	<i>Ibid.</i>
1978	2	<i>Ibid.</i>
1979	1	<i>Ibid.</i>
1980	(.)	<i>Ibid.</i>
1981	(10)	<i>Ibid.</i> Catch estimated in the Hunters' Lists of Game (HLG)
1982	(11)	11 according to <i>Ibid.</i> ; 10 of these estimated. Born (1983 estimated a catch of about 20
1983	(18)	<i>Ibid.</i> (includes an estimate of 10)
1984	(10)	<i>Ibid.</i> Estimate
1985	22	<i>Ibid.</i>
1986	3	J. Thygesen pers. comm. 1988
1987	9	<i>Ibid.</i>
1988	7	<i>Ibid.</i>
1989	12	J. Brønlund <i>in litt.</i> 1994
1990	7	<i>Ibid.</i>
1991	2	<i>Ibid.</i>
1992	2	<i>Ibid.</i>
1993	11	<i>Ibid.</i>
1994	6	<i>Ibid.</i>

state of the carcass, it was evident that the animal had not been long dead".

Due to a general scarcity of walrus in southeastern Greenland the catch in this region has always been negligible (e.g. Mikkelsen & Sveistrup 1944). Since 1966 walrus have been sporadically shot in Kangerlussuaq in the northern part of the municipality of Tasiilaq/Ammassalik (Siegstad 1989, Glahder 1992, 1995). From the limited information available it appears that in the Tasiilaq municipality, walrus may be caught in all seasons, but mainly in the period June-November (Fig. 27).

There is no information specifically relating to walrus

hunting methods in these areas. However, because the hunting traditions and equipment in the Tasiilaq area (Glahder 1995) resemble those in the Kangertittivaq area, hunting methods in the two areas are presumably similar (see below).

The official catch statistics – the Hunters' Lists of Game (HLG) (Anon. 1944) – do not indicate that any walrus were caught in the Tasiilaq area, and there does not seem to be any information from other sources about the number caught during the early decades after colonization in 1894. According to Mikkelsen & Sveistrup (1944:91) walrus were occasionally caught in the district, however they were never of any importance as game animals. Pedersen (1930) estimated that the annual catch in southeastern Greenland during the late 1920s was about 1 walrus.

According to the HLG (Anon. 1954 ... 1987) the annual catch of walrus in the municipality of Tasiilaq averaged 2.3 walrus (SD = 2.24, range: 1-10; 16 years of reporting) between 1954 and 1987 – the last year for which the HLG provide a record of catches. Robert-Lamblin (1986) stated that one or two walrus were caught every year in these areas. According to local informants, a total of only three walrus were taken (1 in Kulusuk in 1993 and 1994; 1 in Isortoq in 1995) during the period 1993-1995 (Department of Fishery, Hunting and Agriculture, Nuuk, via Aqqalu Rosing-Asvid *in litt.* 1997).

In the Kangertittivaq area, the majority of walrus are taken in the shallow waters near Napparuutilikajik (Kap Swainson) between April and August (Fig. 28) (Born 1983, Sandell & Sandell 1991, this study). According to

Sølberg (1975), walrus are shot either from land or from the ice edge when observed during the hunt for ringed seals. Walrus hauled out on ice floes are shot from dinghies powered by outboard engines. Rifles with 7.62 mm caliber (*Ibid.*) or .30-06 caliber are used. Rifles of smaller caliber (.222) have occasionally been used for killing walrus (Sandell & Sandell 1991). The hunters try to kill the walrus instantly by shooting metal-jacketed bullets from a short range at the head, neck or backbone. Harpoons are rarely used, and if the walrus sinks in shallow water it is retrieved with a hook. Although some meat is used for human consumption, much of the meat, blubber and intestines is used for dog food. The tusks are traded to the Greenland Trade Company (KNI), or sold privately (Born 1983, Sandell & Sandell 1991). Although a few subadults and adult females are occasionally killed, the catch in the Kangertittivaq area consists mainly of adult males. A sample of 18 walrus killed at the entrance to Kangertittivaq between 1988 and 1994 was comprised entirely of males with a mean age of 16.9 years (SD = 6.9; range: 5 to 30 years; this study).

When the Kangertittivaq area was re-populated by humans in 1925 (Mikkelsen & Sveistrup 1944), about 70 walrus were landed between mid 1925 and mid 1926 (Pedersen 1930, Mikkelsen & Sveistrup 1944; Fig. 29). Twenty-five were shot in June-August 1925 (Pedersen 1926). The subsequent catch dropped dramatically. During 1926/27, 1927/28 and 1928/29, only 10, 6 and 2 walrus were taken (*Ibid.*).

Between 1928 and 1979 (22 years of reporting), the reported annual catch averaged 2.6 walrus per year (SD =



Fig. 29: An adult walrus killed near the settlement of Ittoqqortoormiit (Scoresbysund) in the mid-1920s. Judging from the slender tusks and neck, and the lack of skin tubercles, this animal was a female. Photo: probably A. Pedersen. Copyright: Arktisk Institut, Copenhagen.



2.6, range: 1-13 animals; Table 9). In the period 1980-1994, the reported catch in the Kangertittivaq area averaged 9.3 per year (SD = 5.7, range: 2-22 animals; 14 years of reporting; Table 9).

Sølberg (1975) estimated that the catch averaged about 5 walrus per year in the early 1970s. Based on information obtained from residents in the Kangertittivaq area, Born (1983) estimated that at the beginning of the 1980s about 10 walrus were landed annually. Sandell & Sandell (1991:109) estimated that during the 1970s and 1980s the landed catch of walrus varied between 5 and 15 animals per year. Based on the information presented in Table 9 and the assumption that not all catches were reported, it is estimated that the annual catch in the Kangertittivaq area since 1980 has varied between 10 and 20 walrus.

Losses are not well documented. Dietz & Joensen (1986) witnessed a kill of three walrus during the spring hunt where one walrus was killed-but-lost. Of nine walrus killed at Napparuutilikajik during April 1983, three were lost (Born 1983). Four out of a total of 23 walrus killed during the spring hunts in 1986, 1987 and 1988 were not retrieved (Jens Thygesen, pers. comm. 1988). When combined this information suggests an overall loss rate of about 23% (*i.e.* per cent lost of all killed).

The resulting estimate of the landed catch in eastern Greenland is about 15 to about 25 walrus per year. If 23% loss is included, the total number of animals removed annually ranges between 20 and 30, mostly adult males.

## Estimation of present population size

During a kayaking trip from Nordostrundingen to Kangertittivaq, Andersen (1984) recorded a total of about 329 walrus between Nordostrundingen and Clavering Ø in the period 15 July to 23 August 1984. About 240 of these animals were observed between Kilen and Norske Øer in the period 15 to 25 July. No information about the proportion of these animals that were hauled out is available.

During aerial reconnaissance surveys along the coasts and over the offshore pack ice in the Northeast Water area in the period 26 May to 18 June 1993 (Born & Thomassen 1994), the highest number observed during a single day was 108 (observed on 3 June 1993 between Henrik Krøyers Holme and Kilen). This included the concentration of about 80 animals hauled out on the fast ice in Antarctic Bugt (see Sex and age composition). Five of the 108 animals observed were in the water; the remainder were hauled out. When the same areas were surveyed on 14 June 1993, 94 walrus were observed, 17 of which were in the water (Born *et al.* 1994b). On 25 July 1993, Tahon & Vens (1994) counted a total of 93 walrus (19 in the water) during an aerial reconnaissance between Nordostrundingen and Eskimonæs.

Information obtained from satellite telemetry and from direct observations in northeastern Greenland (during

August-September) indicates that during this period male walrus are either hauled out or at the water's surface, and are therefore available for detection about 44% of the time (Born & Knutsen 1997). If this correction factor is applied to the counts given above, an estimated 200 to 250 walrus, primarily adult females and young of both sexes, were present in the Northeast Water area north of approximately 79° N during June-July 1993.

During the open water season, male walrus concentrate in northern Dove Bugt and in Young Sund. This same pattern of distribution was observed during studies in 1989, 1990, 1991 and 1994, when walrus were found concentrated at Lille Snenæs and at Sandøen (Søder 1991, this study).

Andersen (1984) observed only 10 and 6 walrus in the Dove Bugt and Young Sund areas, respectively. However, about 50 males are known to occur in each of these areas during the open water season (this study). Thus, about a hundred animals may be tentatively added to the 329 animals recorded by Andersen (1984). Therefore, a conservative (*i.e.* negatively biased) estimate of the population in eastern Greenland is about 429 walrus. This estimate is not corrected for walrus which may have been present in areas not covered during the surveys. Although the walrus in eastern Greenland appear to concentrate in a few areas, the stretch of coastline where they potentially occur is considerable. It can therefore be concluded that the true population size is between 500 to 1000 walrus. However, this represents a cautious estimate. A relatively large proportion of this population is distributed north of approximately 79° N during much of the year.

## Estimation of historical population size

Calculations of historical population size in eastern Greenland were based on catch statistics documented in this study. An average loss rate of about 20% ( $\times 1.25$ ) was applied to data for the vessel catches. This figure was based on information about vessel catches at Franz Joseph Land and Novaya Zemlya (Ian Gjertz *in litt.* 1997, Chapskii 1936:58). An overall loss rate of 26.5% ( $\times 1.36$ ), and 23% ( $\times 1.30$ ) (this study) for the catch taken by European trappers and Greenlanders, respectively, was applied to the documented catches. For years of no reporting, estimates of kills were included: 1) for the period 1940-1955 it was assumed that the trappers landed 5 walrus per year (this study), 2) for all years with no reporting of the Greenlanders' catch it was assumed that at least one walrus had been landed annually in both the Tasiilaq and Ittoqqortoormiit municipalities.

Estimates of the population size at the beginning of 1889 ranged between 676 and 1934 walrus when different combinations of present population size, natural mortality, maximum net increase and density-dependent exponent were used (Fig. 30). All population trajectories

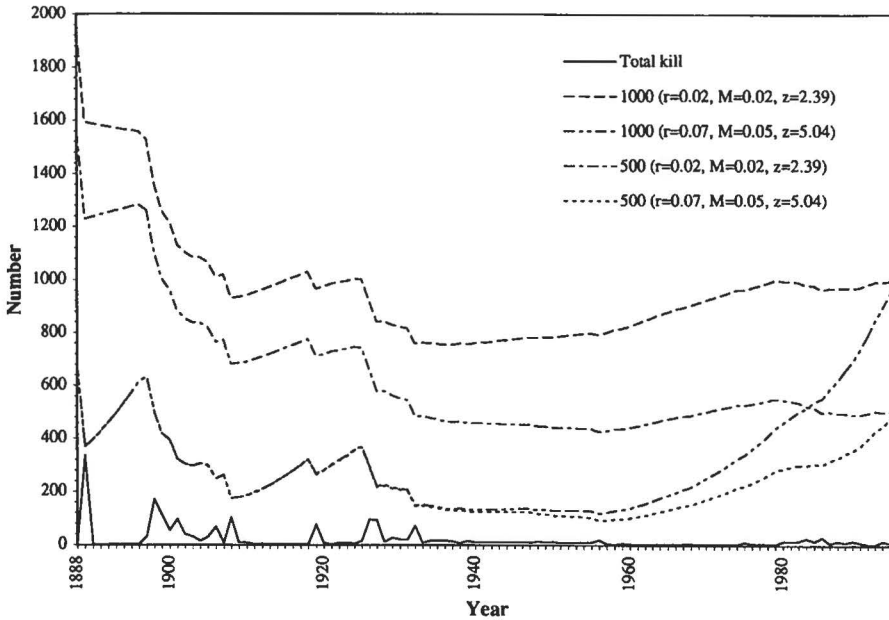


Fig. 30: Walrus population trajectories, 1889-1995, based on back-calculation from estimates of current population size (500, 1000), total kill and estimates of maximum net increase ( $r$ ). In order to encompass the extremes of the theoretical population development, only the minimum and maximum values of historical population size for different combinations of  $r$ ,  $M$  (natural mortality) and  $z$  (density-dependent exponent) are shown.

declined until the 1930s, when the population may have been reduced to less than 200 animals. This development is consistent with other information (e.g. Koch 1953) which also suggested that by the 1930s the population had been severely depleted as a consequence of substantial harvest for several decades. The proposed model also indicates that the population has been increasing since the late 1950s, following the partial protection of walrus.

Differing estimates of natural mortality had only a minor effect on the estimates of historical population size (difference 2-3% of highest estimates of  $N_h$ ), whereas estimates of historical population size were 4-16% higher when a density-dependent exponent of 2.39 was used instead of 5.04.

Observations of the number of male walrus using the Lille Snenæs haulout indicates an annual maximum net increase of about 4.8% between 1952 and 1995. Using this as an estimate of the rate of population increase for various combinations of current population size, kill,  $M$  and  $z$  results in an estimate of historical population size of about 872 animals ( $SD = 27.7$ , range: 839-1698,  $N=8$ ).

## Regulations

Because the population of walrus in northeastern Greenland decreased substantially during the 1930s it was suggested that the species be completely protected (Anon. 1938a:13). Anon. (1938a) and Jennov (1939b: 81) presented hunting regulations that were supposed to be obeyed on a more or less voluntary basis by Danish hunters employed by the company "Nanok" in northeastern Greenland. According to Jennov (1939b) it was per-

mitted to shoot walrus whenever there was a chance, and there was a need for the meat. However, the hunting of walrus at or within 1 km of terrestrial haulouts was not permitted. Care was to be taken to ensure that only bulls were killed, and the shooting of females with calves was to be avoided. If females were killed, a report was to be written (*Ibid.*). It was suggested that hunting of walrus between 15 June and 15 September be prohibited [*i.e.* during the period when walrus occur inshore] (Anon. 1938a), however this regulation was never implemented (see Jennov 1939b). Norwegian trappers and vessels, and tourists on board Norwegian vessels, were permitted to shoot walrus all year round. However, they were only allowed to kill females with young if it was absolutely necessary to obtain dog food (Giæver 1939: 53). In 1952, a Norwegian law banned hunting of walrus by Norwegian citizens in all areas (Anon. 1952).

Taking effect from 1 June 1951, a decree from the Ministry for State Affairs gave complete protection to walrus north of Dronning Augusta Dal ( $74^{\circ} 24' N$ ) on Wollaston Forland (Anon. 1950); [Spärck (1953) erroneously writes "north of Dove Bugt"]. By the same decree, Sandøen in Young Sund, and a 300 m zone around this island, became a game reserve to which access was prohibited. These regulations were amended in 1956 (Anon. 1956).

By 1 July 1974, the National Park in North and Northeast Greenland was established (Anon. 1976, 1987, 1989). Although hunting is generally prohibited within the borders of the national park (§ 4), residents of the municipality of Ittoqqortoormiit are allowed to conduct traditional hunting at sea and on the sea ice inside the national park (§ 22). It is not explicitly stated that walrus can not be taken during such hunting activity.

According to the Greenland Home Rule's regulations

for walrus hunting (Anon. 1994b) only licensed persons resident in Greenland are allowed to hunt walruses. Only vessels less than 40 BRT can be used for hunting walruses. It is not permitted to use aircrafts, helicopters and other motorized vehicles to hunt walruses. Rifles must have a minimum caliber of 7.62 mm and metal-jacketed bullets. It is stated explicitly that wounded walruses must be harpooned before they are killed. Municipal councils can, if they wish, place further restrictions on walrus hunting. Furthermore, by May 1994 it became mandatory, according to the legislation, for hunters to complete specific forms reporting on the catch of walruses (number, sex, age, date, position, vessel size, names of other hunters participating in the hunt etc.) (Anon. 1994b).

## Foraging and foraging areas

Walruses feed on benthic invertebrates – mainly bivalves – in the shallow waters of the continental shelf, usually at depths of less than 100 m (e.g. Vibe 1950, Fay 1982, Gjertz & Wiig 1992). Vertebrates are also occasionally preyed upon – ringed seals in particular (e.g. Johansen 1910, Pedersen 1930, Born 1983, Fay *et al.* 1984, 1990, Gjertz 1990).

We assume that access to shallow feeding banks, particularly during winter, is an important factor limiting the size of the walrus population in eastern Greenland. However, information on distribution and productivity of the walrus feeding banks in eastern Greenland is fragmentary, and specific information about the foraging by walruses is limited.

Ockelmann (1958) described the distribution of bivalves along the east coast of Greenland, including all the important walrus habitats as far north as Île de France (i.e. Tasiilaq/Ammassalik, Kangerlussuaq, Kangerittivaq/Scoresby Sund, Young Sund, Sabine Ø – Hvalros Ø, Dove Bugt); and from a single site north of there – Jørgen Brønlund Fjord (approx. 82° 08' N, 30° 00' W). Arctic *Macoma* communities (e.g. *Ibid.*: 225) which include important walrus food items such as *Clinocardium* [*Cardium*] and *Mya*, are typically found on clay and sandy clay bottoms at depths of 4 to about 45 m, and are usually fairly rich in both number of species and weight of animals per m<sup>2</sup>. *Gomphina fluctuosa* communities (= *Venus fluctuosa* community, Thorson 1934, Ockelmann 1958: 226) which includes both *Serripes groenlandicus* and *Astarte* sp., are also found in shallow waters. These communities have a more limited distribution in eastern Greenland than the *Macoma* communities, but a larger biomass per area (Ockelmann 1958).

Densities of bottom-dwelling invertebrates are generally much higher along the outer coasts in comparison with the inner parts of the fjords (Thorson 1937). Furthermore, in many of the fjords, water depths of over 100 m are found less than 100 from the shore (Berthelsen 1937) therefore limiting the distribution of potential walrus

feeding areas in the fjords to a narrow zone along the coast. According to Thorson (1937) these differences in the densities of bottom-dwelling invertebrates explain why walruses and bearded seals (*Erignathus barbatus*) prefer coastal areas and not the fjords.

South of Kangerittivaq (Scoresby Sund), typical walrus food items including *M. truncata*, *Astarte*, *S. groenlandicus* and *Macoma calcaria* (cf. Vibe 1950, Fay 1982) have been reported from the Kangerlussuaq and Tasiilaq areas. In the latter area, *Clinocardium* was also found (Thorson 1934, Berthelsen 1937, Ockelmann 1958). *Macoma* communities were found in the fjords of Sermilik, Ikerasaasuaq and Kuummiut in the Tasiilaq area; (Fig. 3), with an average density of 623 g per m<sup>2</sup> (Berthelsen 1937). The total fresh weight of the *Gomphina fluctuosa* community at Tasiilaq (Angmagssalik *sic!*) has been reported to be as high as 980 g per m<sup>2</sup> (Ockelmann 1958: 227). Thorson (1953) reported densities of *Clinocardium* in Kangerlussuaq of about 1000 g wet weight (including hard parts) per m<sup>2</sup>.

Further north at the entrance to Kangerittivaq and from Young Sund *Serripes*, *Mya*, *Astarte*, *Macoma*, *Clinocardium* and *Hiatella* have been reported. Walruses shot at Napparuutiligajik (Kap Swainson) and Appalik (Raffles Ø) have often been feeding on bivalves (Jens Thygesen, pers. comm. 1988). One walrus shot at Napparuutiligajik in April 1983 had been feeding on *M. truncata*. (Born 1983). *Macoma* communities were reported to be common throughout Kangerittivaq and Kejser Franz Joseph Fjord (Thorson 1933, Ockelmann 1958) with total fresh weights between 100 and 200 g per m<sup>2</sup> (Ockelmann 1958; see also Vibe 1939: 35). According to Thorson (1953), densities of benthic invertebrates found at 10 m depth at the entrance to Kangerittivaq were 350 g per m<sup>2</sup>. At Ittaajimmiit (Kap Hope), the *Gomphina fluctuosa* community was reported to have a fresh weight of 370 g per m<sup>2</sup> (Ockelmann 1958: 227).

However, in the inner parts of Kangerittivaq and in Kejser Franz Joseph Fjord at depths of 600-700 m, densities were much lower, being only about 1 g wet weight per m<sup>2</sup> (Thorson 1953). This probably explains why walruses do not occur in these areas.

Walrus fecal matter found in August 1994 on the beach of Sandøen (Young Sund) contained pericardia from *Mya* and opercula from *Buccinum* (Øystein Wiig, pers. comm. 1994). Walruses taken in the Sabine Ø – Hvalros Ø area had been feeding on *M. truncata* and *Hiatella* sp. [*Saxicava*] (Peters 1874, Payer 1877a,b).

Similarly walruses from the Dove Bugt area reportedly had been feeding on *Serripes*, *Astarte* and *Macoma* (Ockelmann 1958). Walrus feces found on Lille Snenæs (Dove Bugt) consisted of parts of *Mya* sp. and the decapod *Sclerocrangon* sp. (Born & Knutsen 1990b). Parts of *M. truncata* were found in the stomach of a walrus killed in north-eastern Dove Bugt (Ockelmann 1958:145). Johansen (1910) reported finding the remains of *Clinocardium* sp. and *Sclerocrangon* sp. in stomachs of walruses that were presumably taken in the Dove Bugt area.

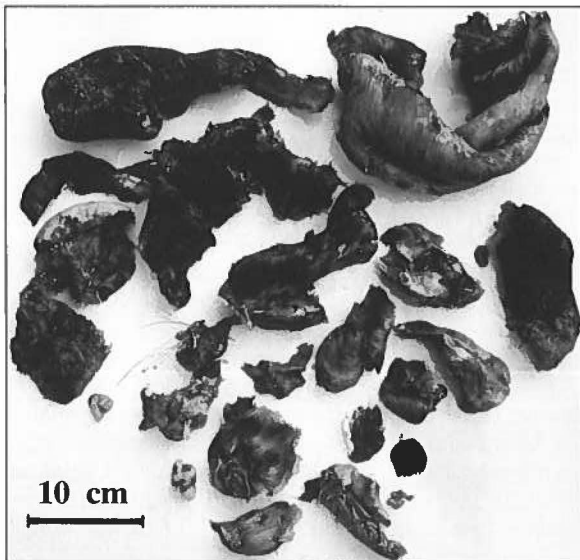


Fig. 31: Several reports of walrus that have killed and devoured seals exist from eastern Greenland (see text). The picture shows the contents of the stomach of a male walrus killed at the entrance to Kangerittivaq (Scoresby Sund) on 30 April 1983. Pieces of ringed seal skin that apparently had been sucked out by the walrus are seen. Photo: E.W. Born.

