Hallvard Strøm, Kjell Isaksen &
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Seabird and wildfowl surveys in the Pechora Sea during August 1998

The joint Norwegian-Russian Commission
on Environmental Cooperation
The Norwegian-Russian Biodiversity Working Group
The Seabird Expert Group

Norwegian Ornithological Society

Report No. 2-2000

NOF RAPPORTSERIE
RAPPORT NR. 2-2000

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NORSK ORNITOLOGISK FORENING (NOF)
KLÆBU 2000

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This publication should be sited as:
Strøm, H., Isaksen, K. & Golovkin, A. N. (eds.). 2000. Seabird and wildfowl surveys in the Pechora Sea during August 1998. *Norwegian Ornithological Society. Report No. 2-2000*. 62 pp.

Single papers:
Isaksen, K., Strøm, H., Gavrilo, M. V. & Krasnov, Yu. V. 2000. Distribution of seabirds and wildfowl in the Pechora Sea, with emphasis on post-breeding marine ducks. Pp. 7-44 in: Strøm, H., Isaksen, K. & Golovkin, A. N. (eds.). Seabird and wildfowl surveys in the Pechora Sea during August 1998. *Norwegian Ornithological Society. Report No. 2-2000.*

Golovkin, A. N., Shchadilov, Yu. M. & Morozov, Yu. V. 2000. Waterfowl censuses in coastal waters of the Pechora Sea. Pp. 45-59 in: Strøm, H., Isaksen, K. & Golovkin, A. N. (eds.). Seabird and wildfowl surveys in the Pechora Sea during August 1998. *Norwegian Ornithological Society. Report No. 2-2000.*

Series editor: Ingar J. Øien
E-mail: *ingar@birdlife.no*
Layout: Trond Haugskott
Maps: Kjell Isaksen (NOF) and Anne Estoppey (Norwegian Polar Institute)
Front cover photo: King Eiders *Somateria spectabilis* south of Maly Zelenets Island (photo by Kjell Isaksen)
Printed: March 2000
Number of copies: 150
ISSN 0805-4932
ISBN 82-7852-040-2

PREFACE

This study was made possible through a grant from the Norwegian-Russian Working Group on Biodiversity. The joint Norwegian-Russian co-operation on biological diversity is supported by the Norwegian Ministry of Environment. This co-operation is one of five working groups under the Joint Russian - Norwegian Commission on Environmental Protection, and is sponsored by the Norwegian government's Co-operation Programme with Central and Eastern Europe. The geographical area of this joint co-operation is concentrated to the Murmansk and Archangelsk oblasts and the republic of Karelia.

The main objective of the study was to map important moulting and staging areas for waterfowl in the Pechora Sea. The Pechora Sea is a part of the East-Atlantic Flyway and supports large concentrations of waterfowl. At the same time large oil and gas deposits have been discovered in the Pechora Sea, and offshore production is planned in near future.

The project has been a cooperative effort by the Norwegian Ornithological Society (NOF), the Polar Research Institute of Marine Fisheries and Oceanography (PINRO) and Kandalaksha State Nature Reserve (KSNR). The field work was organised as two separate surveys, thus the resulting two separate papers.

Tromsø/Oslo/Moscow, March 2000

Hallvard Strøm Kjell Isaksen Alexander N. Golovkin

Hallvard Strøm (NOF) coordinated the project and was responsible for the open sea survey (Paper 1), together with Kjell Isaksen (NOF). Also participating in the open sea survey were Maria V. Gavrilo (Arctic and Antarctic Research Institute, St. Petersburg) and Yuri V. Krasnov (Kandalaksha State Nature Reserve). Vladimir I. Chernook (PINRO) organised the flights for the open sea survey, and prepared necessary permission for conducting the field work.

Alexander N. Golovkin coordinated the coastal survey (Paper 2). Also taking part in the coastal survey were Yuri M. Shchadilov & Yuri V. Morozov.

The editorial team would like to thank Vidar Bakken (Norwegian Polar Institute) for valuable comments in the planning process, Paul Shimmings for commenting on the manuscripts and Morten Ekker (Directorate for Nature Management) for support during all phases of the project. The aeroplane and helicopter crews are thanked for their co-operation and for skilfully carrying out the flights. The distribution maps were made by Kjell Isaksen, whereas the two maps in the coastal survey paper were made by Anne Estoppey (Norwegian Polar Institute).

CONTENTS

DISTRIBUTION OF SEABIRDS AND WILDFOWL IN THE PECHORA SEA, WITH EMPHASIS ON POST-BREEDING MARINE DUCKS

Kjell Isaksen, Hallvard Strøm, Maria V. Gavrilo & Yuri V. Krasnov

ABSTRACT

The Pechora Sea (the southeastern part of the Barents Sea) is a very important area for many species of birds (especially swans, geese and ducks) during the breeding, moulting and migration periods. The birdlife in large parts of the area is not well documented, especially with respect to birds at sea. The Pechora Sea is also rich in hydrocarbon resources and there are plans for extensive petroleum activity in both onshore and offshore areas. As marine birds are very vulnerable to oil spills in their environment, the plans for future petroleum activity raises concern for the well-being of the bird populations in the area. To evaluate the potential impacts of petroleum activity, information on the spatial distribution of marine birds at sea and in coastal areas is needed. The present study, an aerial survey conducted in August 1998, focuses on this need for information.

