



SEABIRDS AND MARINE MAMMALS IN NORTHEAST GREENLAND

Aerial surveys in spring and summer 2008

NERI Technical Report no. 721 2009



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Data sheet

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Abstract: This report presents the results of two aerial surveys for seabirds and marine mammals in Northeast Greenland in spring and summer 2008. The report is part of the KANUMAS East Strategic Environmental Impact Assessment programme.

Keywords: Northeast Greenland, aerial survey, spring concentrations, seabird, marine mammal, moulting concentrations.

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Photo: David Boertmann

Preface

In 2006 the Bureau of Minerals and Petroleum decided to initiate the opening process of the so-called KANUMAS areas for a licensing round.

KANUMAS is the acronym for an oil exploration initiative, Kalaallit Nunaat Marine Seismic project, and the KANUMAS areas are the waters off Northeast and Northwest Greenland (Figure 1).

The KANUMAS project was a regional seismic exploration programme that was initiated at the end of 1989. A group of companies, the KANUMAS group, was then granted a prospecting licence to the KANUMAS areas.

Strategic environmental impact assessments (SEIA) of hydrocarbon activities in the two regions are under preparation. The data for these SEIAs are not adequate, and a number of projects for supplementing data to the SEIA-work has been initiated as a co-operation between NERI, Greenland Institute of Natural Resources (GINR) and the Bureau of Minerals and Petroleum (BMP).

This report presents the results of one of these projects: Aerial surveys in spring and summer in search of coastal seabirds and marine mammals.

Sammenfatning

Denne rapport beskriver resultaterne af to optællinger af fugle og havpattedyr foretaget fra fly i Nordøstgrønland i området mellem Kap Coster på Blossesville Kyst og Kap Morris Jesup (Grønlands nordspids). Flyvningerne blev gennemført i to perioder: Slutningen af maj til de første dage af juni og i slutningen af juli til de første dage af august.

Projektet indgår i en generel videnindsamling omkring biologiske forhold i de såkaldte KANUMAS-områder (områder, hvor en række olieselskaber i 1990'erne foretog seismiske undersøgelser og som omfatter store dele af havet ud for Nordøstgrønland (Figur 1 viser KANUMAS-området ud for Nordøstgrønland). Arbejdet blev finansieret af Råstofdirektoratet, og den indsamlede viden skal indgå i miljøvurderinger af olieeftersforskning.

Formålet med flyvningerne i 2008 var primært at lokalisere koncentrationer af havfugle og havpattedyr. I maj særligt ansamlinger af svømmefugle i de isfrie områder (polynyer) langs kysterne og i juli ynglekolonier (fuglefjelde og -øer) og ansamlinger af fældende dykænder (Figur 2).

De fleste tællinger var "total-tællinger", dvs. der blev fløjet langs kystlinier, og iskanter hvor flokke og koncentrationer opsøgte. Systematiske tællinger langs et sæt transekter blev forsøgt i maj-juni i polynyerne Nordøstvandet og Scoresby Sund (Figur 3).

Umiddelbart inden tællingen i juli gennemførte tælleholdet en optælling af fældende gæs i Jameson Land. Resultaterne fra denne tælling er med på de viste kort, men vil ellers blive rapporteret i anden sammenhæng.

Resultaterne fra optællingerne præsenteres på kortene Figur 6-34.

I maj var de vigtigste områder for fugle de tre store polynyer ved Scoresby Sund, Wollaston Forland og Nordøstvandet. Den talrigeste og mest udbredte art var almindelig ederfugl af hvilke i alt ca. 27.000 taltes langs kysterne: 4.600 i Nordøstvandet, 13.000 ved Wollaston Forland og 6.500 ved Scoresby Sund (Figur 12). Dette antal repræsenterer sandsynligvis en meget stor andel af den samlede ederfuglebestand i Nordøstgrønland.

Kongeederfugle blev i maj-juni kun set i store antal i Nordøstvandet hvor der var ca. 1.500 fugle, som lå sammen med de almindelige ederfugle (Figur 13).

Søkonger var meget mere talrige end de øvrige fugle, men den blev kun set i Scoresby Sund og nærliggende farvande. De store ynglekolonier ligger på kysterne af Liverpool Land og Volquart Boon Kyst.

De mest interessante observationer af havpattedyr i maj-juni var flere flokke af narhvaler langs sydkanten af Nordøstvandet (17 flokke med mindst 32 individer, Figur 25) og store antal af hvalrosser også i Nordøstvandet. En beregning af antallet i det område, hvor der blev fløjet langs transekter (Figur 29) giver 470 dyr (95 % usikkerhedsinterval: 100-2.207 dyr). Dette antal tager ikke højde for de dyr der var neddykkede under optællingen. Langs kysterne sås i alt mindst 104 hvalrosser (når der korrigeres for dobbeltregistrering). Mange af disse hvalrosser var hunner med unger; i alt

sås mindst 15 unger på de to tællinger langs kysterne. Der blev også set hvalrosser langs iskanter i polynyet ved Wollaston Forland, i alt 20 den 25. maj (Figur 21).

I juli-august var fuglene især udbredt langs kysterne, syd for Dove Bugt. Nord herfor lå der fastis ind til kysten så langt mod nord som Holm Land, hvor der igen var isfrit (Nordøstvandet).

De vigtigste steder for ynglefugle var øerne og fjeldene med fuglekolonier. De store fuglefjelde på Kap Stewart og langs kysterne af Scoresby Sund polynyet blev dog ikke talt for ikke at forstyrre. Vigtige øer med fuglekolonier var: Dunholme, Jackson Ø, Vinterøer, Hvalros Ø, Renskarret, Maroussia og Henrik Krøyer Holme.

Der fandtes i alt 62 ynglekolonier for havfugle, som ikke var registreret før. I disse var der arter som Sabinemåge, ismåge, sildemåge og havterne (Tabel 4). Især resultaterne for ismåge er bemærkelsesværdige, idet der blev fundet i alt 12 nye ynglesteder for denne art (Figur 32), bl.a. en større koloni på en grusdækket isflage i munden af Independence Fjord (Boertmann *et al.* in press).

Der blev desuden observeret ynglende og fældende knortegæs i et større område end hidtil kendt (Figur 10), og den hidtil nordligste observation af islom i Grønland blev gjort nær Fyn Sø (Figur 6).

Den mest talrige og udbredte andefugl var i juli-august almindelig ederfugl (Figur 12). Hunner med unger blev set flere steder i Nordøstvandområdet og lidt nord herfor. Disse er de hidtil nordligste ynglefund for denne art i Grønland. Ellers var arten talrig langs de fleste isfrie kyster, og især i fjordene på Blosserville Kyst sås mange fældende fugle, som kan tænkes at have islandsk oprindelse. Ellers var flokke af fældende havlitter talrige og udbredt langs kysterne syd for Dove Bugt (Figur 14). Kongeederfugle var derimod forbløffende fåtallige, kun to steder sås større flokke af fældende fugle (Figur 13).

Fældende bram- og kortnæbbede gæs blev talt i Jameson Land umiddelbart inden optællingerne langs kysterne i juli (Figur 9, 11). Her var bestandene af fældende gæs tredoblet siden 1988/1989, da de sidst blev talt. Både på Hold-With-Hope og på Wollaston Forland blev der fløjet ind over lavlandsområder, hvor der også blev talt gæs i 1988, og bestandene af fældende gæs var her ligeledes meget større i 2008 end i 1988. Store antal af fældende kortnæbbede gæs blev set i området omkring Skjoldungeelv og ved Bliss Bugt i Johannes V. Jensen Land (Figur 11).

I juli-august sås forbløffende få narhvaler og hvalrosser i Nordøstvandet. Derimod sås talrige flokke af narhvaler i Dove Bugt langs vestsiden af Store Koldewey (Figur 25). I alt 5 grønlandshvaler sås langs iskanter og kyster (Figur 24).

Summary

This report describes the results of two aerial surveys carried out in Northeast Greenland in the spring and summer of 2008. The aim was to survey concentrations of seabirds and marine mammals along the shores and ice edges in May-June and in July-August. The survey was a part of a larger data acquisition programme carried out by NERI and Greenland Institute of Natural Resources for future environmental impact assessment of hydrocarbon activities in the sea off Northeast Greenland. The Bureau of Minerals and Petroleum (Greenland Home Rule) financed the surveys.

Two kinds of surveys were carried out: Total counts along shores and ice edges and transect counts over the two larger polynyas (Northeast Water and Scoresby Sund). The latter were only done in May-June.

The results are presented on the maps shown in Figures 6-34.

Not surprisingly, the large coastal polynyas were important seabird habitats in spring. The most numerous and widespread species was common eider; in total 27,000 were counted, most likely representing a very significant part of the total breeding population in Northeast Greenland. Little auks were much more numerous, but were only seen in the Scoresby Sund polynya and adjacent waters, close to the large breeding colonies on the Liverpool Land coast and Volquart Boon Coast. King eiders were, except for the Northeast Water polynya, only seen in low numbers.

During the July-August survey, moulting seaducks were seen widespread along the coasts to the south of Dove Bugt. Common eiders were numerous, especially along the Blosserville Kyst, long-tailed ducks were also numerous, and usually found in shallow bays while very few moulting king eiders were located.

Many new seabird breeding colonies (n= 62) were located both on small islands and on steep coasts. The major part was colonies of glaucous gull and Arctic tern (Table 4, Figure 31). Most notably were twelve new ivory gull colonies (Figure 32) and seven with Sabines gulls (Figure 33).

Among the marine mammals concentrations of walrus and narwhal were observed in the Northeast Water in early June, while only a few walruses were seen here in August. A noteworthy observation of narwhals was a large concentration in Dove Bugt in July. Five different bowhead whales were seen in July-August.

Eqikkaaneq

Nalunaarusiami uani timmissanik miluumasunillu imarmiunik Tunup avannaani, Kap Coster-ip, Blosseville Kystenip Kap Morris Jesup-illu (Kalaallit Nunaata avannamut isua) akornanni kisitsinerit marluk eqqartorneqarput. Timmisartornerit piffissani marlunni ingerlanneqarput: Majip naalerneraniit junip aallartilaarneranut aammalu julip naalerneraniit augustusip aallartilaarneranut.

Pilersaarut nalinginnaasumik KANUMAS-områdenik (uuliasioqatigiiffiit assigiinngitsut arlallit 1990-ikkunni sajuppillatitsisarlutik Tunup avannaata kangiaata avataani imarujussarmi misissuiffigisimasaat, (titartagaq/figur 1-ip takutippaa Tunup avannaata kangiani KANUMAS-områdeqarfik) taagorneqartuni uumasunut tunngatillugu ilisimasassanik nalinginnaasunik katersinermut ilaavoq. Suliaq Råstofdirektoratimit aningaasalersorneqarpoq ilisimasassallu katersorneqartut uuliasiornermut tunngatillugu avatangiisinik nalilersuinermit ilaatinneqassapput.

2008-mi timmisartornerni salliutillugu siunertaavoq timmissat miluumasullu imarmiut eqiterusimaffiginerusaasa sumiinnerat paasiniarlugu. Pingaartumik majimi sinerissap saavani aakkarneqarfinni (polyniani) timmissat imamiut julimilu piaqqiorfimminni (innani qeqertanilu) katersuusimasarput aammalu timmissat alluumasartut isat katersuusimasarfii paasiniarneqarput (titartagaq/figur 2).

Kisitsinerit amerlanersaat "tamakkiisumik kisitsinerupput" imaappoq sineriak sikullu sinaava sinerlugu eqiterusimasunik amerlasuukkuutaanilluunniit ujarlerneqarluni. Majimi-junimi aakkarneqarfinni Nordøstvandimi Scoresby Sundimilu narlusuumik timmisarluni peqqissaartumik kisitsinerit misilinneqarput (titartagaq/figur 3).

Julimi kisitsinissaq sioqqutitsiarlugu kisitsisut Jameson Landimi nerlernik isasunik kisitsipput. Kisitsinerup taassuma inernerit nunap assingani takutinneqartumi ilaapput, kisiannili amma allakkoortillugit nalunaarutigineqarumaarlutik.

Kisitsinerni inernerit nunap assingini titartakkani 6-34-mi saqqummiunneqarput.

Majimi timmissanit najorneqarnerpaat tassaapput aakkarneqarfiit, polyniat, pingasut Scoresby Sundip, Wollaston Forlandip Nordøstvandillu eqqaanniittuut. Timmissat siammarsimanersaraat miteq nalinginnaasoq, taakkunangga 27.000 missaat sinerissani kisinneqarput: 4600 Nordøstvandimi, 13.000 Wollaston Forlandimi 6500-illu Scoresby Sundimi (titartagaq/figur 12). Kisitsisinut taakkunangga Tunup avannaani mitit tamarmiusut amerlanersaat ilaasimassagunarput.

Mitit siorakitsut amerlasuut taamaallaat Nordøstvandimi takuneqarput 1500 missaanniittut, mitermik siorartuunik ilaqartut (titartagaq/figur 13).

Appaliarsuit timmissanut allanut naleqqiullugit amerlanipilorujussuusut Scoresby Sundimi immanilu qanitaaniittuni taamaallaat takuneqarput. Erniorferujussui Liverpool Landip Volquart Boon Kystillu sineriaanniipput.

Miluumasunik imarmiunik takusat soqutiginarsaraat Nordøstvandip kujammu sinaani qilalukkat qernertat ataatsimoortitertut arlariijaat (ataatsimoortukkuutaat 17-it minnerpaamik 32-inik qilalugartarqartartut, (Titartagaq/figur 25) aammalu Nordøstvandimi aaverpassuit. Tamaani narlusuumik timmisarluni kisitsinikkut takusat amerlassusiinik naatsorsuinerup inerneraa aarrit 470-iusut (95% usikkerhedsinterval atorlugu: aarrit 100-2207) Kisitsit taanna aavernut kisitsinermi aqqaamasimasinnaasunik ilaqartinneqanngilaq. Sinerissami minnerpaamik katillugit aarrit 104 takuneqarput (tassani kisitsinermi ilannguteqqittoorneqarsimasinnaasut naqqiutigalugit). Aarrit tamakkua ilarpassui arnaviaapput piaqqisartut; sineriak atuarlugu kisitsilluni timmisartornerni marlunni taakkunani katillugit minnerpaamik piaqqat 15-it takuneqarput. Wollaston Forlandi-ip aakkarneqarfiata sinaavani aamma aavernik 20-nik taku-soqarpoq majip 25-ani.

Juli-augustusimi Dove Bugt-ip kujataani timmissat sinerissami takussaanerujussuupput. Tamatuma avannaani suli sikuuvoq avammamut Holm Land tikillugu, tassanngaanniilli imaroqqilluni (Nordøstvandet).

Timmissat erniorfii pingaernerit tassaapput qeqertat innallu timmiaqarfiusut. Kisianni Kap Stewardimi innani sinerissanilu Scoresby Sundip aakkarneqarfiata sinaaniittuni timmiaqarferujussuit kisitsiffigineqanngilat timmissat akornusersorumanagit. Qeqertat timmiaqarfiit pingaarutilit makkuupput: Dunholme, Jackson Ø, Vinterøer, Hvalros Ø, Renskæret, Maroussia aamma Henrik Krøyer Holme.

Timmissat imarmiut piaqqiorfiit siornatigut nalunaarsorneqarsimangitsut katillugit 62-it tamaaniipput. Tamakkunaniipput ilaatigut Sabinemåge, naajavaarsuk, sildemåge aamma imeqqutaallat (titartagaq/figur 4). Pingaartumik naajavaarsummut tunngatillugu uisaallaatissaavoq, tassami timmissap taassuma piaqqiortarfii siornatigut ilisimaneqanngitsut katillugit 12 nassaarineqarmata (titartagaq/figur 32), ilaatigut amerlajaarsuit ineqarfiat Independece Fjord-ip paavaniittoq puttaami sioqqanik ujaraaqqanillu qallersimasumi (Boertmann *et al.* in press).

Nerlerittaaq knortegæs-it piaqqiortut isasullu siornatigut tamakkoqartarneranik ilisimaneqanngitsumi nunami annertujaarujussuarmititut takuneqarput (titartagaq/figur 10), maannamullu Kalaallit Nunaanni tuullimmik takuffiit avannarpasinnarsaat Fyn Søp qanittuani takkuigineqarpoq (titartagaq/figur 6).

Timmiarli juli-augustusimi siaruarsimanerpaaq amerlanerpaarlu tassaavoq miteq sigguttoq (titartagaq/figur 12). Arnavissat piaqqisartut Nordøstvandimi eqqaanilu tamatumalu avannannguani arlalinni takuneqartarput. Tamakkualu tassaapput maannamut aatsaat taamak avannarpasitsigisumi timmissat taakkua piarqiorfiannik takuffiit. Sumi tamaanili sinerissap sikoqanngitsortaani mitit amerlallutik takussaaqaat, pingaartumik Blosseville Kystip kangerluini amerlasoorujussuit isasut takuneqarput Islandimeersimasinnaasutut ilimagineqarsinnaasut. Soorlu allerit isasut eqimattakkuutaat sinerissami Dove Bugtenip kujataaniittumi sumi tamaani amerlapput (titartagaq/figur 14. Kisiannili mitit siorakitsut tupaallannartumik akuttupput, taamaallaat marlunni eqimattat anner-tunerusut isasut takuneqarlutik (titartagaq/figur 13).

Nerlernat nerlerillu siggukitsut isasut Jameson Landimi kisinneqarput sinerissami kisitsinissat sioqqutitsiarlugu (titartagaq/figur 9, 11). Tama-

ani isasut 1988/1989-imi kingullermik kisitsinermut naleqqiullugu pingasoriaammik amerlisimapput. Hold-With-Hopemi aamma Wollaston Forlandimi nuna pukitsunnguaq, 1988-imi kisitsiviusimasoq, qarsuallugu timmisartorneqarpoq, tamaanissaaq nerlerit isasut 2008-mi taamanimut naleqqiullugu amerlanerujussuupput. Nerlerit siggukitsorpassuit isasut Skjoldungeelvip aamma Bliss Bugtip Johannes V. Jensen Landimiittup eqqaanni takuneqarput (titartagaq/figur 11).

Juli-augustusimi qilalukkat qernertat aarrillu tupaallaannartumik ikituinnat Nordøstvandimi takuneqarput. Akerlianilli Dove Bugtimi Store Koldewey-ip kimmuk sineriaani qilalukkat qernertat eqimattakkuutaat amerlasuut takuneqartarput (titartagaq/figur 25). Sikup simaavini sinerissamilu katillugit arfiviit 5 takuneqarput (titartagaq/figur 24).



Photo: David Boertmann

1 Introduction

It is well known that oil spills have the potential to kill substantial numbers of seabirds, particularly in coastal areas where seabirds congregate. Long time effects have also been documented after spill events such as the Exxon Valdez in Alaska in 1989 and the Prestige in northern Spain in 2002 (Peterson *et al.* 2003, Alonso-Alvarez *et al.* 2007, Perez *et al.* 2008). Therefore knowledge on seabird abundance and concentration areas is essential when EIAs of hydrocarbon activities with risk of oil spills (drilling, transport, storage of oil) shall be prepared. Such knowledge is limited from the KANUMAS East-area (Figure 1) and National Environmental Research Institute (NERI) in co-operation with Greenland Institute of Natural Resources (GINR) and Bureau of Minerals and Petroleum (BMP) decided to survey seabirds from aircraft in order to strengthen the knowledge base on seabird abundance in two periods, when seabirds will concentrate along the coasts of the KANUMAS East area.

Two aerial surveys were carried out: One in late May, when freshwater habitats were still frozen and inaccessible to waterbirds, and when both freshwater and marine birds congregate in the limited coastal open water areas; and one in late July, when breeding seabirds are in their colonies and moulting seabirds are assembled in moulting areas.

Marine mammals were included in and recorded throughout the surveys.

During the late July survey some terrestrial areas were included in the survey, in order to collect data from some potentially very rich habitats only known from brief visits by non-biologists.

An aerial survey for moulting geese was carried out on 17-18 July 2008 (just before the July-August survey presented in this report) in Jameson Land. The observations of coastal birds from these two surveys are included here.