Less is known about walrus feeding and the bivalve communities north of Dove Bugt. Remains of shrimp were found in walrus feces sampled at Eskimonæs (approximately 80° 30' N) during May-June 1993 (Weslawski & Wiktor 1994), as well as *M. truncata* (40 mm original length), *Buccinum* sp., *Sabinea septemcarinata*, *Anonyx nugax*, and polychaetes (Weslawski *et al.* 1997). Dredging samples from Eskimonæs contained *Mya truncata*, *Hiatella arctica* and *Macoma calcarea* (*Ibid.*). Greenish-grey fecal staining of the ice on 3 June 1993 in the Antarctic Bugt (Figs 20 and 21) where walruses hauled out indicated that they had been foraging in the area (Born, unpublished data). In the Northeast Water area extensive banks with water depths of 200 m or less stretch up to 200 km offshore (*e.g.* Schneider & Budéus 1994). These banks presumably offer foraging opportunities for walruses during winter. High biomass has been found locally on these banks in areas where the megabenthic fauna consisted mainly of brittle stars, sea urchins, and several species of shrimp (including *Sclerocrangon*) (*e.g.* Piepenburg 1988, Ambrose *et al.* 1994, Piepenburg *et al.* 1995). These taxa have, however, only been reported as being walrus food to a limited degree (*cf.* example Chapskii 1936, Mansfield 1958, Fay 1982, Fay *et al.* 1984).

*Mya* and *Macoma* have been found in Jørgen Brønlund Fjord north of the Northeast Water (Ockelmann 1958).

Walruses that had fed on vertebrates were reported from eastern Greenland. Pedersen (1942) found polar cod (*Boreogadus saida*) in a walrus from Dove Bugt on 3 August 1939. A number of observations of walruses which

had preyed on seals have also been reported from these areas (Gray 1889, 1927, 1933, 1942, Johansen 1910, Pedersen 1930, 1951, Born 1983). For example, Gray (1927, 1942) referred to an observation of a walrus having a ringed seal in its mouth in June 1887 at 73° 40' N – 16° W, Pedersen (1930) described how a young male walrus in Kangersaajua (Hurry Fjord) pushed a ringed seal up onto an ice floe and devoured it (Fig. 31).

Gray (1927, 1929) described an episode from 6 July 1879 where a walrus flensed a narwhal (*Monodon monoceros*) at 78° 03' N. Another mutilated narwhal, found off the coast of eastern Greenland in July 1890, was thought to have been killed by a walrus (Gray 1929). Giæver (1955) referred to an event where a group of walruses attacked and killed a polar bear (*Ursus maritimus*). In April 1983, a recently shot polar bear which was drifting at the ice edge near the entrance to Young Sund was grabbed by a walrus and dragged away under water (Ole Brønlund, pers. comm. 1983).

## Discussion

### Distribution

The assessment of the occurrence of walruses in eastern Greenland presented in this report is based on observations made over a long period of time. Inevitably, any account of walrus 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. Nevertheless, the inferred distribution based on recent observations from aircraft and ice-breaking vessels to a large extent supports the general picture derived from historical information. The major differences, which are directly related to improved survey techniques and accessibility to the east coast of Greenland, are the findings that: (1) Walruses occur year round and are relatively abundant in the Northeast Water area and (2) they can winter in offshore pack ice over deep waters at high latitudes.

The seasonal distribution of observations also reflect the human settlement pattern and travelling activity. South of Dove Bugt observations of walruses have also been recorded during the winter months in areas where Greenlanders, European hunters and station personnel have wintered. During summer a larger proportion of the recorded observations have been made by hunting parties, sealers, expeditions etc. visiting these areas. Observations in Dove Bugt have been made mainly by wintering parties (station personnel and hunters) whereas north of Dove Bugt nearly all observations have been recorded during recent expeditions visiting the area comparatively early in the season.

Overall, most observations have been made between May and September. Walruses generally occur closer to the coasts during this period due to break up of the fast



ice, and are therefore more likely to be observed. Furthermore, light and weather conditions during this period favor increased activity by expeditions, hunters, station personnel etc. Therefore, information about walrus wintering is inevitably under-represented.

Information about walruses was extracted from 83 unpublished journals, as well as from other unpublished sources primarily written by Norwegian and Danish trappers in the 1930s to 1950s. The journals searched represent a selection from known journals. Based on his previous study of 199 journals in Danish and foreign private and public archives (*cf.* Mikkelsen 1994), Mr. Mikkelsen kindly helped identify those that were likely to contain information about walruses. The criterion for selection was either that the informant had stayed or traveled in areas where walruses are known to occur, or that the writer had kept his journal during the open-water period when walruses usually were encountered (Danish trappers usually did not keep a journal during the summer when there was no trapping activity; Peter Schmidt Mikkelsen pers. comm. 1994). Because the survey of these unpublished sources was selective, it is possible that some interesting information has been missed. However, most of the journals that were expected to have information about walruses actually contained little or unspecified information. Overall about one quarter of *all* sources searched contained information about walruses.

In several cases exact information about numbers of animals seen or killed and the location was missing or the information was uncertain. This must be kept in mind when interpreting presentations of distribution and numbers.

However, despite these limitations we do believe that the data presented here are representative in both time and space and that they reflect the historical and present distribution of walruses in eastern Greenland with a high degree of accuracy.

Our survey did not reveal any observations of walruses north of about 81° N. Walruses may, however, have occurred north of Nordostrundingen during periods with less severe ice conditions (Bennike 1997). A lack of polynyas north of the Northeast Water and a dense sheet of shore-fast consolidated multi-year pack ice at Nordostrundingen (The Ob' Bank Ice Shelf; Minnett *et al.* 1997) perhaps prevent walruses from occurring north of about 81° N.

The walruses in northeastern Greenland have apparently benefitted from the protection provided in the 1950s, and have subsequently expanded their range. For example, they have reoccupied northern Dove Bugt and the Young Sund area where they have resumed the habit of using the previously abandoned terrestrial haulouts. Furthermore, during an interview survey in 1983 (Born 1983) residents of Ittoqqortoormiit (Scoresbysund) expressed that they believed that walruses had become more regular visitors to the entrance to Kangertittivaq in the late 1970s – early 1980s, presumably due to an overall increase in the walrus population further north.

Historically, when walruses were much more abundant in eastern Greenland (this study) and at Svalbard (*e.g.* Lønø 1972, Gjertz & Wiig 1994), exchange between these two areas was likely to be more frequent, perhaps also showing some fluctuation in relation to changing ice conditions.

## Migrations and offshore observations

Pedersen (1942) suggested that the uneven sex-ratio observed, with an apparent surplus of males, reflected the fact that walruses in eastern Greenland are mainly immigrants. He claimed that males generally tended to migrate further than females, and that the heavy pack ice and the deep water of the Greenland Sea area prevented the walruses from migrating from the Svalbard to eastern Greenland. Pedersen was of the opinion that walruses migrated from northwestern Greenland along the shores of North Greenland. However, during a review of observations of walruses and other wildlife in North Greenland, Dietz & Andersen (1984) found no records of observations of walruses along the northern coasts of Greenland.

Studies of variation in mitochondrial DNA showed the haplotype of 10 male walruses from the Kangertittivaq area to be distinctly different from that in 10 walruses sampled in the Avanersuaq (Thule) area in northwestern Greenland (Cronin *et al.* 1994). Hence, a connection between walruses in northwestern Greenland and eastern Greenland seems unlikely.

Offshore observations summarized in this study indicate a connection between walruses in northeastern Greenland and the Svalbard area. An observation of a walrus, which had been tagged in Dove Bugt in 1989, in 1992 near the island of Moffen (northwestern Svalbard) (Born & Gjertz 1993) proved that there is some exchange between northeastern Greenland and Svalbard. Walruses occurring in western Svalbard (*i.e.* in the Spitsbergen area) during summer are primarily males from a population that extends eastwards to the Franz Joseph Land archipelago (Born 1984, Gjertz & Wiig 1995). Satellite telemetry revealed that adult male walruses migrate between Svalbard and Franz Josef Land (Wiig *et al.* 1996). These studies suggest that adult male walruses are more migratory than females, and that males in particular could be expected to migrate between northeastern Greenland and the Svalbard region.

A study of mitochondrial DNA showed that three animals out of ten walruses sampled from Central West Greenland had a haplotype which was also found in walruses from Eastern Greenland (Cronin *et al.* 1994). This indicates that some genetic mixing has occurred between eastern Greenland and Central West Greenland. Walruses are occasionally caught in southwestern Greenland in the period January to August (Born 1990). However, these could be stragglers from either eastern Greenland or from Central West Greenland.

Thus, the information reviewed here indicates that walrus occur in eastern Greenland all year round and that they form a group which is, to a large extent, geographically isolated. This group may have some contact with walrus in the Svalbard-Franz Joseph Land area, although the extent of which is not known.

## Identification by use of natural marks

A combination of different natural marks were used for studying walrus numbers and activity in Dove Bugt, and for demonstrating movements in eastern Greenland. Vishnevskaja & Bychkov (1985:5) used natural "tags" (*sic!*) to identify 56 Laptev walrus (*O.r. laptevi*) for studying local activity at a haulout in M. Pronchishchev Bay. In 1988 Maagaard (1990) identified 41 different walrus at Lille Snææs. However, neither of these studies presented any information about methods and marks used for identification.

In the present study tusk length was used for initial identification. As tusks grow throughout life, their length can be used as a rough estimator of individual age. However, after sexual maturity has been attained the growth rate decreases and wearing of the tip may balance or surpass growth, so that old animals may have relatively short tusks (*e.g.* Mansfield 1958, Fay 1982). The rate of tusk wear at Lille Snææs appeared to be highly variable. Judging from body size and the width at the base of the tusks some animals which appeared to be young had heavily worn tusks whereas the tusks of some large and apparently old males were only slightly worn. The tusks of about half of the identified animals were heavily worn or broken. However, in some cases the shape of the fracture was useful for confirming matches. Nevertheless, tusk length has obvious limitations as a character for use in identification and can only be used in combination with other characters.

Asymmetric growth of tusks had resulted in some animals having tusks differing in angle relative to the medial plane of the head, and in size and shape. These differences served as a useful tool for identification. After animals have reached sexual maturity and the growth of the skull has slowed down (Fay 1982), the relative angle of the tusks is not likely to change significantly. This implies that this character might be useful for identification over a long period of time. However, correct identification of such animals from photos depends largely on the angle of view. The distortion of the tusks was not apparent on some photos taken from certain angles, thereby limiting the use of this character for identification.

In some cases patterns of longitudinal dark lines (cracks) in the tusk ivory served as a reliable mark for identification (Figs 16 and 17). However, if the photos were over-exposed or if there were reflections from the wet ivory these lines were difficult to detect.

Old bulls in particular have numerous tubercles on the

neck and thorax region (*e.g.* Mansfield 1958, Fay 1982). According to Mansfield (1958) these tubercles increase in size during life. Our study indicates that tubercles remain in the same position for several years and therefore can be used for identification of individuals. The pattern of tubercles is particularly clear and visible on photos of wet animals. Furthermore, the skin of the head and neck region has many wrinkles and folds. Chapskii (1936) noted that the skin of the walrus retains a characteristic pattern of folds from the embryonic stage until the end of life. Fay (1982) presumed the pattern of folds remains more or less constant during lifetime and that it is unique for each individual. The finding of an animal in which a characteristic pattern of wrinkles in the forehead had remained unchanged between 1982 and 1990 (Fig. 15) supports this assumption.

About 16% of the walrus catalogued had unpigmented or lightly pigmented scars in the head region. These scars presumably result from tusk stripe and contact with ice (*e.g.* Chapskii 1936). Although it was found with one animal that these scars remained unchanged for a three year period, our study did not determine how long such scars remain. However, it was found that the patterns of such scars were useful for individual identification in combination with other characters.

These methods may also be useful for identifying adult females and subadults. Sometimes females and subadults are also heavily scarred and their tusks can be worn and broken (*e.g.* Fay 1982, Mansfield 1958). However, photo-ID is likely to be a less practical tool for studying female walrus. Females with young tend to be more shy than adult males, which implies that it will be more difficult to obtain systematic photographic documentation of females.

## Catches and catch composition

The majority of the walrus catch in eastern Greenland was taken by Norwegian sealers. However, information on the position and the magnitude of the Norwegian catches in this area is generally inadequate. Catches were not always reported by area but more often by port of landing in Norway, and the Norwegian system of registration of catches was not organized until 1924 (Isachsen 1922, Isachsen & Isachsen 1932, Krogh 1932). During the review of catches it was assumed that only ships reporting catches of walrus with the area of operation as "East Greenland", "Jan Mayen" or "The West Ice" (*i.e.* the term used by Norwegian sealers for the pack ice between Svalbard and eastern Greenland) had caught walrus in eastern Greenland. The statistics from other ships reporting catches at Svalbard and in any of the above mentioned areas were not included. For these reasons, the catch reviewed in this study is likely to be an under-estimate.

Greenland catch statistics are incomplete. Catches are generally under-reported in the HLG, and information is incomplete or not available for many years (*e.g.* Born *et*



al. 1994a, Kapel & Rosing-Asvid 1997). By January 1993, a new system of reporting the catch on a voluntary basis – the “Piniarneq” – came into force in Greenland (see Anon. 1994b, Kapel & Rosing-Asvid 1996). According to Piniarneq 10, 60 and 8 walrus were reported for the municipality of Tasiilaq/Ammassalik in 1993, 1994 and 1995, respectively (unpublished data *in litt.* 1997 from the Department of Fishery, Hunting and Agriculture, Nuuk). However, when local informants were later contacted directly it was revealed that during these years a total of only three walrus had been taken (A. Rosing-Asvid *in litt.* 1997). According to Piniarneq, 5, 26 and 46 walrus were reported for the municipality of Ittoqqortoormiit in 1993, 1994 and 1995, respectively, when in fact only 11, 6 and 2 had been taken (Jonas Brønlund, *in litt.* 1994; pers. comm. 1997). In these cases it is likely that summaries of the catch of other species (e.g. polar bears?) had been recorded as walrus in “Piniarneq”. Kapel & Rosing-Asvid (1997) concluded that “there is a need for a more close and detailed review of the results obtained from the new system of collecting information on hunting results in Greenland, in order to evaluate its efficiency and draw conclusions on the actual level of catches”.

Only limited information was found about the sex of walrus killed by the sealers operating in eastern Greenland. However, this review indicates that adult males were taken selectively at least in some areas and during certain periods. To some extent this reflects the fact that males were easier to observe and kill, because of their habit of occurring inshore at terrestrial haulouts. The statement in the hunting regulations (Jennov 1939b, Giæver 1939) specifying that hunters should avoid killing females with calves indicates, however, that these were also regularly available.

## Estimation of present population size

Historical data summarized in this study indicate that the number of walrus south of approximately 77° N was severely depleted when walrus first became protected in northeastern Greenland in 1950.

Vibe (cited pers. comm. in Reeves 1978) estimated that there were only about 200 walrus in eastern Greenland, and he believed that the population had increased during the preceding decade. Fischer (1983) considered the population size to be in the same order of magnitude. However, no basis for these estimates was given.

The estimate of the walrus population in eastern Greenland today given in this study is between 500 and 1000 animals. The reasoning behind this estimate is, however, complex. An attempt to explain this reasoning is given in the following numbered discussion:

1) The estimate of 100 males in northern Dove Bugt and in Young Sund is based on recent observations, activity data and natural markings. It is meant to include all

animals summering in these areas where Andersen (1984) observed only few walrus. We therefore added this estimate to the direct count of 329 given by Andersen (1984) for the areas between Nordostrundingen and the entrance to Kangertittivaq/Scoresby Sund, giving a total of at least 429.

2) We applied a correction factor of 2.27 (assuming that the animals are available for detection on ice or at surface for 44% of time) to the aerial counts in the North Water area. This gives an estimate of 200-250 for the “North Water group” during late spring 1993.

3) The proportion of radio-instrumented (satellite-linked and VHF) male walrus that hauled out at terrestrial haulouts in Bristol Bay (Alaska) during peak periods averaged 0.55. During a maximum count day, this proportion was 0.83 (Hills 1992a: 61). For walrus fitted with VHF-transmitters at Round Island (Bristol Bay) in 1980, the proportion ashore during six peak haul out periods averaged 0.76 (SD=0.13; range: 0.53-0.92) (Taggart 1987 *vide* Hills 1992a). These maximum proportions can be interpreted as estimates of the maximal fraction of the population hauled out at any one time. In the Bering and Chuckchi Sea, female walrus equipped with satellite-linked radio transmitters spent 66% to 75% of their time in the water during spring and summer (Hills 1992b:107). However, Hills (1992b) also pointed out that: “There is little reason to believe that the availability correction factor would be the same for animals using ice and land haulouts and may well differ for the same haulout type in different geographical areas or different seasons”.

The study at the Lille Snenæs haulout provided some information about the proportion of animals potentially missed during surveys (Born & Knutsen 1997, this study). In 1989-90 only 50-87% of the walrus using a haulout occurred there on “peak” days in August. During 18 August 1989, when the “mark-resight” estimate indicated that about 40 walrus used Lille Snenæs and therefore likely to be present in Dove Bugt, the aerial reconnaissance and the ground count documented the presence of only 20 walrus in the area.

Correction factors (assuming 50% or 87% of walrus hauled out on peak days) applied to Andersens’ count result in estimates of between 658 and 378 walrus in east Greenland.

We recognize the potential for grossly under-estimating number of walrus in an area if survey data are not properly adjusted to account for walrus haul-out activity in that area. Factors other than the number of walrus hauling out can affect survey results. During aerial surveys walrus at the water surface may be difficult to detect (e.g. Estes & Gilbert 1978) while some may not be visible at all because they are submerged. Foraging walrus for example are submerged about 80% of the time (Wiig *et al.* 1993, Born & Knutsen 1997).

However, it is believed that a rough estimate of 1000, including compensatory adjustments for animals missed during surveys or present in areas not surveyed, is closer to the real order of magnitude than an estimate of 500.

Walrus are highly gregarious (e.g. Fay 1982, Miller & Boness 1983, Hills 1992a,b). Therefore, in areas where they are abundant, large concentrations can be encountered. The complete lack of observations of large groups or herds in eastern Greenland suggests that the abundance is generally low. This, together with the data from Andersen (1984) and the 1993 and 1994 reconnaissance aerial surveys which covered essential walrus habitat, suggest that the population estimates presented here approach the real order of magnitude.

## Estimation of historical population size

The estimates of historical population size at the beginning of the 1889 season ranged roughly between about 700 and 1900 animals. Using an annual net recruitment rate of 4.8% resulted in estimates of the historical population of about 900 walrus.

Because there was no information available about a possible lag between the reduction of walrus population density and a compensatory increase in the population's recruitment rate, we did not incorporate any lag-time parameter into the model (cf. Breiwick *et al.* 1981). At any rate, this parameter had only a minor effect on back-calculations of bowhead whale (*Balaena mysticetus*) population size (*Ibid.*).

In calculating historical population size of harbor seals (*Phoca vitulina*), Heide-Jørgensen & Härkönen (1988) incorporated a factor  $F$  to account for animals killed in year  $t$  that were assumed to have reproduced earlier during the same year. Therefore, when calculating historical population sizes the estimates of the number of animals caught in season  $t$  may be increased by factor  $F$  to adjust for loss of neonates and/or under-reporting of this age class.

Most of the annual harvests of walrus in eastern Greenland have taken place during the open water period (*i.e.* at or just after the birth season which peaks between mid-May and early June according to Vibe (1950) and Mansfield (1966, 1973). Although some abandoned calves may be adopted by foster mothers under particular circumstances (Fay 1982), the number of such adoptions is apparently small, and there is no certainty that the adopted calves will survive. Walrus have a much longer period of parental care (cf. Fay 1982) than for example harbor seals, so the chances of survival of an unweaned walrus orphan are probably much less than those of a harbor seal pup. In addition, the kill of neonates was presumably often not reported because of the insignificant yield of products from small calves.

Estimates of the population birth rate (fraction of neonates in the total population) in eastern Greenland are not available. However, the estimates of the population birth rate in Atlantic walrus of 7 to 11% (Mansfield 1966, 1973) probably represent the higher bounds of the factor  $F$ .

However, despite its obvious relevance we did not incorporate a factor  $F$  in calculations of historical popula-

tion size due to a nearly complete lack of information about sex and age composition of the catch and the crude birth rate of the walrus population in eastern Greenland. We suggest that the corrections already applied to the catch data to encompass unretrieved kills (20 to 26.5%) also include the additional mortality of neonates.

Mortality rates of 2% and 5% per year were used assuming there was no extraordinary, large-scale natural mortality (e.g. diseases, "mass mortality") during the period involved. Natural mortality rate of walrus is not well known, but is assumed to be low because productivity is relatively low and the longevity is high (Fay 1982). Fay *et al.* (1994) suggested that natural mortality is greater than 1%, but is probably not above 2% per year. However, in our back-calculations the different estimates of natural mortality had only minor effect on the estimates of historical population size.

Although Fay *et al.* (1989) indicated that the maximum net recruitment rate may be lower than 2% for a population at carrying capacity, it is suggested here that the maximum net recruitment rates of 2% and 7% used in calculations of historical populations size in eastern Greenland bounds the plausible values. There was some indication that the number of male walrus on the Lille Snenæs haulout has increased since the early 1950s, by a rate of about 4.8% per year. In a hypothetical walrus population with a highly skewed sex composition (1 male:3 females), an adult female harvest at 'maximum sustainable yield' of between 2% and 5% appeared to be sustainable provided that natural mortality was fairly low (DeMaster 1984). Empirical data indicate that between 1960 and 1975, the Pacific walrus population increased at about 7% per year under favorable environmental conditions (low density of walrus in relation to carrying capacity) and during a regime of catch (Sease & Chapman 1988, Fay *et al.* 1989, 1997). During this period the sex composition in the population was thought to be 1 male to 2-3 females (Fay *et al.* 1997). The limited information about the sex composition in the walrus population in eastern Greenland (this study) does not suggest that it is skewed in favor of females. The sex composition in eastern Greenland is therefore assumed to be 1:1.

Because of inadequate data, back-calculations of population size did not consider potential age – and sex selective harvest. The limited information from the records made by Danish and Norwegian trappers indicate, that their catch consisted primarily of large males (this study). However, prior to this hunting activity, large catches were taken for which no information on sex and age composition is available. Females clearly occurred and were taken in the central parts of eastern Greenland as indicated by for example records from the 1920s from the Scoresby Sund area, and the early hunting regulations (see section Regulations).

Given that walrus foraging areas in eastern Greenland are of limited extension (see section Foraging and foraging areas) and that severe ice conditions (e.g. Koch 1945) prevent walrus from reaching their inshore for-

aging grounds during some summers, it is likely that population growth has been slow and that the calculations based on an annual net increment of 2% are more representative than those assuming 7%. On the other hand, in some areas and during certain periods, the hunt may have targeted more males than females. Theoretically, this pattern of exploitation would allow for a larger population net increase and a faster population recovery.

The calculations of historical population size assumed a constant carrying capacity. It is possible that during cold seasons the fast ice will cover larger areas and that the fast ice will break up later, or in some cases will not break up at all. Such changes may influence benthic productivity as well as accessibility to inshore mollusk banks, and thereby the carrying capacity of walruses. According to Vibe (1967) there are indications that during the 19th century and most of the 20th century, temperature and off shore pack ice conditions in the east Greenland area have showed some fluctuations. We have, however, not been able to find any information about long term changes in temperatures or fast ice cover in eastern Greenland during the period in question (*i.e.* 1889-1994) allowing for further speculations about these relationships.