As the Pechora Sea is a huge area to cover and the time and resources available in the study were limited, the survey was designed to attain a rough picture of the relative distribution of marine birds in the area, with emphasis on post-breeding ducks. This means that obtaining detailed information about species, sex and age composition, as well as absolute numbers, had to be given low priority. Both an aeroplane as well as a helicopter were used to carry out aerial surveys. A combination of pre-defined transect routes covering the study area and flights in areas with supposedly high density of birds were used. Observations was also made during excursions on foot in areas around Amderma on the northern Yugorskiy Peninsula.

The distribution of ducks found during the aerial surveys was very patchy. Several areas with large aggregations of post-breeding ducks were identified in shallow coastal areas. The density of ducks was generally low in areas several kilometres off the coast. A minimum of 40 000 ducks, mainly King Eiders *Somateria spectabilis* and scoters *Melanitta* spp., stayed in the surveyed area in the second half of August. The highest number of ducks, mainly King Eiders, were found in the areas around the Dolgiy Island in the eastern Pechora Sea, especially in the southern part around Maly Zelenets Island. A large aggregation consisting of a minimum number of 16 000 ducks, probably closer to 25 000 individuals, was located in this area. Large aggregations were also found in the areas off the west coast of the Yugorskiy Peninsula (among these was one large concentration of about 15 000 scoters) and in the shallow coastal areas of southern Kolguev. Relatively high numbers of swans, geese and other species of birds as well as some marine mammals were also recorded during the aerial surveys.

This study provides the first quantitative information, as well as more detailed distribution patterns, on ducks at sea in the Pechora Sea. The results show that the Pechora Sea is a very important area for post-breeding ducks. More detailed studies are, however, needed to more accurately estimate the size of the populations present, the turnover in the populations during the season, and to clarify whether the distribution found during the present study is representative also for other years and for other stages in the post-breeding period. Further studies should focus on the coastal areas identified in this study.

INTRODUCTION

The southeastern part of the Barents Sea, also known as the Pechora Sea, is an important breeding and moulting area for many species of birds. It is also one of the main stop-over areas for migrating birds following the East-Atlantic Flyway on their way to and from their breeding areas in western parts North Russia. Approximately 130 species of birds have been registered in the Pechora Sea region, and the majority of these are found primarily in connection with the marine and freshwater ecosystems. The dominating species groups are Anseriformes (swans, geese and ducks) and Charadriiformes (especially waders and gulls). (Estafiev 1991, Kalyakin 1993, Estafiev *et al.* 1995, Rogacheva *et al.* 1995). Colonial seabirds are not abundant in the Pechora Sea; the nearest main breeding colonies are found on the southern coast of Novaya Zemlya.

There have been a number of studies on birds in the Pechora Sea area. Extensive studies on the biology of huntable species (primarily colonial seabirds and waterfowl) were carried out on Novaya Zemlya and Vaygach in the 1940's and 1950's (Belopolskiy 1957; Uspenskiy 1965; Karpovich & Kokhanov 1963, 1967), and a number of general faunistic articles have been published (*e.g.* Dmokhovskiy 1933, Sdobnikov 1937). Recently, researcers of the Academic Research Center of the Komi Republic have been making a significant contribution resulting in several ornithological monographs (Mineev 1987, 1994a; Estafiev *et al.* 1995). An increasing number of publications on specific species and areas have emerged during the last two decades, some of them stimulated by joint projects with western scientists (*e.g.* Shchadilov & Orlov 1984; Kalyakin 1986, 1987; Bianki & Krasnov 1987; Ponomareva 1992, 1994; Poot *et al.* 1993; Morozov 1995; Syroechkovskiy *et al.* 1995; Litvin & Syroechkovskiy 1996; Gurtovaya 1997).

The majority of the above mentioned studies have focused on birds in the terrestrial environment. Although some aerial surveys have been conducted along the mainland coast (Uspenskiy 1972; Mineev 1981, 1982), and some data on distribution and abundance at sea has been collected very recently (Krasnov & Nikolaeva 1996a, 1996b; Decker *et al.* 1998; Gavrilo *et al.* 1998a), the Pechora Sea remains poorly studied with respect to birds at sea.

Wildfowl (Anseriformes; swans, geese and ducks) is the species group of main interest in the Pechora Sea. Large numbers of these birds use the area during the breeding, moulting and migration periods. The Bewick's Swan *Cygnus columbianus bewickii* and the Whooper Swan *Cygnus cygnus* are both numerous in the region. Bewick's Swans generally breed on maritime tundra whereas Whooper Swans mainly breed in the more southern tundra areas. Both species are, however, closely connected to coastal areas during the moulting and migration periods. The largest moulting and autumn pre-migrating concentrations have been recorded in the Korovinskaya Bay, in the Pechora Delta and at Russkiy Zavorot Peninsula, with up to 10-15 000 birds recorded in Korovinskaya Bay (Mineev 1987, 1994b).

Bean Geese *Anser fabalis* and White-fronted Geese *A. albifrons* breed on various types of tundra, but they are more strongly connected to coastal areas during the moulting and pre-migration periods. Most geese moulting in the Pechora Sea area are Bean Geese, whereas the major moulting grounds of White-fronted Geese are found farther north. The Russkiy Zavorot Peninsula, Pechora Bay, Kolokolkova Bay, Kolguev and Vaygach are the most important moulting grounds for the two species in the area (Romanov 1989; Kalyakin 1993; Ponomareva 1994; Mineev 1995, 1999; M. Gavrilo unpubl. data). The Pechora Sea area is the main breeding area for Barnacle Goose *Branta leucopsis* in Russia, with approximately half of the East European population (Pokrovskaya & Gavrilo 1998). The Brent Goose *B. bernicla* is observed in the area on migration only.