1.1 Acknowledgements

Thanks to the Bureau of Minerals and Petroleum for the grant which made the survey possible. To the staff of Constable Pynt especially Henrik "Thy" Jensen, to the staff at Station Nord, to Grønlands Kommando (GLK) for permission to use Station Nord as base for the surveys in the northern part of the survey area, and particularly to John Lau Hansen who arranged the transport of fuel to Station Nord. Finally to air captain Leif Petersen and his aircraft OY-CAG, who has flown seabird and marine mammals surveys in Greenland since 1982.

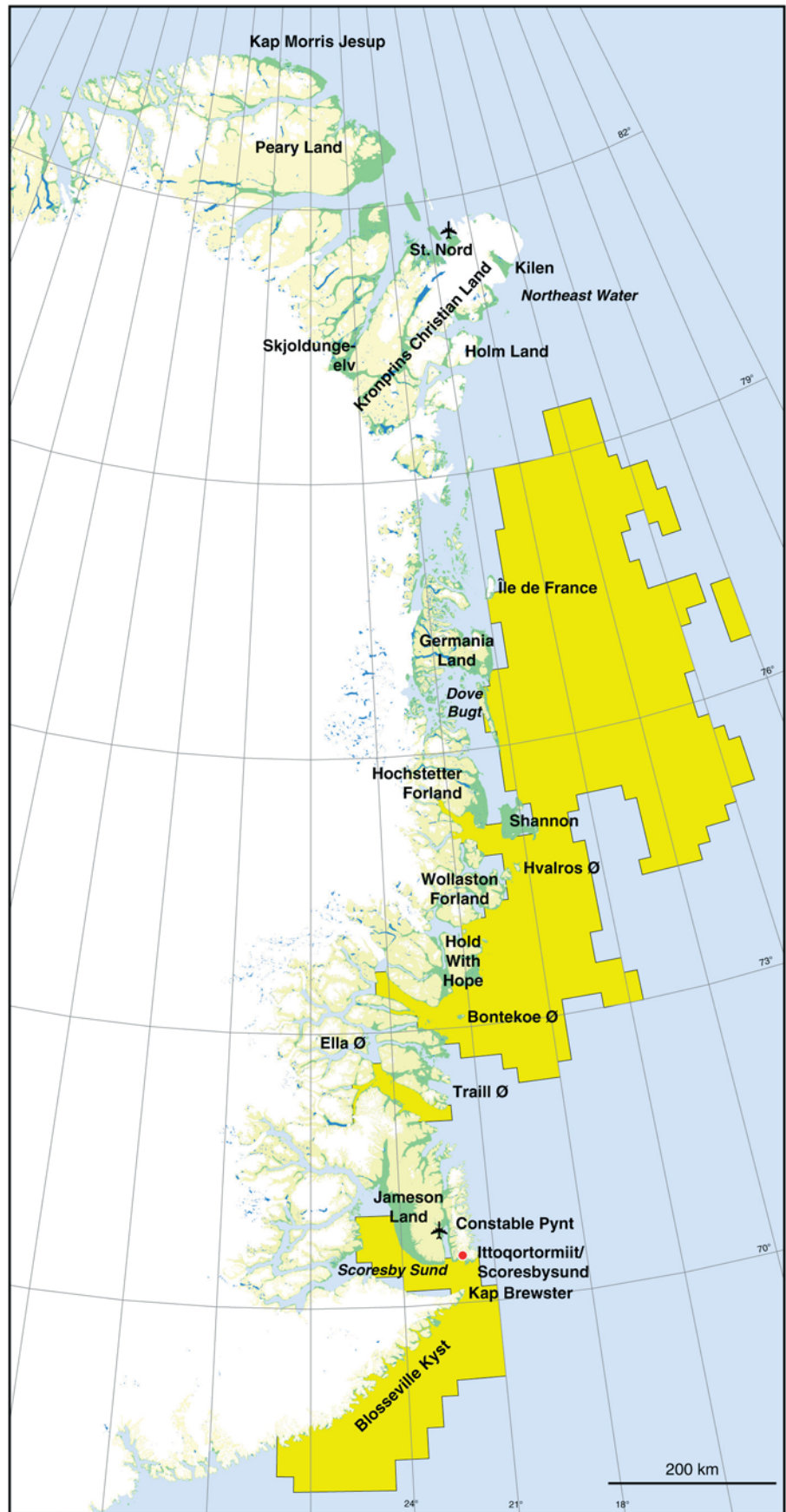


Figure 1. Overview of the surveyed region with the most important site names and the KANUMAS East area shown with yellow.

2 Methods

The aircraft used was a Partenavia P-68 Observer equipped with bubble windows at the seats behind the pilot seats. Most of the surveys were carried out as “total counts” (cf. Laursen *et al.* 2008) flying in an altitude of 250 feet (85 m) and with a speed of 90 knots (160 km/t). Occasionally lower or higher altitude were applied if conditions allowed, and even during ferry flights at an altitude of 5000 feet a few observations of whales were made. The observation routes are shown in Figure 2.

Two sets of transect flights applying distance sampling (Buckland *et al.* 1993) were performed over the two major polynyas in May-June. Observations were sampled in transect bands (Table 1), which were determined by the use of a clinometer. One set was placed in the Scoresby Sund polynya, where six east-west transects spaced with 3 nautical miles (c. 5 km) were flown. In the Northeast Water six north-south transects spaced with 1° (c. 18 km) were flown (Figure 3).

Table 1 Transect bands.

Transect band	Angle compared to horizon (°)	Distance from trackline (m)
1/A	60-25	44-164
2/B	25-15	164-285
3/C	15-10	285-433
4/D	10-4	433-1091
5/E	4-3	1091-1456

Observations of seabirds and marine mammals were recorded on a tape recorder and each observation was dictated together with the observation time. A GPS (Trimble GeoXT) recorded the flown track lines, and by combining the observation time and GPS time each observation could be georeferenced. All clocks were synchronised with the GPS-clock (UTC-time).

During the surveys and mainly in July-August seabird breeding colonies were recorded. Previously known colonies were controlled and new were searched for. However, the large colonies at Kap Brewster and Mallemukfeldet were avoided in order not to scare and disturb breeding birds, and the coasts with little auk colonies were also avoided due to the risks of possible bird strikes.

The base of the operations was the airport Constable Pynt (CNP) close to Ittoqqortormiit/Scoresbysund supplemented for a brief period during both surveys with Station Nord (NOR) (Figure 2).

The aircraft was navigated by pilot Leif Petersen (LP) and observers were David Boertmann (DMB) (both surveys), Rasmus Due Nielsen (RDN) (May-June survey) and Kent Olsen (KEO) (July-August survey). Kasper Johansen calculated the distance sampling results.

Table 2 gives an overview of the activities and Figure 2 and 3 the flown routes.

Figure 2. Survey routes during the May-June survey (blue) and July-August (red). Incl. the distance sampling transects in the Northeast Water and in the Scoresby Sund polynya.

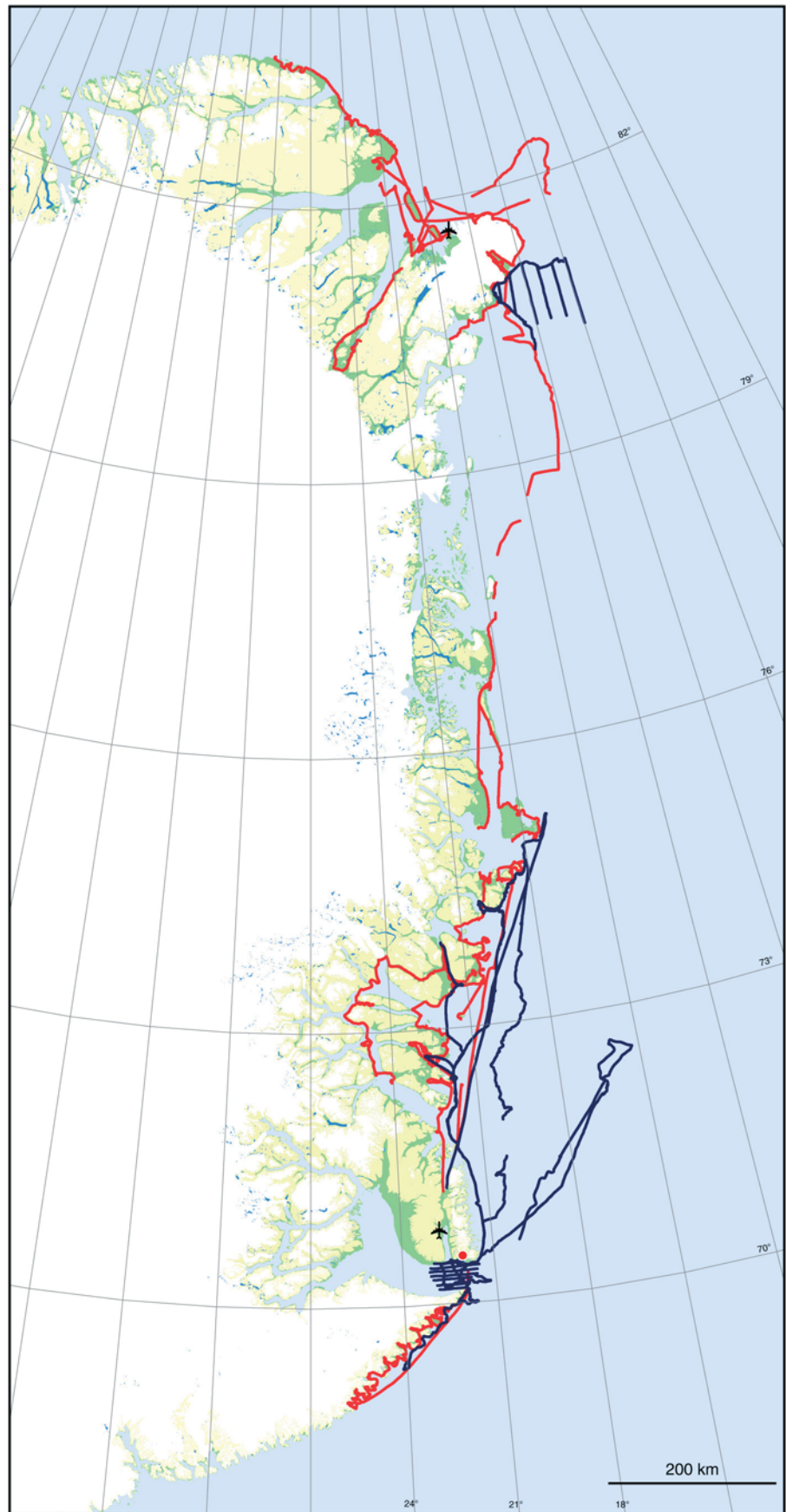


Figure 3. Transect flights (yellow lines). Top: 22 May over the Scoresby Sund polynya and below: 4. June over the Northeast Water. Red hatching indicates fog. Ice situation are images from the MODIS-satellite from mid-June 2008.

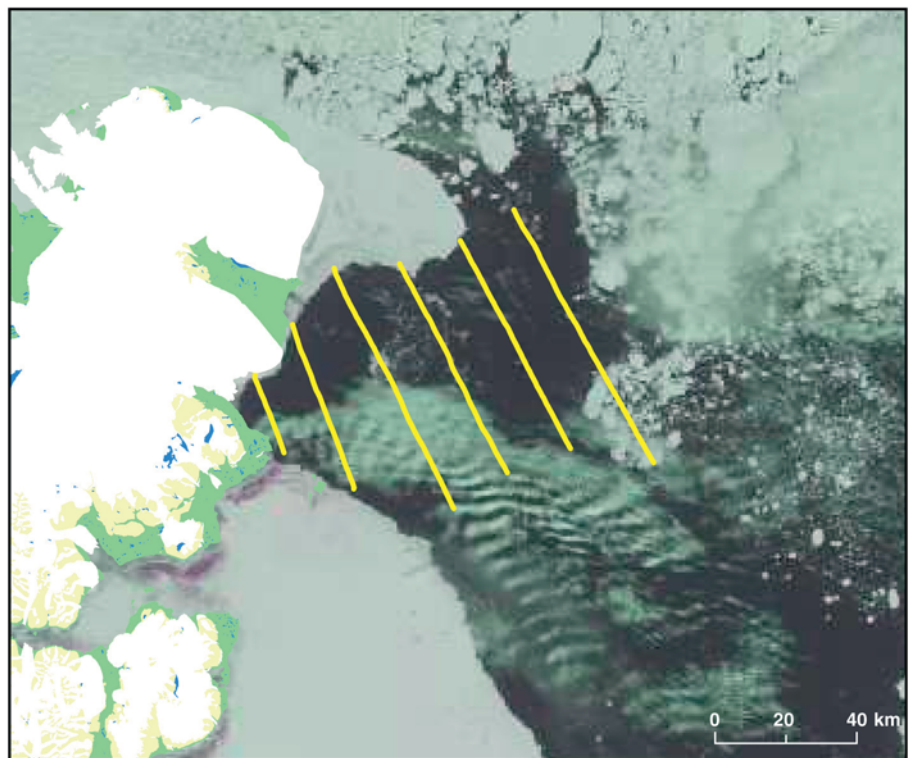
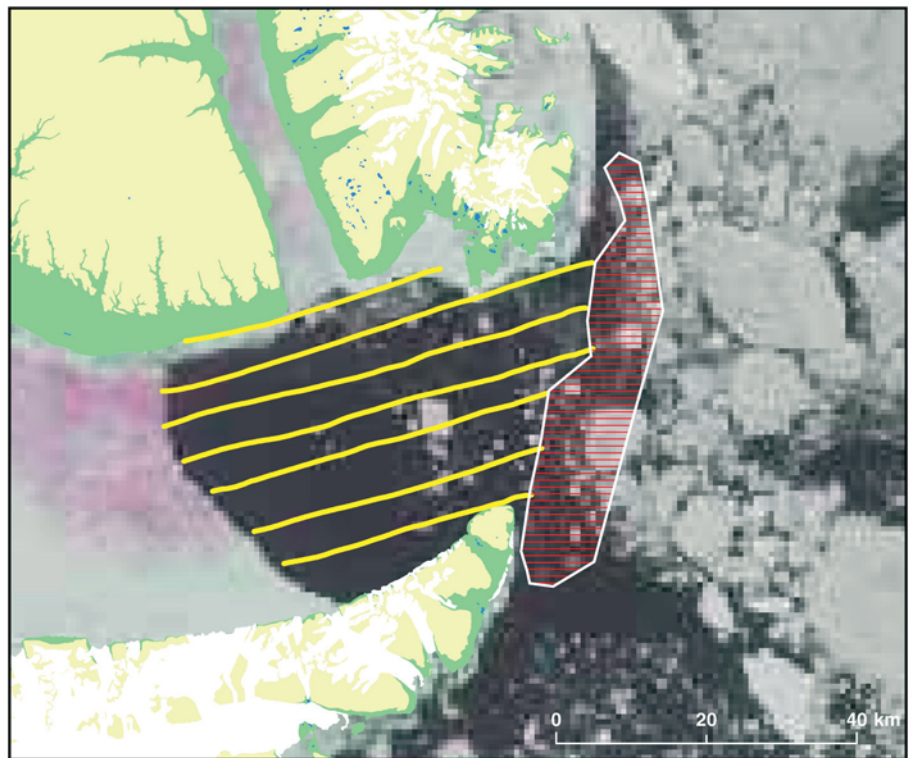


Table 2. The observation activities during the two survey periods. NEW = Northeast Water, CNP = Constable Pynt, NOR = Station Nord.

Date	Airborne	On ground	Survey and airport of departure	Co-pilot seat	Rear seat
22 May	10.24	12.35	Scoresby Sund polynya, CNP	DMB	RDN
24 May	9.26	13.35	Outer coast N to Hold with Hope, CNP	DMB	RDN
25 May	9.20	14.49	Outer coast between Hold w Hope and Shannon, CNP	DMB	RDN
26 May	11.43	14.34	Transects in Scoresby Sund polynya, CNP	DMB	RDN
27 May	9.11	10.30	survey abandoned due to fog, CNP	DMB	RDN
29 May	9.24	15.38	Ice edge and drift ice north to Wollaston Forland, CNP	DMB	RDN
30 May	9.23	14.58	North of Wollaston Forland, but much fog, CNP	DMB	RDN
2 June	9.31	15.32	Drift ice east of Liverpool Land, CNP	DMB	RDN
3 June	10.30	16.03	NEW and St. Nord, CNP	DMB	RDN
4 June	9.31	14.28	Transects and total count in NEW, NOR	DMB	RDN
5 June	9.16	13.53	NOR to Constable Pynt, NOR	RDN	DMB
19 July	9.15	14.12	Outer coast north to Hold With Hope, CNP	DMB	KEO
21 July	9.08	13.55	Fjords north to Hold With Hope, CNP	DMB	KEO
24 July	9.03	14.39	Outer coast between Hold With Hope and Bass Rock, CNP	DMB	KEO
25 July	9.06	15.55	Shannon, outer Dove Bugt, Hochstetter Forland, CNP	DMB	KEO
26 July	9.05	13.45	Coast and fjords of northern Blosseville Kyst, CNP	DMB	KEO
29 July	9.07	15.07	Ice edge from Germania Land to NEW, coast of NEW, CNP	DMB	KEO
30 July	9.50	14.18	Coasts of Kronprins Chr. Land, inland areas at Skjoldungeelv, NOR	DMB	KEO
31 July	9.12	12.28	Northern ice edge of NEW, coasts and islands n of St. Nord, NOR	DMB	KEO
1 Aug.	8.23	12.30	Coasts of Peary Land and Johs. V. Jensen Land, NOR	DMB	KEO
2 Aug.	10.40	15.06	North coast of Wollaston Forland, NOR	DMB	KEO

2.1.1 The ice situation

In May the drift ice belt east of Greenland was very wide, with large ice free waterbodies at the Scoresby Sund Polynya, at the Wollaston Forland Polynya and particularly in the Northeast Water (Figure 4). The edge of the fast ice was well defined from Liverpool Land northwards to Wollaston Forland and further north from Wollaston Forland all the way to Am-drup Land. The shear zone off this ice edge had many lesser ice free area.

The small polynyas at Bontekoe Ø, St. Koldewey and Île de France (Dietz *et al.* 1985) were not open.

In July/August most of the drift ice and the coastal fast ice had disappeared. Only east of St. Koldewey was a large ice field present, and between Germania Land and Holm Land the large semi-permanent ice barrier was in place. Only far from the coast and above the shelf break drift ice was present in higher concentrations, cf. Hvidgaard *et al.* (2008) and Figure 5. This ice was however outside the area covered by the surveys. As in recent years, the ice situation off Northeast Greenland was very light in the summer.

Figure 4. The ice situation on May 26, 2008. AMSR-E passive microwave image from the NASA Aqua satellite retrieved from www.seaice.dk. Purple and red indicate high ice concentrations, yellow and green low concentrations and blue no ice.