Furthermore, density-dependent responses to the changing carrying capacity (food resources) may be expected when the walrus population itself impacts on their benthic prey (Fukuyama & Oliver 1985, Fay *et al.* 1989). Bivalves, which constitute the major food source, are known to be nearly as long lived as walruses, and have a very slow recovery (*e.g.* Fay & Stoker 1982a,b, Fay & Lowry 1981). The siphon of *M. truncata* is a principal component of the diet of walruses (*e.g.* Vibe 1950, Fay *et al.* 1984). Welch & Martin-Bergmann (1990) concluded that *M. truncata* which have been grazed upon by walrus die shortly after the loss of their siphons. However, we have no information about the dynamics between the walruses and the densities of their primary food sources in eastern Greenland. Thorson (1953) estimated that regeneration of mollusks in Kangerlussuaq would take 12-14 years after complete extermination from "grazing" by walruses and bearded seals, and suggested that this is the reason why these marine mammals have to use different feeding grounds from year to year. This statement is, however, not consistent with the fact that walruses occur in eastern Greenland every summer in relatively few and limited areas.

## Foraging and foraging areas

The densities of benthic walrus prey reported from eastern Greenland indicates that food is abundant at least locally. Densities of bivalve communities reported in eastern Greenland are comparable to those reported from walrus habitats in western Greenland. At Qeqertarsuaq (Disko) in western Greenland the *Macoma* communities

had an average biomass (wet weight) of 36.0 and 313.0 g per m<sup>2</sup> in sheltered and exposed localities, respectively (Petersen 1978). In northwestern Greenland biomasses were about 390 g per m<sup>2</sup> in the Upernavik area (Vibe 1939), and about 450 g per m<sup>2</sup> on walrus foraging banks in the Avanersuaq (Thule) area (Vibe 1950).

A factor which may limit the growth of the walrus population in eastern Greenland is likely to be accessibility to the inshore feeding areas. Accessibility may be restricted in certain years when the fast ice does not break up. For example, in some years the fast ice in Dove Bugt does not break up (*e.g.* Johansen 1910).

Fast ice excludes the walruses from reaching their inshore feeding grounds for a major part of the year in several areas in eastern Greenland. It is therefore likely that walruses survive the winter by feeding to a large extent on polar cod (*Boreogadus saida*) and seals for example. Feeding facultatively on seals during winter may explain why walruses occurred for prolonged periods of time offshore in areas with relatively deep waters as revealed by satellite telemetry (Born & Knutsen 1992).

## Acknowledgements

This study was funded by Aage V. Jensen Foundation, the Commission for Scientific Research in Greenland (KVUG), The Greenland Institute of Natural Resources and the Department of Arctic Environment (National Environmental Research Institute). We wish to express our thanks to all the people who provided information about walruses in eastern Greenland, in particular Knud Fischer, the Geological Survey of Greenland, Ian Gjertz (Norwegian Polar Institute), Nunatek, Sirius Military Patrol, the late Jens Thygesen and the inhabitants of the Tasiilaq and Ittoqqortoormiit municipalities. Also thanks to Lars Maagaard and René Søder who provided us with photos of walruses at Lille Snenæs. Peter Schmidt Mikkelsen kindly gave us valuable information extracted from some hunters' journals and helped us identify journals containing specific information about walruses. We are grateful for the help that we received from the staff of the libraries at the Scott Polar Research Institute (Cambridge), the Museum of Tromsø and the City of Tromsø, Norwegian Polar Institute (Oslo), and Arktisk Institut (København). Will C. Knutsen is thanked for providing us with photos of former days Norwegian hunting.

We are most indebted to Jonas Brønlund for organizing the collection of biological samples in Ittoqqortoormiit (Scoresbysund) and to the hunters who collected the samples. Hardy Larsen is thanked for age determination of the samples. Jette Jensen, Jonas Teilmann and Mario Acquarone kindly assisted in drawing the maps.

We wish to thank Alfred Wegener Institute für Polar- und Meeresforschung (Bremerhaven and Potsdam), the crews of RV *Polarstern* and the pilots Jürgen Büchner, Uwe Lahrman and Ditlev Schreiber (Helikopterservice

Wasserthal). Our colleagues Jørn Thomassen (Norwegian Institute for Nature Research, Trondheim) and Øystein Wiig (Zoological Museum, Oslo) are thanked for their pleasant company and participation during the aerial surveys.

We thank Ian Gjertz, Godtfred Høpner Petersen (Zoological Museum, Copenhagen) and Randall R. Reeves (Okapi Wildlife Associates, Hudson) who reviewed this paper and offered useful criticism.

# References

- Akre, B. 1957. *Fri Manns Liv*. – Oslo, Gyldendals Norsk Forlag: 143 pp.
- Ambrose, W., Ahrens, M., Brandt, A., Dimmler, W., Graf, G., Gutt, J., Herman, R., Jensen, P., Piepenburg, D., Queisser, P., Renard, P., Scheltz, A. & Thomsen, L. 1994. Benthos, 106-112. – *In*: H.-J. Hirsche & G. Kattner (eds.). The 1993 Northeast Water Expedition Scientific cruise report of RV "Polarstern" Arctic cruises ARK IX/2 and 3, USCG "Polar Sea" cruise NEWP and the NEWLand expedition. – *Berichte zur Polarforschung* 142: 190 pp.
- Amsj , E. 1947-48. *Dagbok*, Kap Humboldt, 1947-48. Unpublished journal Code P105. – Oslo, Norsk Polarinstittut. Available at the library of Norsk Polarinstittut, Middelthunsgate 29, P.O. Box 5072, Majorstua N-0301 Oslo.
- Amtrup, G. 1913. Report on the Denmark Expedition to the North-East Coast of Greenland 1906-1908. – *Meddr Gr nland* 42: 1-270, plates I-X.
- Andersen, J. 1982. Ekspeditionsrapport for Kaptajn Ejnar Mikkelens Mindeekspedition 1980. Scoresbysund – Angmagssalik. – K benhavn, Eget Forlag: 115 pp.
- Andersen, J. 1984. Zoologiske observationer fra Kajak-ekspeditionen Station Nord til Scoresby Sund. – Unpublished. Held at Department of Arctic Environment (National Environmental Research Institute), Tagensvej 135, DK-2200 Copenhagen N.
- Andreasen, C. 1995. NEWLand: the archaeology, p.5 – *In*: Book of Abstracts. NorthEast Water Polynya Symposium 1-5 May 1995, Helsing r, Denmark: 87 pp.
- Andreasen, C. 1997. The prehistory of the coastal areas of Amtrup Land and Holm Land adjacent to the Northeast Water Polynya: an archaeological perspective. – *J. Mar. Syst.* 10 (1-4): 41-46.
- Andresen, H. 1927-29. *Dagbok fra Hird-ekspeditionen*, 1927-28-29. Unpublished journal Code N032. – Oslo, Norsk Polarinstittut. Available at the library of Norsk Polarinstittut, Middelthunsgate 29, P.O. Box 5072, Majorstua, N-0301 Oslo.
- Andresen, H. 1930-31. *Dagbok fra M re Gr nlandsekspeditionen*, overvintring p  Østgr nland 9.7. 1930-14.8. 1931. Unpublished journal Code N033. – Oslo, Norsk Polarinstittut. Available at *Ibid*.
- Andresen, H. 1931-32. *Dagbok fra overvintringen p  Østgr nland fra 15.08.1931 til 16.08.1932*. Unpublished journal Code N031. – Oslo, Norsk Polarinstittut. Available at *Ibid*.
- Andresen, H. 1934-36. *Dagbok f rt under overvintring p  Gr nland, 1934-1936*. Sul ya Gr nlandsekspedisjon. Unpublished journal Code N035. – Oslo, Norsk Polarinstittut. Available at *Ibid*.
- Anonymous 1898-1913. *Norsk Fiskeritidende*. – Bergen, J. Griegs Boktrykkeri.
- Anonymous 1920. *Oversigt over Produkter hjemsendt 1920* (Summary of products shipped in 1920). Unpublished report A267 Lb. nr. 32. – Copenhagen, Arktisk Institut. Available at the archives of Arktisk Institut, Strandgade 100H, DK-1401 Copenhagen K.
- Anonymous 1919-20. *Nogle Optegnelser vedr rende Fugle- og Dyreliv*, Sabine Ø 1919-20 (Some observations of animal life, Sabine Ø 1919-20). Unpublished report A267 Lb. nr. 37. – Copenhagen, Arktisk Institut. Available at *Ibid*.
- Anonymous 1921. *Oversigt over Produkter hjemsendt 1921* (Summary of products shipped in 1921). Unpublished report A267 Lb. nr. 33. – Copenhagen, Arktisk Institut. Available at *Ibid*.
- Anonymous 1929-31. *Journal fra Germaniahavn og Hvalrosodden*. Unpublished journal A265 Lb. nr. 144. – Copenhagen, Arktisk Institut. Available at *Ibid*.
- Anonymous 1932. *Den norske Regjerings Motinnlegg ang enden rettslige Status for visse Deler av Østgr nland*. Fremlagt for Den faste Domstol for mellemfolkelig Rettspleie 15. Marts 1932. – Oslo, Fabricius & S nner: 324 pp. + appendices.
- Anonymous 1933-36. *Journal fra Hvalrosodden*, 11. August 1933-24. Oktober 1934; 9. Maj 1935-10. Marts 1936. Unpublished journals A265 Lb. nr. 144. – Copenhagen, Arktisk Institut. Available at the archives of Arktisk Institut, Strandgade 100H, 1401 Copenhagen K.
- Anonymous 1936-37. *Bilag II*, Bogen [?], 10. Juli 1936-14. April 1937. – Manuscript A265 Lb. nr. 296. – Copenhagen, Arktisk Institut. Available at *Ibid*.
- Anonymous 1938a. *Fredning af Dyrebestanden i Nord stgr nland*. – K benhavn, Levin & Munksgaard. Publikationer om Østgr nland Nr. 6: 50 pp.
- Anonymous 1938-39. *Journal fra Sandodden*. – Unpublished journal A265 Lb nr. 148. – Copenhagen, Arktisk Institut. Available at the archives of Arktisk Institut, Strandgade 100H, 1401 Copenhagen K.
- Anonymous 1944. *Sammendrag af Statistiske Oplysninger om Gr nland III*. – *Beretninger vedr rende Gr nlands Styrelse* 1: 561-665.
- Anonymous 1950. *Bekendtg relse af 1. december 1950 vedr rende fredninger i Nord stgr nland*. – *Kundg relser vedr rende Gr nland* Nr. 12 (Journal nr. 10457/1947). Statsministeriet nr. 528: 357-360.
- Anonymous 1950-52. *Journal fra "Aalborghus" Station*, 1950-52. – Unpublished journal Code G121; Mogens Graae Private Collection (see Mikkelsen 1994).
- Anonymous 1952. *Fredning av hvalros*. – Kongelig resolusjon av 20. juni 1952. Oslo, Norway.
- Anonymous 1954-1987. *Sammendrag af Gr nlands Fangstlister* (Summaries of Hunters' Lists of Game). – Until 1984 the Ministry for Greenland, Copenhagen, Denmark; 1985-1987, Ministry of Fisheries, Nuuk, Greenland.
- Anonymous 1956. *Bekendtg relse nr. 218 vedr rende fredninger i Nord stgr nland*. – *Kundg relser vedr rende Gr nland*, Afsnit 16, Gruppe 13, lb. nr. 10. 31. juli 1956. Ministeriet for Gr nland: 3 pp.
- Anonymous 1976. *Executive Order on the National Park in Northern and Eastern Greenland*, 25 June 1976. – Ministry for Greenland J. nr. 1780-06: 5 pp.
- Anonymous 1985. *Landstingslov nr. 5 af 8. juni 1985 om Gr nlands inddeling i landsdele og kommuner*. – *Offentligg relse af landstingslov*. Gr nlands Hjemmestyre, ISSN 0107-346X: 9 pp.
- Anonymous 1986. *Annex F. Report of the Sub-Committee on Northern Hemisphere Minke Whales*. – *Rep. int. Whal. Commn* 36: 79-85.
- Anonymous 1987. *Hjemmestyrets bekendtg relse nr. 16 af 16. juni 1987 om Nationalparken i Nord- og Østgr nland*. – Nuuk. *Offentligg relse af Hjemmestyrets bekendtg relse*, ISSN 0107-3214: 8 pp (order no. 16 of 16 June 1987 from the Greenland Home Rule Authority concerning the National Park in North and East Greenland).
- Anonymous (year not stated). *Vejledning i Behandling af Fugle og Pattedyrskind*. *Fangstmetoder m.m. Hvalros og S l* (Instruction in treatment of skins of birds and mammals. Hunting methods etc. Walrus and seals). Unpublished manuscript from "Nanok" A267 Lb. nr. 69. – Copenhagen, Arktisk Institut. Available at the archives of Arktisk Institut, Strandgade 100H, DK-1401 Copenhagen K.
- Anonymous 1994a. *Cruises ARK IX/2 and 3*. Introduction, p.1-9. *In*: H. J. Hirsche & G. Kattner (eds.). The 1993 Northeast Water Expedition Scientific cruise report of RV "Polarstern" Arctic cruises ARK IX and 3, USCG "Polar Sea" cruise NEWP and the NEWLand expedition. – *Berichte zur Polarforschung* (Bremerhaven) 142. '94: 190 pp.



- Anonymous 1994b. Hjemmestyrets bekendtgørelse nr. 19 af 11. maj om fangst af hvalros ved Grønland. – Nuuk, Offentliggørelse af Hjemmestyrets bekendtgørelse: 7 pp.
- Anonymous 1995. Report of the *ad hoc* Working Group on Atlantic Walrus. Annex 2, 101-119. – In: NAMMCO (North Atlantic Marine Mammal Commission) Annual Report 1995; Tromsø, Norway: 186 pp.
- Bang, O. 1944. Blant Fangstfolk og Bikkjer i Eirik Raudes Land. – Oslo, Kamban Forlag: 221 pp.
- Bay, E. 1894. Hvirveldyr, 1-58. In: Den Østgrønlandske Expedition udført Aarene 1891-1892 under ledelse af C. Ryder. – Meddr Grønland 19: 272 pp.
- Bengtsson, M. 1927. Ene med Dyr og Mennesker. Et Aar i Scoresby Sund. – København, Steen Hasselbalchs Forlag: 229 pp.
- Bennike, O. In Press. Quaternary vertebrates from Greenland: a review. – Quaternary Science Reviews.
- Berthelsen, E. 1937. Contributions to the Animal Ecology of the Fiords of Angmagssalik and Kangerdlugssuaq in East Greenland. – Meddr Grønland 108(3): 58 pp. + 2 plates.
- Bjørnlo, M. 1909-10. Dagbok. Overvintring på Østgrønland, 1909-1910. Unpublished journal Code N086. – Oslo, Norsk Polarinstittut. Available at the library of Norsk Polarinstittut, Middelthunsgate 29, P.O. Box 5072, Majorstua, N-0301 Oslo.
- Boertmann, D., Forchhammer, M. & Meltofte, H. 1990. Biologisk-arkæologisk kortlægning af Grønlands Østkyst mellem 75° N og 79° 30' N. Del II: Optællinger af fugle og pattedyr mellem Bessel Fjord (76° N) og Zachariae Isstrøm (78° 30' N). – Teknisk rapport, Grønlands Hjemmestyre. Miljø- og Naturforvaltningen. Nr. 10 – januar 1990: 102 pp.
- Born, E. W. 1983. Havpattedyr og havfugle i Scoresby Sund: fangst og forekomst 1983 (Marine mammals and sea birds in Scoresby Sound: catch and distribution 1983). – Rapport til Råstofforvaltningen for Grønland og Grønlands Fiskeri- og Miljøundersøgelser fra Danbiu ApS. (biologiske konsulenter), december 1983: 112 pp. (With an English summary).
- Born, E.W. 1984. Status of the Atlantic walrus *Odobenus rosmarus rosmarus* in the Svalbard area. – Polar Research 2 n.s.: 27-45.
- Born, E. W. 1990. Distribution and numbers of Atlantic walruses (*Odobenus rosmarus rosmarus*) in Greenland, 95-153. – In: F.H. Fay, B.P. Kelly & B. Fay (eds.). The Ecology and Management of Walrus Populations. Report of an International Workshop. Seattle, Washington, USA, October 1990. U.S. Marine Mammal Commission, Washington D.C.: 186 pp.
- Born, E. W. & Knutsen, L. Ø. 1990a. Hvalrosundersøgelser: rapport over feltarbejde 1989 (Walrus studies: report on field work in 1989 with preliminary results). Teknisk rapport – Grønlands Hjemmestyre, Miljø- og Naturforvaltningen. Nr. 13 – februar 1990: 37 pp. (With an English summary).
- Born, E. W. & Knutsen, L. Ø. 1990b. Satellite tracking and behavioural observations of Atlantic walrus (*Odobenus rosmarus rosmarus*) in NE Greenland in 1989. – Teknisk rapport – Grønlands Hjemmestyre, Miljø- og Naturforvaltningen. Nr. 20 – oktober 1990: 68 pp.
- Born, E. W. & Knutsen, L. Ø. 1990c. Walrus studies in NE Greenland, August 1990: Report on field work. – Teknisk rapport – Grønlands Hjemmestyre, Miljø- og Naturforvaltningen. Nr. 22 – oktober 1990: 19 pp.
- Born, E. W. & Knutsen, L. Ø. 1992. Satellite-linked radio tracking of Atlantic walruses (*Odobenus rosmarus rosmarus*) in northeastern Greenland, 1989-1991. – Z. Säugetierk. 57: 275-287.
- Born, E. W. & Gjertz, I. 1993. A link between walruses (*Odobenus rosmarus*) in northeast Greenland and Svalbard. – Polar Record 29: 329.
- Born, E. W. & Thomassen, J. 1994. Polar bear studies, 119-125. – In: H. J. Hirche & G. Kattner (eds.). The 1993 Northeast Water Expedition Scientific cruise report of RV "Polarstern" Arctic cruises ARK IX/2 and 3, USCG "Polar Sea" cruise
- NEWP and the NEWland expedition. – Berichte zur Polarforschung 142: 190 pp.
- Born, E. W., Heide-Jørgensen, M. P. & Davis, R. A. 1994a. The Atlantic walrus (*Odobenus rosmarus rosmarus*) in West Greenland. – Meddr Grønland, Biosci. 40: 33 pp.
- Born, E. W., Jøiris, C. & Bochet, A. 1994b. Aerial survey of walruses 14 June 1993, 125-128. – In: H. J. Hirche & G. Kattner (eds.). The 1993 Northeast Water Expedition Scientific cruise report of RV "Polarstern" Arctic cruises ARK IX/2 and 3, USCG "Polar Sea" cruise NEWP and the NEWland expedition. – Berichte zur Polarforschung 142: 190 pp.
- Born, E. W., Wiig, Ø. & Neve, P. B. 1995a. Observations of Muskoxen (*Ovibos moschatus*) in Central East Greenland. – Z. Säugetierk. 60: 1-7.
- Born, E. W., Gjertz, I. & Reeves, R. R. 1995c. Population Assessment of Atlantic Walrus. – Norsk Polarinstittut Meddelelser 138: 100 pp.
- Born, E. W. & Knutsen, L. Ø. 1997. Haul out and diving activity of male Atlantic walruses (*Odobenus rosmarus rosmarus*) in NE Greenland. – J. Zool., Lond. 243: 381-396.
- Boyd, L. A. 1935. The fiord region of East Greenland. – New York, American Geographical Society: 369 pp + plates.
- Brandal, A. 1908-09. Dagbok, Grønland 1908-1909. "Flora". Severin Liavaags Ekspedition. Unpublished journal Code N018. – Oslo, Norsk Polarinstittut. Available at the library of Norsk Polarinstittut, Middelthunsgate 29, P.O. Box 5072, Majorstua, N-0301 Oslo.
- Brandal, A. 1930. Dagbok ført av Adolf Brandal under overvintring på Østgrønland, 1908-1909. – Norges Svalbard- og Ishavsundersøkelser 10: 73 pp.
- Breiwick, J. M., Mitchell, E. D. & Chapman, D. G. 1981. Estimated initial population size of the Bering Sea stock of bowhead whales (*Balaena mysticetus*): An iterative method. – Fishery Bulletin 78(4): 843-853.
- Breiwick, J. M. & Mitchell, E. D. 1983. Estimated initial population size of the Bering Sea stock of bowhead whales (*Balaena mysticetus*) from logbook and other catch data. – Rep. int. Whal. Commn, Spec. Issue 5: 147-151.
- Böhm, E., Hopkins, T.S. & Minnett, P.J. 1997. Passive microwave observations of the Northeast Water Polynya interannual variability: 1978-1994. – J. Mar. Syst. 10(1-4): 87-98.
- Chapman, F. S. 1932. Northern lights. – London, Chatto & Windus: 304 pp.
- Caughley, G. 1977. Analysis of vertebrate populations. – New York, John Wiley & Sons: 234 pp.
- Chapksii, K. K. 1936. The walrus of the Kara Sea. – Trudy Vsesoiuz. Arkticheskogo Institute 67 (Transactions of the Arctic Institute 67, Leningrad. Translated by F. H. Fay and B. A. Fay): 124 pp.
- Clavering, D. C. 1830. Journal of a Voyage to Spitzbergen, and the East Coast of Greenland in H. M. S. Griper. – London, Edited by J. Smith. 8 Vols.
- Cronin, M. A., Hills, S., Born, E. W. & Patton, J. C. 1994. Mitochondrial DNA variation in Atlantic and Pacific walruses. – Can. J. Zool. 72: 1035-1043.
- Dahl, K. R. 1924. Paa Isflage langs Østgrønland. Motorskonerten Teddy's Forlis i Ishavet og Besætningens Frelse. – København, Hage & Clausens Forlag, J. Fr. Clausen: 213 pp.
- Dalskov, F. 1938-39. Dagbok. Unpublished journal A265 Lb nr. 152. – Copenhagen, Arktisk Institut. Available at the archives of Arktisk Institut, Strandgade 100H, 1401 Copenhagen K.
- Degerbøl, M. 1937. A Contribution to the Investigation of the Fauna of the Blossville Coast, East Greenland, with special Reference to Zoogeography. – Meddr Grønland 194 (19): 36 pp. + 1 plate.
- DeMaster, D. P. 1984. An analysis of a hypothetical population of walruses, 77-80. – In: F.H. Fay & G. A. Fedoseev (eds.). Soviet-American Cooperative Research on Marine Mammals. Volume 1 – Pinnipeds. NOAA Technical Report NMFS 12: 104 pp.
- Dietz, R. 1984. Studies of distribution and presence of marine mammals in the Greenland Sea, 29-32. – In: T. Vinje (ed.).