Of the diving ducks, Scaup *Aythya marila*, Common Eider *Somateria mollissima*, King Eider *S. spectabilis*, Long-tailed Duck *Clangula hyemalis*, Common Scoter *Melanitta nigra*, Velvet Scoter *M. fusca* and Red-breasted Merganser *Mergus serrator* are common breeders. The main breed-

ing habitats of the Common Eider in the Pechora Sea are on small inshore islands along the coasts of Vaygach and southern Novaya Zemlya. The King Eider is a widespread breeder on the maritime tundra both on the mainland and on islands. The two species of scoters breed on mainland tundra as well as on Vaygach (Estafiev *et. al.* 1995).

Previous studies in the southern Pechora Sea indicate the following sites as particularly important for ducks during moulting and migration (Mineev 1999):

- Sengeiskiy Strait (moulting aggregations);
- Kolokolkova Bay (pre-migration aggregations);
- Western Pechora Bay (pre-migration aggregations);
- Korovinskaya Bay, Pechora Delta, Bolvanskaya Bay, Khaypudyrskaya Bay (moulting and pre-migration aggregations); and
- Dolgiy Island with adjacent shallows (moulting aggregations).

In addition, the shallow coastal areas of southeast Kolguev and Vaygach (Kara Gate Strait, Lyamchina Bay and Yugorskiy Shar Strait) have been found to be important moulting areas for marine ducks (Trevor-Betty 1895, Karpovich & Kokhanov 1963, Ponomareva 1992).

The King Eider is one of the most numerous ducks in the area during the moulting period. Very large numbers of moulting King Eiders were previously found in coastal shallows of Kolguev (Trevor-Betty 1895, Fedorov 1926), and more recently flocks of several hundred birds have been recorded in this area (Ponomareva 1992). A large area covered by King Eiders was observed from a ship near Dolgiy Island in September in the 1980's (K. Galaktionov pers. comm.). King Eiders have been reported to moult in Khaypudyrskaya Bay, being the second most numerous species after the Common Scoter (Mineev 1981). Males of both eider species have also been found moulting around Vaygach (Karpovich & Kokhanov 1963).

There is insufficient knowledge on the post-breeding behaviour of Common and Velvet Scoters in the Pechora Sea. Flocks of Common Scoters have been recorded in several areas along the coast of the Pechora Sea in July (Mineev 1975), and it has been found to be the most numerous moulting duck in Khaypudyrskaya Bay (Mineev 1983). Khaypudyrskaya Bay was also reported as an important area for moulting males of several species, including Common and Velvet Scoters, by Uspenskiy (1972). According to Mineev (1983), Velvet Scoters do not form large aggregations in the Pechora Sea.

Long-tailed Ducks moult both on tundra lakes and in coastal waters in the Pechora Sea area. Most birds moulting in this area are females (Karpovich & Kokhanov 1963; Mineev 1975, 1987). Flocks of moulting Pintails *Anas acuta* and Scaup have been found along the mainland coast from Yugorskiy Peninsula to Pechora Bay (Mineev 1975). Goosanders *Mergus merganser* and Red-breasted Mergansers moult in the sheltered coastal waters of Vaygach. Karpovich & Kokhanov (1963) estimated that about 3 000 individuals of the two species moulted in this area, with the Red-breasted Merganser as the dominating species, comprising about 75% of the total number. No major moulting areas of the two species are known along the mainland coast from Yugorskiy Peninsula to Pechora Bay, but relatively high numbers have been found in Korovinskaya and Pechora Bays in September in connection with the migration (Mineev 1975).

In addition to being an important area for birds and other biological resources, the Pechora Sea is also rich in hydrocarbon resources. The shelf and the coastal plains of the Russian western Arctic from the eastern Barents Sea to the southwestern Kara Sea is one of the richest regions of the world in terms of oil and gas deposits (Doré 1995), and it also contains rich mineral resources. Whereas the hydrocarbon resources onshore in this area has been explored and developed at a low level for some time, exploratory drilling in the Pechora Sea

itself was started only very recently and there is yet no petroleum extraction at a larger scale in the area (Chimbulatov & Firsov 1998). There are, however, plans for extensive petroleum activity in the Pechora Sea, including large-scale extraction of oil and gas, reloading of oil and gas extracted in areas to the south and east, and transportation of oil and gas on tankers through the area (also as a part of the development of the Northern Sea Route; see EPPR 1997, Moe & Semanov 1999, Østreng 1999). Both extraction and transportation of oil necessarily entails a risk of oil spills polluting the environment; the risk may be reduced by preventive measures, but will probably never be removed altogether. Marine birds are very vulnerable to oil spills in their environment (see *e.g.* Piatt *et al.* 1990, 1991; Isaksen *et al.* 1998). The plans for future petroleum activity in the Pechora Sea therefore raises concern for the well-being of the populations of wildfowl and seabirds in the area.

The information on marine birds in the Pechora Sea is fragmentary and there is a need for surveys covering larger parts of the area that can give comparable information from different sub-areas. The aim of the present study is to obtain information on the spatial distribution of seabirds and wildfowl in the Pechora Sea, with special focus on post-breeding aggregation of ducks at sea. This information is relevant when evaluating the potential impacts of petroleum activity in the area.