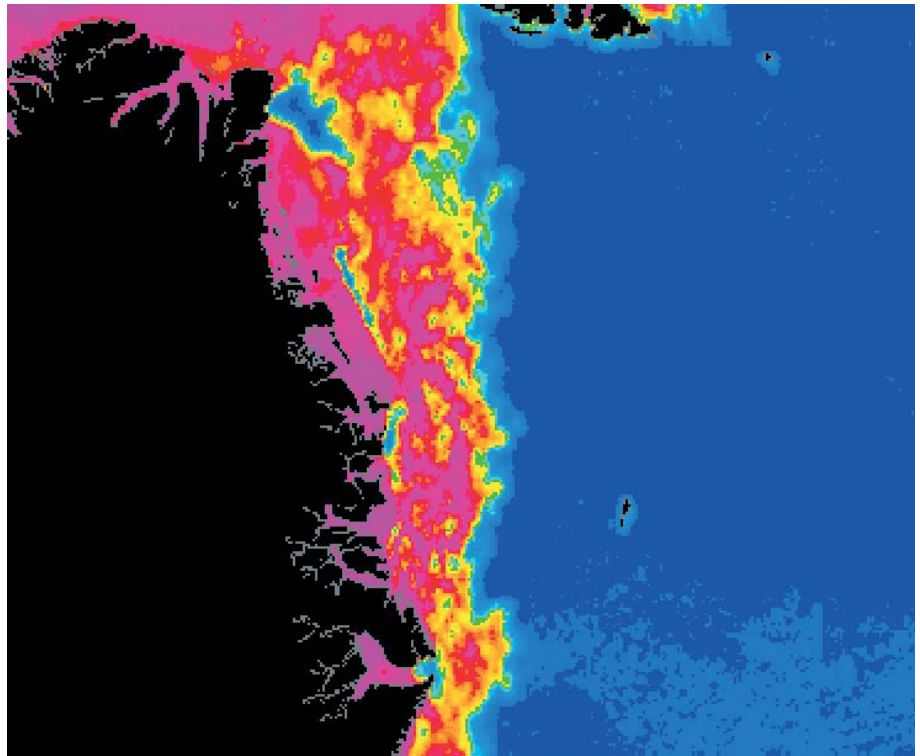
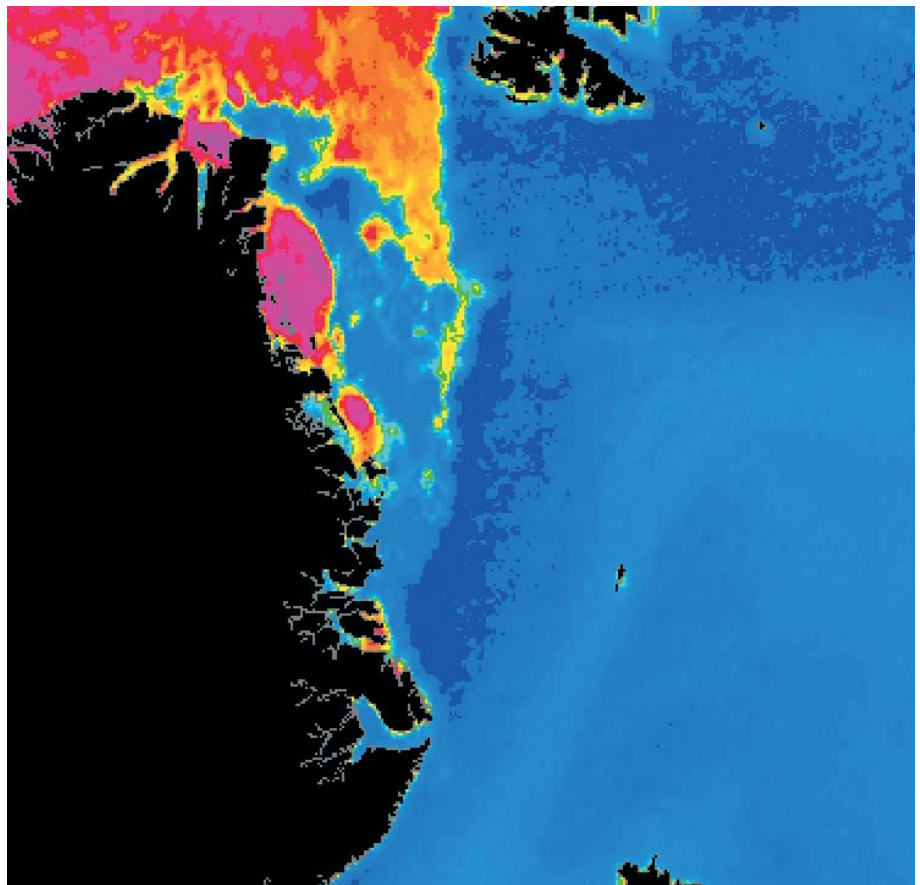


Figure 5. The ice situation on July 26, 2008. AMSR-E passive microwave image from the NASA Aqua satellite retrieved from www.seaice.dk. Purple and red indicate high ice concentrations, yellow and green low concentrations and blue no ice.



3 Results

3.1 Species account

3.1.1 Birds

Only relevant coastal birds will be enumerated here.

Great northern diver *Gavia immer*

Only few observed, in May-June one and in July-August a few both in fjords and on lakes, the latter presumably being breeding sites. No concentrations recorded in coastal habitats (Figure 6).

The most remarkable observation was a pair of adult birds on a lake to the south of Fyn Sø in the Skjoldungeelv-valley at approx. 80° 30' N. This is 430 km north of the northernmost known breeding record in Northeast Greenland. It was also recorded here in August 2005 by a field team from Geological Survey of Denmark and Greenland, GEUS (H. Højmark pers. comm.).

Red-throated diver *Gavia stellata*

In May-June 77 birds were observed with almost half of the birds (n = 32) in the Wollaston Forland polynya (Figure 7). Elsewhere single birds and small flocks seen along ice edges especially between Wollaston Forland and Kong Oscar Fjord (n = 17) and off the coast of Blossville Kyst (n = 21).

During the second survey in July and August 110 birds were observed throughout the surveyed area. These were seen inland on small lakes and ponds (breeding birds) and in marine habitats close to the shore (including breeding birds on foraging trips and non-breeding birds), both along the outer coasts and in the surveyed fjordlands (Figure 7).

Northern fulmar *Fulmarus glacialis*

Very few seen during the May-June survey (n = 134), with the major part along the southern border of the Northeast Water (n = 93) (Figure 8).

Also in July-August few fulmars were observed (n = 202), with the major part (n = 137) in a small area off Wollaston Forland. There were no concentrations along the ice edge north of 78° N, where fulmars (n = 51) were almost evenly dispersed (Figure 8).

None were seen at Home Forland and Hvalros Ø, where breeding have been claimed (Bay & Boertmann 1989, Stemmerik 1990).

Barnacle goose *Branta leucopsis*

The spring migration peaked in the first day of the May-June survey. Numerous flocks heading north and northwest were observed from Constable Pynt and during the surveys.

The map in Figure 9 shows the distribution of flocks observed during the July-August survey when more than 22.500 barnacle geese were recorded.

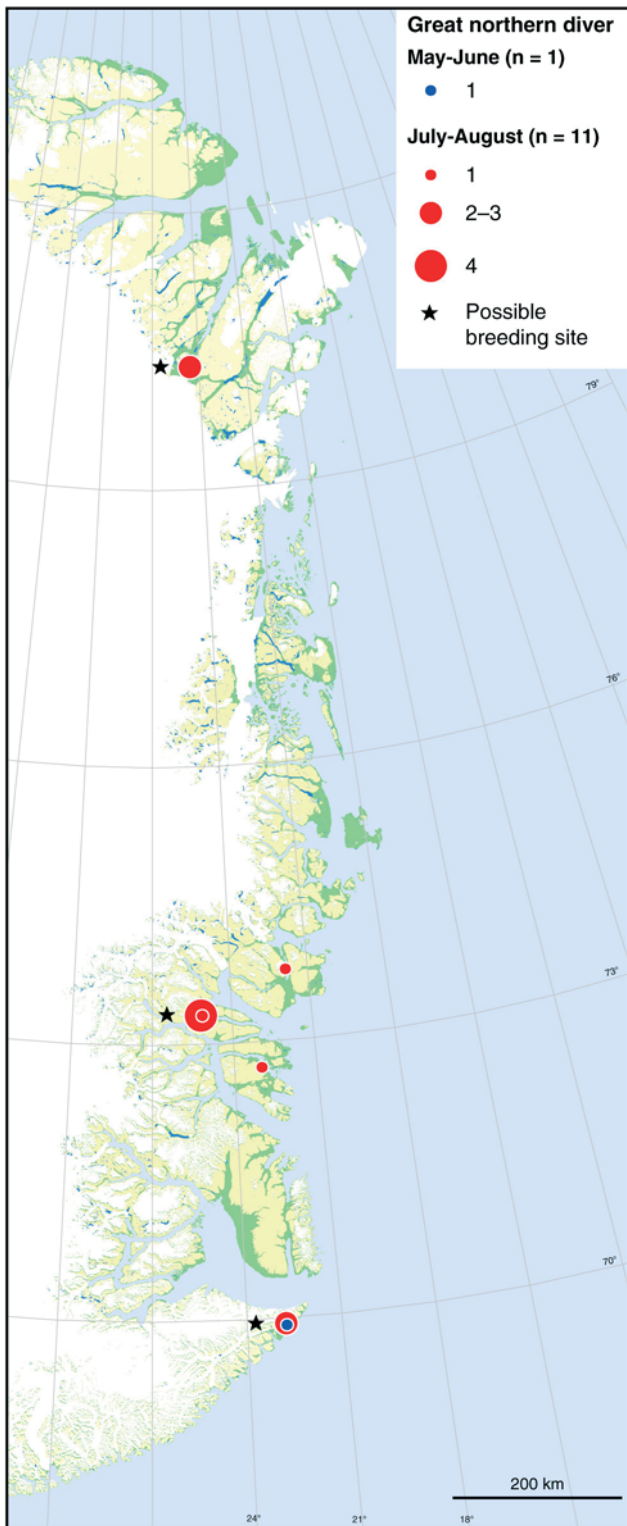


Figure 6. Observations of great northern diver observed during the two surveys in 2008.

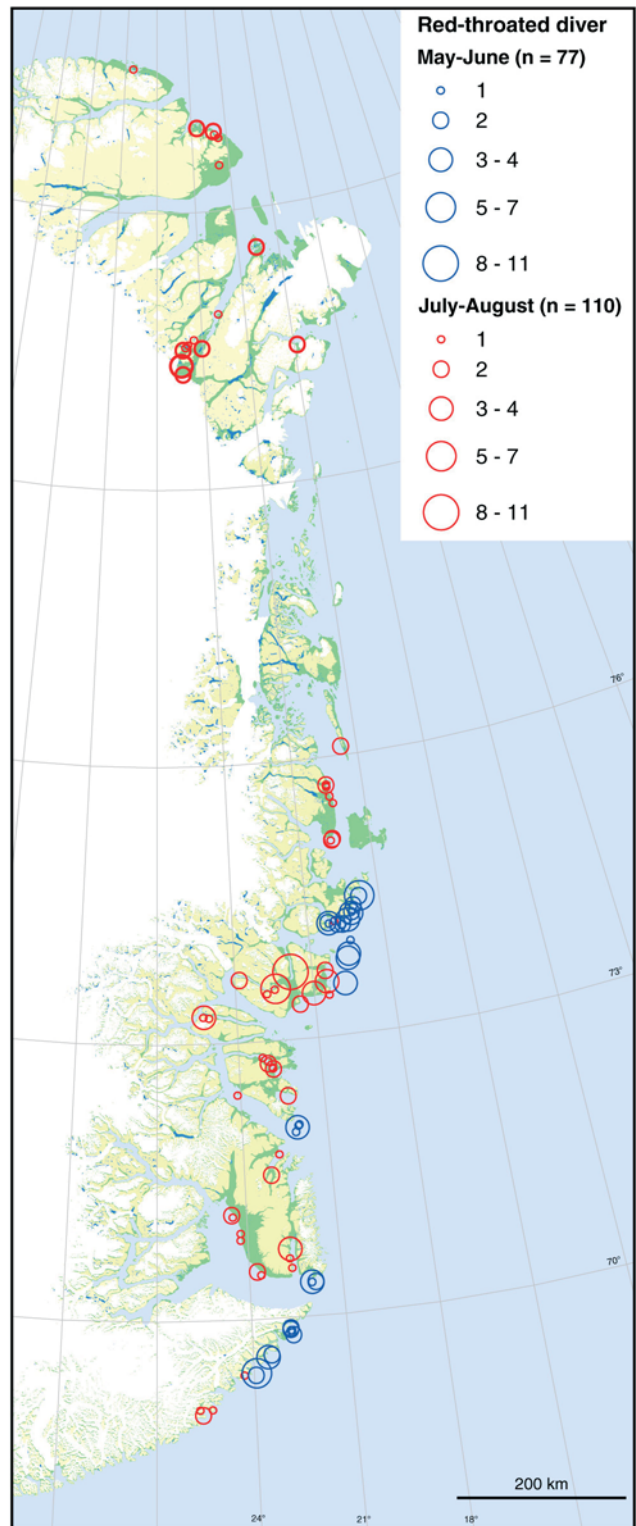


Figure 7. Observations of red-throated diver observed during the two surveys in 2008.

These were for the major part moulting birds and only few breeding birds were observed. The Jameson Land-area was surveyed in the days 17 and 18 July. Most of the birds seen outside Jameson Land were staying in coastal habitats. But some inland areas were also surveyed: Southern Østersletten and Badlanddal of Hold with Hope and Storsletten of Wollaston Forland.

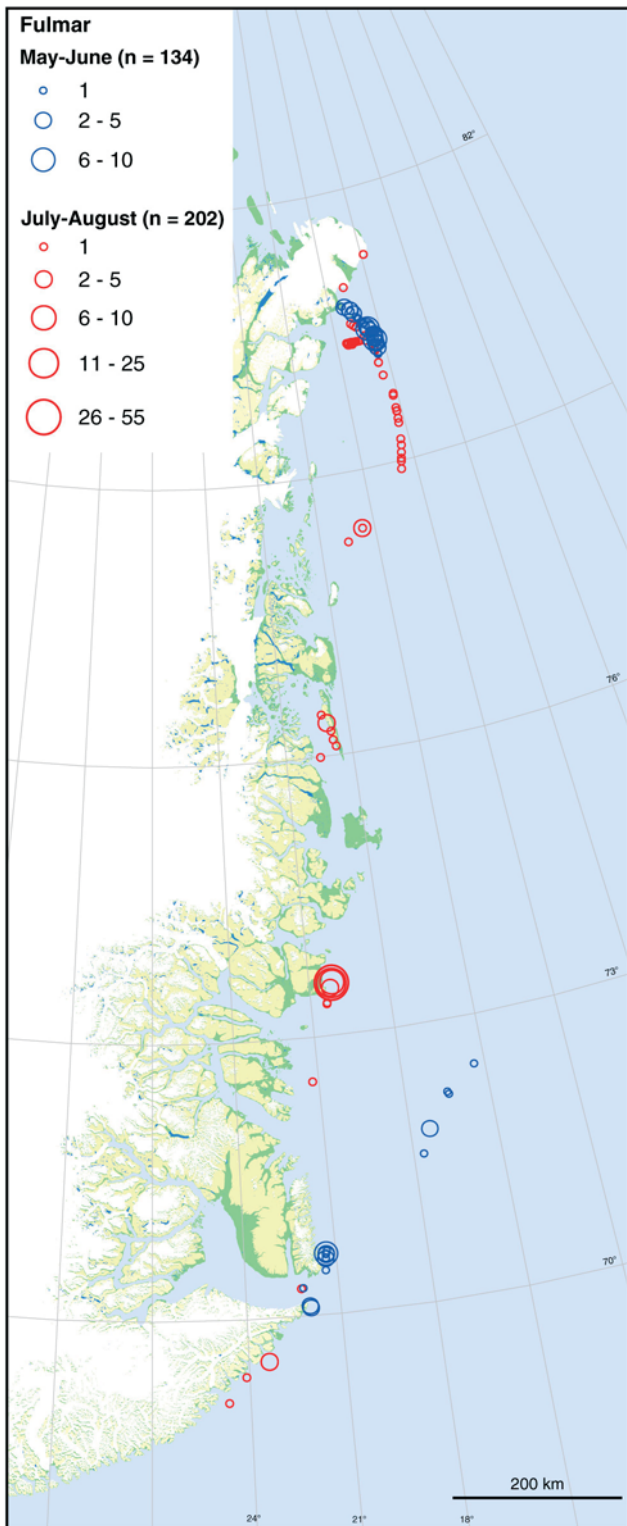


Figure 8. Distribution of fulmars observed during the two surveys in July-August 2008.

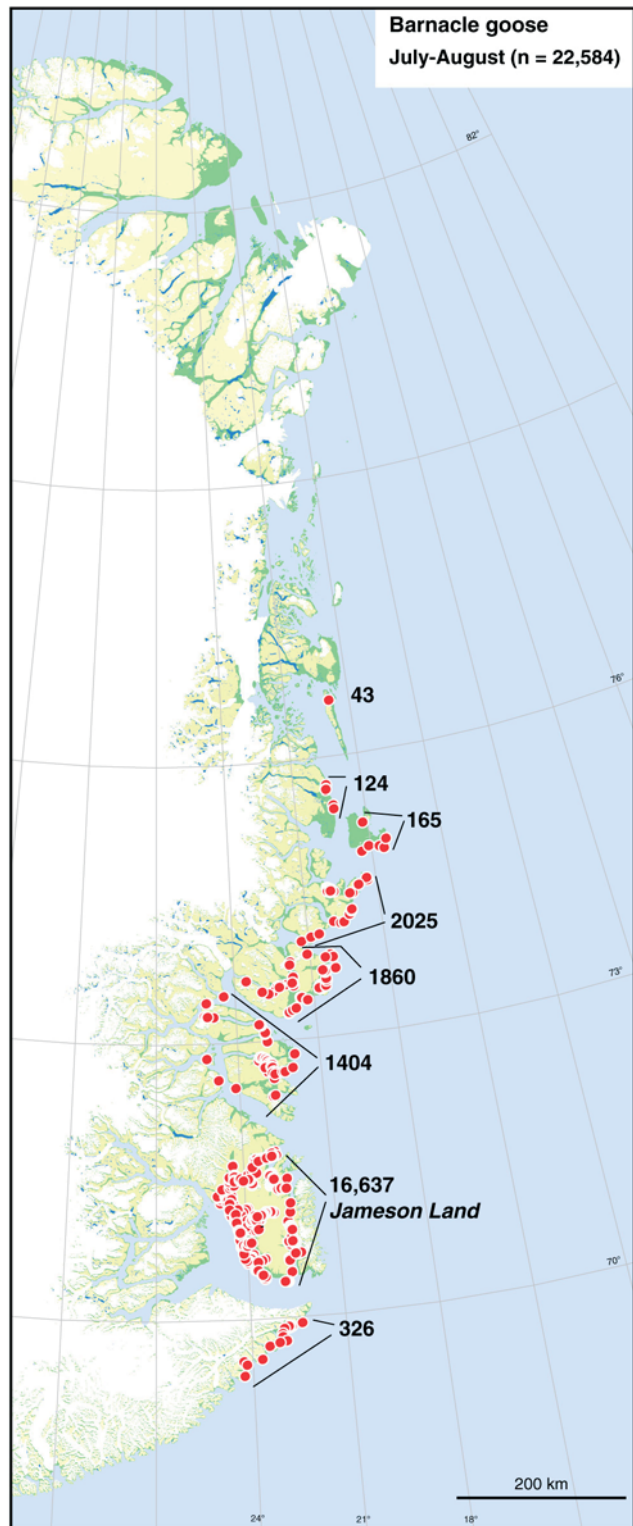


Figure 9. Distribution of barnacle geese observed during the July-August survey 2008. Dots represent flocks.

Light-bellied brent goose *Branta bernicla hrota*

On the first survey, five flocks were seen 4 June at Kilen (in total 91). These had apparently arrived the same day, as none were present when we surveyed Kilen the day before. Two birds migrated west at Station Nord in the evening of 4 June.



Figure 10. Distribution of brent geese observed in July-Aug.