- The Fram Strait Cruise with M/S "Lance", 17-31 August 1984. Norsk Polarinstittutt Rapportserie nr. 18: 34 pp.
- Dietz, R. & Andersen, O.G.N. 1984. Status over dyre- og plantelivet i Nordgrønland (Humboldt Gletscher – Independence Fjord). Del 1: Pattedyr og fugle. – Rapport til Råstofforvaltningen for Grønland og Grønlands Fiskeri- og Miljøundersøgelser fra Danbiu ApS (Biological Consultants), Henningsens Allé 58, 2900 Hellerup: 133 pp.
- Dietz, R. & Joensen, S. 1986. Rapport over indsamling af marine pattedyr og fugle i Scoresby Sund distrikt, 9.5 – 22.6. 1986. – Unpublished report. Available at Department of Arctic Environment (National Environmental Research Institute), Tagensvej 135, DK-2200 Copenhagen N.
- Dietz, R., Heide-Jørgensen, M. P. & Born, E. W. 1985. Havpattedyr i Østgrønland: En litteraturundersøgelse. – Rapport til Råstofforvaltningen for Grønland og Grønlands Fiskeri- og Miljøundersøgelser fra Danbiu ApS (Biological Consultants), Henningsens Allé 58, 2900 Hellerup: 277 pp. (With English Summary).
- Drastup, E. 1932. Blandt danske og norske Fangstmænd i Nordøstgrønland. – København, Gyldendalske Boghandel: 132 pp.
- Eberhardt, L. L. 1992. An analysis of procedures for implementing the dynamic response method. – Marine Mammal Science 8: 201-212.
- Estes, J. A. & Gilbert, J. R. 1978. Evaluation of an aerial survey of Pacific walruses (*Odobenus rosmarus divergens*). – J. Fish. Res. Board Can. 35: 1130-1140.
- Emkjær, D. E. 1944a. Brev til J. G. Jenov, 20. December 1944. Unpublished letter A265 Lb. nr. 286. – Copenhagen, Arktisk Institut. Available at the archives of Arktisk Institut, Strandgade 100H, 1401 Copenhagen K.
- Emkjær, D. E. 1944b. Brev til J. G. Jenov, 21. December 1944. Unpublished letter A265 Lb. nr. 286. – Copenhagen, Arktisk Institut. Available at *Ibid*.
- Fay, F. H. 1982. Ecology and biology of the Pacific walrus, *Odobenus rosmarus divergens* Illiger. – Washington D.C., North American Fauna No. 74, USFWS, USDI: 279 pp.
- Fay, F. H. & Lowry, L. F. 1981. Seasonal use and feeding habits of walruses in the proposed Bristol Bay clam fishery. – Anchorage, AK. North Pacific Fishery Management Council. Final report, contract 80-3: 61 pp.
- Fay, F. H. & Stoker, S. W. 1982a. Analysis of reproductive organs and stomach contents from walruses taken in the Alaskan native harvest, spring 1980. – Anchorage, AK. U.S. Fish and Wildlife Service Final report, contract 14-16-0007-81-5216: 86 pp.
- Fay, F. H. & Stoker, S. W. 1982b. Reproductive success and feeding habits of walruses taken in the 1982 spring harvest, with comparisons from previous years. – Nome, AK. Eskimo Walrus Commission. Final report: 91 pp.
- Fay, F. H., Bukhtiyarov, Y. A., Stoker, S. W. & Shults, L. M. 1984. Foods of the Pacific walrus in winter and spring in the Bering Sea, 81-88. – In: F. H. Fay & G. A. Fedoseev (eds.). Soviet-American Cooperative Research on Marine Mammals. Volume 1 – Pinnipeds. NOAA Technical Report NMFS 12:104 pp.
- Fay, F. H., Kelly, B. P. & Sease, J. L. 1989. Managing the exploitation of Pacific walruses: a tragedy of delayed response and poor communication. – Marine mammal Science 5: 1-6.
- Fay, F. H., Sease, J. L. & Merrick, R. L. 1990. Predation on ringed seal, *Phoca hispida*, and a black guillemot, *Cepphus grylle*, by a Pacific walrus, *Odobenus rosmarus rosmarus*. – Marine Mammal Science 6(4): 348-349.
- Fay, F. H., Burns, J. J., Stoker, S.W. & Grundy, J. S. 1994. The struck-and-lost factor in Alaskan walrus harvests, 1952-1972. – Arctic 47(4): 368-373.
- Fay, F. H., Eberhardt, L. L., Kelly, B. P., Burns, J. J. & Quakenbush, L. T. 1997. Status of the Pacific walrus population, 1950-1989. – Marine Mammal Science 13(4): 537-565.
- Fischer, K. 1982. Hyttebogsoptegninger fra Danmarkshavn. – Unpublished notes. Available at Department of Arctic Environment (National Environmental Research Institute), Tagensvej 135, DK-2200 Copenhagen N.
- Fischer, K. 1983. Polarsommer. – København, Forlaget Komma: 132 pp.
- Freuchen, P. 1921. Om Hvalrossens Forekomst og Vandringer ved Grønlands Vestkyst. – København. Videnskabelige Meddelelser Dansk Naturhistorisk Forening 72: 237-249 (Translated: Distribution and migration of walruses along the western coast of Greenland. Fisheries Research Board of Canada Translations Series 2383: 14 pp.).
- Friis, A. 1909. Danmarks Ekspeditionen til Grønlands Nordøstkyst. – København. Gyldendal: 670 pp.
- Friis, A. 1925. Arktiske Jagter. – København: 206 pp.
- Fukuyama, A.K. & Oliver, J.S. 1985. Sea star and walrus predation on bivalves in Norton Sound, Bering Sea, Alaska. – Ophelia 24(1): 17-36.
- Génsbøl, B. 1978. Grønlands Natur. – Forlaget Hamlet: 91 pp.
- Giæver, J. 1937. Kaptein Knudsens Ishavsferder. – Norges Svalbard- og Ishavsundersøkelser 38: 137 pp.
- Giæver, J. 1939. Den norske Fangstvirksomheten på Østgrønland. 7-57.- In: Dansk og Norsk Fangstvirksomhed paa Østgrønland. – København, Ejnar Munksgård. Publikationer om Østgrønland Nr. 8.
- Giæver, J. 1944. Turister og jegere i Ishavet. – Oslo, Tanums Forlag: 160 pp.
- Giæver, J. 1955. Dyretrækk. – Oslo, Tiden Norsk Forlag: 214 pp.
- Gjertz, I. 1990. Walrus predation of seabirds. – Polar Record 26: 317.
- Gjertz, I. & Wiig, Ø. 1992. Feeding of walrus *Odobenus rosmarus* in Svalbard. – Polar Record 28(164): 57-59.
- Gjertz, I. & Wiig, Ø. 1994. Past and present distribution of walruses in Svalbard in summer. – Arctic 47: 34-42.
- Gjertz, I. & Wiig, Ø. 1995. The number of walruses (*Odobenus rosmarus*) in Svalbard in summer. – Polar Biology 15: 527-530.
- Glahder, C. 1990. Baggrundsundersøgelser ved Skærgården. 1990. Indsamling af marine og limniske prøver til fastlæggelse af baggrunds niveauet i forbindelse med Corona Corporation og Platinova Resources Ltd.'s efterforskningkoncession. – Copenhagen. Report from Grønlands Miljøundersøgelser: 35 pp.
- Glahder, C. 1992. Hunting in Kangerlussuaq, East Greenland 1951-1991. An interview-investigation. – Greenland Environmental Research Institute Report Series (1): 201 pp.
- Glahder, C. 1995. Hunting in Kangerlussuaq, East Greenland 1951-1991. An assessment of local knowledge. – Meddr Grønland, Man & Society 19: 86 pp.
- Gray, R. 1889. Notes on a voyage to the Greenland Sea in 1888. – Zoologist 13 (145): 1-9.
- Gray, R. W. 1927. The Walrus. – Nature 119 (3008): 923.
- Gray, R. W. 1929. The Peterhead Whalers. An Epic of the North. – Extract from Buchan Observer, Feb. – Oct. 1929: 53 pp.
- Gray, R. W. 1933. Peterhead sealers and whalers: A contribution to the history of the whaling industry. – Scottish Naturalist 201: 97-104.
- Gray, R. W. 1942. Peterhead and the Greenland Sea. – Transactions of the Buchan Club 16: 99-127.
- Grødhall, O. 1914. Article in "Signal" 31 January 1914 *vide* Sæther 1936.
- Halliday, G. & Higgs, W. J. 1980. British North-east Greenland Expedition 1980. – Unpublished report held by Department of Arctic Environment (National Environmental Research Institute), Tagensvej 135, DK-2200 Copenhagen N, Denmark.
- Hanken, N. 1934-37. Dagbok, Kap Herschell. Unpublished journal Code P101. – Oslo, Norsk Polarinstittutt. Available at the library of Norsk Polarinstittutt, Middelthungsgate 29, P.O. Box 5072, Majorstua, N-0301 Oslo.
- Hanken, N. 1935-36. Dagbok fra Østgrønland. Unpublished journal Code N063. – Oslo, Norsk Polarinstittutt. Available at *Ibid*.
- Hansen, Aa. 1944. Brev til J. G. Jenov, 19. December 1944. Unpublished letter A265 Lb. nr. 286. – Copenhagen. Arktisk

- Institut. Available at the archives of Arktisk Institut, Strandgade 100H, DK-1401 Copenhagen K.
- Hansen, G. & Jennov, J. G. (year not stated). Brev af 5. februar til Grønlands Styrelse vedrørende fangstregler i Nordøst Grønland. Unpublished letter concerning hunting regulations in Northeast Greenland A 267: 2 pp. – Copenhagen. Arktisk Institut. Available at the archives of Arktisk Institut, Strandgade 100H, DK-1401 Copenhagen K.
- Hartz, N. 1902. Beretningen om Skibsexpeditionen til Grønlands Østkyst. – *Meddr Grønland* 27(3): 153-181.
- Heide-Jørgensen, M. P., Härkönen, T. J. 1988. Rebuilding seal stocks in the Kattegat-Skagerrak. – *Marine Mammal Science* 4(3): 231-246.
- Hennings, P. 1936-41. Breve og noter fra Dove Bugt. Unpublished notes A265-296. – Copenhagen. Arktisk Institut. Available at the archives of Arktisk Institut, Strandgade 100H, DK-1401 Copenhagen K.
- Hennings, P. 1939-40. Dagbog. Unpublished journal A265 Lb. nr. 157. – Copenhagen. Arktisk Institut. Available at the archives of Arktisk Institut, Strandgade 100H, DK-1401 Copenhagen K.
- Hennings, P. 1941. Brev til Schultz [C. H.]. Year not stated [presumably 1941]. Unpublished letter A265 Lb. nr. 296. – Copenhagen, Arktisk Institut. Available at the archives of Arktisk Institut, Strandgade 100H, DK-1401 Copenhagen K.
- Higgins, A. K. 1989. A short history of exploration in North-east Greenland with an appendix of place names 76° – 77° 10' N. – Copenhagen. Report by The Geological Survey of Greenland: 19 pp. + 3 maps.
- Hills, S. 1992a. Terrestrial hauling out behavior of Pacific walrus in Bristol Bay, Alaska, 1987-1991. Chapter 3, 39-70. *In*: Hills, S. 1992. The effect of spatial and temporal variability on population assessment of Pacific walrus. – Ph.D. Dissertation, University of Maine, December 1992: 120 pp.
- Hills, S. 1992b. Evidence of trends in the Pacific walrus population., 97-109. *In*: *Ibid*.
- Hjort, C. 1981. Kvartärgeologisk strandhugg på Nordostgrønland, 83-89 *In*: Expedition Ymer-80. – Generalstabens Litografiske Anstalts Förlag, Stockholm: 176 pp.
- Holm, G. 1887. Ethnologisk Skizze af Angmagssalikkerne. – *Meddr Grønland* 10: 43-166.
- Holm, G. & Petersen, J. 1921. Angmagssalik distrikt. – *Meddr Grønland* 61: 560-561.
- Hvidberg, A. 1932. Pelsjægerliv i Nordøstgrønland. – København, Hage & Clausens Forlag. J.Fr. Clausen: 146 pp.
- Hubberten, H.-W. 1995. Summary and itinerary, 1-10. *In*: H.-W. Hubberten (ed.). Die Expedition ARKTIS-X/2 mit FS "Polarstern" 1994. – *Berichte zur Polarforschung* 174, '95: 186 pp.
- Høegh, H. 1931. En lille Indberetning fra Scoresbysund. Unpublished letter 31 July 1931 to Captain E. Mikkelsen. – Copenhagen, Arktisk Institut. Available at the archives of Arktisk Institut, Strandgade 100H, DK-1401 Copenhagen K.
- Iversen, T. 1936. Sydøstgrønland. Jan Mayen. – *Fiskeridirektoratets Skrifter* 5(1): 3-100.
- Isachsen, G. 1922. Norske Fangstmenns Ferder til Grønland. – Kristiania, Det Norske Geografiske Selskabs Aarbok 1919-21: 201-261.
- Isachsen, G. 1925. Grønland og Grønlandsisen. – Oslo, J. W. Cappelens Forlag: 248 pp.
- Isachsen, G. & Isachsen, F. 1932. Norske Fangstmenns og Fiskeres Ferder til Grønland 1922-1931. – Særtrykk av Norsk Geografisk Tidsskrift 4 (1-3). Norges Svalbard og Ishavsundersøkelser Meddelelse nr. 18: 74 pp.
- Jennov, J. G. 1930-31. Rapport om fangstaktiviteten på Sabine Ø. Unpublished report A265 Lb. nr. 129. – Copenhagen, Arktisk Institut. Available at the archives of Arktisk Institut, Strandgade 100H, DK-1401 Copenhagen K.
- Jennov, J. G. 1933. Rapport fra sommerexpeditionen. Unpublished report A265 Lb. nr. 130. – Copenhagen, Arktisk Institut. Available at *Ibid*.
- Jennov, J. G. 1935. Østgrønlandsk Fangstkompani "Nanok's" "Gefion"-ekspedition til Danmarkshavn og Hvalrosodden Juli-September 1932 og nogle lagttagelser vedrørende Isforhold ved den grønlandske Nordøstkyst. – Publikationer om Østgrønland 2: 54 pp.
- Jennov, J. G. 1939a. Rapport fra sommerexpeditionen. Unpublished report A265 Lb. nr. 134. – Copenhagen, Arktisk Institut. Available at the archives of Arktisk Institut, Strandgade 100H, DK-1401 Copenhagen K.
- Jennov, J. G. 1939b. Østgrønlandsk Fangstkompani Nanok A/S. 7-123. *In*: Dansk og Norsk Fangstvirksomhed paa Østgrønland. – København. Ejnar Munksgård. Publikationer om Østgrønland Nr. 8.
- Jennov, J. G. 1945a. Moskusoksebestanden i Nordøstgrønland og nogle spredte iagttagelser og betragtninger vedrørende dyrelivet i Nordøstgrønland. – Østgrønlandsk Fangstkompani Nanok A/S. København. Eget forlag: 128 pp.
- Jennov, J. G. 1945b. Nogle spredte iagttagelser og betragtninger vedrørende dyrelivet i Nordøstgrønland. Manuscript A265 Lb.nr. 203: 45 pp. – Copenhagen, Arktisk Institut. Available at the archives of Arktisk Institut, Strandgade 100H, DK-1401 Copenhagen K.
- Jennov, J. G. 1948. Rapport fra sommerexpeditionen. Unpublished report A265 Lb.nr. 138. – Copenhagen, Arktisk Institut. Available at *Ibid*.
- Jennov, J. G. 1949. Rapport fra sommerexpeditionen. Unpublished report A265 Lb.nr. 139. – Copenhagen, Arktisk Institut. Available at *Ibid*.
- Jennov, J. G. 1959. På Jagt efter Hvalros med Bøsse og Kamera. – Unpublished manuscript 14 October 1959: 8 pp. – Copenhagen, Arktisk Institut. Available at *Ibid*.
- Jennov, J. G. 1965 (year uncertain). Med Nanok til Nordøstgrønland. Manuscript A265-126: 2 pp. – Copenhagen, Arktisk Institut. Available at *Ibid*.
- Jensen, B. 1938-39. Dagbog. Unpublished journal A265 Lb. nr. 153. – Copenhagen, Arktisk Institut. Available at *Ibid*.
- Jensen, C. 1938-39. Dagbog. Unpublished journal A265 Lb. nr. 154. – Copenhagen, Arktisk Institut. Available at *Ibid*.
- Jensen, H. L. 1919. Rapport fra en rejse fra Stormnæs til Hvalrosodden, 1919. Unpublished journal A267 Lb. nr. 39. – Copenhagen, Arktisk Institut. Available at *Ibid*.
- Jensen, H. L. 1922a. Rapport fra Germaniahavn 21. august 1922 til direktør N.C. Møller A/S Østgrønlands Kompagni. Unpublished journal A267 Lb. nr. 40. – Copenhagen, Arktisk Institut. Available at *Ibid*.
- Jensen, H. L. 1922b. Brev fra Germaniahavn 22. august 1922 til Manniche. Unpublished letter A267 Lb. nr. 41. – Copenhagen, Arktisk Institut. Available at *Ibid*.
- Jensen, H. L. 1922c. Rapport 1919-1922. Unpublished journal A267 Lb. nr. 40. – Copenhagen, Arktisk Institut. Available at *Ibid*.
- Jensen, H. L. 1922-23. Dagbog. 1922-23. Unpublished journal A267 Lb. nr. 43. – Copenhagen, Arktisk Institut. Available at *Ibid*.
- Jensen, H. L. 1936-1938. Dagbog. Unpublished journal A265 Lb. nr. 244. – Copenhagen, Arktisk Institut. Available at *Ibid*.
- Jensen, J. 1928. Brev til J. G. Jennov. Unpublished letter A265 Lb. nr. 245. – Copenhagen, Arktisk Institut. Available at *Ibid*.
- Jensen, S. 1909. Mammals observed on Amdrup's journeys to East Greenland 1898-1900. – *Meddr Grønland* 29(1): 1-62.
- Johansen, F. 1910. Observations on seals (Pinnipedia) and whales (Cetacea) made on the Danmark-Expedition 1906-08. – *Meddr Grønland* 45: 201-224
- Johnsen, P. 1953. Birds and mammals of the Peary Land in North Greenland, including notes from Northeast Greenland 1953. – *Meddr Grønland* 128(6): 135 pp + maps.
- Joiris, C. 1991. Summer distribution and ecological role of seabirds and marine mammals in the Norwegian and Greenland Seas (June 1988). – *J. Mar. Syst.* 3: 73-89.
- Joiris, C. & Tahon, J. 1992. Distribution and food intake of seabirds and marine mammals in the Norwegian and Greenland Seas (July 1988), 113-133. – *In*: J.J. Symoens (ed.). Proceedings of Symposium "Whales: Biology-Threats-Conservation". Brussels, 5-7 June 1991.