MATERIAL AND METHODS

Study area

The area of study is the Pechora Sea with adjoining coastal areas from Kolguev in the west to the Yugorskiy Peninsula and southern Vaygach in east (Figs. 1 and 2). The oceanography in the Pechora Sea is characterised by inflow and mixing of different water masses. Atlantic water flows into the area from west, water from the Kara Sea from east, water from the White Sea from southwest, and freshwater from the rivers, mainly Pechora River (Terziev *et al.* 1990). Almost the entire Pechora Sea is ice-covered from November until late June, although polynyas are semi-permanent features in some areas. The extent of sea-ice cover can vary considerably from year to year, according to the inter-annual dynamics of inflowing Atlantic waters as well as air temperature and wind characteristic. The Pechora Sea is shallow, with depths of less than 50 metres, except for the northern part (Midttun & Loeng 1987, Terziev *et al.* 1990).

Data collection

The Pechora Sea is a huge area to cover with the limited time and resources available in this study. The aerial surveys were designed to attain a rough picture of the relative distribution of marine birds in the area, with emphasis on post-breeding ducks. This means that obtaining detailed information about species, sex and age composition, as well as absolute numbers, had to be given low priority.

Both an aeroplane as well as a helicopter were used during the aerial surveys. An *AN-26 BRL*, a two-propeller Russian aeroplane originally built for cargo transport, was used to cover areas off the coast. The aeroplane has been modified to be suitable as a platform for observations and for oceanographical work. It has previously been used during seabird censuses in the Barents Sea by Russian scientists (Borkin *et al.* 1992, Krasnov & Chernook 1999). During the surveys the aeroplane generally flew at a speed of 280-320 km/h, which was the aeroplane's slowest secure travelling speed, and at a height of 100-150 m a.s.l. The flights followed predefined straight transect lines over open sea, and on some occasions along the coast or over land. There was one observer in a blister at each side of the aeroplane. The main focus of the observers was on a transect 150 m wide perpendicular to the direction of flight, but birds and mammals observed further out were also recorded to some extent, especially larger concentrations. Observations were continuously reported by way of an intercommunication system to a PC operator who entered them onto a data file. Time and coordinates from the aeroplane's GPS receiver were automatically logged in the same file. The AN-26 was operated by a crew from Archangelsk Airlines, while personnel from the Polar Research Institute of Marine Fisheries and Oceanography (PINRO) operated the equipment including PCs, GPS and the intercommunication system.

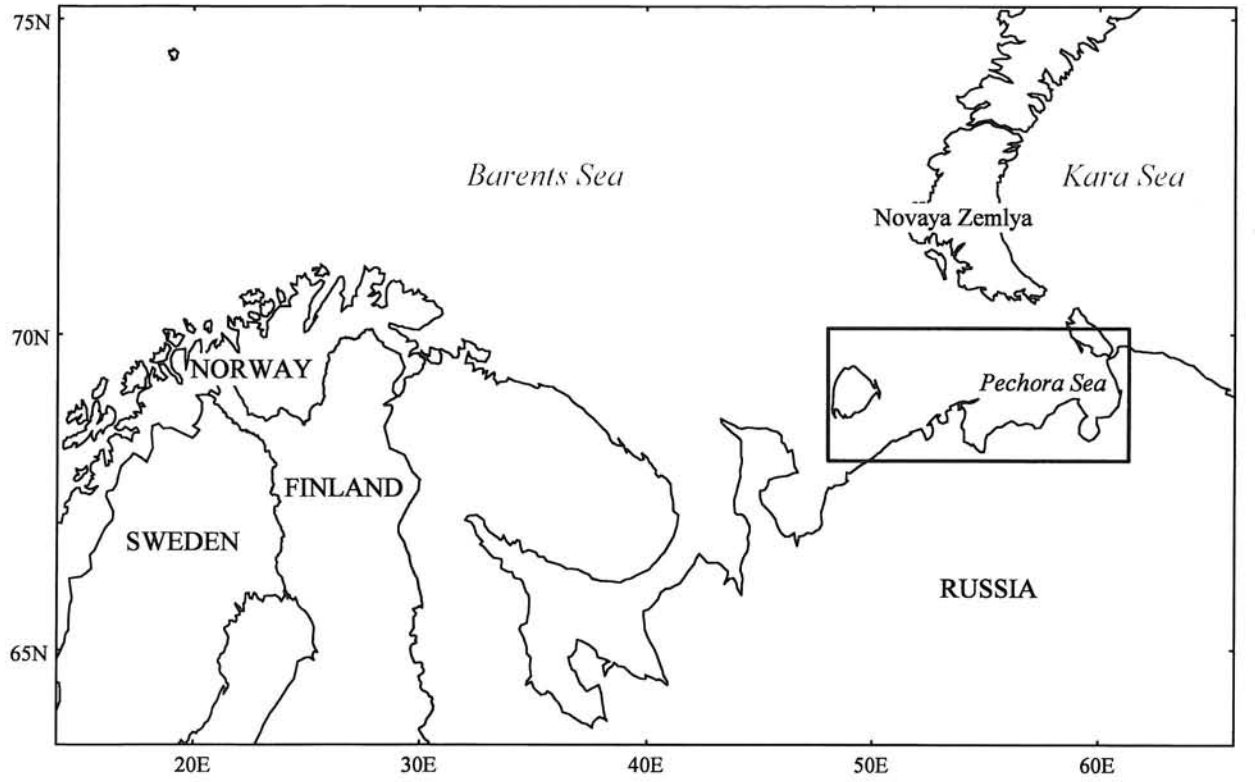


Fig. 1. *Map of northern Europe and the Barents Sea with the extent of the study area indicated.*