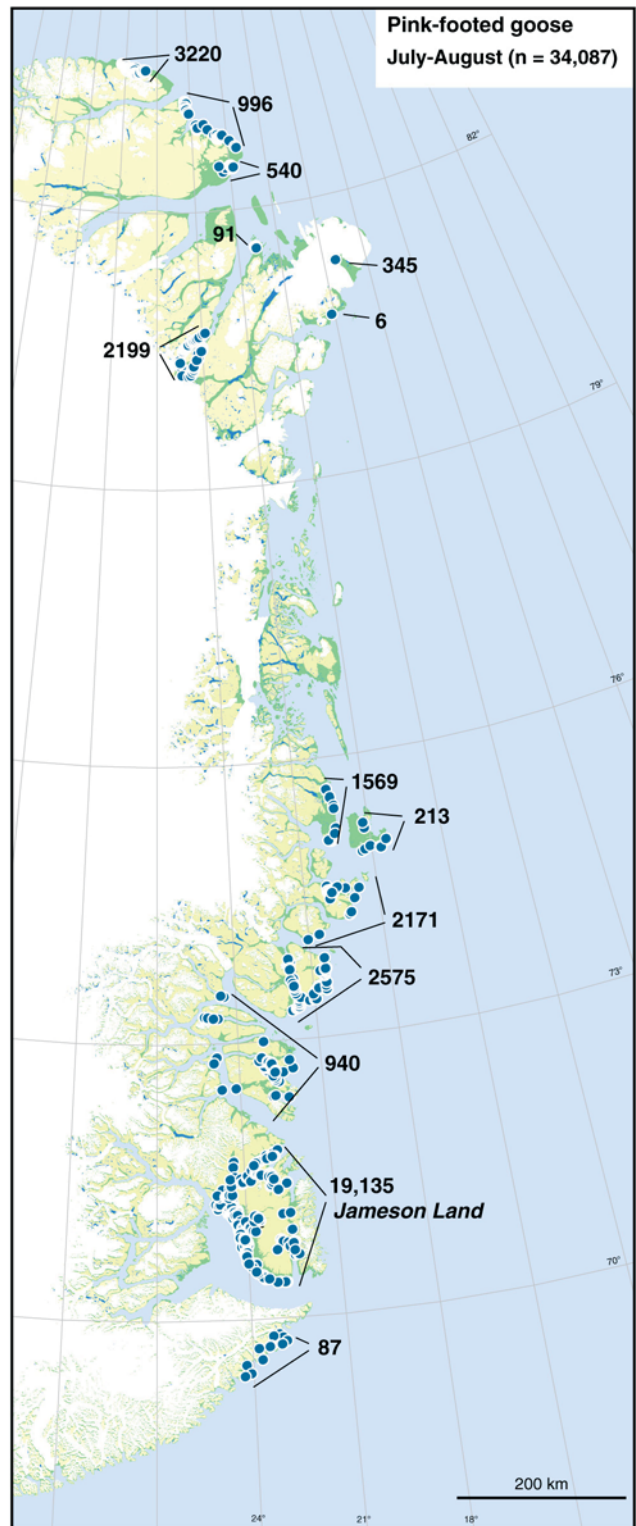


Figure 11. Distribution of pink-footed geese during the July-Aug. survey 2008. Dots represent flocks.

In total 1075 brent geese were recorded on the second survey (Figure 10). A single moulting flock was observed on the coast of Wollaston Forland, while the rest were seen in the stronghold for the species: the coasts north of 80° N. Broods of rather large, but still downy chicks were observed at twelve sites. At Kilen, which usually is considered the most important

breeding site, 44 chicks (~15 broods) were seen, and on the islands north of Station Nord (Prinsesse Dagmar Ø and Prinsesse Thyra Ø) 42 chicks (~14 broods). The most remarkable observation was a brood of three chicks a few km east of Kap Morris Jesup. Approx. 1015 of the observed brent geese were either non-breeders or failed breeders.

Pink-footed goose *Anser brachyrhynchus*

Spring migration was peaking in the first days of the first survey 21-25 May, when numerous flocks were heading northwards over Constable Pynt and during the aerial surveys.

Almost 35,000 birds were observed during the second survey in July and August (including approx. 19,000 in Jameson Land). Outside Jameson Land the highest numbers were mainly recorded in the few surveyed inland areas in Hold With Hope, Wollaston Forland and the valley of Skjoldungeelv (Figure 11). High numbers were also recorded in the Bliss Bay-area on the north coast of Greenland.

Snow goose *Anser caerulescens*

In total four observations: 21 July, two white phase birds in flocks of moulting pink-footed geese with one bird in the mouth of Geolog Fjord and another bird in Dúsen Fjord, Ymer Ø; 24 July, a blue phase bird among barnacle geese on the coast of Tobiasdal (Hold With Hope); 1 Aug. a blue phase bird flying among pink-footed geese, east of G.B. Schley Fjord (Peary Land).

Mallard *Anas platyrhynchos*

Only a single observation during the two surveys: A pair was seen close to Kap Steward in the northern Blossville Kyst on 2 June.

Common eider *Somateria mollissima*

During the May-June survey almost 27,000 common eiders were recorded (Figure 12). Nearly half of the birds were concentrated along the coasts of the Wollaston Forland Polynya. The other two polynyas also held large concentrations: Scoresby Sund approx. 6,500 and the Northeast Water 4,600. Many small flocks were staging along the ice edge between Caning Land and the Wollaston Forland Polynya (n = 1889). These were resting on the water or on the very sharply defined ice edge.

During the second survey in July and August, common eiders were much more dispersed along the coasts (Figure 12). The observed birds were breeders (females with chicks) and non- or failed breeders and post breeding males. Particularly many were observed along the Blossville Kyst (n = 5121), and major part of these were post-breeding males (69 %), indicating that these coasts constitute a significant moulting area perhaps also for Icelandic birds (F. Merkel pers. comm.).

Females with chicks were seen in the outer parts of Danmark Fjord and Independence Fjord, representing a range expansion compared to the previously northernmost records in the Northeast Water.



Photo: David Boertmann

A mixed flock of common and king eiders off the front of the glacier to the north of Antarctic Bugt on 4 June 2008. In total 3219 birds, of which 1227 are common eider males, 279 are king eider males and 1613 are females of both species.

King eider *Somateria spectabilis*

King eiders were recorded in relatively small numbers compared to common eiders during the May-June survey. However, significant numbers were located in the Northeast Water ($n = 1542$), while the other polynyas held much fewer (Figure 13).

During the second survey in July-August, surprisingly few were found (Figure 13). In a fjord on the Blossville Kyst a congregation of moulting males ($n = 173$) were located, and another lesser congregation were seen at the coast of Hochstetter Forland (Figure 13).

Long-tailed duck *Clangula hyemalis*

Only few were located during the first survey in May-June ($n = 149$). The major part was found at the shores of the Scoresby Sund Polynya and Blossville Kyst. None were present in the Wollaston Forland Polynya and only a few in the Northeast Water. A few small flocks were seen at ice edges to the south of Wollaston Forland and off Amstrup Land (Figure 14).

Many more were observed in July-August ($n = 3341$). The highest concentration was located in the delta of Dr. Augusta Dal in Wollaston Forland (Figure 14), and many flocks of moulting birds were seen along shallow coasts of Shannon, Hold With Hope, in Vega Sund, Jameson Land and Blossville Kyst.

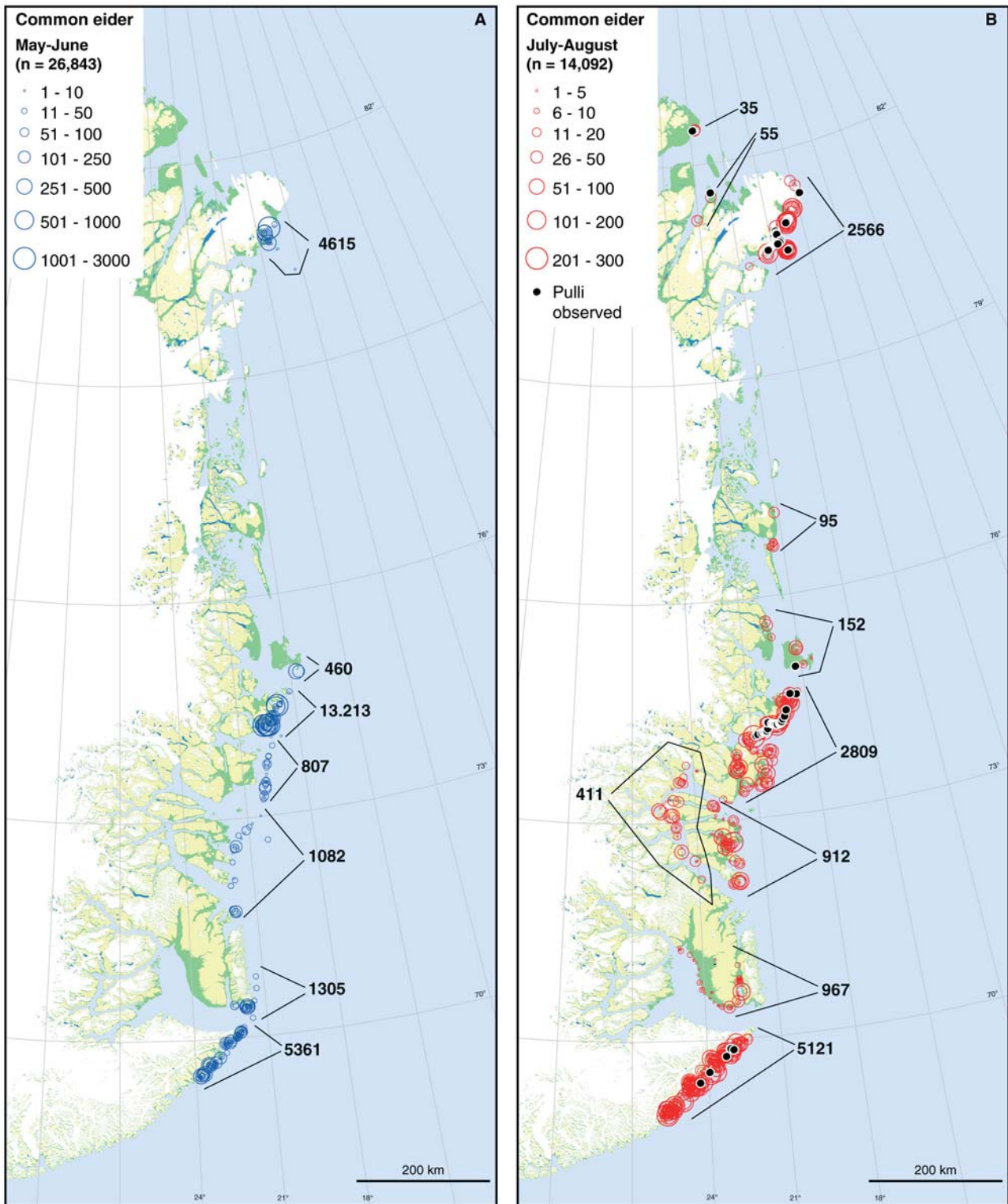


Figure 12. Distribution of common eiders observed during the two surveys in 2008.

Red-breasted merganser *Mergus serrator*

During the spring survey only 8 observations of 18 birds. All were observed on the outer coast between 69° 30' and 73° N.

In July-August none were seen during the surveys, but during ferry flights one was seen on the coasts of Jameson Land and during the goose surveys 17 and 18 July a flock of seven was seen at Sydkap in the Scoresby Sund fjord complex.

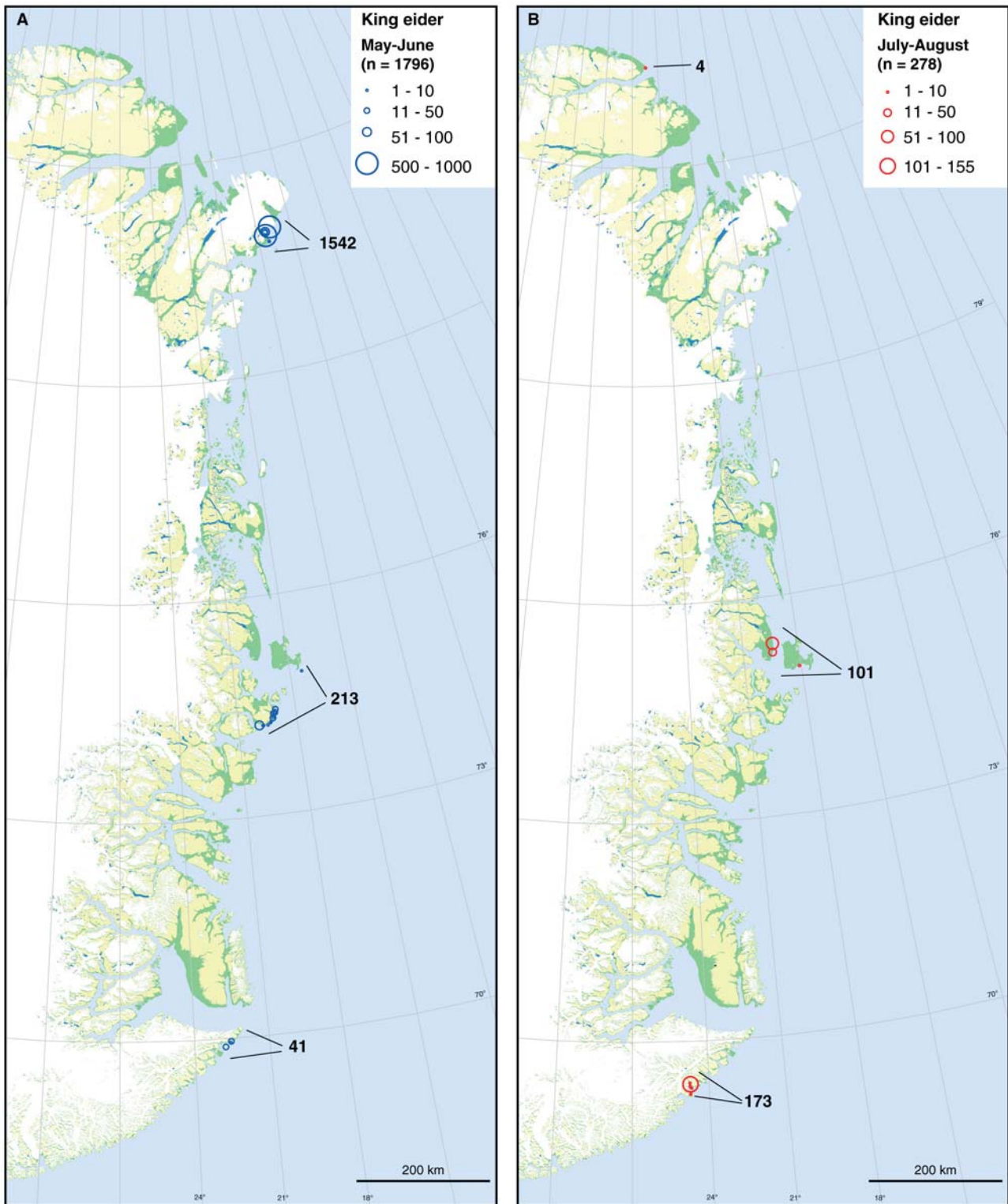


Figure 13. Distribution of king eiders observed during the two surveys in 2008.

Great skua *Stercorarius skua*

Two seen during the spring survey: 29 May one south of Sabine Ø and 4 June one in the Northeast Water. Another two were seen during the July-August survey: 21 July one north of Ella Ø and 26 July one at the coast west of Turner Ø (Blosseville Kyst).

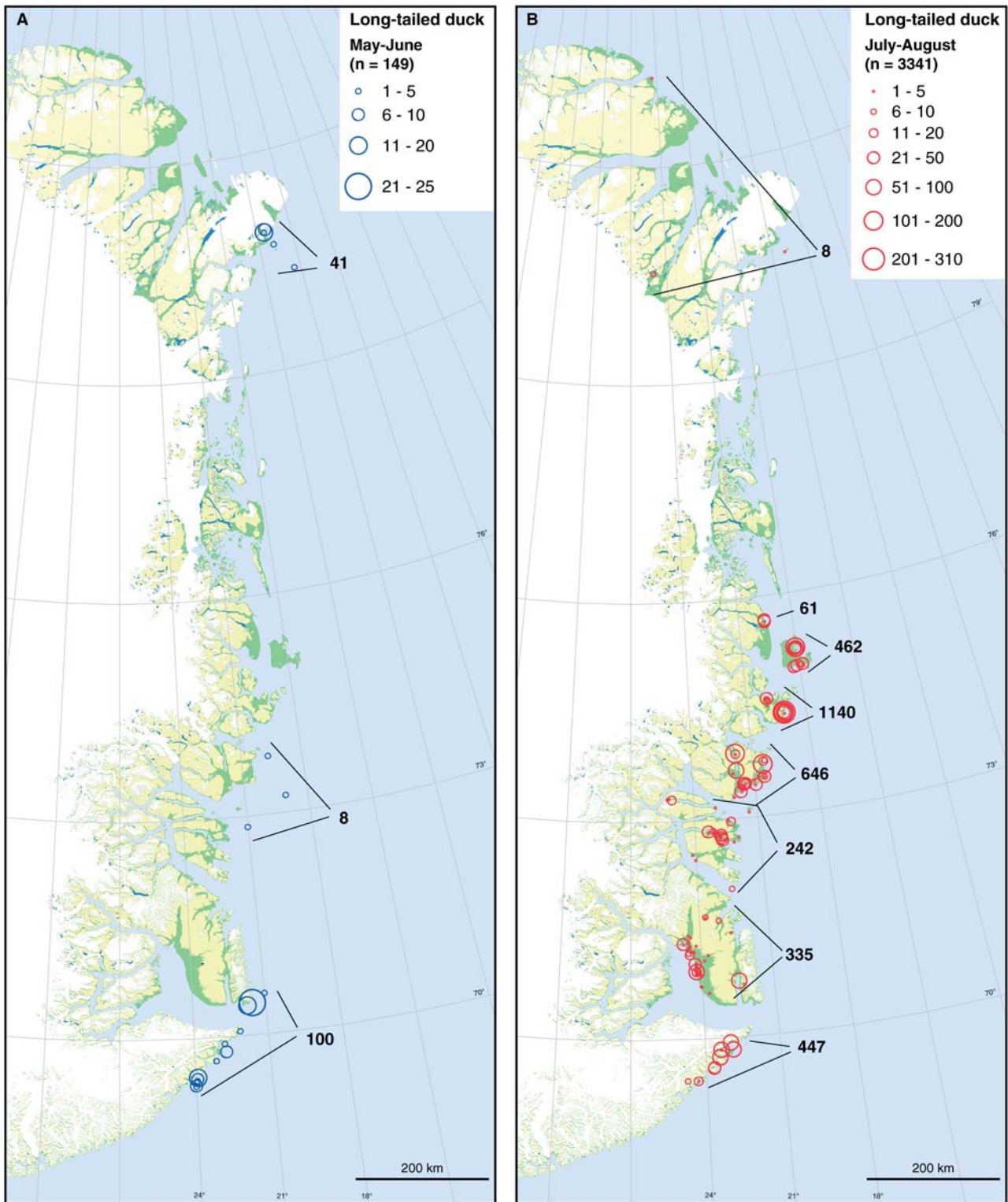


Figure 14. Distribution of long-tailed ducks observed during the two surveys in 2008.

Pomarine skua *Stercorarius pomarinus*

Surprisingly, only one was observed during the two surveys: 4 June an adult in the Northeast Water.

Arctic skua *Stercorarius parasiticus*

In May-June only five were observed: One at the ice edge off Traill Ø and four at the ice edge off Hold With; all adult light phase birds.

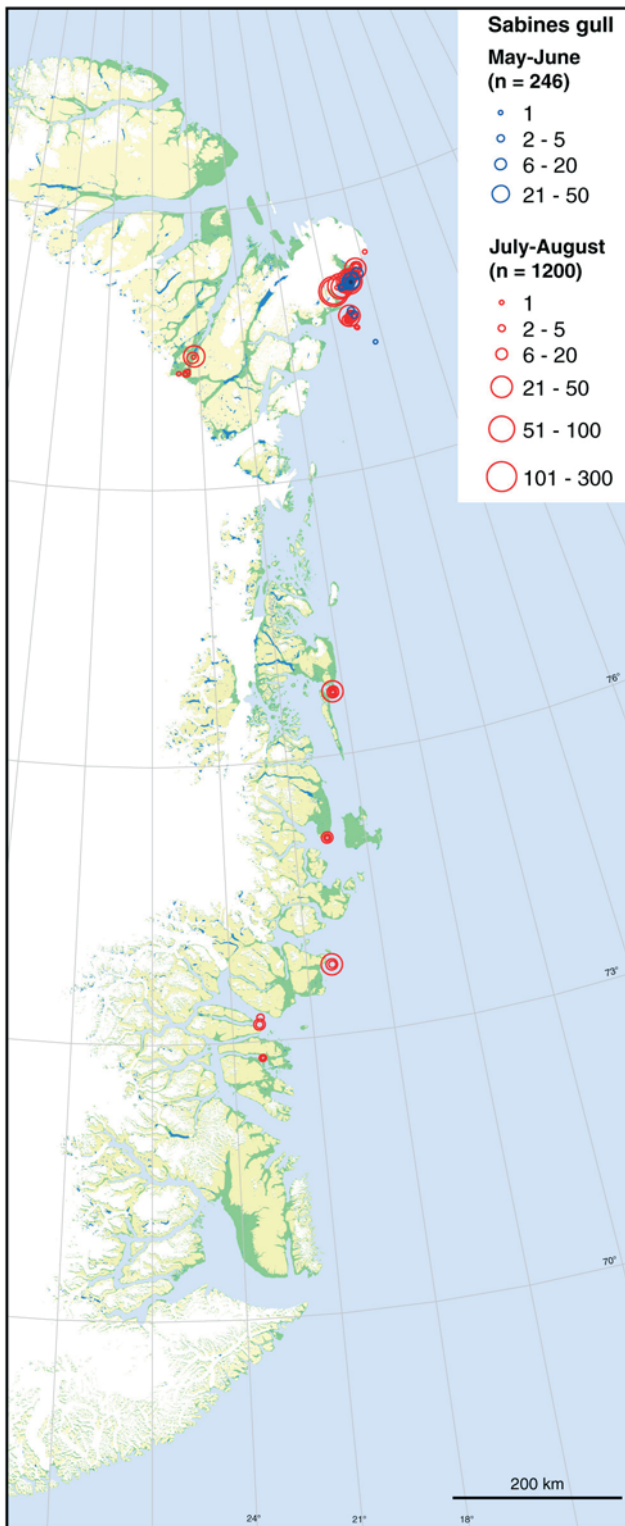


Figure 15. Distribution of Sables gulls observed during the two surveys in 2008.