- Joiris, C., Tahon, J. & Elander, M. 1992. Seabirds and marine mammals at sea, 57-60. – In: G. Kattner (ed.). The Expedition ARKTIS VIII/1 of RV "Polarstern" 1991. – Berichte zur Polarforschung 113: 75 pp.
- Karlsbak, J. 1927-28. Dagbok på *Hird* ekspedisjonen, 1927-28. Unpublished journal Code N142. – Oslo, Norsk Polarinstittut. Available at the library of Norsk Polarinstittut, Middelthunsgate 29, P.O. Box 5072, Majorstua, N-0301 Oslo.
- Karlsbak, J. 1928-29. Dagbok II. Bak Østgrønlands Ismur Høsten og Vinteren 1928-29. Unpublished journal Code N143. – Oslo, Norsk Polarinstittut. Available at *Ibid*.
- Kapel, C. M. & Berg, T. 1994. Summarized observations of mammals, 159-162. – In: H.-J. Hirche & G. Kattner (eds.). The 1993 Northeast Water Expedition Scientific cruise report of RV "Polarstern" Arctic cruises ARK IX/2 and 3, USCG "Polar Sea" cruise NEWP and the NEWland expedition. – Berichte zur Polarforschung 142: 190 pp.
- Kapel, F.O. & Rosing-Asvid, A. 1996. Seal hunting statistics for Greenland 1993 and 1994, according to a new system of collecting information, compared to the previous Lists-of-Game. – NAFO Sci. Coun. Studies, 26: 71-86.
- Kinnear, N. B. 1907. Journal of a whaling voyage in S.Y. *Scotia* to the Greenland Seas, 15 April to 6 August 1907. – Unpublished manuscript. Available at British Museum of Natural History, London.
- Kmünke, R. 1910. Auf der Eisbären und Moschusochsen. Tagebuchblätter der Jagderlebnisse in Ostgrönland. – Wien, Wilhelm Frick: 125 pp.
- Knudsen, R. 1889. Sælfangeren D/S Heklas Reise paa Nordishavet og til Østgrönland 1889, 18-31. – In: J. Giæver 1937. Kaptein Ragnvald Knudsens Ishavsferder. Norges Svalbard- og Ishavsundersøkelser Meddelelse Nr. 38: 137 pp.
- Knudsen, R. 1890. Kapt. R. Knudsens fangstrejse til Østkysten af Grönland 1889, med det norske sælfangerdampskib "Hekla". – Geografisk Tidsskrift 9-10: 143-148.
- Knudsen, R. 1892. Sælfangeren Heklas Reise til Scoresbysund og Overvintring der med den danske Ryder-Ekspedition 1891-92, 32-133. – In: J. Giæver 1937. Kaptein Ragnvald Knudsens Ishavsferder. Norges Svalbard- og Ishavsundersøkelser Meddelelse Nr. 38: 137 pp.
- Knuth, E. 1940. Under det nordligste Dannebrog. Beretning om dansk Nordøstgrönlands Ekspedition 1938-39 udsendt af Alf Trolle, Ebbe Munck og Eigil Knuth til Minde om Danmark-Ekspeditionen. – København, Gyldendalske Boghandel. Nordisk Forlag: 205 pp.
- Knuth, E. 1965. Pearylands's arkæologi I. – Naturens Verden 1965: 170-184.
- Knuth, E. 1968. The Independence II bone artifacts and the Dorset-evidence in North Greenland. – Folk 10: 61-80.
- Knuth, E. 1981. Greenland news from 81° and 83° North. – Folk 23: 91-111.
- Knutsen, W. 1992. Mitt Arktis. Norges ukjente polarkjempe fortæller om 33 eventyrlige år (1936-1969) i Arktis til sin sønn Will C. Knutsen. – Oslo, Grøndahl og Dreyers Forlag AS: 251 pp.
- Koch, J. P. 1913. Gennem den hvide Ørken. Den danske Forskningsrejse tværs over Nordgrönland 1912-13. – København, Gyldendalske Boghandel. Nordisk Forlag: 286 pp.
- Koch, L. 1928. Dansk Arbejde i Østgrönland. – "Ymer", Tidsskrift utgivet av Svenska Sällskapet för Antropologi och Geografi, Häft 3: 253-281.
- Koch, L. 1930. Report on the Geological Expedition to East Greenland 1926-27. – Meddr Grönland 76(6): 227-287.
- Koch, L. 1945. The East Greenland Ice. – Meddr Grönland 130(3): 373 pp.
- Koch, L. 1953. Central-Østgrönland I. – Tidsskriftet Grönland 1: 21-27.
- Kristensen, N. M., & Kristensen, R. M. 1993. Nordøstvandpolynta – ørken eller ose i havet ud for Nordøstgrönland. – Forskning i Grönland/tusaat 1/93: 14-20.
- Kristoffersen, F. 1969. Jæger og fangstmand. – København, Ny Nordisk Forlag, Arnold Busck: 185 pp.
- Krogh, R. von 1932. Norske Ekspedisjoner til Grönlands Østkyst og norsk Virksomhet i Grönlandsisen og på Øst-Grönland. – Norsk Tidsskrift for Sjøvesen: 109-119.
- Larsen, H. 1934. Dødemandsbugten. An eskimo settlement on Clavering Island. – Meddr Grönland 102 (1): 185 pp.
- Larsen, K. 1941-42. Del af dagbøger, Hvalrosodden, 1919-21, 1941-42. Bass Rock, 1923-24. Unpublished journals A267 Lb. nr. 44. – Copenhagen, Arktisk Institut. Available at the archives of Arktisk Institut, Strandgade 100H, DK-1401 Copenhagen K.
- Larsen, H. E. 1951. Dagbog. Unpublished journal A265 Lb. nr. 169. – Copenhagen, Arktisk Institut. Available at *Ibid*.
- Liavaag, S. 1908-1909. Dagbok ført på Grönland, 1908-1909. Unpublished journal Code N087. – Oslo, Norsk Polarinstittut. Available at the library of Norsk Polarinstittut, Middelthunsgate 29, P.O. Box 5072, Majorstua N-0301 Oslo.
- Livingstone-Learmonth, W. 1888. Diary from a journey to the Greenland Sea. – London. Unpublished manuscript available at British Museum of Natural History, London.
- Lowry, L. L. & Fay, F. H. 1984. Seal eating by walrus in the Bering and Chuckchi seas. – Polar Biology 3: 11-18.
- Lund, V. S. 1928. Brev til J.G. Jennov, 11. november 1928. Unpublished letter A265 Lb. nr. 245. – Copenhagen, Arktisk Institut. Available at the archives of Arktisk Institut, Strandgade 100H, 1401 Copenhagen K.
- Lønø, O. 1964. Den norske fangstvirksomheten på Øst-Grönland fra 1938 til 1959. – Polarårboken 1963-64. Oslo, Norsk Polarklubb: 79-123.
- Lønø, O. 1972. The catch of walrus (*Odobenus rosmarus*) in the areas of Svalbard, Novaja Zemlja, and Franz Josef Land. – Norsk Polarinstittutts Årbok 1970: 199-212.
- Løppenthin, B. 1932. Die Vogel Nordostgrönlands zwischen 73° 00' und 75° 30' N Br. samt Beobachtungsergebnisse von der dänischen Godthaab-Expedition 1930. Mit einer englischen Zusammenfassung und Übersicht die Vogel des Gebietes. – Meddr Grönland 91(6): 127 pp.
- Maagaard, L. 1990. Observationer af hvalros (*Odobenus rosmarus*) i Dove Bugt, Nordøstgrönland. – Århus, Flora og Fauna 1990 (1): 3-9.
- Madsen, J. 1900. Polarjagt. Moskusoxer og Isbjørne. – Illustreret Tidende 21. Oktober, 42(3): 39-42.
- Madsen, M. 1989. Strandet i Østgrönland. To års kamp for livet efter Dagny's forlis. – Forlaget Komma: 119 pp.
- Mansfield, A. W. 1958. The biology of the Atlantic walrus *Odobenus rosmarus rosmarus* (Linnaeus) in the eastern Canadian Arctic. – Fisheries Research Board of Canada MS Rept. Ser. (Biology) No. 653: 146 pp.
- Mansfield, A. W. 1966. The walrus in Canada's arctic. – Canadian Geographical Journal 72(3): 88-95.
- Mansfield, A.W. 1973. The Atlantic walrus *Odobenus rosmarus* in Canada and Greenland, p. 69-79. In: Seals. Proceedings of a Working Meeting of Seal Specialists on Threatened and Depleted Seals of the World, held under auspices of the Survival Service Commission of IUCN, 18-19 August 1972 at the University of Guelph, Ontario, Canada. – IUCN Publications New Series, Supplementary Paper 39: 179 pp.
- Mathiassen, T. 1933. Prehistory of the Angmagssalik Eskimos. – Meddr Grönland 92(4): 158 pp. + 11 plates.
- Meltofte, H. 1974. Dagbog fra Scoresby Sund 1974. – Unpublished journal. Copy held at Department of Arctic Environment (National Environmental Research Institute), Tagensvej 135, DK-2200 Copenhagen N.
- Meltofte, H. 1976. Observationer af fugle og pattedyr i Nordøstgrönland mellem 74° 30' og 76° 00' N maj-aug. 1976. – Unpublished journal. Copy held at Department of Arctic Environment (Environmental Research Institute), Tagensvej 135, DK-2200 Copenhagen N.
- Mikkelsen, E. 1922. Alabama Ekspeditionen til Grönlands Nordøstkyst, 1909-1912. – Meddr Grönland 52 (1): 142 pp.
- Mikkelsen, E. 1924. Rapport over Ekspeditionen til Scoresbysund med Formaal at forberede dens Kolonisering. – Unpublished report, 19 pp. – Copenhagen, Arktisk Institut. Available



- at the archives of Arktisk Institut, Strandgade 100H, DK-1401 Copenhagen K.
- Mikkelsen, E. 1925. Ekspeditionen til Scoresbysund med det Formaal at Forberede Koloniseringen. – Geografisk Tidsskrift 28(3): 19 pp.
- Mikkelsen, E. 1956: Fangstlister fra Scoresby Sund (1925-1956). Unpublished catch statistics. – Copenhagen, Arktisk Institut. Available at the archives of Arktisk Institut, Strandgade 100H, DK-1401 Copenhagen K.
- Mikkelsen, E. & Sveistrup, P. P. 1944. The East Greenlanders possibilities of existence. Their production and consumption. – Meddr Grønland 134 (2): 244 pp.
- Mikkelsen, P. S. 1994. Nordøstgrønland 1908-60 Fangstmandsperioden. – København, Dansk Polarcenter: 408 pp.
- Miller, E. H. & Boness, D. J. 1983. Summer behavior of Atlantic walrus, *Odobenus rosmarus rosmarus* (L), N.W.T. (Canada). – Z. Säugetierk. 48 (5): 298-313.
- Minnett, P. J., Bignami, F., Böhm, E., Budéus, G., Galbraith, P. S., Gudmandsen, P., Hopkins, T. S., Ingram, R. G., Johnson, M. A., Niebauer, H. J., Ramseier, R. O. & Schneider, W. 1997. A summary of the formation and seasonal progression of the Northeast Water Polynya. – J. Mar. Syst. 10(1-4): 79-85.
- Mosbech, A. 1990. Rapport fra Scoresby Sund 1990. – Unpublished notes. Held at Department of Arctic Environment (Environmental Research Institute), Tagensvej 135, DK-2200 Copenhagen N.
- Munck, E. 1924. Med "Grønland" til Scoresby Sund – Dagbogsoptegnelser af Letmatros, Stud. polit Ebbe Munck. – Unpublished journal. – Copenhagen, Arktisk Institut. Available at the archives of Arktisk Institut, Strandgade 100H, DK-1401 Copenhagen K.
- Munsterhjelm, L. 1937. Blant Isbjørnar och Myskoxar på Nordost-Grønland. – Stockholm, Fahlcrantz: 182 pp.
- Nathorst, A. G. 1900. Två Somrar i Norra Ishafvet. – Stockholm, Vol I: 352pp. Vol II: 414 pp.
- Nielsen, H. 1919-21. Dagbog fra Germaniahavn. Unpublished journal A267 Lb. nr. 46. – Copenhagen, Arktisk Institut. Available at the archives of Arktisk Institut, Strandgade 100H, 1401 Copenhagen K.
- Nielsen, H. V. 1944a. Brev til direktør Jennov "Nanok", København 19. december 1944. Unpublished letter A265 Lb. nr. 286. – Copenhagen, Arktisk Institut. Available at the archives of Arktisk Institut, Strandgade 100H, 1401 Copenhagen K.
- Nielsen, H. V. 1944b. Brev med noter fra Nordøst Grønland til direktør Jennov "Nanok". Unpublished letter A265 Lb. nr. 286. – Copenhagen, Arktisk Institut. Available at *Ibid*.
- Nielsen, H. V. 1944c. Brev til direktør Jennov "Nanok", København 21. december 1944. Unpublished letter A265 Lb. nr. 286. – Copenhagen, Arktisk Institut. Available at *Ibid*.
- Nielsen, P. & Valeur, H. 1994. Satellite based ice charts. Greenland Sea, January 1993-June 1994. Prepared for the MAST-II Programme under EC contract MAS2-CT93-0057. – Copenhagen. Danish Meteorological Institute Data Report 94-2: unpaginated.
- Nooter, G. 1972/73: Change in a hunting community in East Greenland. – Folk 14-15: 164-204.
- Ockelmann, K. 1958. Marine Lamellibranchiata. – Meddr Grønland 122(4): 256 pp + plates.
- Olrik, H. 1916: Forslag om at bebygge Scoresby Sund-egnen i Østgrønland ved vestgrønlandske Sælfangere. – Det Grønlandske Selskabs Skrifter 3: 13 pp.
- Orléan, P. Duc de 1911. Hunters and Hunting in the Arctic (Transl. G. Richards). – David Nutt, London: 204 pp.
- Orvin, A. K. 1931. Ekspedisjonen til Østgrønland med *Veslekari* sommeren 1929. – Norsk Geografisk Tidsskrift 3 (2-3): 89-146.
- Orvin, A. K. 1934: Norges Svalbard – og Ishavsundersøkelser Ekspedisjoner til Nordøst-Grønland i Årene 1931-33. – Norges Svalbard- og Ishavsundersøkelser 25: 31 pp.
- Payer, J. 1877a. Upptäcktsresor i Norra Polarhafvet. – Stockholm, Albert Bonniers Förlag: 464 pp.
- Payer, J. 1877b. Den østrigsk-ungarnske Nordpol-Ekspedition i Aarene 1872-1874. – København: 667 pp.
- Pedersen, A. 1926. Beiträge zur Kenntnis der Säugetier- und Vogelfauna der Ostküste Grönlands. – Meddr Grønland 68 (3): 149-249.
- Pedersen, A. 1930. Fortgesetzte Beiträge zur Kenntnis der Säugetier- und Vogelfauna der Ostküste Grönlands. – Meddr Grønland 77(5): 344-506.
- Pedersen, A. 1934. Polardyr. – Gyldendal, København: 150 pp.
- Pedersen, A. 1942. Säugetiere und Vögel. – Meddr Grønland 128(2): 119 pp.
- Pedersen, A. 1951. Rosmarus – en beretning om hvalrossens liv og historie. – København, Gyldendal: 98 pp.
- Pedersen, A. 1960. Sammentræf med hvalrosser. – Tidsskriftet Grønland 1960: 93-102.
- Peters, W. 1874. Die zweite deutsche Nordpolarfahrt in den Jahren 1869 und 1870 unter Führung des Kapitän Karl Koldevey. – Leipzig, F. A. Brockhaus: 157-169.
- Petersen, G. H. 1978. Life cycles and population dynamics of marine benthic bivalves from the Disko Bugt area of West Greenland. – Ophelia 17(1): 95-120.
- Petersen, J. 1921: Rapport over observationer i Nordøst Grønland. Unpublished report A267 Lb. nr. 48. – Copenhagen, Arktisk Institut. Available at the archives of Arktisk Institut, Strandgade 100H, 1401 Copenhagen K.
- Petersen, J. 1926: Dagbog fra Scoresby Sund 1925-26. Unpublished journal. – Copenhagen, Rigsarkivet. Available at Rigsarkivet, Rigsdagsgården 9, DK-1812, Copenhagen K.
- Petersen, J. 1957: Kolonibestyrer Johan Petersens Ujuåts Dagbøger fra Østgrønland 1894-1935 ved B. Rosenkilde Nielsen. – Det Grønlandske Selskabs Skrifter XIX: 188 pp.
- Petersen, M. K. 1994. Feltrapport. Fugle og Pattedyrobervationer i Grønlandshavet 17.08. – 08.09. 1994. – Unpublished report prepared for Greenland Environmental Research Institute: 8 pp. Held at Department of Arctic Environment (National Environmental Research Institute), Tagensvej 135, DK-2200 Copenhagen N, Denmark.
- Piepenburg, D. 1988. Zur Zusammenfassung der Bodenfauna in der westlichen Fram-Strasse. – Berichte zur Polarforschung 52: 118 pp.
- Piepenburg, D., Ambrose Jr., W. G., Brandt, A., Renaud, P. E. & Ahrens, M. J. 1995. The Influence of Water Column Processes on Benthic Distribution Patterns in the Northeast Water Polynya, p. 63. – In: Book of Abstracts. NorthEast Water Polynya Symposium 1-5 May 1995, Helsingør, Denmark: 87 pp.
- Poulsen, K. 1900. Den Østgrønlandske Expedition 1898-1900. Kapitel III. Zoologiske Meddelelser. – Geografisk Tidsskrift 15 (1899-1900), København: 69-71.
- Poulsen, I. 1938-39. Oplysninger om Nordøstgrønland. Vejrforhold og dyrelivet iagttaget fra Eskimonæs, 1938-39. Unpublished notes A265-331. – Copenhagen, Arktisk Institut. Available at the archives of Arktisk Institut, Strandgade 100H, 1401 Copenhagen K.
- Quennerstedt, A. 1868. Anteckningar om Djurlifvet i Ishafvet mellan Spetsbergen och Grönland. – Kungliga Svenska Vetenskaps-Akademiens Handlingar 7(3): 35 pp. + 3 plates.
- Rasmussen, J. K. 1925. Scoresby Sund Expeditionen 1924-25. Unpublished journal. – Copenhagen, Arktisk Institut. Available at the archives of Arktisk Institut, Strandgade 100H, 1401 Copenhagen K.
- Reeves, R. R. 1978. Atlantic walrus (*Odobenus rosmarus rosmarus*): A literature survey and status report. – U. S. Department of Interior. Fish and Wildlife Service. Wildlife Research Report 10: 41 pp.
- Robert-Lamblin, J. 1986. Ammassalik, East Greenland – end or persistence of an isolate? Anthropological and demographical study on change. – Meddr Grønland 10: 186 pp.
- Ryder, L. 1895. Beretning om den Østgrønlandske Expedition 1891-92. – Meddr Grønland 17: 158 pp.
- Sandell, H. T. & Sandell, B. 1991. Archaeology and environment in the Scoresby Sund fjord. Ethno-archaeological investi-



- gation of the last Thule culture of Northeast Greenland. – *Meddr Grønland, Man & Society* 14: 150 pp.
- Schneider, W. & Budéus, G. 1994. The North East Water Polynya (Greenland) I. A physical concept of its generation. – *Polar Biology* 14: 1-9.
- Schneider, W. & Budéus, G. 1997. A note on Norske Ø Ice Barrier (Northeast Greenland), viewed by Landsat 5TM.- *J.Mar.Syst.* 10(1-4): 99-106.
- Sease, J. L. & Chapman, D. G. 1988. Pacific walrus *Odobenus rosmarus divergens*, 17-38. – *In*: J.W. Lentfer (ed.). Selected marine mammals of Alaska. Species account with research and management recommendations. – Washington, D.C. Marine Mammal Commission: 175 pp.
- Siegstad, H. 1989. Kangerlussuaq – en aktiv fangstplads. – *Forskning i Grønland/tusaat* 1-2: 55-59.
- Scoresby, W. Jr. 1820. An Account of the Arctic Regions with a History and Description of the Northern Whale-fishery. – Edinburgh, Archibald Constable and Co., Vol. 1: 551 pp.
- Scoresby, W. J. 1823. Journal of a Voyage to the northern Whale fishery; including Researches and Discoveries on the eastern Coast of West Greenland, made in the Summer of 1822, in the Ship *Baffin* of Liverpool. – Edinburgh, Archibald Constable and Co. 1823. Whitby, Caedman Reprint 1980: 472 pp.
- Smith, T. D. 1983. Changes in size of three dolphin (*Stenella* spp.) populations in the eastern tropical Pacific. – *Fishery Bulletin* 81: 1-13.
- Southwell, T. 1899. Notes on the Seal and Whale Fishery, 1898. – *The Zoologist* 3: 103-112.
- Spärck, R. 1933. Contributions to the Animal Ecology of the Franz Joseph Fjord and adjacent East Greenland Waters. I-II. – *Meddr Grønland* 100(1): 38 pp. + tables and plates.
- Spärck, R. 1953: Naturfredning i Grønland. – *Tidsskriftet Grønland*: 262-264.
- Stirling, I. Cleator, H. & Smith, T. G. 1981. Marine Mammals, 45-58. – *In*: I. Stirling & H. Cleator (eds.). Polynyas in the Canadian Arctic. – Canadian Wildlife Service Occasional Paper 45: 73 pp.
- Storgaard, E. 1926: Under Dannebrog og Tricoloren paa Grønlands Østkyst. – København, Nyt Nordisk Forlag, Arnold Busck: 148 pp.
- Sulebak, P. 1930-32. Dagbok fra Østgrønland, juli 1930-juli 1932. Unpublished journal Code N059. – Oslo, Norsk Polarinstitut. Available at the library of Norsk Polarinstitut, Middelthunsgate 29, P.O. Box 5072, Majorstua N-0301 Oslo.
- Sæther, C. S. 1936. Fangstmenn som Opdagere, 106-107 – *In*: Polar-Årboken 1936. Norsk Polarklubb. Oslo, Gyldendal Norsk Forlag.
- Søder, R. 1991. Rapport over biologiske observationer i Nordøstgrønland ved marine seismiske undersøgelser aug.-sep. 1991. – Unpublished report on field work, November 1991. Held at Department of Arctic Environment (National Environmental Research Institute), Tagensvej 135, DK-2200 Copenhagen N.
- Sølberg, F. 1975. Beskrivelse af jagt og fangst i Scoresbysund. – Unpublished manuscript. Held at Department of Arctic Environment (National Environmental Research Institute), Tagensvej 135, DK-2200 Copenhagen N.
- Sølberg, F. 1980. Jagten i Scoresbysund. – København, Borgen: 292 pp.
- Sørensen, S. 1948-49. Dagbok, Myggbukta, 1948-49. Unpublished journal Code P144. – Oslo, Norsk Polarinstitut. Available at the library of Norsk Polarinstitut, Middelthunsgate 29, P.O. Box 5072, Majorstua N-0301 Oslo.
- Sørensen, S. 1952-53. Dagbok, David Gray, Ottostrand, 1952-53. Unpublished journal Code P147. – Oslo, Norsk Polarinstitut. Available at *Ibid*.
- Sørensen, S. 1953-54. Dagbok, Kap Herschell, 1952-53. Unpublished journal Code P148. – Oslo, Norsk Polarinstitut. Available at *Ibid*.
- Taggart, S. J. 1987. Grouping behavior of Pacific walruses (*Odobenus rosmarus divergens* Illiger): an evolutionary perspective. – Ph.D. Dissertation, University of California at Santa Cruz: 152 pp.
- Tahon, J. & Vens, V. 1994. Marine mammals and birds. ARK IX/3, 115-119. – *In*: H.-J. Hirche & G. Kattner (eds.). The 1993 Northeast Water Expedition Scientific cruise report of RV "Polarstern" Arctic cruises ARK IX/2 and 3, USCG "Polar Sea" cruise NEWP and the NEWland expedition. – *Berichte zur Polarforschung* 142: 190 pp.
- Thorson, G. 1933. Investigations on Shallow Water Animal Communities in the Franz Joseph Fjord (East Greenland) and adjacent Waters. – *Meddr Grønland* 100 (2): 70 pp. + 3 plates.
- Thorson, G. 1934. Marine Molluscs. – *Meddr Grønland* 104 (17): 8 pp.
- Thorson, G. 1937. Fjordenes Udforskning, 119-141. – *In*: G. Thorson (ed.) 1937. Med Treårsekspeditionen til Christian X's Land. - København, Nordisk Forlag: 281 pp.
- Thorson, G. 1953. Verdens dybeste Fjord. – *Tidsskriftet Grønland*: 368-373.
- Thostrup, C. B. 1911. Ethnographic Description of the Eskimo Settlements and Stone Remains in North-East Greenland. – *Meddr Grønland* 44 (4): 177-355 + 6 plates.
- Tolløfsen, S. 1932-33. Nordøstgrønland, 1932-33. Unpublished journal Code N027. – Oslo, Norsk Polarinstitut. Available at the library of Norsk Polarinstitut, Middelthunsgate 29, P. O. Box 5072, Majorstua N-0301 Oslo.
- Tolløfsen, S. 1933-34. Dagbok – Herschell, 1933-34. Unpublished journal Code N026. – Oslo, Norsk Polarinstitut. Available at *Ibid*.
- Trolle, A. 1908. Rapport over den nordgående Slæderejse 1907 med Mylius Erichsens, Hagens og Brønlunds Rejse til Peary Kanalen og de Rejser, der dermed står i Forbindelse. Skrevet af Alf Trolle d. 11. August 1908 og afleveret til Danmark-Ekspeditionens Komité ved Hjemkomsten. – Publikationer om Østgrønland 1: 21-47.
- Vibe, C. 1939. Preliminary Investigation on Shallow Water Animal Communities in the Upernavik- and Thule districts (Northwest Greenland). – *Meddr Grønland* 124 (2): 43 pp. + 4 plates.
- Vibe, C. 1950. The Marine Mammals and the Marine Fauna in the Thule District (Northwest Greenland) with Observations on Ice Conditions in 1939-41. – *Meddr Grønland* 150(6): 115 pp.
- Vibe, C. 1967. Arctic animals in relation to climatic fluctuations. – *Meddr Grønland* 170 (5): 227 pp.
- Vibe, C. 1973. Nationalparken i Nordøstgrønland. – *Tidsskriftet Grønland* 1973: 38-42.
- Vibe, C. 1981. Hvalros, 405-408. – *In*: B. Muus, F. Salomonsen & C. Vibe (eds.). Grønlands fauna. Fisk, Fugle og Pattedyr. – København, Gyldendal: 464 pp.
- Vishnevskaja, T. U. & Bychkov V.A. 1985. A mixed herd of the Laptev walrus in M. Pronchishchev Bay and prospects for its protection, 3-14. – *In*: V. E. Flint (ed.). Ecological aspects of protection of the beasts of the world. Ministry of Agriculture, Moscow. (Transl. by F. H. Fay, 1986).
- Wade, P.R. 1993. Estimation of historical population size of the eastern spinner dolphin (*Stenella longirostris orientalis*). – *Fishery Bulletin* 91: 775-787.
- Welch, H.E. & Martin-Bergmann, K. 1990. Does the clam *Mya truncata* regenerate its siphon after predation by walrus? an experimental approach. – *Arctic* 43(2): 157-158.
- Weslawski, J. & Wiktor, J. 1994. Marine shallow coastal ecology – with special reference to the plankton development, 145.-150. – *In*: H.-J. Hirche & G. Kattner (eds.). The 1993 Northeast Water Expedition Scientific cruise report of RV "Polarstern" Arctic cruises ARK IX/2 and 3, USCG "Polar Sea" cruise NEWP and the NEWland expedition. – *Berichte zur Polarforschung* 142: 190 pp.
- Weslawski, J.M., Wiktor, J., Koszsteyn, J., Zajaczkowski, M., Wiczorek, P. & Kotwicki, L. 1997. The coastal edge of the Northeast Water Polynya in spring 1993. – *J. Mar. Syst.* 10(1-4): 429-444.
- Winge, H. 1902. Grønlands Pattedyr. – *Meddr Grønland* 21 (2): 319-521.