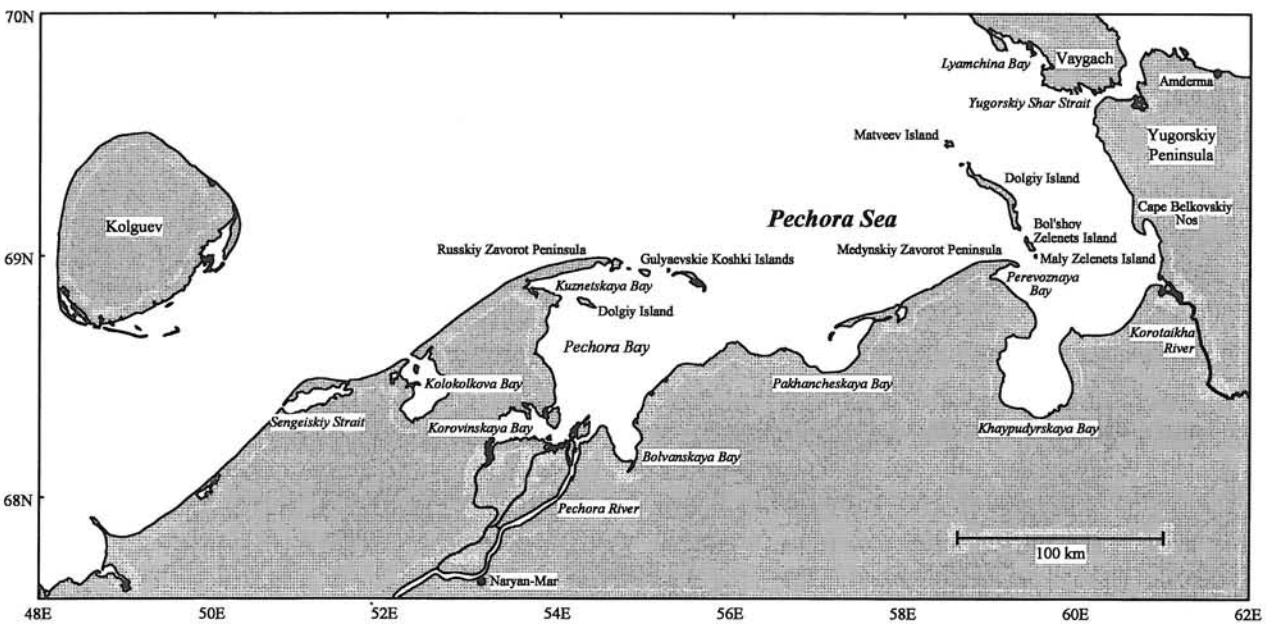
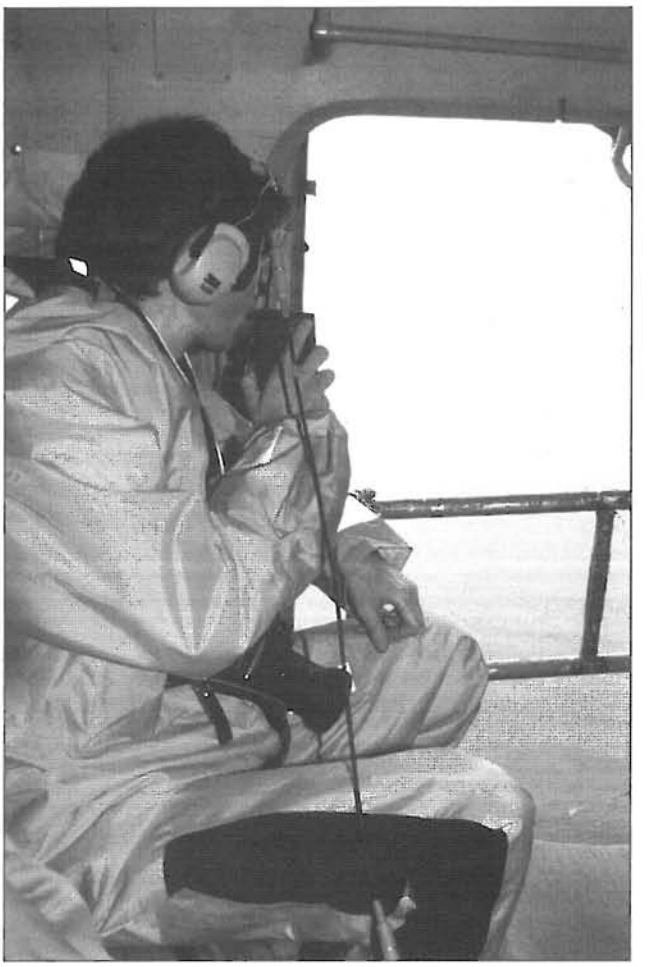


Fig. 2. *The study area with place names used in the text.*

The AN-26 BRL has been modified to be suitable as a platform for observations and for oceanographical work. This includes blisters on both side of the aeroplane. Photo: Hallvard Strøm.