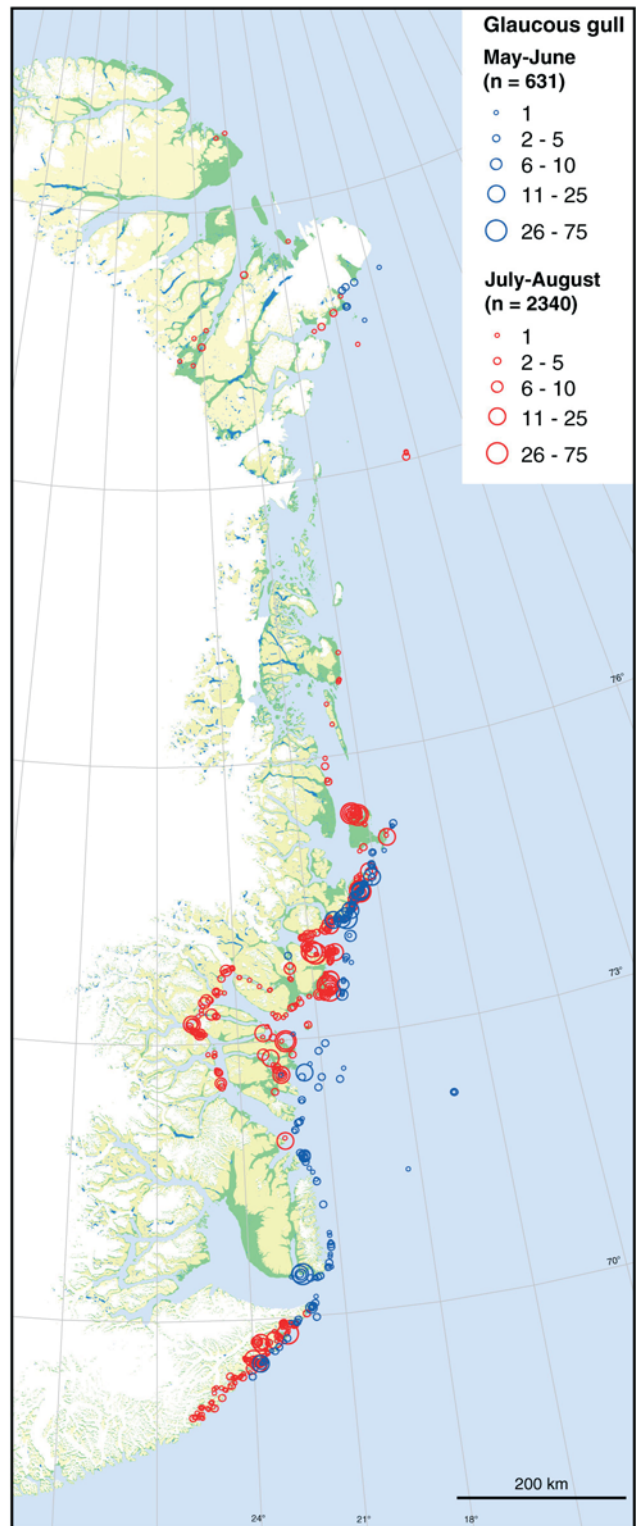


Figure 16. Distribution of Glaucous gulls observed during the two surveys in 2008.

In July-August, Arctic skuas were observed at the Blosseville Coast (n = 5), in Jameson Land (n = 19), in the region between Ella Ø and Hold With Hope (n = 12, both in the fjord lands and at the outer coast), at the coast of Hochstetter Forland (n = 3) and a single bird at Henrik Krøyer Holme in the Northeast Water; all were adult and light phase birds.

Long-tailed skua *Stercorarius longicaudus*

In May-June, 43 birds seen along the ice edges and in the drift ice (n = 2), some in flocks with up to 17 indivs. A Further 33 birds were seen on the transect flights in the Scoresby Sund Polynya 26 May.

In July-August, a total of 160 birds were seen. The major part (n = 135) in Jameson Land, were a few flocks numbered up to 50 birds. Further north much fewer was seen: 15 in the region between Traill Ø and Hold With Hope, 16 up to Dove Bugt and three along the ice edge to the north of Germania Land. The flocks seen from 17 July indicate that many gave up breeding this summer. B. Sittler (pers. comm.), who worked in Karup Elv (Traill Ø), this summer later told us that the breeding success was medium.

Sabine's gull *Larus sabini*

In May-June, the first were seen along the coasts of the Northeast Water 3 and 4 June: 15 and 231 respectively (Figure 15).

In total, 1200 were observed in July-August. Many were seen at breeding colonies, but the major part (n = 775) were foraging along the glacier in Antarctic Bay in Amdrup Land, where melt water were falling down from the steep glacier front (Figure 15).

Lesser black-backed gull *Larus fuscus*

Probable breeding colonies were discovered in July on Dunholme (n = 19 adult birds) and the island 12 km to the southwest (n = 3 adult birds). Furthermore, three adults were seen at Arundel Ø off Hold With Hope 24 July and an adult off Kap Brewster on 26 July.

Glaucous gull *Larus hyperboreus*

The most widespread of the seabirds during both surveys and seen at coasts, ice edges, in the drift ice and even in inland sites. Several new colonies were discovered. Figure 16 shows the distributing of the observations.

Great black-backed gull *Larus marinus*

In May seven adults were seen on the northern part of the Blosseville Kyst. In July birds were seen in the Scoresby Sund mouth (n = 2) and along the Blosseville Kyst (n = 23), where several looked like breeding pairs.

Black-legged kittiwake *Rissa tridactyla*

Seen during both surveys in moderate numbers. Distribution and numbers of kittiwakes appear from Figure 17. The larger concentrations are seen at breeding colonies (Dunholme, Kap Brewster, Hvalros Ø and Rensskæret).

Ivory gull *Pagophila eburnea*

During the May-June survey ivory gulls were mainly seen in the Northeast Water (Figure 18). Many more were observed in July-August, when colonies were specifically searched for (see section on colonies). Outside the colonies a few were seen along the ice edges of the Northeast Water

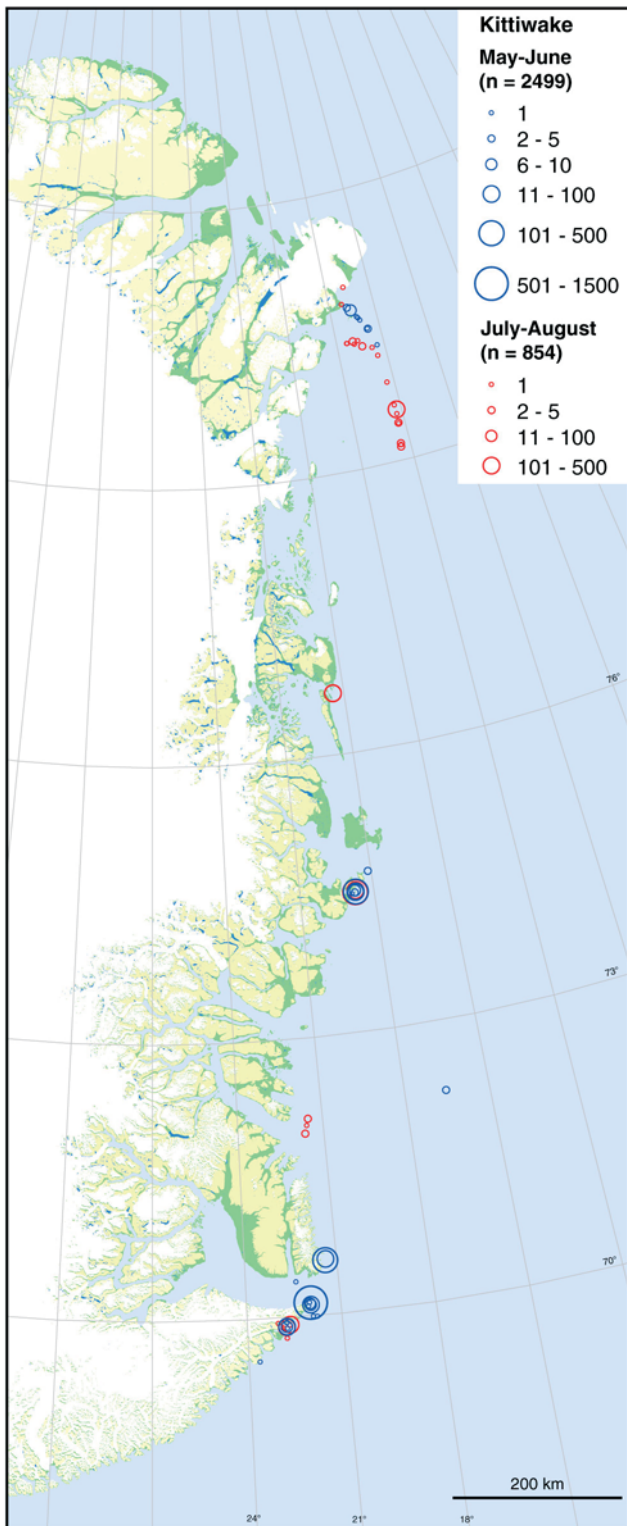


Figure 17. Distribution of kittiwakes observed during the two surveys in 2008.

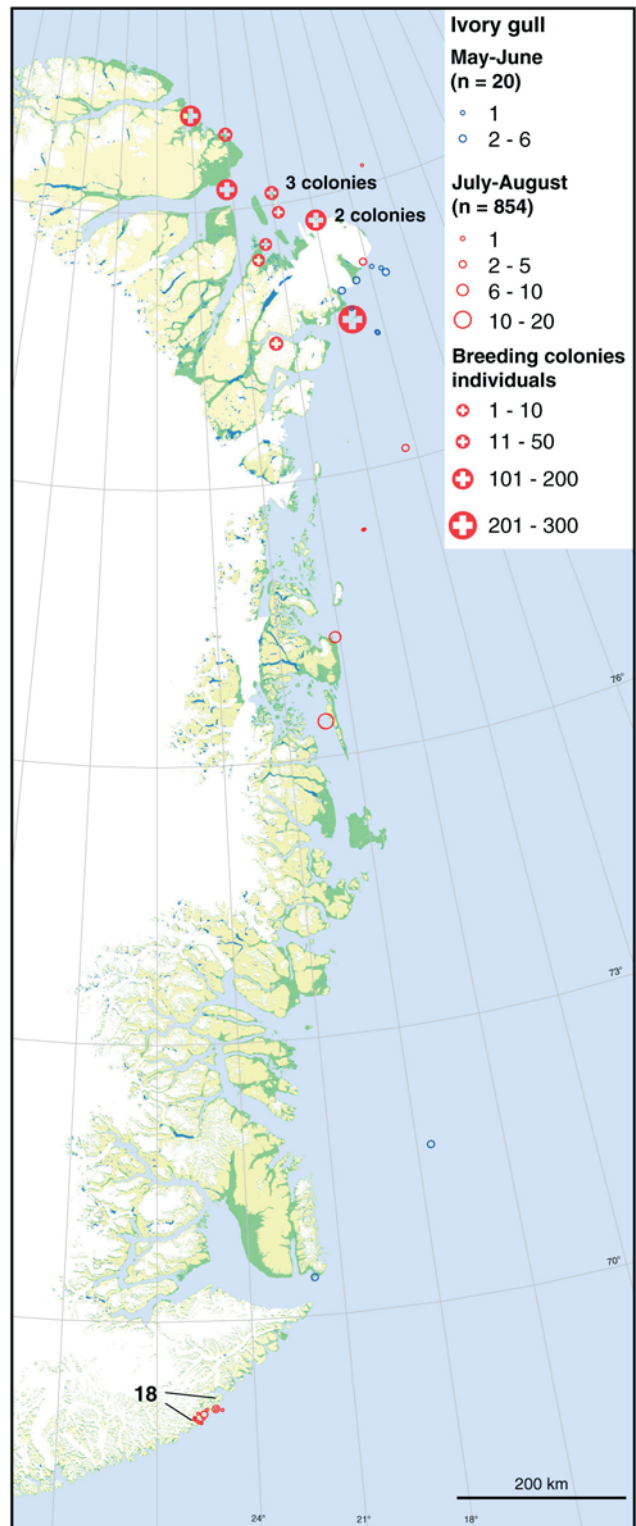


Figure 18. Distribution of ivory gulls observed during the two surveys in 2008. Breeding colonies are indicated.

and in Germania Land/Dove Bugt. However the most remarkable observation outside the breeding colonies was 18 birds in the fjords to the north and south of Kap Coster on the Blosseville Kyst (Figure 18). These were most likely birds from the breeding colonies on the nunataks 130 km towards NW.

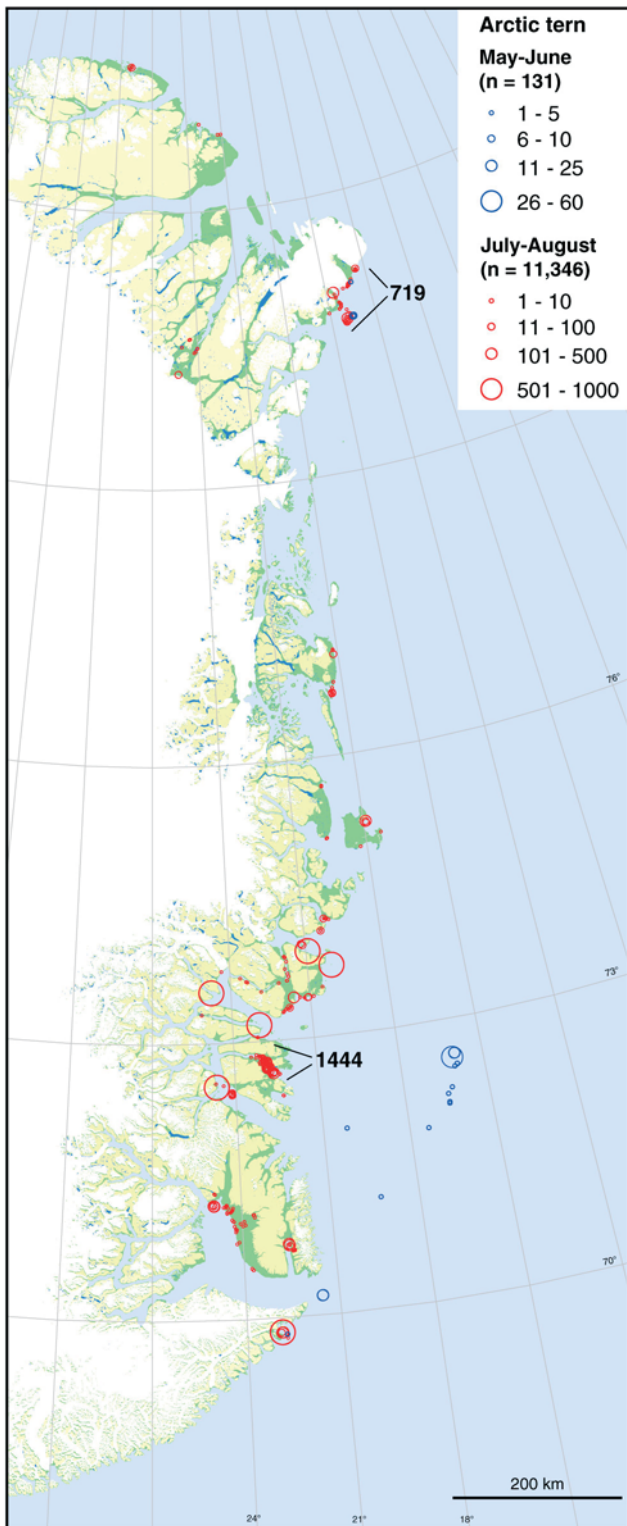


Figure 19. Distribution of Arctic terns during the two surveys in 2008. Birds seen at colonies in July-August included (cf. Figure 33).

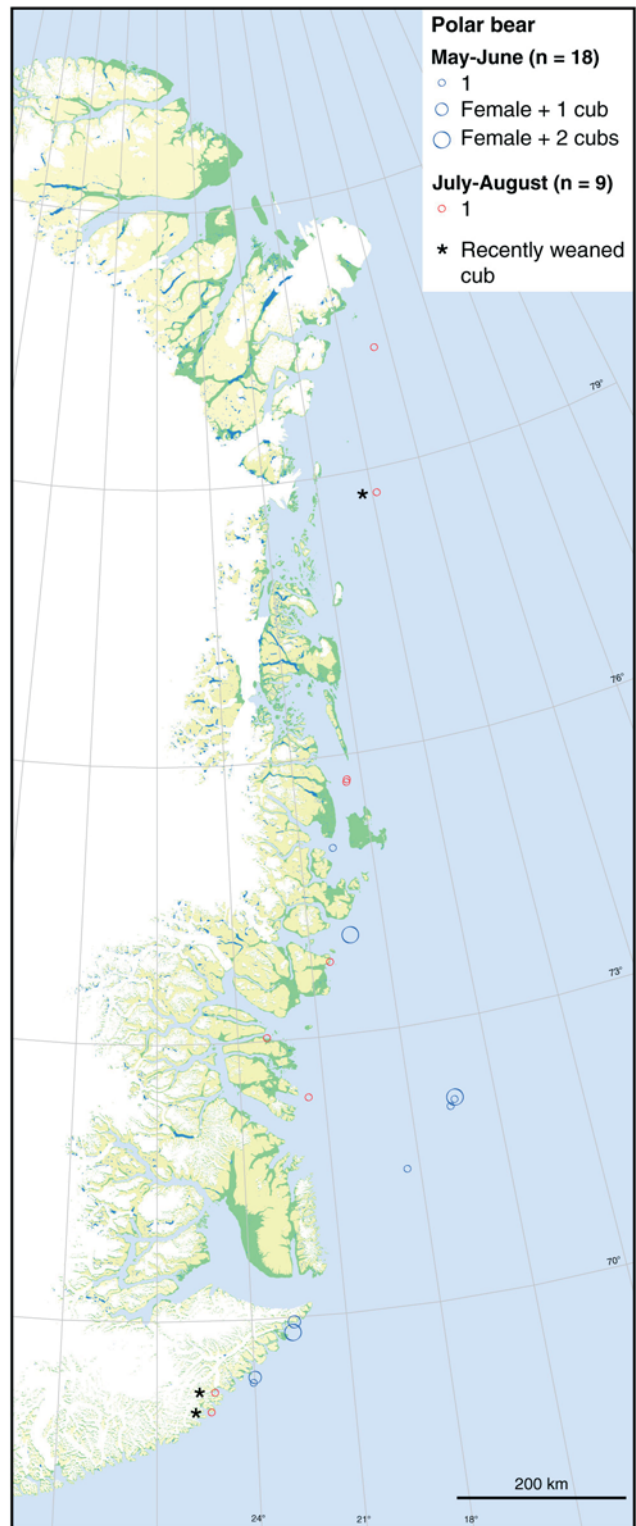


Figure 20. Distribution of polar bears observed during the two surveys in 2008.