Wiig, Ø., Gjertz, I., Griffith, D. & Lydersen, C. 1993. Diving patterns of an Atlantic walrus *Odobenus rosmarus rosmarus* near Svalbard. – Polar Biol. 13:71-72.

Wiig, Ø., Gjertz, I. & Griffith, D. 1996. Migration of walruses (*Odobenus rosmarus*) in the Svalbard and Franz Josef Land area. – J. Zool., Lond. 238: 769-784.

Appendix 1: List of hunters' journals, journals kept at hunting stations, and other unpublished sources at Arctic Institute (Copenhagen) and Norwegian Polar Institute (Oslo) that were searched for information on walrus in eastern Greenland. Only those journals etc. that are cited appear in the list of references.

ID code	Journals, etc.	Hunting station or area of operation	Year/period
A265-123	Correspondence regarding A/S Nanok, J. G. Jennov	.	1955
A265-124	Correspondence regarding A/S Nanok, J. G. Jennov	.	1956
A265-125	Correspondence regarding A/S Nanok, J. G. Jennov	.	1957-58
A265-126	Correspondence regarding A/S Nanok, J. G. Jennov	.	1960-73
A265-127	Jennov, J. G. Report from Germania Havn	Germania Havn	24 Aug. 1929
A265-128	Jennov, J. G. Report from East Greenland	Hochstetter Forland	12 Dec. 1929-11 Jul. 1930
A265-129	Jennov, J. G. Report from East Greenland	Hochstetter Forland-Sabine Ø Dove Bugt	1930-1931
A265-130	Jennov, J. G. Report from the summer expedition	Young Sund-Dove Bugt	1933
A265-131	Jennov, J. G. Report from the summer expedition	Young Sund-Dove Bugt	1934
A265-132	Jennov, J. G. Report from the summer expedition	Young Sund-Dove Bugt	1935
A265-133	Jennov, J. G. Report from the summer expedition	Young Sund-Dove Bugt	1938
A265-134	Jennov, J. G. Report from the summer expedition	Young Sund-Dove Bugt	1939
A265-135	Jennov, J. G. Report from the summer expedition	Young Sund-Dove Bugt	1945
A265-136	Jennov, J. G. Report from the summer expedition	Young Sund-Dove Bugt	1946
A265-137	Jennov, J. G. Report from the summer expedition	Young Sund-Dove Bugt	1947
A265-138	Jennov, J. G. Report from the summer expedition	Young Sund-Dove Bugt	1948
A265-139	Jennov, J. G. Report from the summer expedition	Young Sund-Dove Bugt	1949
A265-140	Jennov, J. G. Report from the summer expedition	Young Sund-Dove Bugt	1950
A265-141	Jennov, J. G. Report from the summer expedition	Young Sund-Dove Bugt	1951
A265-142	Jennov, J. G. Report from the summer expedition	Young Sund-Dove Bugt	1952
A265-143	Jennov, J. G. Report from the summer expedition	Young Sund-Dove Bugt	1954
A265-144	Journal from Germania Havn and Hvalrosodden	Sabine Ø Dove Bugt	25 Aug. 1929-31 Jul. 1931 11 Aug. 1933-24 Oct. 1934 9 May 1935-10 Mar. 1936 1938-39
A265-148	Journal from Sandodden	Young Sund	
A265-149	Journal from Ålborghus, and Zackenberg	Dove Bugt Tyroler Fjord (Young Sund)	25 Aug. 1938-12 Aug. 1939 15 Sep. 1945-26 Jul. 1946
A265-150	Larsen, L. E.	Hochstetter and Germania Havn	18 Oct. 1931-18 Aug. 1932
A265-152	Dalskov, Frantz	Ålborghus (Dove Bugt)	23 Aug. 1938-16 Aug. 1939
A265-153	Jensen, Berndt	Sandodden (Young Sund)	10 Oct. 1938-9 Aug. 1939
A265-154	Jensen, Chr.	Hvalrosodden (Dove Bugt)	24 Aug. 1938-1 Mar. 1939
A265-156	Jensen, Chr.	Hvalrosodden (Dove Bugt)	4 Mar. 1939 -19 Apr. 1939
A265-157	Hennings, Poul	Dove Bugt	23 Aug. 1939-28 Mar. 1940
A265-162	Journal from Zackenberg	Tyroler Fjord (Young Sund)	3 Aug. 1950-31 Jul. 1951
A265-163	Journal from Zackenberg	Tyroler Fjord	6 Nov. 1951-1 Aug. 1952
A265-168	Frederiksen, Hans. Journal from Zackenberg	Tyroler Fjord	27 Sep. 1952-24 Aug. 1953
A265-169	Larsen, H. E.	Hochstetter Forland	1 Oct. 1951-2 Dec. 1951
A265-173	Wind, K. E. P. Journal from Sandodden	Tyroler Fjord	1 Nov. 1950-18 Apr. 1951
A265-201	Summary of hunting statistics, A/S Nanok	.	1929-1938
A265-203	Jennov, J. G. Manuscript	.	1945
A265-214	Hansen, Godfred and Jennov, J. G. Letter	.	-
A265-241	Jensen, Hans Ludvig. Journal from Hochstetter	Hochstetter Forland	2 Aug. 1929-1 May 1930 1 May 1930-27 Jul. 1930 30 Jul. 1930-25 Aug. 1930
A265-244	Jensen, Hans Ludvig. Journal from Hochstetter	Hochstetter Forland	23 Aug. 1936-10 Sep. 1938
A265-245	Larsen, L. E. Letter	Gael Hamke Bugt	6 Jan. 1928
-	Larsen, L. E. Letter	Germania Havn	1928
-	Lund, V. S. Letter	Pendulum Strædet	11 Jan. 1928
-	Jensen, J. Letter	Clavering Ø	1928
A265-286	Nielsen, H. V. Letter	Dove Bugt	19 Dec. 1944a
-	Nielsen, H. V. Letter with notes from NE Greenland	Dove Bugt	1944b
-	Nielsen, H. V. Letter	Dove Bugt	21 Dec. 1944c
-	Hansen, Aage. Letter	Young Sund	1944
-	Emkær, D. E. Letter	Young Sund-Germania Havn	20 Dec. 1944a
-	Emkær, D. E. Letter	Hvalros Ø	21 Dec. 1944b
A265-296	Hennings, Poul. Letters and notes.	Dove Bugt	1936-1941
A265-331	Poulsen, Ib Hvalrosodden (Dove Bugt)	Eskimonæs (Clavering Ø)	1938-1939
A267	Hansen, G. and Jennov, J. G. Letter		5 Feb. no year
A267-32	Summary of products shipped in 1920	Germania Havn	1920
A267-33	Summary of products shipped in 1921	Shannon	1921
A267-37	Some observations of animal life	Sabine Ø	1919-1920
A267-39	Jensen, Hans L. Report on a journey from Stormnæs to Hvalrosodden, 1919	Dove Bugt	1919
A267-40	Jensen, H. L. Report 1919-1922	Dove Bugt - Young Sund	1922

## Appendix 1 – continued

ID code	Journals, etc.	Hunting station or area of operation	Year/period
A267-41	Jensen, H. L. Letter	Tyroler Fjord	22 Aug. 1922
A267-43	Jensen, H. L. Journal	Young Sund- Hvalros Ø	1922-1923
A267-44	Larsen, Kristen. Excerpts from journals summarized in 1941-42	Hvalrosodden, 1919-21 Bass Rock, 1923-24	1941-42
A267-45	Stjernebo, Hugo; report from station A (Carlshavn)	Hold with Hope	1920-1921
A267-46	Nielsen, H. Journal from Germania Havn	Sabine Ø	1919-1921
A267-47	Meyer, Carl; report from station B (Kap Hold with Hope)	Hold with Hope	1920-1921
A267-48	Petersen, Johan. Report on observations	SE Clavering Ø	1921
A267-69	Instruction in treatment of skin		(year not stated)
G110	Ingwersen, Leo. Journal	Ålborghus	28 Nov. 1950-18 Mar. 1952
G111	Engelbrecht Christensen, Jack. Journal	Sandodden (Young Sund)	20 Nov. 1949-14 Mar. 1950
G112	Pedersen, Erling. Journal	Sandodden	4 Feb. 1948-9 Jun. 1948
G113	Soelberg, K. B. Journal	Sandodden	23 Oct. 1946-10 Aug. 1947
G115	Jensen, Marius. Journal	Ålborghus (Dove Bugt)	8 Feb. 1939-5 May 1939.
G116	Andersen, Jørgen. Journal	Young Sund	20 Feb. 1947-13 May 1947
G119	Journal from Zackenberg	Young Sund	8 Aug. 1946-14 Jul. 1947
G121	Journal from Ålborghus	Dove Bugt	31 Aug. 1951-3 Aug. 1952
G123	Journal from Mønstedhus	Hochstetter Forland	23 Sep. 1938-31 Aug. 1940
G125	Jensen, Orla. Journal	Hochstetter Forland	5 Nov. 1947-9 Nov. 1947
G125	Jensen, Orla. Journal	Hochstetter Forland	25 Oct. 1946-11 May-1947 14 Aug. 1947-28 May-1948
N018	Brandal, Adolf. The wintering of the sealer <i>Floren</i> Liavåg's Expedition.	East coast of Wollaston Forland	1908-1909
N026	Tolløfsen, Sigurd	Kap Herschell (Young Sund area)	1933-34.
N027	Tolløfsen, Sigurd	Kap Herschell	1932-33.
N031	Andresen, Herman	Kap Herschell	15 Aug. 1931-16 Aug. 1932
N032	Andresen, Herman The <i>Hird</i> -Expedition	Kap Herschell	1927-28-29
N033	Andresen, Herman The wintering of Møre – Greenland Expedition	Kap Herschell	9 Jul. 1930-14 Aug. 1931
N035	Andresen, Herman Suløya – Greenland Expedition	Kap Herschell	1934-1936
N059	Sulebak, Peter	Kong Oscars Fjord area	1930-1932
N063	Hanken, Nils	Kap Herschell	1935-1936
N082	Giæver, John South coast of Hochstetter Forland	Moskusoksefjord-	1932-1934
N086	Bjørnlo, Martin Wintering of the sealer <i>7de Juni</i>	Sabine Ø area	1909-1910
N087	Liavåg, Severin	East coast of Wollaston Forland	1908-1909
N142	Karlsbak, Jonas The <i>Hird</i> -Expedition	Southeastern coast of Clavering Ø	1927-1928
N143	Karlsbak, Jonas	Sabine Ø area	1928-1929
P101	Hanken, Nils	Kap Herschell and Kong Oscars Fjord area	1934-1937
P105	Amsjø, Egil	Eastern Ymer Ø	1947-1948
P106	Amsjø, Egil	Eastern C.H. Ostenfeld Land	1949-1950
P107	Havold, Trygve	Moskusoksefjorden	1947-1949
P108	Myrvold, Per	Kong Oscars Fjord area	1948-1950
P109	Larsen Lie, Martin	Kong Oscars Fjord area	29 Jul. 1947-9 Aug. 1948
P111	Larsen, Birger	Eastern Ymer Ø	1949-1950
P112	Larsen, Birger	Southern coast of Hold with Hope	1953-1954
P130	Sulebak, Karsten	Kong Oscars Fjord area	29 Jul. 1934-8 Jul. 1936
P131	Sulebak, Karsten	Kong Oscars Fjord area	9 Jul. 1936-31 Aug. 1937
P144	Sørensen, Stein	Southern coast of Hold with Hope	7 Aug. 1948-2 Aug. 1949
P145	Sørensen, Stein	Southern coast of Hold with Hope	13 Aug. 1949-10 Aug. 1950
P146	Sørensen, Stein	Southern coast of Hold with Hope	10 Aug. 1950-20 Aug. 1951
P147	Sørensen, Stein	Southern coast of Shannon and eastern coast of Hochstetter Forland	22 Aug. 1952-18 Aug. 1953
P148	Sørensen, Stein	Kap Herschell	19 Aug. 1953-25 Aug. 1954
P149	Sørensen, Stein	Southern coast of Hold with Hope	22 Aug. 1955-20 Aug. 1956

## Legend:

- A = Archives of Arktisk Institut, Copenhagen  
 G = Mogens Graaes Private Collection. Searched by Peter Schmidt-Mikkelsen  
 N = Norwegian Polar Institute Library, Oslo  
 P = Private Collection. Searched by Peter Schmidt-Mikkelsen

Appendix 2: Coastal observations of walrus in East Greenland, 1889-1994 (from south to north). Legend: – = same entry as above; a dot = no information; ad. = adult; subad. = subadult; M = male; F = female; a letter indicates that walrus have been observed on land – given in alphabetical order from south to north.

Obs. no.	Locality	Day	Month	Year	Observation	Source
<i>South of Kangerittivaq (Scoresby Sund), see Figs 3, 5 A and 10</i>						
1	Kap Herluf Trolle 61° 10' N	.	9	1992	1 walrus hauled out on an ice floe	A. Rosing-Asvid pers. comm. 1992
2	At 63° N	25	4	1870	1 walrus	Peters 1874
3	Isortoq	.	summer	1988	1 caught	H. Siegstad pers. comm. 1990
4	At the Ikkatteq Base	.	summer	1989	Subadult male (M) shot	R. Nielsen pers. comm. 1989
5	Near Tinetiqlaaq	.	11	1987	1 caught	H. Siegstad pers. comm. 1990
6	Sermilik Fjord	.	.	1980-88	Total of 10 caught in the period	<i>Ibid.</i>
7	Kangerlussuaq	26	.	1930	1 seen	Chapman 1932
8	–	.	8	1932	Some seen	Iversen 1936
9	Bagnæsset, Am-drup Fjord	.	8	1979	1 walrus observed	Glahder 1990
10-A	Kangerlussuaq	7	8	1990	1 walrus seen at entrance to Kangerlussuaq	Glahder 1990
11	–	.	.	1951-92	Since 1951, 20 observations or hunts of walrus	Glahder 1992, 1995
12	Kap Hammer	10	8	1980	3 seen	Andersen 1982
13	Kangerlussuaq to Kangerittivaq (Scoresby Sund)	9-21	8	1932	Single and in groups on the ice	Degerbøl 1937
14	Rømer Fjord	11	7	1980	1 walrus skeleton in water	Andersen 1982
15	Turner Ø	22	7	1900	Several seen	Hartz 1902:160
16-B	Turner Sund	.	8	1972	Adult M hauled out on the beach in Turner Sund	Sølberg 1980
17	–	27	7	1900	2 observed	Jensen 1909
18	Sulussugutikajik	.	3	1928	Quite a few. "A large family"	Pedersen 1930
19	(Steward Ø)	.	4	1983	A total of ca. 20 observed during the last week of April	Born 1983
20	Kangikajik (Kap Brewster)	.	6	1988	1 walrus observed	J. Thygesen pers. comm. 1988
21	–	.	6	1988	1 ad. M seen	<i>Ibid.</i>
22	–	.	8	1988	1 shot	<i>Ibid.</i>
23	–	.	.	1991	1 shot	Søder 1991
<i>The Kangerittivaq (Scoresby Sund) area, see Figs 3, 4, 5 A and 10</i>						
24	Kangersuttuaq (Sydkap)	.	7-11	1934	1 shot	Petersen 1957
25	–	.	.	1980s?	1 shot recently (1980s?)	Sandell & Sandell 1991
26	Kangersaajua (Hurry Fjord)	6	8	1891	1 seen at Ittoritseq (Kap Stewart)	Knudsen 1892
27	–	.	9	1924	Some seen at Ittoritseq	Bengtson 1927
28	–	23	6	1926	6 shot at Ittoritseq	Pedersen 1926
29	–	29	6	1926	Few shot at Ittoritseq	<i>Ibid.</i>
30	–	4	7	1926	5 seen at Ittoritseq	<i>Ibid.</i>
31	–	2	8	1926	2 shot at Ittoritseq	<i>Ibid.</i>
32	–	10	8	1924	3 and 1 seen (in the fjord)	Mikkelsen 1924
33	–	10	9	1924	4 observed	Rasmussen 1925
34	–	11	9	1924	6 or 7 seen	<i>Ibid.</i>
35	–	20	9	1924	2 seen	<i>Ibid.</i>
36	–	23	9	1924	Sounds of walrus	<i>Ibid.</i>
37	Immikkeertikajit (Fame Øer)	5	8	1891	1 observed	Bay 1894 Ryder 1895
38	–	31	7	1899	2 observed	Nathorst 1900
39-C	–	7	8	1899	3 hauled out on land on Immikkeertikajit Shot according to Olrik (1916)	<i>Ibid.</i>
40	–	.	8	1924	Some shot	Isachsen & Isachsen 1932
41	–	7	8	1924	Quite a few shot at Immikkeertikajit	Isachsen 1925
42	–	13	9	1926	1 shot at Immikkeertikajit	Koch 1930
43	–	.	8	1983	Old M seen at Immikkeertikajit in early August	Sandell & Sandell 1991
44	Ittaajimmiit (Kap Hope)	17	6	1926	Many at Ittaajimmiit	Pedersen 1926



## Appendix 2 – continued

Obs. no.	Locality	Day	Month	Year	Observation	Source
45	–	19	6	1926	3 shot at Ittaajimmiit	<i>Ibid.</i>
46	–	12	9	1926	1 shot at Ittaajimmiit	Koch 1930
47	–	.	9	1975	Small herd seen and 1 M was shot near Ittaajimmiit	Sandell & Sandell 1991
48	–	.	9	1976	Adult M shot	<i>Ibid.</i> :109
49	–	.	8	1978	Young walrus seen near Ittaajimmiit	<i>Ibid.</i>
50	–	20	7	1988	1 ad. M shot	J. Thygesen pers. comm. 1988
51-D	Rosenvinge Bugt area	.	8	1924	27 seen in Qingaajiva (Hvalros Bugten)	Pedersen 1926
52	–	.	8	1924	30 seen	Munck 1924
53	–	.	7	1924	10 seen	Bengtson 1927
54	–	30	7	1924	2 groups with five in each seen	Pedersen 1926
55	–	4	8	1924	6 observed	<i>Ibid.</i>
56	–	.	.	1925	8 shot in the "colony"	Mikkelsen 1925
57	–	.	summer	1925	1 adult M, 2 ad. F with 0-year-olds plus 1 subadult	Pedersen 1926
58	–	10	9	1925	2 shot	Petersen 1926
59	–	11	9	1925	Quite a few seen	<i>Ibid.</i>
60	–	17	9	1925	Quite a few seen	<i>Ibid.</i>
61	–	18	9	1925	Quite a few walruses hauled out on ice floes. 2 ad. and 1 subad. killed	<i>Ibid.</i>
62	–	26	9	1925	2 shot	<i>Ibid.</i> , Petersen 1957
63	–	27	9	1925	Many	<i>Ibid.</i>
64	–	15	9	1934	2 shot	Pedersen 1934
65	–	2	10	1925	Several in the harbor	Petersen 1926
66	–	5	10	1925	Many on ice floes near land. 2 shot	<i>Ibid.</i>
67	–	13	7	1926	1 walrus shot	<i>Ibid.</i>
68	–	14	7	1926	1 shot	<i>Ibid.</i>
69	–	5	8	1926	1 shot on ice floe in Amdrup Havn	Koch 1930
70	–	.	7	1983	Mid July single walrus seen on two occasions	Born 1983
71	–	.	9	1975	1 large walrus on an ice floe	Sandell & Sandell 1991
72	–	primo	9	1991	1 shot on land in Qingaajiva	J. Brønlund <i>in litt.</i> 1994
73	Kangertittivaq entrance to	24 28	7 to 8	1924	In this period a total of 169 walruses observed	Mikkelsen 1924
74	–	24	7	1924	4 ad. F each with a young, 1 ad. M and 1 subad. M	Pedersen 1926
75	Uunarteq	6	10	1925	2 shot	Petersen 1926
76	(Kap Tobin)	12	10	1925	1 shot	<i>Ibid.</i>
77	–	13	10	1925	1 shot	<i>Ibid.</i>
78	–	28	10	1925	1 observed	<i>Ibid.</i>
79	–	4	12	1925	1 shot	<i>Ibid.</i>
80	–	5	8	1926	1 ad. (1000 kg) shot at entrance to Scoresby Sund. First year, 60 shot by 10 hunters	Storgaard 1926
81	–	ultimo	7	1931	The catch of walruses decreases continuously. 2 were shot. Site not stated specifically	Høegh 1931
82	–	9	5	1974	1 on ice	Meltofte 1974
83	–	.	4	1987	4 shot	J. Thygesen pers. comm. 1988
84	–	.	10	1988	1 walrus shot	J. Thygesen pers. comm. 1988
85	Napparuutilikajik (Kap Swainson)	3	2	1926	1 shot	Pedersen 1926
86	–	.	5	1986	1 ad. M shot in late May	J. Thygesen pers. comm. 1988
87	–	.	3	1987	1 ad. F with 1 year old calf and subadult seen	<i>Ibid.</i>
88	–	.	4	1987	1 ad. M shot while hauled out on edge of fast ice in late April	<i>Ibid.</i>
89	–	.	4	1987	1 ad. M shot	<i>Ibid.</i>
90	–	.	5	1987	1 ad. F shot	<i>Ibid.</i>
91	–	20	5	1987	1 two-year-old M shot	<i>Ibid.</i>