An *Mi-8 MTV*, a Russian helicopter, was used for surveys along the coast. The flying speed during the surveys was 120-170 km/h at an altitude of 80-100 m. There was one observer in the navigator's seat in front of the helicopter, one observer by an open door at the left side, and (14 August only) one additional observer by an open window on the right side of the helicopter. Photographs of some of the observed flocks, mostly the larger ones, were taken with a telephoto lens. As in the AN-26, the observers' main focus was on the 150 m wide transect on each side, but observations from further out were also recorded. Time and GPS positions were logged automatically on a data file during the flights. Observations were recorded on dictaphones together with the time of the observations and other relevant information. A flight route 300 m off the shoreline was generally held when flying along the coast. However, the distance varied somewhat and the route was sometimes altered in order to get close to flocks observed ahead of the helicopter. A strict transect schedule was therefore not followed during the helicopter surveys. The Mi-8 was operated by military personnel from the Russian border service in Vorkuta.



A Mi-8 MTV, a Russian helicopter, was used for surveys along the coast. One of the observers were situated by an open door at the left side of the helicopter. Photo: Hallvard Strøm.

Altogether six flights were conducted in the period 11-25 August 1998; four with the AN-26 (Fig. 3) and two with the Mi-8 (Fig. 4):

11 Aug. (AN-26): Flight from Archangelsk via the southern part of Kolguev, Dolgiy and Zelenets Islands to Amderma.

12 Aug. (AN-26): Transect lines covering the eastern and northern parts of the study area from Pakhancheskaya Bay to the coast of Yugorskiy Peninsula and Vaygach.

13 Aug. (AN-26): Transect lines covering the southwestern part of the study area from Kolokolkova Bay to Medynskiy Zavorot Peninsula.

14 Aug. (Mi-8): Surveys flown around Dolgiy, Matveev, Maly Zelenets and Bol'shoy Zelenets Islands at approximately 300 and 3 000 m distance from the islands. Vaygach was visited as part of another mission.

15 Aug. (AN-26): South coast of Kolguev overflown.

25 Aug. (Mi-8): Survey along the coast from Yugorskiy Shar Strait south to Khaypudyrskaya Bay and the southern parts of the Zelenets Islands.