Arctic tern *Sterna paradisaea*

Very few were seen during the May-June survey. Two were seen 22 May and higher numbers ($n = 113$) were seen on the survey in the drift ice along the northern side of the Scoresby Sund polynya and off the Blossville Kyst. In the Northeast Water three were seen on 3 June and 13 on 4 June (Figure 19).

During the July-August survey Arctic terns were numerous at many sites (Figure 19), mainly in areas with breeding colonies (see section on colonies).

Thick-billed murre *Uria lomvia*

During the May-June survey only seen in low numbers (max. 47 on 22 May) in the Scoresby Sund polynya and the majority close to the breeding colony at Kap Brewster.

During the July-August Survey the same situation was apparent, and only 24 were observed 26 July near the breeding colony at Kap Brewster.

Black guillemot *Cephus grylle*

In May-June only seen in the Scoresby Sund polynya (22 May, n = 4, along the ice edge north to Wollaston Forland (24 May, n = 2, 29 May n = 8), in the drift ice off Liverpool Land and along the Blosseville Kyst (2 June n = 37). A single bird was seen on 3 June in the Northeast Water close to Henrik Krøyer Holme.

During the July-August survey, breeding colonies were seen at Hvalros Ø, (24 July n = 18 birds), at Jackson Ø (24 July, n = 3) and at several sites along the Blosseville Kyst (26 July, n = 42 birds at 2 sites). None were observed in the Northeast Water.

Little auk *Alle alle*

Immense numbers seen in and near the Scoresby Sund polynya in May-June: In the mouth of the Scoresby Sund 22 May, n = 25,507, along the ice edge off Liverpool Land 29 May, n = 2624 and along the northern offshore side of the polynya 22 May, n = 150,636. See also the transect flights when numerous were counted in the Scoresby Sund.

Much fewer seen in July-August, and only in the Scoresby Sund polynya (26 July, n = 683) and the waters off Kong Oscar Fjord mouth (24 July n = 267, 25 July n = 222).

None were seen north of 73° N, i.e. in the Wollaston Forland polynya or in the Northeast Water polynya, neither in May-June nor in July-August.

Other bird observations

Gyr falcon *Falco rusticolus*: An immature female was seen at Constable Pynt 25 May and 2 June. Two were seen during the goose surveys in Jameson land 17 June. A single Snowy Owl *Nyctea scandiaca* was seen inland on Hold With Hope 21 July. Raven *Corvus corax*; in May-June 14 seen at the Scoresby Sund mouth and on the northern part of the Blosseville Kyst; largest assemblage was 10 near the town of Scoresbysund. The northernmost raven (n = 1) was then seen at military outpost Daneborg. In July-August ravens were seen here and there in the inland areas north to Hold With Hope (n = 13). Further north only one observation; at southern Hochstetter Forland (n = 1).

3.1.2 Marine mammals

Polar bear *Ursus maritimus*

During the May-June survey in total (incl. cubs) 18 polar bears were observed (Figure 20). Among these were five females with cubs: Two with one cub and three with two cubs.

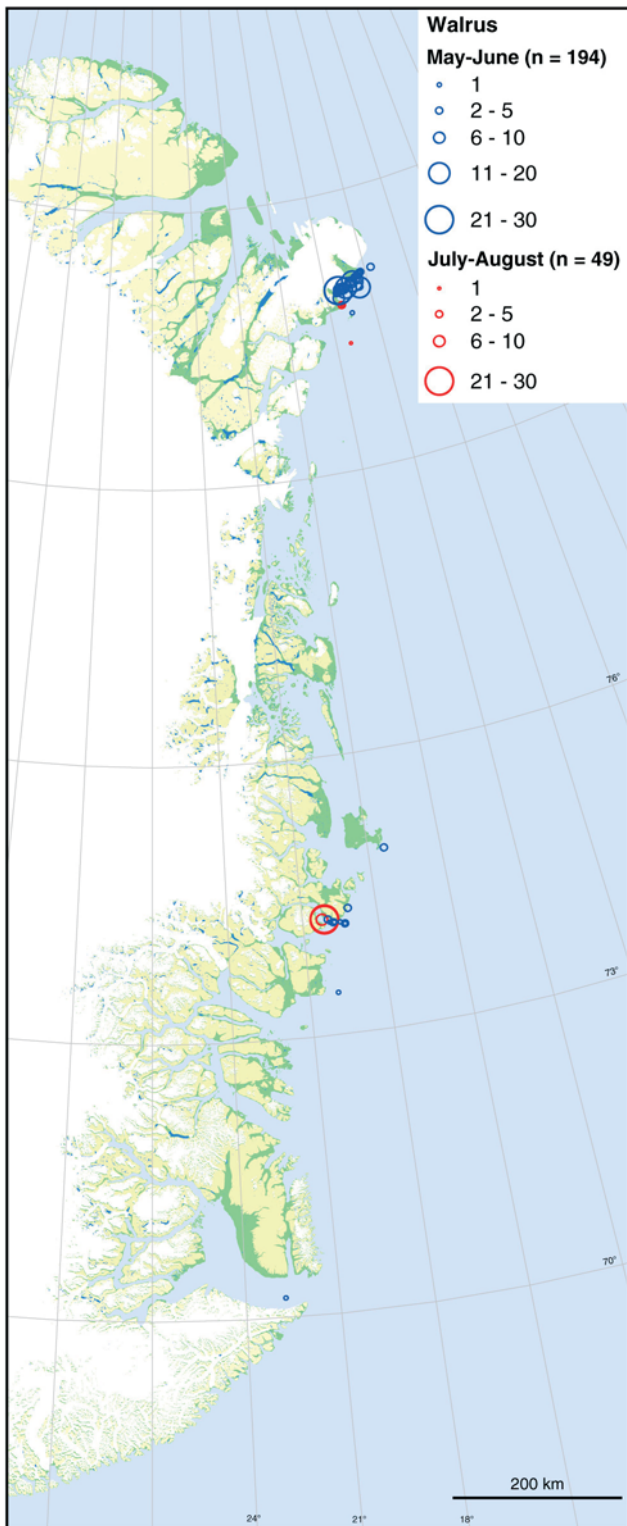


Figure 21. Distribution of walrus observed during the two surveys in 2008. Note that the totals are not corrected for double observations – on the haul-out in Young Sund in July-August, and in the Northeast Water in May-June.



Figure 22. Distribution of bearded seals observed during the two surveys in 2008.

During the July-August survey nine polar bears were observed, and no females with cubs (Figure 20). Three of these bears (26 July n = 2 and 29 July n = 1) were small and were assessed to be young bears recently weaned (2,5 years old).

Walrus *Odobenus rosmarus*

In May-June walrus were observed at three locations (Figure 21): The Scoresby Sund (n = 1 on 22 May), in the Wollaston Forland polynya (n = 20 on 25 May) and in the Northeast Water (n = 104 on 3 and 4 June, minimum numbers with correction for double counts).

In the Wollaston Forland polynya the major part stayed very close to their haul-out on Sandøen, and a few were seen off Clavering Ø and at Kap Phillip Broke on Shannon (Figure 21).

In the Northeast Water, at least 15 calves were seen on 3 and 4 June. However, there were probably many more as many flocks were seen on too long range to ascertain if there were calves present. Almost all the walrus were seen close to the shore, but see also the section on transect flights.

Much fewer were seen in July-August. At the haul-out on Sandøen 30 were counted 24 July, and in the Northeast Water only seven (three females with calves + 1) were seen off Sophus Müller Næs on Amdrup Land and another female with a calf were seen 30 km due south of Henrik Krøyer Holme.

Hooded seal *Cystophora cristata*

Only three observations, all in July-August. Two were seen resting on ice 24 July south of Hvalros Ø and off Traill Ø, and 26 July one was seen on ice in the mouth of Scoresby Sund.

Bearded seal *Erignathus barbatus*

Widespread, but in low numbers (n = 23) in May-July (Figure 22), with almost a third seen on the edges of the Northeast Water. Usually single seals resting on ice floes or at leads. A female with a pup was seen in the mouth of Scoresby Sund 22 May.

Much fewer seen (n = 11) in July-August (Figure 22). The major part seen in a fjord in northern Blosseville Kyst, where four were resting on the same ice floe and three more on small floes close by.



Photo: Kent Olsen

Bearded seals resting on an ice floe to the west of Turner Ø on 26 July 2008.

Harp seal *Phoca groenlandica*

None seen in May-June. In July-August nine flocks with in total 419 indivs (flock range 2-300) seen both during survey and when ferry flying in high altitude (5000 feet). Four flocks off Kap Broer Ruys (Hold With Hope) n = 327, three flocks south of Hvalros Ø (n = 60) and two flocks in the mouth of Ardencable Fjord (n = 32).

Ringed seal *Phoca hispida*

Numerous (n = 438) during the May-June survey, where they were observed almost everywhere where open water occurred (Figure 23). Largest concentrations were seen in the drift ice north of the Scoresby Sund polynya where 315 were seen dispersed on very large ice floes (up to 44 on a single floe).

These concentrations occurred in areas close to the whelping ground of the Greenland Sea stock of harp seals. However, those seals seen on close range were all ringed seals, and none were suspected as harp seals.

Less numbers (n = 110) were seen in July-August and no assemblages as those in the drift ice in May were encountered (Figure 23).

Bowhead whale *Balaena mysticetus*

None were seen in May-June. In July-August, five large individuals were observed between Traill Ø and 80° N (Figure 24). The southernmost (25 July) stayed in open waters with only very scattered drift ice 13 km from the coast. Two were close together (24 July) just south of Hvalros Ø (0.6 km), in the edge of a drift ice belt 5 km off the mainland coast. The last two (29 July) stayed at the edge of the consolidated coastal ice barrier (85 km from the coast) to the south of the Northeast Water with approx. 10 km between them.

Narwhal *Monodon monoceros*

In May-June: Along the Northeast Waters southern ice edge 17 pods with in minimum 32 whales were observed on 3 June very concentrated off Sophus Müller Næs (Figure 25). They were not observed the following day, when both total counts and transect flights were performed in the same area. Along the fast ice edge between Shannon and Bontekoe Ø, 10 pods with minimum 19 individuals were observed on 25 and 29 May (Figure 25). The number of individuals is given as a minimum, because it is very difficult to assess pod size when the pods are more than a few hundred meters away and several flocks were just recorded as a pod without number of indivs.

In July-August narwhals were observed between Blossville Kyst and 80° N (Figure 24). The largest concentration was seen on 25 July in Dove Bugt west of St. Koldewey: in total 59 pods with a minimum of 101 indivs. Further north some pods were seen close to the edge of the consolidated ice barrier (17 pods or single whales, > 19 individuals). On the Blossville Kyst four pods with > 8 indivs were observed at the cape between Kap Ryder and Kap Coster, and five pods with > 9 indivs were seen at the coast just south of Kap Brewster, all on 26 July.

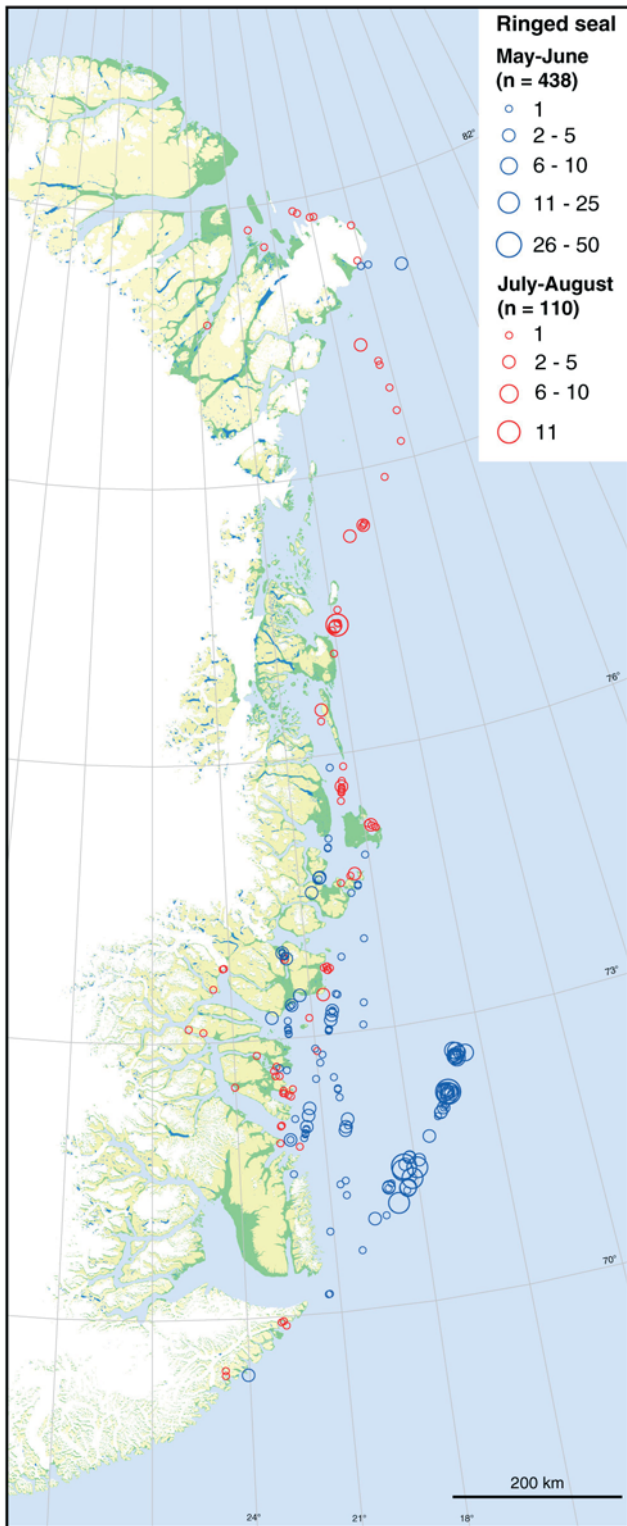


Figure 23. Distribution of ringed seals observed during the two surveys in 2008.

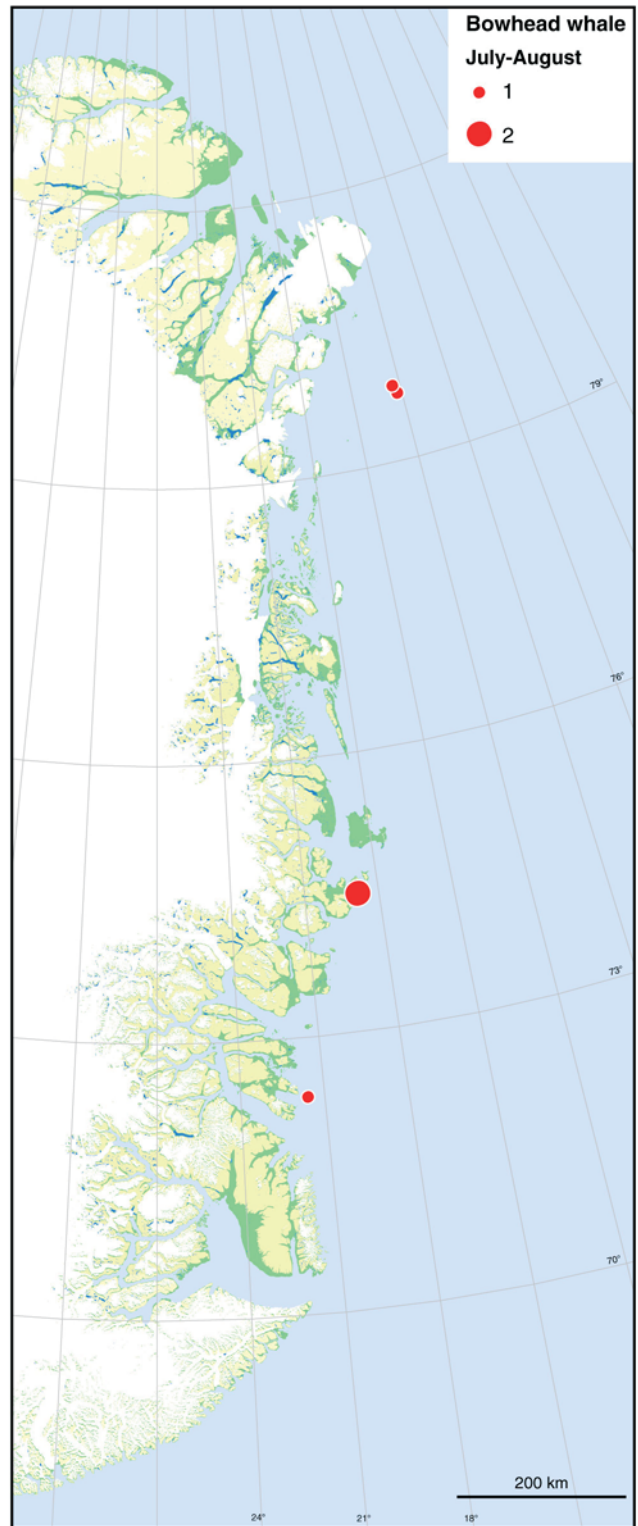


Figure 24. Distribution of five bowhead whales observed in July-August 2008.

3.2 Distance sampling

During the May-June survey distance sampling (Buckland *et al.* 2001) was applied in two areas: The Scoresby Sund polynya and the Northeast Water polynya (Figure 3).

Figure 25. Distribution of narwhals observed during the two surveys in 2008.

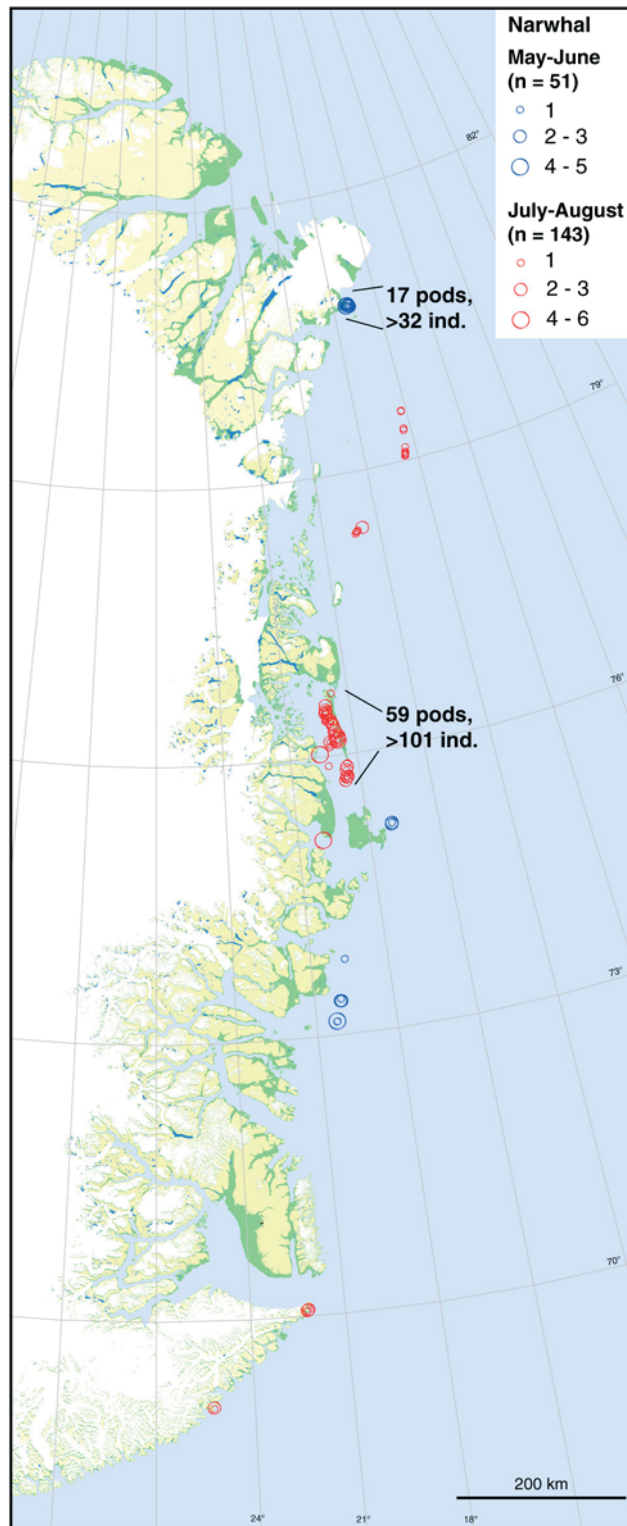


Table 3 gives an overview of the observed species of birds and marine mammals. Except for little auks in the Scoresby Sund polynya and walruses there were only few birds and mammals present in the surveyed parts of the two polynyas.