## Appendix 2 – continued

Obs. no.	Locality	Day	Month	Year	Observation	Source
92	–	.	4	1988	Late April 3 walrus seen; and 1 ad. M shot	<i>Ibid.</i>
93	–	1	5	1988	1 small M shot	<i>Ibid.</i>
94	–	.	5	1988	During a 14 day period 3 ad. M were feeding in the area	<i>Ibid.</i>
95	–	20	5	1988	1 ad. M swimming north	<i>Ibid.</i>
96	–	.	5	1988	During last week of May 3 walrus observed	<i>Ibid.</i>
97	–	.	5	1988	1 subad. M shot 2 km N of Napparuutilikajik	<i>Ibid.</i>
98	–	1	6	1988	1 three-year-old M shot	<i>Ibid.</i>
99	–	.	6	1988	Walrus observed at Vardepynt	<i>Ibid.</i>
<i>From Kangertittivaq (Scoresby Sund) to Dove Bugt, see Figs 7, 5 B and 11</i>						
100	Liverpool Land	10	9	1922	1 seen	Isachsen 1925
101	Kejser Franz Joseph Fjord	.	7	1931	1 seen close to Nord Fjord	Boyd 1935
102	–	.	.	1938-43	1 seen	Akre 1957
103	Kap Humboldt (E. Ymers Ø)	24	7	1947	1 shot (at Hoelsbu in Moskusoksefjord according to Amsjø; but at K. Humboldt according to B. Myrvold; Mikkelsen <i>in litt.</i> 1994)	Amsjø 1947-48
104	Myggbukta	20	8	1944	1 ad. M shot; rare in this area	Bang 1944
105	–	28	8	1962	Males and females seen	B. Nielsen pers. comm. 1990
106	Arundel Ø	.	8	1949	1 dead walrus found	Jennov 1949
107	Kap Krauss	7	8	1930	1 subadult seen	Løppenthin 1932
108	Jackson Ø	19	7	1909	1 ad. F, 2 ad. M and 1 young shot	Kmunke 1910
109	Clavering Ø area (Eskimonæs)	.	.	1938-39	Walrus occur very rarely and only 1 has been observed [in the Eskimonæs area]	Poulsen 1938-39
110-E	–	11	8	1992	15 walrus on the beach near Eskimonæs. One on beach about 5 km further south	B. Nielsen pers. comm. 1992
111	Dødemandsbugten	.	6	1932	Common in Dødemandsbugten	Larsen 1934
112-F	–	23	8	1984	2 on land in Dødemandsbugten	Andersen 1984
113	–	23	8	1984	8 on ice floes in Dødemandsbugten	<i>Ibid.</i>
114	–	29	7	1989	Walrus hauled out on the beach	M. Elander <i>in litt.</i> 1991
115	–	13	8	1991	2 on the beach	Søder 1991
116	–	7	11	1991	6 adults in the water and on the ice	Sirius <i>in litt.</i> 1993
117	–	21	11	1993	2 in water in Dødemandsbugten	<i>Ibid.</i>
118-G	Basaltkap	22	7	1989	Drag marks from walrus at the beach of Basaltkap	M. Elander <i>in litt.</i> 1991
119	–	6	11	1991	3 adults in water at Basaltkap	Sirius <i>in litt.</i> 1993
120-H	Kap Mary	.	8?	1921	1 attempting to haul out on land at Kap Mary	Petersen 1921
121	–	26	7	1927	3 walrus shot	Karlsbak, J. 1927-28
122	–	7	7	1932	7 shot at Kap Mary. Two of these were lost. All with long tusks	Tolløfsen 1932-33
123	–	19	7	1932	1 walrus shot at Kap Mary	<i>Ibid.</i>
124	–	20	4	1983	Some seen at Kap Mary	Born 1983
125	Clavering Ø area	14	9	1909	1 large walrus seen	Bjørnlo 1909-10
126	–	3	9	1991	Swimming 20 km offshore in 30% ice cover	Søder 1991

Obs. no.	Locality	Day	Month	Year	Observation	Source
127	Sandøen area (Young Sund)	.	.	1929-31	Walrus seen several times in the water at Sandøen. They did not haul out there	Emkjær 1944a
128	–	.	.	1930	1 shot	Jennov 1930-31
129	–	.	.	1932	37 (hides at the station; K. Her- schell). All M according to Pedersen (1942)	Orvin 1934
130	–	28	5	1932	1 old M shot on ice floe; Total length: 426 cm; tusks worn, about 2 inches long	Tolløfsen 1932-33
131	–	.	5	1937	Captain Schjelderup ( <i>Quest</i> ) killed 7 in a group of 20 on an ice floe According to Munsterhjelm (1937), 8 were shot in July near "Sandodden"	Hansen 1944
132	–	5	7	1939	1 walrus on the ice at Sandøen	Anon. 1938-39 Jensen, B. 1938-39
133	–	7	7	1939	Several walrus on the ice	<i>Ibid.</i>
134	–	ca. 18	7	1964	5 and 2 (including 2 ad. M, and a subadult identified as F in Génsbøl 1978)	Génsbøl 1978 and pers. comm. 1995
135	–	17	8	1976	M at Daneborg.	Meltofte 1976
136	–	.	6	1979	At least 4 ad. M on a floe	Mikkelsen 1994
137	–	14	8	1991	7 near Sandøen	Søder 1991
138	–	3	9	1991	3 hauled out on ice floes near Sandøen	<i>Ibid.</i>
139	Kap Herschell	29	7	1927	1 shot on an ice floe	Andresen 1927-29 Karlsbak 1927-28
140	–	22	7	1928	1 shot between Clavering Ø and K. Herschell	Karlsbak 1928-29
141	–	21	6	1929	1 walrus shot on ice	<i>Ibid.</i>
142	–	1	7	1929	2 shot in the water	<i>Ibid.</i>
143	–	28	7	1929	1 walrus shot	<i>Ibid.</i>
144	–	21	6	1931	1 shot close the cabin	Andresen 1930-31
145	–	28	6	1931	3 walrus shot	<i>Ibid.</i>
146	–	26	5	1932	Several hundred seen. 26 shot on 29 May. The same event mentioned by Andresen (1931-32): 25 shot off K. Herschell Station on 29 May 1932. No mentioning of total number seen.	Emkjær 1944a Jennov 1945a,b
147	–	30	5	1932	1 shot close to K. Herschell	Andresen 1931-32
148	–	8	6	1932	1 shot	<i>Ibid.</i>
149	–	20	9	1932	3 walrus on ice 800 m from the coast	Tolløfsen 1932-33
150	–	11	5	1932	Quite a few walrus in the direction of Sandodden. 1 shot but lost	<i>Ibid.</i>
151	–	16	5	1932	Quite a few seen in the slush ice	<i>Ibid.</i>
152	–	23	5	1932	4 on the ice 1 km from land	<i>Ibid.</i>
153	–	25	5	1932	1 ad. M shot; 2 more M shot. Many in the water	<i>Ibid.</i>
154	–	8	6	1932	2 walrus shot (1 of these lost)	Sulebak 1930-32
155	–	19	6	1932	6 shot (4 on ice and 2 in water). 2 of these were lost	Tolløfsen 1932-33
156	–	20	6	1932	1 walrus shot	Sulebak 1930-32 Andresen 1931-32
157	–	22	7	1932	1 large walrus shot between Henningelv and K. Herschell	Tolløfsen 1932-33
158	–	27	3	1934	3-4 walrus in a group	Tolløfsen 1933-34
159	–	3	5	1934	17 walrus on the ice	<i>Ibid.</i>
160	–	31	5	1934	Quite a few walrus on the ice	<i>Ibid.</i>
161	–	10	6	1934	2 walrus shot (1 of these lost)	<i>Ibid.</i>
162	–	2	7	1934	1 shot west of K. Herschell	<i>Ibid.</i>
163	–	15	7	1934	1 shot	
164	–	17	8	1934	1 walrus shot	Hanken 1934-37
165	–	23	8	1934	1 adult shot in water	<i>Ibid.</i>
166	–	27	4	1935	1 walrus seen on the ice	<i>Ibid.</i>

## Appendix 2 – continued

Obs. no.	Locality	Day	Month	Year	Observation	Source
167	–	12	5	1935	1 walrus seen on the ice	<i>Ibid.</i>
168	–	15	5	1935	1 walrus seen north of Kap Herschell	<i>Ibid.</i>
169	–	3	7	1935	3 walruses foraging about 3.5 km from the coast	<i>Ibid.</i>
170	–	10	7	1935	Some walruses seen	<i>Ibid.</i>
171	–	12	7	1935	2 walruses shot at Lavenæsset	<i>Ibid.</i>
172	–	6	8	1935	1 walrus shot. Quite a few observed in water	<i>Ibid.</i>
173	–	16	10	1935	Quite a few seen in water	<i>Ibid.</i>
174	–	23	6	1936	8 shot on ice at point north of K. Herschell	Hanken 1935-36 Andresen 1934-36
175	–	10	7	1936	2 walruses shot	<i>Ibid.</i>
176	–	23	6	1949	2 walruses shot at Herschell	Sørensen 1948-49
177	–	23	6	1954	Old M shot on edge of land-fast ice	Sørensen 1953-54
178	–	24	6	1954	Ad. F (?) shot on edge of land-fast ice; lost	<i>Ibid.</i>
179	–	26	6	1954	3-4 walruses swimming along edge of land-fast ice	<i>Ibid.</i>
180-K	–	27	9	1991	3 hauled out on land	Søder 1991
181	Young Sund	ultimo	6	1932	A herd of 40 during end of June. Shortly before 37 had been killed (See Orvin 1934). All these were males. Probably those shot (Obs. 146)	Pedersen 1934,1942
182	–	.	.	1947	1 ad. M shot on ice	Mikkelsen 1994
183	–	.	8	1973	4-5 at entrance to Young Sund	Hinsteiner pers. comm. 1984
184	–	.	8	1983	8 in Young Sund	H. Lauritsen pers. comm. 1984
185	–	22	8	1984	6 in eastern Young Sound	Andersen 1984
186	–	.	7	1989	1 ad. F and a one-year-old calf on an ice floe in Young Sund	E. Villadsen <i>in litt.</i> 1990
187	Kap Borlase Warren	27	10	1869	Some	Payer 1877a,b
188	–	3	11	1869	Some	<i>Ibid.</i>
189	–	.	.	1923	Ad. M shot (photo)	Dahl 1924:36
190	–	.	.	1923	Ad. M shot (photo). Exact site not stated	<i>Ibid.</i>
191	–	.	.	1920-30s	Occasionally seen on drifting floes, but always single	Emkjær 1944a
192	–	27	5	1932	Walruses hauled out on three ice floes	Tolløfsen 1932-33
193	–	17	6	1932	3 walruses shot	Andresen 1931-32
194	Kap Wynn	.	12	1869	Walruses heard	Payer 1877a,b
195	–	12	11	1919	Some walruses observed	Nielsen 1919-21
196	–	15	1	1920	Estimated at 10	Petersen 1921
197	–	.	2	1920?	Walruses in water	Anon. 1919-20
198	–	.	5	1920	15 seen	Petersen 1921
199	–	.	5	1920?	1 seen	<i>Ibid.</i>
200	Hvalros Ø	6	7	1899	5 seen	<i>Ibid.</i>
201	–	16	7	1899	1 observed	Nathorst 1900
202	–	8	6	1910	4 shot by <i>Balaena</i>	<i>Ibid.</i>
203	–	.	8	1919	Walrus at southern coast	Bjørnlo 1909-10
204	–	.	9	1919	A total of 12 seen (Clavering-strædet)	Petersen 1921
205	–	17	10	1919	A total of 8 seen. Same site	<i>Ibid.</i>
206	–	.	12	1919	Several seen in open water at the E coast of Hvalros Ø	Nielsen 1919-21
207	–	25	6	1920	About 60, according to	Anon. 1919-20
208	–	.	6	1921	1 seen	Petersen 1921
209	–	2	9	1922	2 ad M shot at southern tip of Hvalros Ø	<i>Ibid.</i>
210	–	21	5	1923	8 seen	<i>Ibid.</i>
211	–	23	5	1923	Group of walruses in water. Mating behavior observed	Emkjær 1944b
	–				Many walruses seen in water	Jensen 1922-23
	–				2 walruses shot on an ice floe (1 of these lost). A total of 3 shot in 1923 (Larsen 1941-42)	<i>Ibid.</i>

Obs. no.	Locality	Day	Month	Year	Observation	Source
212	–	26	4	1930	1 ad. M shot on land-fast at southern tip of the island	Anon. 1929-31 Hvidberg 1932
213	–	5	5	1930	Several seen in the pack ice	<i>Ibid.</i>
214	–	26	6	1930	8 shot (6 from motorized boat and 2 on the ice)	Jennov 1930-31 Hansen 1944
215	–	14	5	1931	1 walrus shot (lost)	Anon. 1929-31
216	–	23	5	1931	1 swimming walrus seen	<i>Ibid.</i>
217	–	11	6	1931	1 shot	Hvidberg 1932 Anon. 1929-31
218	–	26	6	1931	1 ad. F and 1 subadult shot (one of these sunk, but was found later)	Hvidberg 1932 Anon. 1929-31
219	–	12	7	1931	1 medium sized M shot north of the island	<i>Ibid.</i>
220	–	15	7	1931	1 shot	<i>Ibid.</i>
221	–	16	7	1931	1 ad. M shot	<i>Ibid.</i>
222	–	25	7	1931	1 ad. M shot	<i>Ibid.</i>
223-L	–	.	.	1987-89	3 walruses hauled out on land	U. Vedel pers. comm. 1991
224	Sabine Ø	.	7	1869	2 to 10 seen. The walruses arrive in early July	Peters 1874
225	–	.	6-8	1869	Some seen early August Arrived in June; up to 60 on a floe	Payer 1877a,b
226	–	16	7	1889	16 killed. Information on site uncertain	Knudsen 1890
227	–	11	7	1900	2 observed (playing)	Jensen 1909
228	–	.	.	1907	Walruses shot at Sabine Ø	Giæver 1944
229	–	.	7	1908	Some at Griper Red	Isachsen 1922
230	–	12	7	1908	First walruses observed; 2 shot	Brandal 1908-09 Liavaag 1908-09
231	–	21	7	1908	1 observed (off Griper Red?)	Brandal 1908-09, 1930
232	–	16	10	1908	Quite a few at Griper Red	<i>Ibid.</i>
233	–	19	4	1909	Walrus breathing holes in ice	<i>Ibid.</i>
234	–	5	5	1909	One adult M shot on ice off Griper Red	<i>Ibid.</i> Liavaag 1908-09
235	–	7	5	1909	Walrus breathing holes in ca. 15 cm thick ice	Brandal 1908-09
236	–	8	5	1909	Walrus breathing holes along ice edge. 1 walrus seen	<i>Ibid.</i>
237	–	10	5	1909	Some seen	Liavaag 1908-09 Brandal 1908-09
238	–	19	5	1909	1 seen on ice	<i>Ibid.</i>
239	–	31	5	1909	2 in Pendulum Strædet	<i>Ibid.</i>
240	–	1	7	1909	Sounds of walruses	<i>Ibid.</i>
241	–	27	5	1910	Saw walrus. Site uncertain	Bjørnlo 1909-10
242	–	15	6	1910	1 large walrus seen on edge of fast ice	<i>Ibid.</i>
243	–	23	6	1910	Saw a walrus	<i>Ibid.</i>
244	–	28	6	1910	Flensed a walrus (this kill not mentioned earlier)	<i>Ibid.</i>
245	–	.	.	1909-10	Clavering Ø and Germania Havn personnel took 4 walruses in this period	Isachsen 1922
246	–	.	7	1921	4 seen	Petersen 1921
247	Germania Havn	29	6	1919	3 walruses shot while <i>Dagny</i> was there	Nielsen 1919-21
248	–	10	7	1919	Ad. F with calf shot far offshore (the calf lost)	<i>Ibid.</i>
249	–	10	7	1919	Walruses in water at Germania Havn	<i>Ibid.</i>
250	–	13	7	1919	3 seen	<i>Ibid.</i>
251	–	18	7	1919	Ad. F with young killed	<i>Ibid.</i>
252	–	23	7	1919	1 killed (lost)	<i>Ibid.</i>
253	–	3	8	1919	1 observed	<i>Ibid.</i>
254	–	27	8	1919	4 swimming (1 of these killed)	<i>Ibid.</i>
255	–	29	8	1919	1 ad. killed (lost but later retrieved)	<i>Ibid.</i>
256	–	11	9	1919	1 ad. F and a young observed. The F was killed but lost	<i>Ibid.</i>



## Appendix 2 – continued

Obs. no.	Locality	Day	Month	Year	Observation	Source
257	–	21	9	1919	Saw 3 walrus (of these, 1 ad. M was killed)	<i>Ibid.</i>
258	–	28	10	1919	Many walrus in herd up to 15 along the ice edge between Lille Pendulum and Sabine Ø	Anon. 1919-20
259	–	17	6	1920	1 ad. M together with a one-year-old calf [sic!] shot; the calf was lost	<i>Ibid.</i>
260	–	19	5	1920	1 ad. M shot on ice edge	<i>Ibid.</i>
261	–	12	6	1920	2 walrus observed	<i>Ibid.</i>
262	–	11	7	1920	2 walrus seen	<i>Ibid.</i>
263	–	.	4	1921	5 seen	Petersen 1921
264	–	.	5?	1922	2 ad. M shot	Madsen 1989:98
265	–	.	5?	1922	4 shot on ice	<i>Ibid.</i> : 100
266	–	.	5?	1922	1 subad.	<i>Ibid.</i> : 101
267	–	.	5?	1922	1 ad. M	<i>Ibid.</i> : 102
268	–	26	7	1932	3 ad. (M) shot. Exact site not stated	Andresen 1927-29
269	–	.	.	1929	4 caught at Germania Havn	Orvin 1931
270	–	15	7	1931	1 ad. M shot at Germania Havn	Hvidberg 1932
271	–	.	7	1938	1 ad. F with calf seen in Pendulumstrædet. Probably the same as mentioned by Pedersen (1942)	Jennov 1945a,b
272	–	27	5	1976	2 seen in Germania Havn	Meltofte 1976
273	–	28	5	1976	2 Claveringstrædet	<i>Ibid.</i>
274	–	29	5	1976	2 diving in Germania Havn	<i>Ibid.</i>
275	–	29	5	1976	1 diving at ice edge	<i>Ibid.</i>
276	–	19	8	1984	5 seen south of Sabine Ø	Andersen 1984
277	Lille Pendulum	.	.	1924	Walrus seen during winter in Pendulum Strædet	Lund 1928 Emkjær 1944a
278	–	.	.	1924	1 shot at the ice edge	<i>Ibid.</i>
279	–	22	7	1909	1 M seen	Orlean 1911
280-M	Kuhn Ø	30	7	1889	16 shot. Site uncertain	Knudsen 1889,1890
281-N	–	3	8	1889	80 shot. Information about site uncertain. Perhaps in Grandjean Fjord according to Jennov (1948)	Knudsen 1890 Giæver 1937
282	–	30	7	1909	1 close to Kuhn Ø	Bjørnlo 1909-10
283	–	13	8	1975	1 seen	Meltofte 1976
284	Kap Rink	15	7	1976	Some seen on ice at some distance from the Hochstetter station	<i>Ibid.</i>
285	Shannon, south	14	8	1920	1 walrus shot	Nielsen 1919-21
286	–	9	9	1920	1 walrus shot	<i>Ibid.</i>
287	–	.	6-9	1922	A couple of walrus seen during the period at Kap Philip Broke	Mikkelsen 1922
288	–	.	.	1922	Quite a few shot by Fangstmand	Isachsen & Isachsen 1932 Andresen 1927-29
289	–	.	.	1923-24	A total of 3 seen. 2 of these were shot (1 lost)	Emkjær 1944a
290	–	2	8	1944	1 old adult shot	Bang 1944
291	–	12	10	1952	2 walrus in a lead off Kap David Gray	Sørensen 1952-53
292	–	13	10	1952	Walrus foraging same site as above	<i>Ibid.</i>
293	–	15	10	1952	Walrus observed in broken ice	<i>Ibid.</i>
294	–	17	8	1953	1 walrus off Kap David Gray	<i>Ibid.</i>
295	–	17	8	1984	40-50 in northern part of Hochstetterbugten	Andersen 1984
296-O	–	17	8	1984	4 on land at Kap Philip Broke	<i>Ibid.</i>
297	–	9	8	1989	1 adult hauled out on an ice floe at Kap Philip Broke	Boertmann <i>et al.</i> 1990
298	Freedden Bugt	7	8	1994	2 seen	F. Ploug Nielsen pers. comm. 1994
299	–	21	8	1994	5 walrus swimming about 5 km south of Shannon	This study

Obs. no.	Locality	Day	Month	Year	Observation	Source
300	–	21	8	1994	1 swimming north in Freeden Bugt	<i>Ibid.</i>
301	–	21	8	1994	2 swimming in Freeden Bugt	<i>Ibid.</i>
302	–	24	8	1994	Two groups of 2 walrus hauled out on ice floes at 74° 55' N - 18° 56' W	<i>Ibid.</i>
303	Kap Sussi	7	8	1994	3 seen	F. Ploug Nielsen pers. comm. 1994
304	Hochstetter	3	9	1936	1 walrus observed	Anon. 1936-37
305	–	3	9	1938	1 walrus observed	Jensen, H. L. 1936-38
306	Roseneath Bugt	17	11	1951	2 walrus shot on solid fast ice	Larsen 1951 Mikkelsen 1994:233
307	Haystack	.	8	1973	5-6 seen	Hinsteiner pers. comm. 1984
308	Bessel Fjord	6	8	1988	1 swimming at 75°59' N, 21°22' W	N. Henriksen <i>in litt.</i> 1988
309	–	9	8	1988	Hauled out on ice floe at 75°58' N, 21°25' W	<i>Ibid.</i>
310	Kap Peschel	.	8	1973	5-6 seen	Hinsteiner pers. comm. 1984
311	SW Dove Bugt	30	8	1934	4 observed, single (Bessel Fjord-Hvalrosodden)	Nielsen 1944a
312	Nørre Sundby Ø	11	8	1951	2 M walrus on the ice (SW Dove Bugt)	Anon. 1950-52
313	–	.	.	.	“Walrus haul out on land” Statement unclear	Jennov 1965
314	Godfred Hansens Ø	13	8	1951	Carcass of ad. M	<i>Ibid.</i>
315	–	14	8	1988	1 swimming	K. Secher <i>in litt.</i> 1988
316	–	.	5	1974	8-10 walrus seen late May in approx. 10 km <sup>2</sup> polynya near Alborghus	F. Ploug Nielsen pers. comm. 1994
317	Godfred Hansen Ø	.	.	.	Occur here	Jennov 1959
318	“Kap Niels Landet”	.	.	.	Occur north of Soranerbræen (Rechnitzer Land)	Jennov 1945a,b
319-Q	–	2	9	1934	1 walrus shot on small beach ca. 50 m from hut	Nielsen 1944a,b
320	“Port Arthur Land”	.	.	.	Seen in this area (76° 46' N, 21° 13' W) (Daniel Bruuns Land)	Jennov 1945a,b
321	Mørke Fjord	17	8	1933	Quite a few seen	Jennov 1933
322	–	18	8	1989	1 adult at 76°46' N, 21°05' W	Born & Knutsen 1990a
323	–	18	8	1989	1 adult at 76°48' N, 20°55' W	<i>Ibid.</i>
324	Hvalrosodden area	.	summer	1919	Many walrus seen in northern Dove Bugt but only few were killed due to the ice conditions	Jensen, H. L. 1922c
325	–	.	.	1920	1 shot on the ice off Hvalrosodden	Larsen 1941-42
326	–	7	9	1933	1 walrus shot (northern Dove Bugt)	Anon. 1933-36
327	–	.	8	1933	At least 50 seen between Danmarkshavn and Hvalrosodden (additional to those hauled out on Lille Snæs)	Jennov 1945a,b Hansen & Jennov (no year)
328	–	18	7	1934	Ad. M shot on ice 0.5 km from Hvalrosodden	Anon. 1933-36 Nielsen 1944a
329	–	28	7	1934	Flensed on land (photo) 1 M walrus shot at “Odden”	Mikkelsen 1994:132 Anon. 1933-36 Nielsen 1944a
330	–	7	8	1934	4 walrus seen on the ice off Hvalrosodden	<i>Ibid.</i>
331	–	9	8	1934	2 walrus seen same site	<i>Ibid.</i>
332	–	14	8	1934	3 walrus seen ca. 3 km from Hvalrosodden (1 of these, M, was shot)	<i>Ibid.</i>
333	–	.	.	1939	1 seen on the ice	<i>Ibid.</i>
334	–	6	8	1939	1 killed on ice (lost)	<i>Ibid.</i>
335	–	3	9	1939	2 walrus killed 1 ad. walrus shot on ice floe (lost)	Jennov 1939a Hennings 1939-40