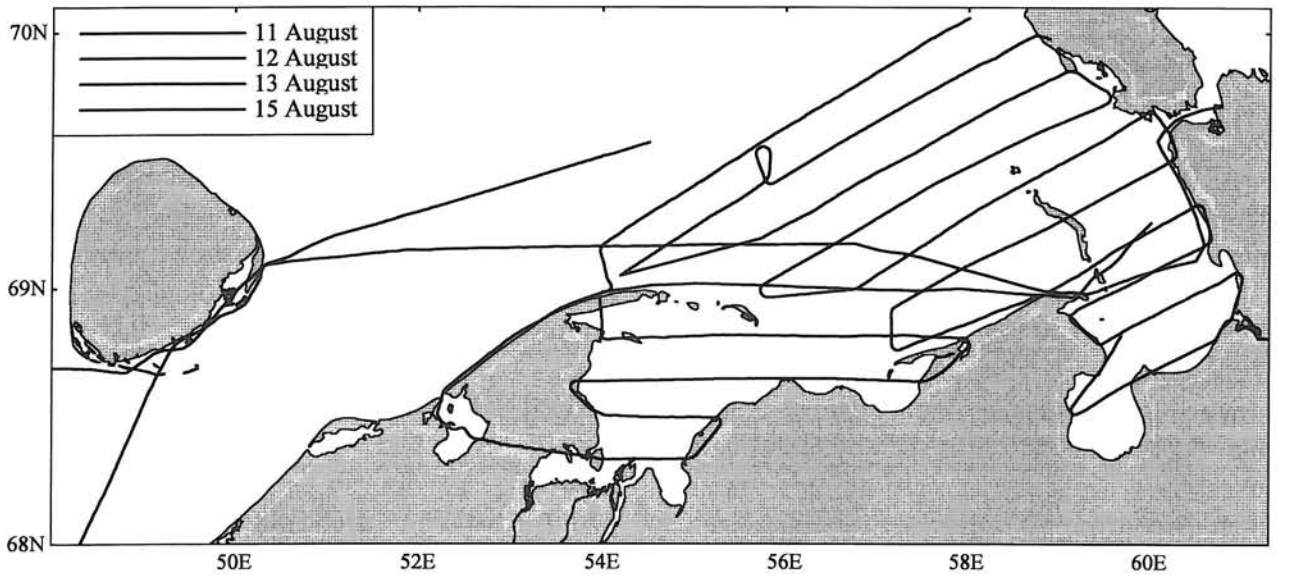


Fig. 3. *Flight routes of the AN-26 aeroplane during the surveys in 1998.*

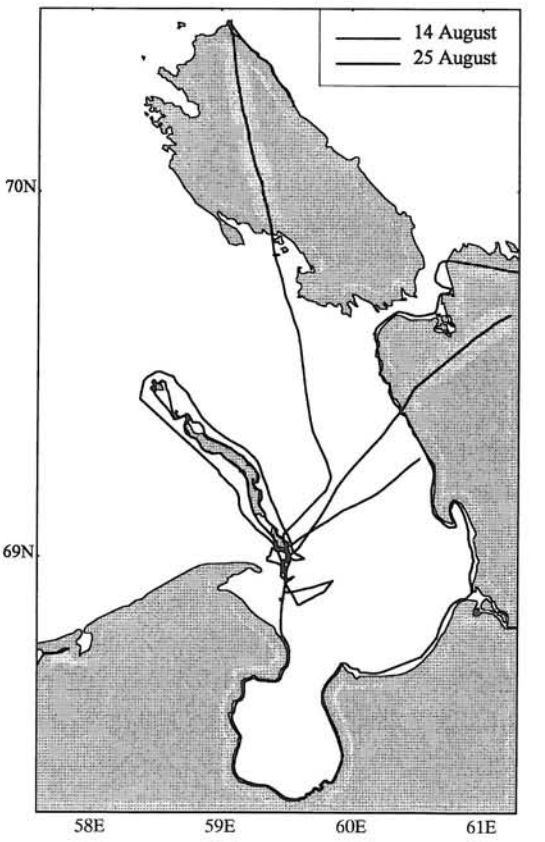


Fig. 4. *Flight routes of the Mi-8 helicopter during the surveys in 1998.*

Several problems were met when organising the flights in Amderma. Dense fog was a problem both during take-off and landing on several days, and some flights had to be cancelled. We also had problems obtaining permissions from the Russian authorities to carry out some of the flights.

In addition to the aerial surveys, observations were conducted on the ground in the areas around the Amderma settlement (northeast on the Yugorskiy Peninsula). Although these observations were not carried out in coastal areas in the Pechora Sea, they still provided valuable information about phenology and relative abundance and breeding success of species on nearby coastal tundra. This is valuable information when interpreting the results from the aerial surveys. The results from the ground surveys are presented in Appendix 2.

Data treatment and presentation

Data collected by the different observers were merged in one database, taking care to avoid double registrations of flocks seen by more than one observer or flocks seen on more than one occasion. Data from the helicopter surveys were kept separate from those collected during the aeroplane transects. This was done because the two survey methods differ somewhat, and because the overlap in area covered could otherwise lead to problems with double registrations.

The photographs from the flights were taken at variable distances from the focal objects (in most cases flocks of ducks) and with lenses with variable magnification. Although photographs were taken both during aeroplane transects and helicopter surveys, only those taken from the helicopter proved to be useful as a tool in estimating numbers of birds. The number of individuals in each flock was counted from those photographs having a quality allowing this. In some cases it was also possible to sex the birds from the photographs. The number of birds in flocks where it was not possible to gain an accurate count from the photographs was estimated by comparing the extent and density of these flocks with those that were counted, in combination with the information recorded during the flights.

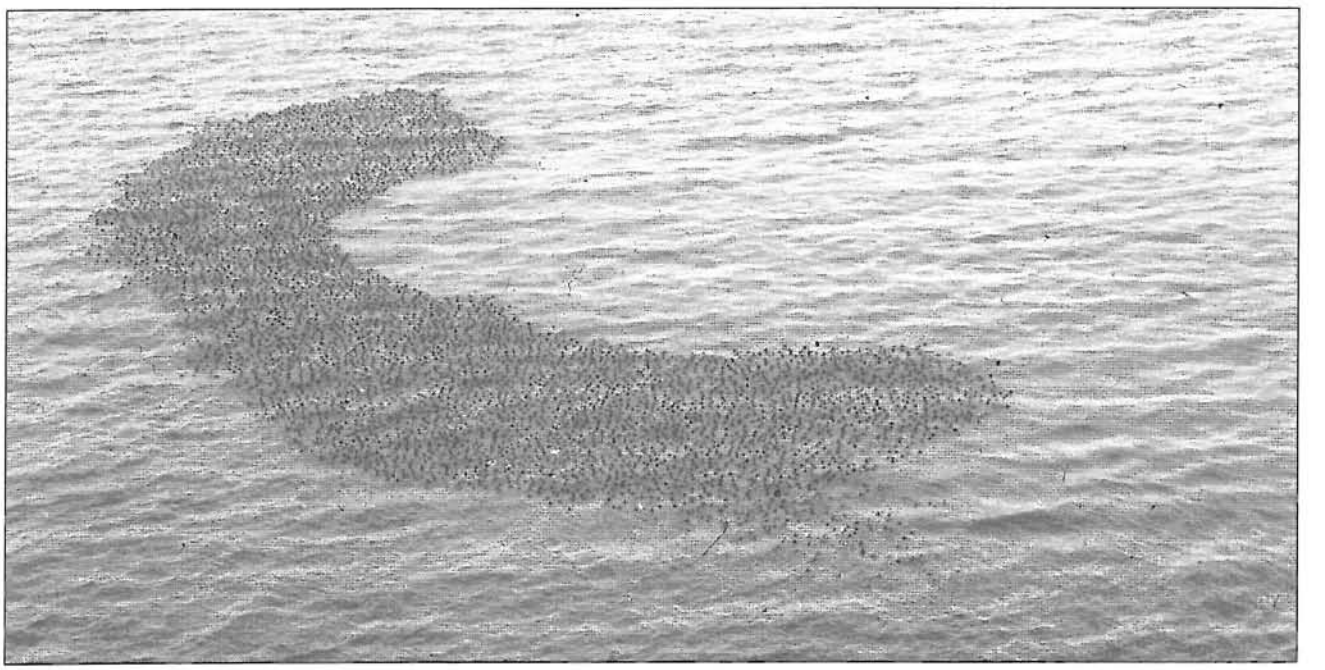
The results are presented on maps with the locality of the observations for each species shown or with the number of observed individuals for one species or species group shown as pie-scaled quantity symbols. Records made close to each other have been aggregated into fewer quantity symbols to avoid information being hidden by overlapping symbols. The actual number of sightings (of single individuals or flocks) is therefore higher than that shown on most maps. In cases where symbols partly overlap, the symbol with the largest value is displayed on top. GPS positions are not available for the start and end of some flights. Observations from the sections where GPS positions are missing are not included on the maps. For some areas there is a lack of correspondence between the flight route (as defined by the GPS positions) and the coastline shown on the maps. This is due to inaccuracies in the digital data defining the coast on the maps.