Most species were observed in very low numbers excluding the possibility of calculating an abundance estimate (cf. Figures 26 and 30). Little auk was extremely abundant (Figure 28) but a very high variance also precluded this calculation. Only for the walruses in the Northeast Water was it possible (Figure 29). The density in the stratum, defined by the transects,

Table 3. Species and numbers of seabirds and marine mammals observed 'on transect' during the two sets of transect flights. * all seen along the coastal transects.

Date	26 May	4 June
Area	Scoresby Sund polynya	Northeast Water
No. of transects	7	6
Total length of transects, km	328	363
Species		
Walrus		85
Bearded seal		10
Ringed Seal	59	7
Seal un-ident.	14	8
Fulmar	10	22
Brent goose		9
Pink-footed goose	15	
Common eider*	2471	1500
King eider		1000
Long-tailed duck		3
Long-tailed skua	33	
Pomarine skua		1
Skua un-ident.	1	1
Glaucous gull	28	4
Great black-backed gull	2	
Ivory gull		3
Kittiwake	61	8
Arctic tern		5
Little auk	21152	
Thick-billed murre	19	
Raven	5	

was 0.075 walrus/km² (95 % c.i. 0.016-0.035) giving a population (not corrected for submerged individuals) at 470 (95 % c.i. 100-2207) walrus. As the c.i. indicates the estimate is inaccurate, and this is caused by the few samples (n = 6 transects) and the few observations (n = 29 flocks).

Many common eiders were observed in the Scoresby Sund polynya (Table 3, Figure 27), but all were seen in a single transect along the coastline of

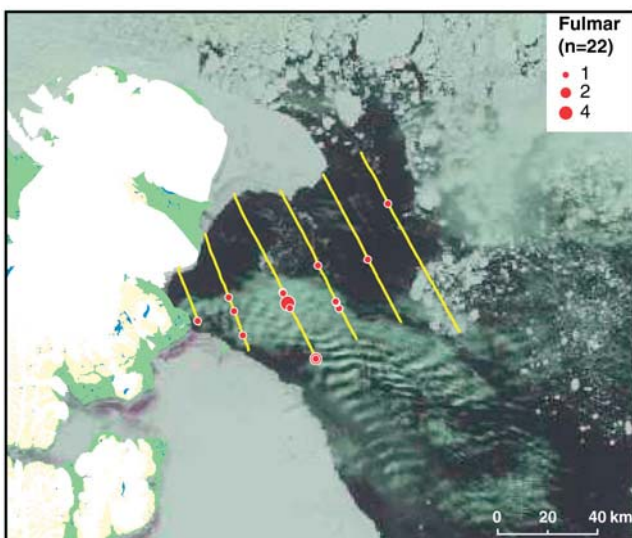


Figure 26. Distribution of fulmars observed on the transect survey on 26 May 2008 in the Northeast Water.

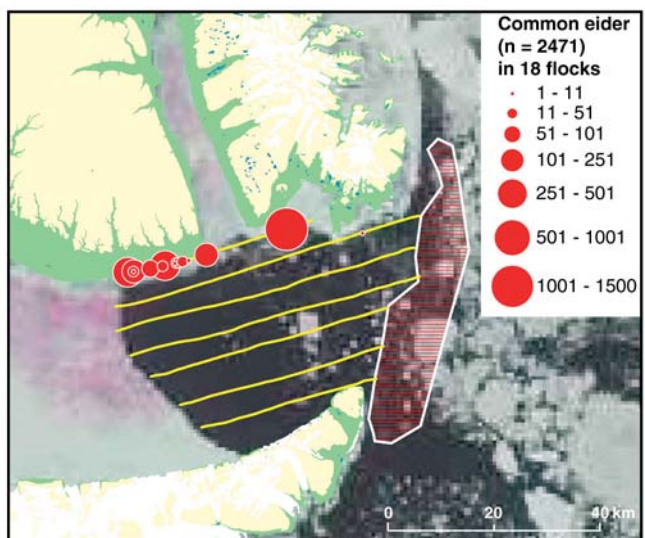


Figure 27. Distribution of common eiders observed on the transect flights in the Scoresby Sund polynya on 26 May 2008. Red hatching indicates fog.

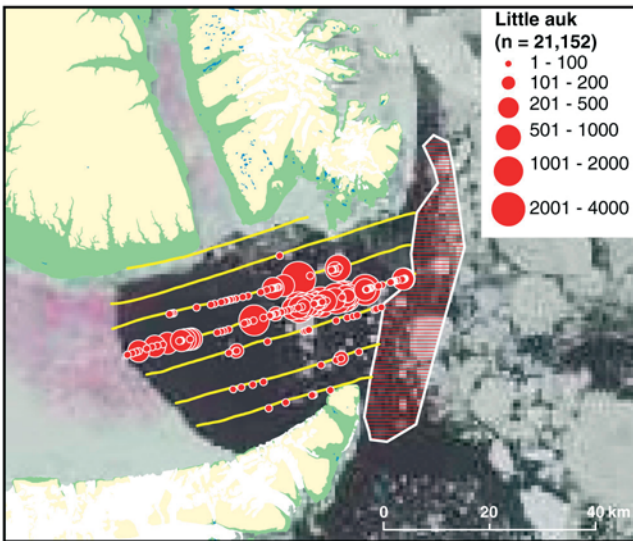


Figure 28. Distribution of little auks observed on the transect flights on 26 May 2008 in the Scoresby Sund polynya.

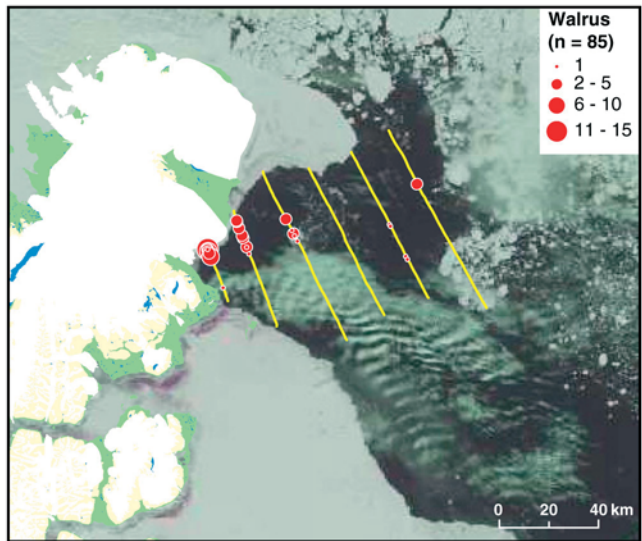


Figure 29. Distribution of walrus observed in the Northeast Water during transect flights on 4 June 2008.

Jameson Land. Many were also seen in the Northeast Water (including king eiders). These were seen at the coast along a single transect therefore not applicable for Distance Sampling analyses.

3.3 Seabird breeding colony register

Data from in total 129 seabird breeding colony sites were obtained during the two surveys and 62 sites were new to the register maintained by NERI (Figure 31).

The two presumed breeding sites for fulmar at Home Forland (Bay & Bortmann 1989) and Hvalros Ø (Stemmerik 1990) were searched, but without seeing any, and most likely these sites are abandoned or have only

Figure 30. Distribution of ringed seals and bearded seals observed in the Northeast Water during transect flights on 4 June 2008.

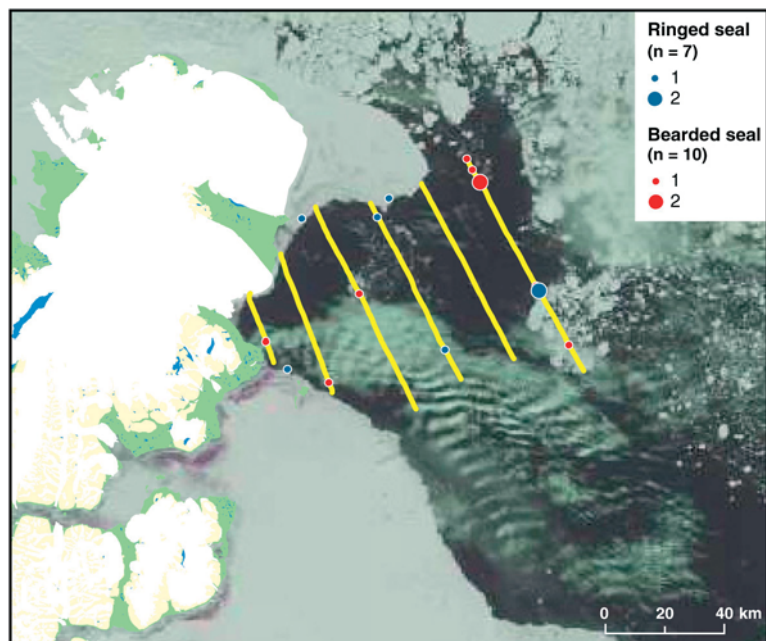
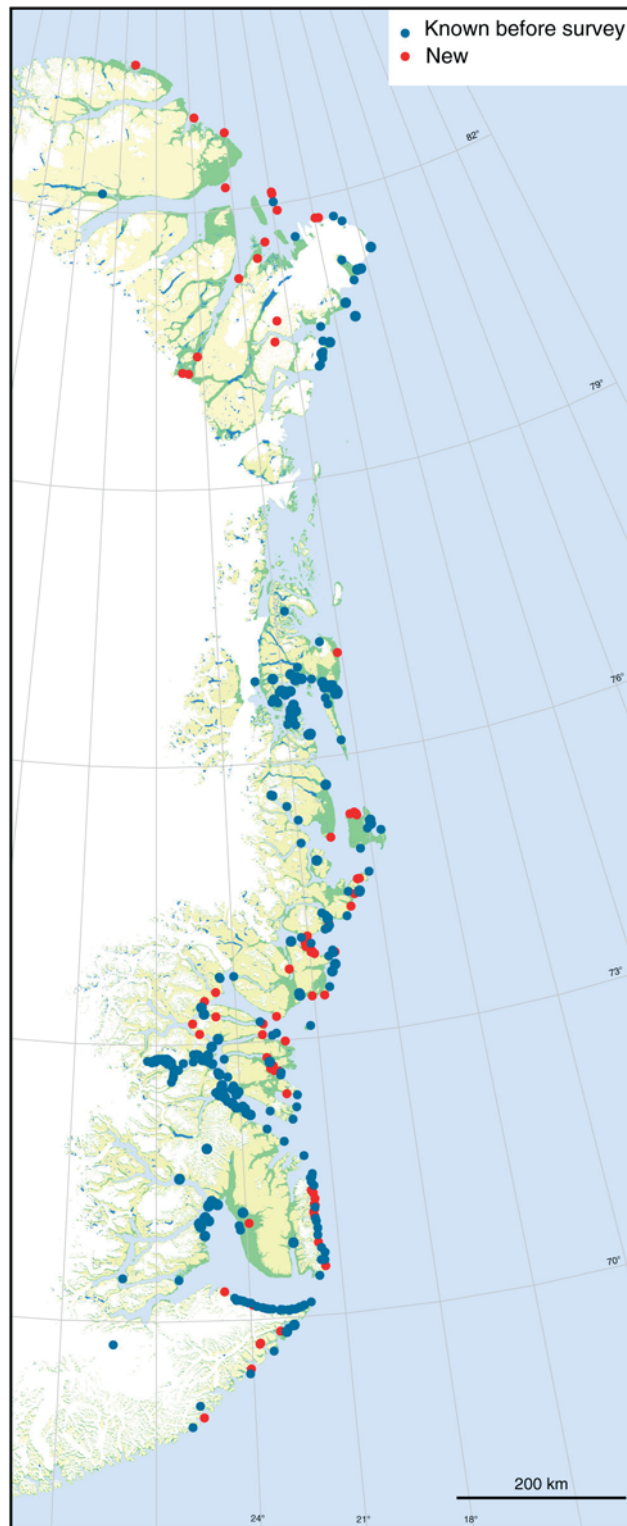


Figure 31. Overview of the new seabird breeding colonies located during the two 2008 surveys.



been visited by non-breeding birds previously. Also Gilg *et al.* (2005) failed to find any fulmars at these sites.

Colonies of lesser black-backed gulls were located on Dunholme and the island to the south of Dunholme (just south of the entrance to Scoresby Sund). Several adult birds were present among the great black-backed gulls, indicating relatively large colonies. Three birds were also seen at Arundel Ø (off Hold With Hope), but under conditions not indicating breeding.

Figure 32. Distribution of ivory gull colonies in northeasternmost Greenland. Red dots indicate the new colonies located during the July-August. Blue dots indicate the previously known breeding sites. Ice situation is from 1 August 2008 (MODIS Image).

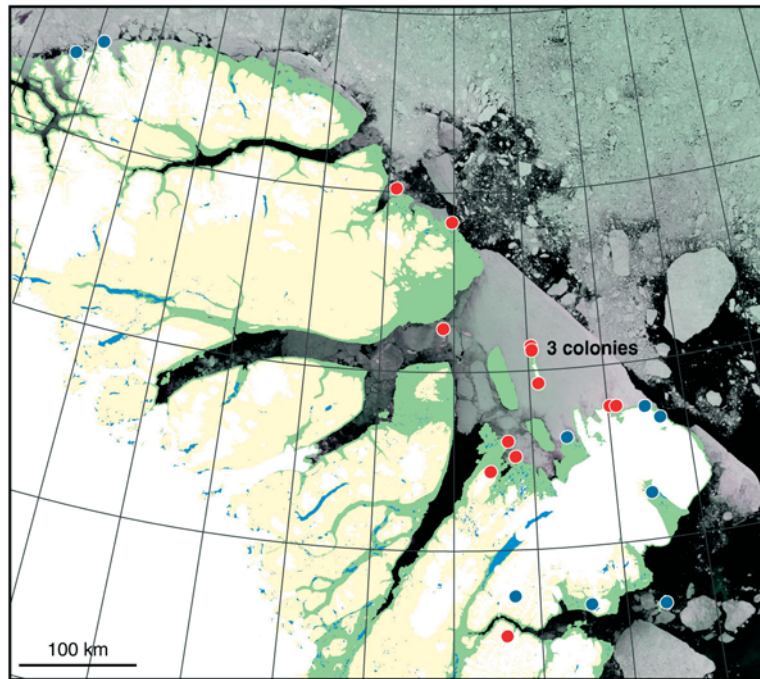


Table 4. Seabird colonies recorded and controlled in 2008 in Northeast Greenland.

*not strictly colonial, but recorded in colony of other species. Note that some of the colonies have more than one species, why the total number of controlled colony sites is lower than the sum of colonies controlled.

Species	No. of colonies controlled	New to the colony register
Fulmar	1	0
Barnacle goose	3	1
Long-tailed duck*	2	1
Common eider	21	12
Red-breasted merganser*	1	0
Glaucous gull	38	26
Lesser black-backed gull	2	2
Great black-backed gull	2	0
Kittiwake	6	0
Sabines gull	13	7
Ivory gull	17	12
Arctic skua*	2	1
Arctic tern	41	17
Black guillemot	4	2

Twelve new ivory gull colonies were located on the coasts of the region from the Northeast Water to Frederick E. Hyde Fjord (Figure 32). Six of these were located based on tracking of satellite-tacked birds. These were tacked in 2007 and 2008 at Station Nord by Olivier Gilg and his team, and some of them repeatedly returned to land sites in the vicinity. All these sites were checked by us and all proved to be breeding sites.

A status for the species in Greenland including the results from the July-August survey is presently under preparation (Gilg *et al.* in press).

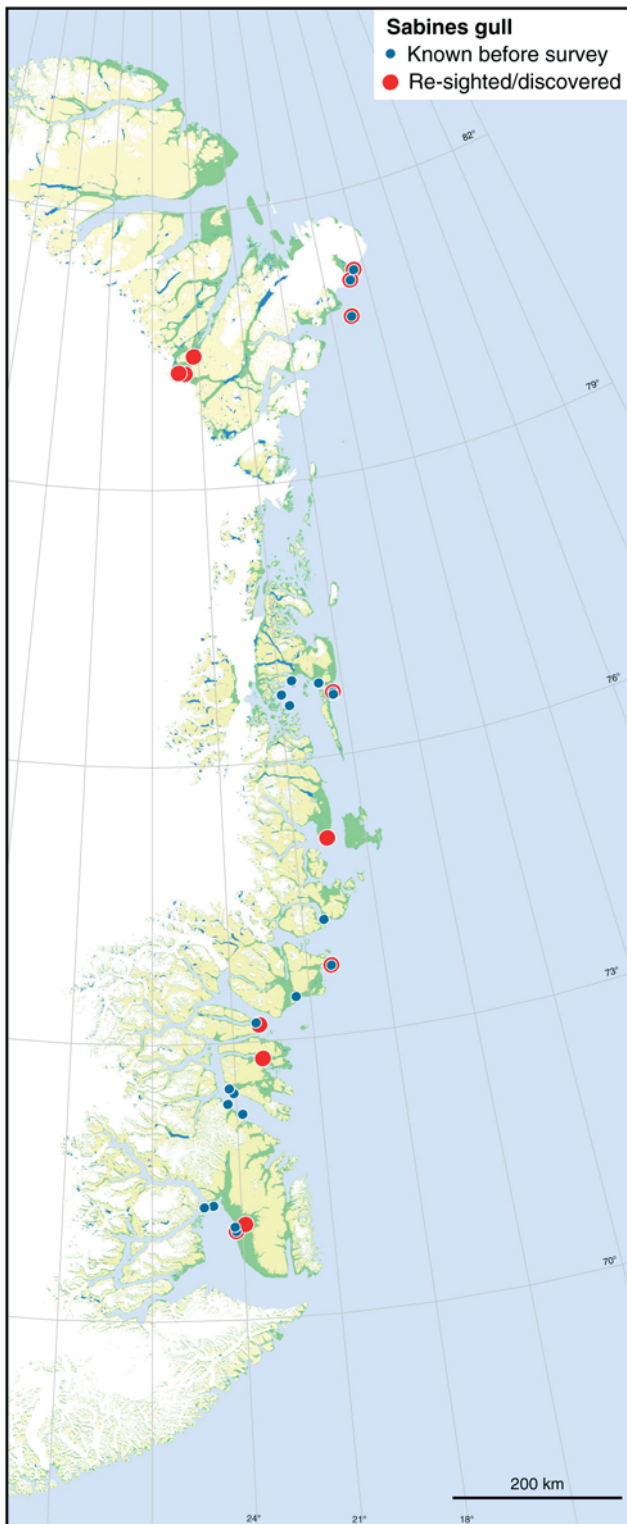


Figure 33. Distribution of Sabine's gull breeding colonies in Northeast Greenland. Blue dots indicate those known before the 2008 survey. Red dots indicate those re-sighted or discovered (pure red) in 2008.