Appendix 2 – continued						
Obs. no.	Locality	Day	Month	Year	Observation	Source
336	–	25	7	1939	First appearance that year of walrus in a lead off Lakseelven	Pedersen 1942
337	–	.	.	1941	6 seen	Jennov 1945a,b
338	–	20-30	7	1969	1 seen off the point	Meltofte 1976
339	–	5-6	8	1975	2 seen off the point	<i>Ibid.</i>
340	–	6	8	1984	2 seen off the point	Andersen 1984
341	–	15	7	1989	2 M hauled out on the edge of the fast ice at Lakseelv	Boertmann <i>et al.</i> 1990
342	–	16	7	1989	2 adult M swimming in lead in fast ice close to shore. 1 adult M hauled out on ice about 5 km offshore	<i>Ibid.</i>
343	–	21	8	1989	1 walrus half ways between Lundager Ø and Hvalrosodden	<i>Ibid.</i>
344	Vindsel Ø	13	8	1939	1 ad. M on ice floe	Knuth 1940:198
345	–	5	9	1988	1 ad. M	Meltofte 1976
346-S	Off Lille Snenæs	13	8	1933	1 shot in water (lost)	Jennov 1933
347	–	16	8	1934	Many walrus at this site. Observation of mating	Nielsen 1944b
348	–	26	8	1934	3 walruses seen	<i>Ibid.</i>
349	–	26	8	1938	2 walruses shot in Farsund	Dalskov 1938-39 Jensen, C. 1938-39
350	–	12	7	1939	2 ad. M shot on the ice off Lille Snenæs	Knuth 1940:186,192
351	–	26	7	1939	1 seen in water	Dalskov 1938-39
352	–	3	9	1939	Walruses seen	Hennings 1939-40
353	–	10	9	1939	1 walrus in water	<i>Ibid.</i>
354	–	28	9	1939	"Last" walrus seen off Snenæs	Pedersen 1942
355	–	.	8-9	1972	About 15 M in water (photo)	Vibe 1973:39
356	Nordre Orienterings Ø	.	.	1906	Some shot	Friis 1925
357	–	26	8	1938	3 observed	Jensen, C. 1938-39
358	–	18	8	1989	1 adult at 76° 50' N 19°30' W	Born & Knutsen 1990a
359	Sydlig Orienterings Ø	9	9	1939	1 walrus killed	Hennings 1939-40
360	Stormnæs	18	8	1933	2 shot (1 was an ad. M)	Jennov 1933
361	–	3	9	1939	1 shot on ice (lost)	Hennings 1939-40
362	–	.	9	1939	6 observed (1 killed)	<i>Ibid.</i>
363	Stormbugten	9	9	1907	One shot	Amdrup 1913
364	–	28	9	1907	One seen	Johansen 1910
365	–	30	9	1907	One seen	<i>Ibid.</i>
366	–	1	7	1969	1 adult F with a calf	Meltofte 1976
367	–	8-10	9	1969	2-4 seen	<i>Ibid.</i>
368	–	4	8	1974	3 seen	<i>Ibid.</i>
369	–	11	8	1974	5 adults, 2 subadults, and 2 two-year-olds	<i>Ibid.</i>
370	–	17	8	1975	6 seen	<i>Ibid.</i>
371	–	22	8	1975	1 seen	<i>Ibid.</i>
372	–	23	8	1975	1 adult F with a one-year-old calf	<i>Ibid.</i>
373	–	24	8	1975	1 adult F with a three-year-old calf	<i>Ibid.</i>
374	–	30	7	1986	1 adult M	Maagaard 1990
375	–	30	8	1988	2 seen	<i>Ibid.</i>
376	Wendel Pynt	8	7	1987	4 adult M	<i>Ibid.</i>
377	–	19	7	1987	2 adult M	<i>Ibid.</i>
378	Bådskæret	12	9	1939	2 seen on ice (1 shot and lost)	Hennings 1939-40 Mikkelsen 1994
379	Korridoren	3-8	6	1969	1 ad. F with a calf on the ice	Meltofte 1976
380	–	22	6	1969	1 adult F with a young	<i>Ibid.</i>
381	–	24	7	1986	1 adult M	Maagaard 1990
382	Danmarkshavn	.	.	1905	22 shot	Sæther 1936
383	–	.	.	1906	4 shot	Friis 1925
384	–	.	.	1906	1 shot	<i>Ibid.</i>
385	–	18	7	1907	1 shot	Amdrup 1913
386	–	ultimo	7	1907	1 shot	<i>Ibid.</i>
387	–	.	.	1908	1 shot (site not stated)	<i>Ibid.</i>

Obs. no.	Locality	Day	Month	Year	Observation	Source
388	–	14	9	1933	Large herd of walrus (1 shot on an ice floe) This is presumably the herd which was seen on Lille Snenæs in August (see Table 4)	Anon. 1933-36
389	–	.	9	1933	50 on Lille Snenæs and 50-70 on floes between Mørke Fjord and Danmarkshavn	Hansen & Jennov (no year)
390	–	24	8	1934	6 seen	Nielsen 1944a
391-U	–	8-13	9	1934	50-70 walrus. 2 hauled out on land where the boats were hauled up	Nielsen 1944a,c Jennov 1945a,b
392	–	2	9	1938	Walrus seen	Jensen, C. 1938-39
393	–	3	9	1938	2 shot on ice floe (one of these lost)	<i>Ibid.</i>
394	–	23	9	1938	2 on ice floe	Pedersen 1942
395	–	12	9	1938	4 walrus on ice	Jensen, C. 1938-39
396	–	25	9	1938	5 in a lead	Pedersen 1942
397	–	.	9	1939	A herd in the harbor 3 killed	Hennings 1941
.	–	.	.	1948-49	19 observed (Poulsen cited; no details)	Johnsen 1953
398	–	13-14	7	1969	2 adult F with a young on the ice	Meltofte 1976
399	–	21	7	1969	2-3	<i>Ibid.</i>
400	–	1	8	1969	1 there for several days	<i>Ibid.</i>
401	–	28	6	1974	1 in the harbor	<i>Ibid.</i>
402	–	9	7	1974	1 in lead in harbor	<i>Ibid.</i>
403	–	25	7	1987	1 adult M	Maagaard 1990
404	–	1	8	1988	1 adult M, 1 adult F with a one-month-old calf	<i>Ibid.</i>
405	–	31	7	1988	1 adult M	<i>Ibid.</i>
406	–	6	8	1988	1 adult M	<i>Ibid.</i>
407	Øresund	7	8	1969	1 subadult	Meltofte 1976
408	–	7	8	1969	1 adult	<i>Ibid.</i>
409	–	15	8	1969	1 adult	<i>Ibid.</i>
410	–	12	7	1974	1-2 on the ice in Øresund	<i>Ibid.</i>
411	Kap Bismarck	primo	9	1907	1 shot	Amdrup 1913
412	–	4	9	1938	Walrus heard	Jensen, C. 1938-39
413	–	.	9	1939	1 walrus killed	Hennings 1939-40
414	–	20	8	1969	1 adult	Meltofte 1976
415	–	5	8	1986	1 adult F with young	Maagaard 1990
416	–	23	8	1969	2	Meltofte 1976
417	–	24	8	1969	3	<i>Ibid.</i>
418	–	10	9	1969	1 adult	<i>Ibid.</i>
419	SW of Kap Bornholm	21	8	1970	1 adult F with a calf	<i>Ibid.</i>
420	–	22	8	1970	1 adult F with a one-year-old calf	<i>Ibid.</i>
421	–	29	8	1970	2 single seen	<i>Ibid.</i>
422	Rensskæret	27	9	1970	2 single seen	<i>Ibid.</i>
423	–	30	7	1988	1 adult M	Maagaard 1990
424	–	15	7	1974	3 on the ice	<i>Ibid.</i>
425	Store Koldewey	10	9	1950	1 walrus shot at northern point on Store Koldewey	Anon. 1950-52
426	–	24	8	1932	A group heading south.	Jennov 1935
427	–	.	.	.	Occur south of Trækpas- set	Jennov 1959
428	–	.	.	1933	Small groups hauled out on ice floes all along the eastern coast of the island	Jennov 1945a,b
429-V	–	.	8	1905	2 old M shot on the southern point	Orlean 1911
430	–	.	.	.	Are said to have a terres- trial haul-out site here	Jennov 1945a,b
431	–	18	8	1989	1 adult at 75°35' N 18°35' W	Born & Knutsen 1990a
432	–	10	8	1984	Feces on a beach on eastern coast of Kap Alf Troll	Andersen 1984

Obs. no.	Locality	Day	Month	Year	Observation	Source
<i>North of Dove Bugt, see Figs 9, 5 C and 20</i>						
433	Fyrretvyvekilo- meternæsset	21	8	1969	1 adult	Meltofte 1976
434	Île de France	20	4	1907	Some. Breathing holes seen Kap St. Jacques: two large ani- mals, walrus or seals ( <i>sic!</i> )	Johansen 1910 Thostrup 1911:212
435	–	.	6-8	1987-89	Several observed regu- larly (exact number not stated) in a lead running W-SW from Kap St. Jacques	E. Knuth pers. comm. 1995 Kristensen & Kristensen 1993
436	78°10' N 17°10' W	.	7	1992	1 subadult	Andersen 1984
437	Norske Øer	25	7	1984	36 about 85 km southeast of Norske Øer	<i>Ibid.</i>
438	–	25	7	1984	15 about 70 km southeast of Norske Øer	<i>Ibid.</i>
439	–	24	7	1984	26 about 50 km east of Norske Øer	Kristensen & Kristensen 1993
440	79°30' N 17°20' W	.	7	1992	1 subadult	This study
441	79°24' N 15°04' W	11	6	1993	1 hauled out near edge of fast ice	Andersen 1984
442	Nioghalvfjerd- fjorden	23	7	1984	24 about 70 km east of 79-Fjorden	This study
443	79° 42' N 14° 42' W	2	6	1993	Dead adult walrus partially frozen into the pack ice	E. Jensen <i>in litt.</i> 1991 K. Kammp <i>in litt.</i> 1993
444	Hovgaard Ø	.	8	1989	10 seen early August	This study
445	79°55' N 17°06' W	9	8	1993	5	<i>Ibid.</i>
446	79° 59' N 17° 05' W	27	5	1993	1 subad. (tusks 12 cm long)	Andersen 1984 Kristensen & Kristensen 1993
447	–	27	5	1993	4 (3 on an ice floc, one in water)	This study
448	Kap H. N. Andersen	22	7	1984	5 on ice near land	<i>Ibid.</i>
449	80°00' N 14°40' W	.	7	1992	1 subadult	Andersen 1984 Kristensen & Kristensen 1993
450	80° 02' N 13° 19' W	2	6	1993	1 adult M at 3 m broad lead in dense pack ice	This study
451	S. coast of Dijnphna Sund	9	8	1993	1 adult M	K. Kammp <i>in litt.</i> 1993
452	Dijnphna Sund	22	7	1984	8 near land	Andersen 1984
453	–	24	7	1989	2 adults on fast ice at Sorteelven	E. Jensen <i>in litt.</i> 1991
454	–	26	7	1989	3 adults same site as above	<i>Ibid.</i>
455	–	27	7	1989	3 on ice	<i>Ibid.</i>
456	–	28	7	1989	1 adult	<i>Ibid.</i>
457	–	29	7	1989	2 animals in leads close to the glacier	<i>Ibid.</i>
458	–	30	7	1989	6 on the ice	<i>Ibid.</i>
459	–	1	8	1989	1 adult M	<i>Ibid.</i>
460	–	2	8	1989	3 at Marmorvigen	<i>Ibid.</i>
461-X	–	3	8	1989	2 hauled out on the beach at Marmorvigen	<i>Ibid.</i>
462	–	4	8	1989	2 at Sortedalen	<i>Ibid.</i>
463	Malleukfjeldet	21	7	1984	20 near land	Andersen 1984
464	–	18	8	1989	8-10 at the glacier	E. Jensen <i>in litt.</i> 1991
465	–	.	3	1990	20-30 in polynya	Sirius via Søder 1991
466	–	.	3	1991	20-30 in polynya	<i>Ibid.</i>
467-Y	Hanseraq Fjord	28	8	1980	10 on land	Hjort 1981
468	–	28	8	1980	1 adult F with calf on a floe	G. Jansson pers. comm. 1980
469	–	20	7	1984	3 on land	Andersen 1984
470	–	20	7	1984	5 on ice	<i>Ibid.</i>
471	Eskimonæs	19	7	1984	12 seen	<i>Ibid.</i>
472	–	18	8	1989	Some seen	E. Jensen <i>in litt.</i> 1991



Obs. no.	Locality	Day	Month	Year	Observation	Source
473	–	27	May to 17 June	1993	Groups from 2 to 20 young M (?) during this period; 2-12 according to Weslawski <i>et al.</i> (1997)	Weslawski & Wictor 1993
474	–	.	4	1994	Walrus observed	T. Rasmussen pers. comm. 1994
475	80° 20'N 13° 01'W	9	6	1993	1 on ice	This study
476	Ingolf Fjord	19	7	1984	8 seen	Andersen 1984
477	80° 30'N 15° 00'W	.	7	1988	1	Joiris 1991
478	Henrik Krøyers Holme	13	8	1975	1 seen	Meltofte 1976
479	–	12	7	1984	2 seen	F. Jensen pers. comm. 1991
480	–	22	7	1992	31 walrus seen (females with calves and subadults)	Kristensen & Kristensen 1993
481	80° 40'N 14° 25'W	3	6	1993	1 adult swimming along edge of fast ice	This study
482	Henrik Krøyers Holme	29	7	1993	10	K. Kampp <i>in litt.</i> 1993
483	Amdrup Land	.	4	1939	4 at the coast	Pedersen 1942
484	–	25	7	1993	6 observed	K. Kampp <i>in litt.</i> 1993
485	Sommerteras- serne	15	6	1993	5 on small floe	This study
486	NW of H. Krøyers Holme	26	7	1993	6 observed	K. Kampp <i>in litt.</i> 1993
487	S. of Dværgfjord	.	8	1993	Up to 30 walrus seen during early August	Kapel & Berg 1994
488	Sophus Müllers Næs	18	7	1984	28 in several groups	Andersen 1984
489	80° 45'N 14° 03'W	13	6	1991	9 walrus including 3 ad. F with newborn	Joiris <i>et al.</i> 1992
490	80° 47'N 14° 03'W	3	6	1993	1 adult M hauled out on an ice floe	This study
491	Antarctic Bugt	29	4	1976	6 on ice	Meltofte 1976
492	–	14	6	1993	94 between Antarctic Bugt and Eskimonæs	Born <i>et al.</i> 1994b
493	–	25	7	1993	A total of 93 observed. Of these 17 were calves	Tahon & Vens 1994
494	–	26	7	1993	25	K. Kampp <i>in litt.</i> 1993
495	80° 56'N 14° 04'W	3	6	1993	1 adult M hauled out on the edge of the shore-fast ice 100 m from water	This study
496	80° 56'N 14° 04'W	3	6	1993	6 adult F and a two-year-old calf hauled out on an ice floe with fecal staining	<i>Ibid.</i>
497	80° 56'N 14° 04'W	3	6	1993	8 adult F and 2 one-year-old calves hauled out on ice floe with fecal staining	<i>Ibid.</i>
498	80° 57'N 13° 52'W	3	6	1993	About 80 walrus hauled out on the edge of the land fast ice. All age classes including newborn. Apparently all adults were F	<i>Ibid.</i>
499	80° 57'N 13° 52'W	3	6	1993	4 in water	<i>Ibid.</i>
500	80° 57'N 13° 52'W	3	6	1993	4 in water about 200 m from above observation	<i>Ibid.</i>
501	Grenen	18	7	1984	36-40 in several groups	Andersen 1984
502	80° 58'N 11° 02'W	13	6	1993	13 on a small ice floe	A. Bochert pers. comm. 1993
503-Z	Kilen (81° 10' N)	5(6)	6	1907	1 on ice about 30 km N of 80° 43' N	Trolle 1908 Amdrup 1913 Johansen 1910:208
504	–	2	5	1976	5 on ice	Meltofte 1976
505	–	16	7	1984	Walrus feces on the beach	Andersen 1984
506	–	16	7	1984	6 on the ice	<i>Ibid.</i>

## Appendix 2 – continued

Obs. no.	Locality	Day	Month	Year	Observation	Source
507	–	5	7	1984	4 on ice about 15 km north of Kilen	<i>Ibid.</i>
508	–	1	4	1991	Drag marks and feces on land of 4-5 walruses. Exact site not specified	Sirius via Søder 1991

## Instructions to authors

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 about acceptance, rejection, or desired alterations. The final decision on these matters rests with the editor.

Manuscripts corresponding to less than 16 printed pages (of 6100 type units) including illustrations are not accepted, unless they are part of a special theme issue. Manuscripts that are long in relation to their content will not be accepted without abridgement.

## Manuscript

**Language.** – Manuscripts should be in English (preferred language), French, or German. Authors who are not writing in their native language must have the language of their manuscript corrected before submission.

**Place names.** – All Greenland place names used in the text and in illustrations must be names authorised by The Greenlandic Language Committee. Authors are advised to submit sketch-maps with all required names to the Secretary for checking before the manuscript is submitted. Names of Greenland localities outside the area with which the paper is concerned should be accompanied by coordinates (longitude and latitude).

**Title.** – Titles should be as short as possible, with emphasis on words useful for indexing and information retrieval.

**Abstract.** – An abstract in English must accompany all papers. It should be short (no longer than 250 words), factual, and stress new information and conclusions.

**Typescript.** – Typescripts must be clean and free of handwritten corrections. Use double spacing throughout, and leave a 4 cm wide margin on the left hand side. Avoid as far as possible dividing words at the right-hand end of a line. Consult a recent issue for general lay-out.

Page I should contain 1) title, 2) name(s) of author(s), 3) abstract, 4) key words (max. 10), 5) author's full postal address(es). Manuscripts should be accompanied by a table of contents, typed on separate sheet(s).

Underlining should only be used in generic and species names. The use of italics in other connections can be indicated by wavy line in pencil under the appropriate words.

Use at most three grades of headings, but do not underline. The grade of heading can be indicated in soft pencil in the left hand margin of one copy of the typescript. Avoid long headings.

**Floppy disc.** – It may be helpful in the printing procedure if, in addition to the hard copies, the manuscript is also submitted on a DOS-formatted floppy disc. However, editing will be made on the hard copy, and the text file on the disc must be identical to the final version of the manuscript.

**References.** – References to figures and tables in the text should have the form: Fig. 1, Figs 2-4, Table 3. Bibliographic references in the text are given thus: Shergold (1975: 16) ... (Jago & Daily 1974b).

In the list of references the following style is used:

Boucot, A. J. 1975. Evolution and extinction rate controls. – Elsevier, Amsterdam: 427 pp.

Sweet, W. C. & Bergström, S. M. 1976. Conodont bio-stratigraphy of the Middle and Upper Ordovician of the United States midcontinent. – In: Bassett, M. G. (ed). The Ordovician System: Proceedings of a Palaeontological Association symposium, Birmingham, September 1974: 121-151. University of Wales Press.

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

*Meddelelser om Grønland, Geoscience (Bioscience, Man & Society)* should be abbreviated thus: *Meddr Grønland, Geosci. (Biosci., Man & Soc.)*

## Illustrations

**General.** – Submit two copies of all diagrams, maps, photographs, etc., all marked with number and author's name. Normally all illustrations will be placed in the text.

All figures (including line drawings) must be submitted as glossy photographic prints suitable for direct reproduction, and preferably have the dimensions of the final figure. Do not submit original artwork. Where appropriate the scale should be indicated on the illustration or in the caption.

The size of the smallest letters in illustrations should not be less than 1.3 mm. Intricate tables are often more easily reproduced as text figures than by type-setting; when lettering such tables use »Letraset« or a typewriter with carbon ribbon.

Colour plates may be included at the author's expense, but the editor must be consulted before such illustrations are submitted.

**Size.** – The width of figures must be that of a column (76.5 mm), 1 1/2 columns (117 mm), or a page (157 mm). The maximum height of a figure (including caption) is 217 mm. Horizontal figures are preferred. If at all possible, fold-out figures and tables should be avoided.

**Caption.** – Captions to figures must be typed on a separate sheet and submitted, like everything else, in duplicate.

## Proofs

Authors receive two page proofs. Prompt return to the editor is requested. Only typographic errors should be corrected in proof; the cost of making alterations to the text and figures at this stage will be charged to the author(s).

Twenty-five copies of the publication are supplied free, fifty if there are two or more authors. Additional copies can be supplied at 55% of the retail price. Manuscripts (including illustrations) are not returned to the author after printing unless specifically requested.

## Copyright

Copyright for all papers published by Kommissionen for Videnskabelige Undersøgelser i Grønland is vested in the Commission. Those who ask for permission to reproduce material from the Commission's publications are, however, informed that the author's permission must also be obtained if the person is still alive.

**Meddelelser om Grønland**

**Bioscience**

**Geoscience**

**Man & Society**

**Published by  
The Commission  
for Scientific  
Research  
in Greenland**