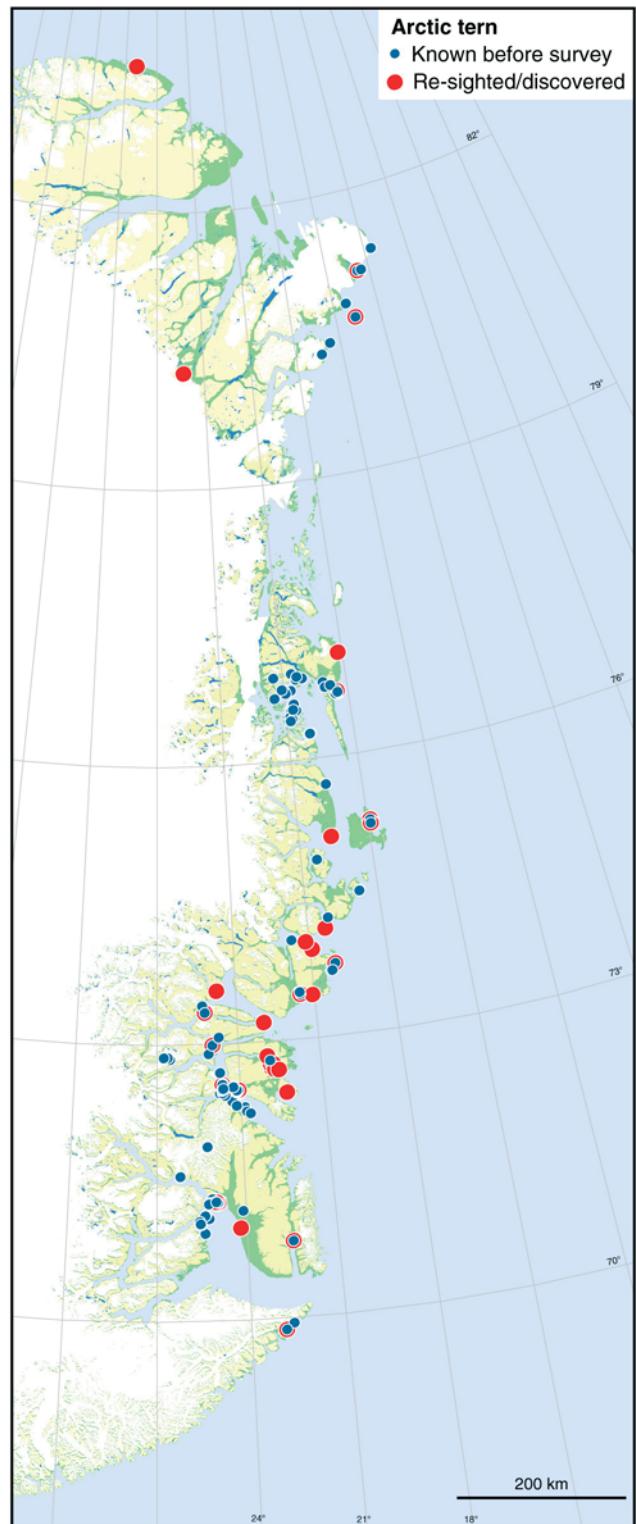


Figure 34. Distribution of Arctic tern breeding colonies in Northeast Greenland. Blue dots indicate those known before the 2008 survey. Red dots indicate those re-sighted or discovered (pure red) in 2008.

One of the new ivory gull breeding colonies were placed on a gravel covered ice floe in the mouth of Independence Fjord. This will be described elsewhere (Boertmann *et al.* in press).

Seven new sites with breeding Sabine's gulls were located (Figure 33). Most of them were on small islands in company with Arctic terns (Figure 34), but both in Jameson Land and in the Skjoldungeelv-area small colonies were found in wetlands far inland.

4 Discussion

4.1 Important spring staging areas

Three significant spring staging areas were identified during the May/June survey: The coastal parts of the Scoresby Sund Polynya, particularly the Jameson Land Coast. The coastal parts of the Wollaston Forland Polynya and the coastal parts of the Northeast Water. In all three, common eider was the most numerous species, with approx. 27,000 birds in total. As most common eiders are supposed to have arrived from the winter quarters in Iceland (cf. Mosbech unpublished), these numbers may represent a minimum estimate of the total breeding population in Northeast Greenland. The staging flocks of common eiders observed along the fast ice edge to the south of Wollaston Forland indicate, however that the spring migration was still going on and that more birds could arrive to the polynyas from south. This is in accordance with observations from the Northeast Water in 1993, when the bulk of the common eiders had arrived but migrating birds was still observed in late May (Falk *et al.* 1997). The dispersal to the breeding sites then took place in the second week of June (Falk *et al.* 1997).

Pre-nesting eiders have been counted in the Northeast Water in 1993, when 2500 common eiders and 1000 king eiders were found off the southern part of Kilen. Both the positions of these flocks and the numbers are very close to the observations in June 2008 (Elander & Ericson 1994, Falk *et al.* 1997).

Pre-breeding concentrations of both common (several thousands) and king eiders (up to 1100-1200) in the Wollaston Forland polynya have been reported previously (see summary in Meltofte *et al.* 1981, Elander & Blomquist 1986).

Significant numbers of staging king eiders were only observed in the Northeast Water (approx. 1800 birds). The king eider is not a numerous breeder in Northeast Greenland (Boertmann 1994, Meltofte 2006), but why so few were observed in the other polynyas remains obscure (cf. above that many have been observed in the Wollaston Forland previously in late May). Falk *et al.* 1997 suggest that king eiders arrive slightly earlier than the common eiders, and the migration should therefore be over when we surveyed in June 2008. The winter quarters of the Northeast Greenland population are unknown.

There was also a large open water area off Kong Oscar Fjord and Traill Ø. This did not reach the coasts and included only deep waters with the seafloor inaccessible to eiders and walruses.

Other staging water birds observed in the polynyas in spring were red-throated divers and long-tailed ducks. Both were present in low numbers. The divers were most numerous in the Wollaston Forland Polynya and some were also seen staging at the fast ice edge to the south of this polynya. Long-tailed ducks were mainly seen in the Scoresby Sund Polynya, - along the Blossville Kyst. As these birds winter in Iceland and south Greenland (A. Mosbech unpublished), the long-tailed ducks observed probably were migrants staging on their way north. Their near absence from the northern areas indicates that the spring migration was in an early phase. The spring migration period for long-tailed ducks is relatively short and pre-breeding concentrations do not occur (Meltofte *et al.* 1981).

Glaucous gulls were numerous in the two polynyas to the south, and also along the ice edges northwards to Wollaston Forland.

4.2 Important moulting areas for seaducks

The literature mentions many observations of moulting seaducks in North-east Greenland. The most widespread species is long-tailed duck which occur in flocks in shallow bays and fjords, and with the largest flocks numbering up to 500 indivs (e.g. Manniche 1910, Pedersen 1926, 1930, 1934, 1942, Meltofte 1975, Meltofte *et al.* 1981, Elander & Blomquist 1986).

The July-August survey could confirm this picture as most of the observed long-tailed ducks were flocks in typical moulting habitats. Moulting long-tailed ducks have been recorded in Dove Bugt (Meltofte 1975), and the 2008 survey indicate that very few may moult further north.

Very few moulting king eider males were observed, with the most significant flock in a fjord on the Blosseville Kyst. Besides these observations the literature only mentions a few sites with moulting king eiders: West coast of Kuhn Ø (Lea *et al.* 1991), Mackenzie Bugt (Dennis 1988) and the North-east Water (Hjort *et al.* 1983). Concentrations as those found in Northwest Greenland (Frimer 1993, Mosbech & Boertmann 1999) apparently do not occur in the surveyed region, although the observation on the Blosseville Kyst indicates that some could be found in the still un-surveyed fjords.

4.3 Important areas for moulting geese

The goose survey in Jameson Land 17 and 18 July, which will be reported elsewhere, indicated that the populations of moulting pink-footed and barnacle geese had increased considerably (almost tripled) since the previous surveys in 1988 and 1989.

This was also the case in the few inland areas we surveyed to the north of Jameson Land: In Hold With Hope 2575 pink-footed geese were counted. This is much more than counted in 1988 (n=1257) when a larger area was surveyed. In Wollaston Forland we counted c. 2100 pink-footed geese compared to 1763 in 1988, also in a larger area. The same apply to the barnacle goose numbers compared to the 1988 survey (Boertmann 1991).

In 1988 moulting pink-footed geese were known as far north as 70° N. In 1998 moulting concentrations were located near Kap Morris Jesup (J. de Korte in Boertmann & Glahder 1999). These concentrations were also seen in 2008 and new were discovered in the Skjoldungeelv-area

Even along rocky coasts, apparently unsuitable to moulting geese, flocks were found, indicating some degree of habitat saturation.

Moulting brent geese were found at the well known sites: Kilen and Mudbugten as well as at new sites on the islands to the north of Station Nord and at the coast of Johannes V. Jensen Land. The most remarkable observation of this species was a flock of moulting birds at the delta of Dr.

Augusta Dal river in Wollaston Forland 700 km to the south of the present range of the species in Northeast Greenland.

Gilg *et al* (2008) reports several sightings of brent geese in Johannes V. Jensen Land in 2007, and suggests that a recovery of the former breeding range is taking place in North Greenland. Our observations of brent geese in 2008 contribute to support this hypothesis.

4.4 Important breeding areas

The survey results contribute significantly to the knowledge of seabird breeding colonies. Sixty-two new sites with eight species were located. Particularly the new sites for Sabine gull and ivory gull are important in a management context as these species are rare and red-listed. Lesser black-backed gull was found at two new sites, confirming that the immigration of this species to Greenland is still under way (cf. Boertmann 2008). Important areas with breeding seabirds include the islands Dunholme (kittiwakes, common eiders, lesser black-backed gulls) Steward Ø and Kap Brewster (kittiwakes and thick-billed murres, but not surveyed in this context) to the south of Scoresby Sund. Further north islands like Raffles Ø, Vinterøer, Hvalros Ø, Renskæret and Maroussia are important breeding sites for colonial seabirds. The most important islands in the surveyed area are Henrik Krøyer Holme in the southern part of the Northeast Water. Greenland's largest colony of ivory gulls is found here.

The bird cliff at Steward Ø (to the south of Scoresby Sund) was surveyed twice: both in May-June and in July-August. Only Kittiwakes were present, and it seems like the thick-billed murres have abandoned this site. None were observed in 2004 (Gilg *et al.* 2005) and the only indication of breeding here is from 1974 (Meltofte 1976).

The July-August survey included the large inland area at the head of Danmark Fjord, the lowlands at Fyn Sø, Skjoldungeelv and Campanuladal. Personal communication with H. Højmark (GEUS) indicated that this extensive lowland had a relatively rich bird fauna. This was indeed confirmed, as the most remarkable species mentioned by H. Højmark, Sabine gull and great northern diver, both were observed. In addition the area supported large numbers of moulting pink-footed geese ($n = 2200$).

Another important breeding area was located in the mouth of Independence Fjord and Danmark Fjord including the islands (Prinsesse Magrethe Ø, Prinsesse Thyra Ø) and the outer coasts of Peary Land and the north coast of Kronprins Christian Land. Here several colonies of ivory gulls were found, and at many sites brent geese were observed with chicks and in moulting flocks.

The observations of lesser black-backed gulls deserved some attention. The species has recently extended the breeding range to include West Greenland (Boertmann 2008). In East Greenland breeding has occurred on Sandøen in Young Sund and presumed breeding a few other sites. The July-August survey revealed breeding colonies on Dunholme (19 birds) and the island just to the south of Dunholme (3 birds). These observations indicate that lesser black-backed gulls may breed along most of the South-east Greenland coast.

Common eiders are known to breed as far north as the Northeast Water (Håkansson *et al.* 1981, Falk *et al.* 1987). However, during the July-August survey females with chicks were observed at a few sites in the entrance of Independence Fjord and Danmark Fjord, e.g. at Mudderbugten. The lighter ice condition will probably facilitate a spread northwards along the coasts.

4.5 Important areas for marine mammals

The surveys confirmed the importance of the Northeast Water to marine mammals. Walruses were abundant (see above) in May-June, and most were females and many had calves. The walruses were most frequent close to the shores, where they were resting on the scattered ice floes and on the ice edge. Surprisingly, very few were seen in the Northeast Water in July-August, but important coasts of Holm Land, Hovgaard Ø and Djiphna Sund were not surveyed.

In the Wollaston Forland Polynya, many walruses were observed in May-June, mainly resting on ice floes and the ice edge. In July-August they were concentrated on the Sandøen haul-out.

Several flocks of narwhals were observed along the southern ice edge of the Northeast Water in May-June. Another concentration was recorded along the west coast of Store Koldewey in Dove Bugt in July-August

Gilg & Born (2005) summarised Bowhead whale observations from the recent decades, and found four areas where sightings were more frequent. Three of our four observations fall into two of these areas: The waters between 79° and 82° (n = 2) and the Wollaston Forland polynya (= Clavering Island area ss. Gilg & Born 2005) (n = 1 observation of two whales).

Concentrations of hauled out ringed seals were seen on the offshore drift ice to the north of the Scoresby Sund Polynya on 2 June. They were mainly lying at breathing holes on very large ice floes. The fact that they were at breathing holes exclude that they were harp seal, which in March and April have a whelping area on the ice slightly more to the east than these ringed seals occurred (Øigård *et al.* 2008).

5 References

- Alonso-Alvarez, C., Munilla, I., Lopez-Alonso, M. & Velando, A. 2007. Sublethal toxicity of the Prestige oil spill on yellow-legged gulls. – *Environment International* 33: 773-781.
- Bay, C. & Boertmann, D. 1989. Biologisk-arkæologisk kortlægning af Grønlands østkyst mellem 75°N og 79°30'N. Del 1: Flyrekognoscering mellem Mestersvig (72°12'N) og Nordmarken (78°N). – Greenland Home Rule, Dpt. Wildl. Mgmt., Technical report no. 4: 63 pp. (Danish, with English summary).
- Boertmann, D. 1991. Distribution and numbers of moulting non-breeding geese in Northeast Greenland. – *Dansk Orn. Foren. Tidsskr.* 85: 77-88.
- Boertmann, D. 2008 The Lesser Black-backed Gull, *Larus fuscus*, in Greenland. – *Arctic*. 61: 129-133.
- Boertmann, D. & C. Glahder 1999. Grønlandske gåsebestande - en oversigt. – Faglig rapport fra DMU, nr. 276: 59 sider.
- Boertmann, D., Olsen, K. & Gilg, O. in press. Ivory Gulls breeding on ice. – *Polar Record*.
- Buckland, S.T., Anderson, D.R., Burnham, K.P., Laake, J.L. Borchers, D.L. & Thomas, L. 2001. Introduction to Distance Sampling: Estimating abundance of biological populations. – Oxford University Press.
- Dennis, R. 1988. Bird Report - 1988 Hold-With-Hope Expedition. – Unpublished field report.
- Dietz, R., Heide-Jørgensen & Born, E. W. 1985. Havpattedyr i Østgrønland. – Danbiu Aps.
- Elander, M. & Blomqvist, S. 1986. The avifauna of central Northeast Greenland, 73°15'N.-74°05'N., based on a visit to Myggbukta, May-July 1979. – *Meddr Grønland, Bioscience* 19: 44 pp.
- Elander, M. & Ericson, M. 1994. 12.3 Prebreeding congregation of common eiders (*Somateria mollissima*) and King Eiders (*S. spectabilis*) in the NEW and onset of breeding. Pp. 153-154 in Hirche H.J. & Kattner, G. (eds) The 1993 Northeast Water Expedition, Scientific cruise report of RV "Polarstern" Arctic cruises ARK IX/2 and 3, USCG "Polar Sea" cruise NEW and the NEWland expedition. – *Ber. Polarforsch.* 142.
- Falk, K., Hjort, C., Andreasen, C., Christensen, K. D., Elander, M., Ericson, M., Kampp, K., Kristensen, R. M., Møbjerg, N., Møller, S., & Weslawski, J. M. 1997: Seabirds utilizing the Northeast Water polynya. – *Journal of Marine Systems* 10: 47-65.
- Frimer, O. 1993. Occurrence and distribution of King Eiders *Somateria spectabilis* and Common Eiders *S. mollissima*, West Greenland. – *Polar Research* 12: 111-116.
- Gilg, O. (ed.). 2005 *Ecopolaris – Tara 5 expedition to NE Greenland 2004*. – Groupe de Recherches en Ecologie Arctique.
- Gilg, O. & Born, E.W. 2005. Recent sightings of the bowhead whale (*Balaena mysticetus*) in Northeast Greenland and the Greenland Sea. – *Polar Biology* 10: 796-801.
- Gilg, O., Sabard, B., Sittler, B. Mariaux, F., Leguesdron, P. & Gilg., V. 2003, *Ecopolaris 2003*. Field report. – Groupe de Recherches en Ecologie Arctique.
- Gilg, O., Sabard, B., Aebischer, A., Hardy, L. & Bernard, F. 2008. *Ecopolaris & Sagax-Revo expeditions to E & N Greenland 2007*. – Field Report, GREA, Francheville.
- Gilg, O. Boertmann, D., Merkel, F. R., Aebischer, A. & Sabard, B. in press. The status of the endangered Ivory Gull, *Pagophila eburnea*, in Greenland. – *Polar Biology*.
- Hjort, C., Håkansson, E. & Stemmerik, L. 1983. Bird observations around the Nordøstvandet polynya, Northeast Greenland, 1980. – *Dansk Orn. Foren. Tidsskr.* 77: 107-114.

- Håkansson, E., Bennike, O., Mølgaard, P. & Frykman, P. 1981. Bird observations from northern Greenland in the summers of 1976 and 1978. – Dansk Orn. Foren. Tidsskr. 75: 51-57. (Danish, with English summary).
- Laursen, K, Frikke, J & Kahlerth, J. 2008. Accuracy of 'total counts' of waterbirds from aircraft in coastal waters. – Wildlife Biology. 14: 165-175.
- Lea, M., Roy, I. & Hooson, J. 1991. Notes on birds of Thomas Thomsen Land and Kuhn Ø, Northeast Greenland, 1990. – Unpublished field report.
- Manniche, A. L. V. 1910. The terrestrial Mammals and Birds of North-East Greenland. – Meddr Grønland 45 (1): 1-200.
- Meltofte, H. 1975. Ornithological observations in Northeast Greenland between 76° 00' and 78° 00' N. lat. 1969-71. – Meddr Grønland 191, 9: 72 pp.
- Meltofte, H. 1976. Ornithologiske observationer i Scoresbysundområdet, Østgrønland, 1974. – Dansk Ornithologisk Forenings Tidsskrift. 70: 107-122.
- Meltofte, H. 2006. Populations and breeding performance of divers, geese and ducks at Zackenberg, northeast Greenland, 1995-2005. – Wildfowl 56: 129-151.
- Meltofte, H., Elander, M. & Hjort, C. 1981. Ornithological observations in Northeast Greenland between 74°30' and 76°00'N. lat., 1976. – Meddr Grønland, Biosci. 3: 53 pp.
- Mosbech, A. & D. Boertmann 1999. Distribution, abundance and reaction to aerial surveys of post-breeding king eiders (*Somateria spectabilis*) in western Greenland. – Arctic 52: 188-203.
- Pedersen, A. 1926. Beiträge zur Kenntnis der Säugetier- und Vogelfauna der Ostküste Grönlands. – Meddr Grønland 68, 3: 151-249.
- Pedersen, A. 1930. Fortgesetzte Beiträge zur Kenntnis der Säugetiere- und Vogelfauna der Ostküste Grönlands. – Meddr Grønland 77, 5: 343-507.
- Pedersen, A. 1934. Die Ornithologie des Mittleren Teiles der Nordostküste Grönlands. – Meddr Grønland 100, 11: 35 pp.
- Pedersen, A. 1942. Säugetiere und Vögel. – Meddr Grønland 128, 2: 119 pp.
- Perez, C., Velando, A., Munilla, I., Lopez-Alonso, M. & Oro, D. 2008. Monitoring Polycyclic Aromatic Hydrocarbon Pollution in the Marine Environment after the *Prestige* Oil Spill by Means of Seabird Blood Analysis. – Environ. Sci. Technol. 2008: 707-713.
- Peterson, C.H., Rice, S.D., Short, J.W., Esler, D., Bodkin, J.L., Ballachey, B.E. & Irons, D.B. 2003. Long-Term Ecosystem Response to the Exxon Valdez Oil Spill. – Science 302: 2082-2086.
- Stemmerik, L. 1990. Hvalrosø – a new breeding site for Fulmar *Fulmarus glacialis* and possibly for Little Auk *Alle alle* in East Greenland. – Dansk Orn. Foren. Tidsskr. 84: 161. (Danish, with English summary).
- Øigård, T. A., Haug, T., Nilssen, K. T. & Salberg, B. 2008. Pup production estimates of Hooded and Harp Seals in the Greenland sea during the 2007 whelping season. – Joint ICES/NAFO Working Group on Harp and Hooded Seals, WP SEA 166.

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SEABIRDS AND MARINE MAMMALS IN NORTHEAST GREENLAND

Aerial surveys in spring and summer 2008

This report presents the results of two aerial surveys for seabirds and marine mammals in Northeast Greenland in spring and summer 2008. The report is part of the KANUMAS East Strategic Environmental Impact Assessment programme.