RESULTS

Ducks

EIDERS (King Eider *Somateria spectabilis* and Common Eider *S. mollissima*) were found to be the most numerous group of ducks during the aerial surveys. King Eiders dominated in numbers whereas Common Eiders(females with young) were identified only in small numbers along the shores. A very large concentration of King Eiders was found close to Maly Zelenets Island (Appendix 1, Fig. 6a). During the helicopter flight around the Matveev, Dolgiy and Zelenets Islands on 14 August, the area off the southern shore of this small island was overflown three times. On the first crossing there was a long raft of birds extending from the shore and several kilometres southward. Most birds were concentrated in a large dense flock close to the shore, with a narrow meandering 'tail' of birds extending south. During repeat flights over the same area 1 and 3 hours later, most of the ducks had spread into a number of smaller flocks and moved south. This was clearly a reaction to disturbance from the helicopter. Photographs of the flocks were taken both on the first flight and later when the flocks were approached at closer range.

A very large concentration of King Eiders Somateria spectabilis *was found close to Maly Zelenets Island on 14 August. The picture show the large dense flock close to the southern shore, and parts of the narrow meandering 'tail' of birds extending several kilometres to the south. Photo: Hallvard Strøm.*



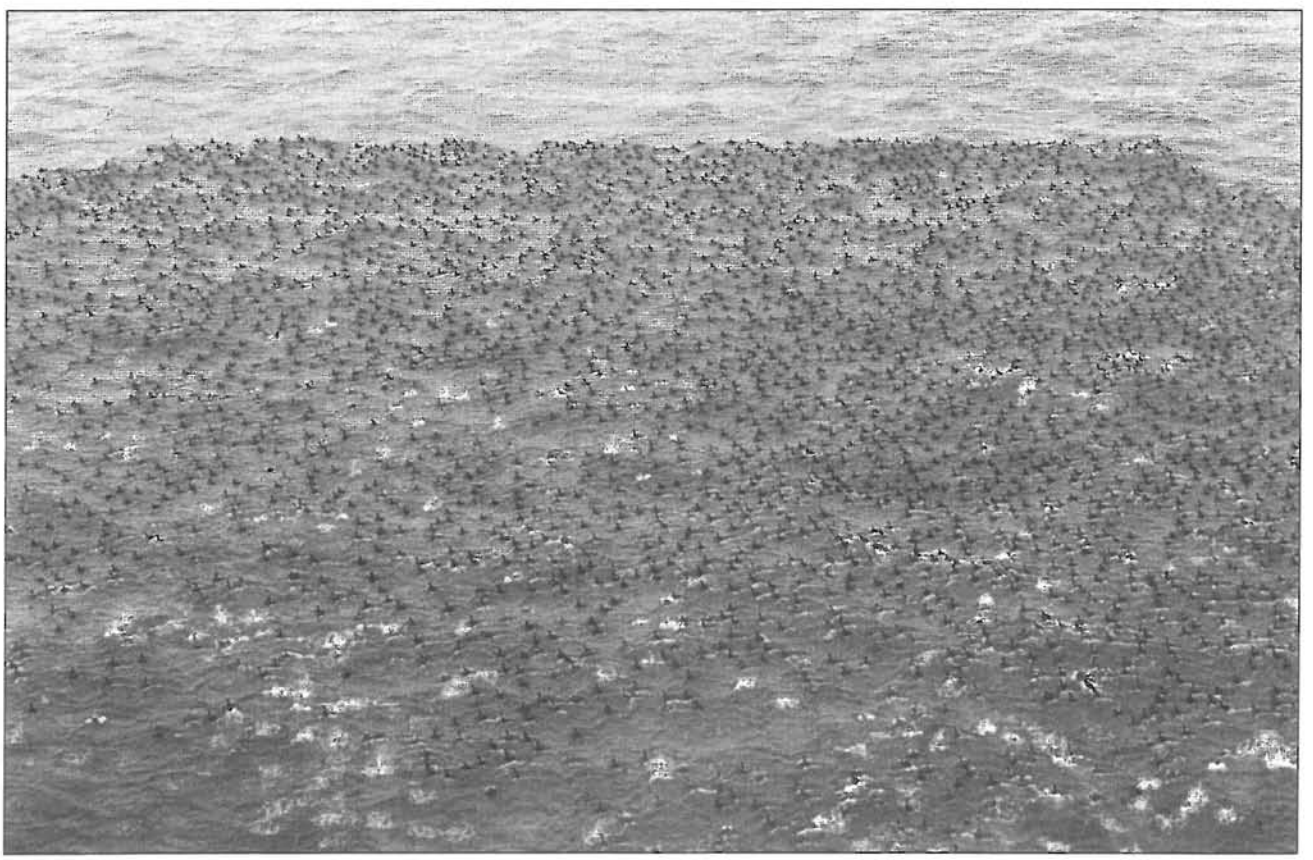
A dense flock of King Eiders Somateria spectabilis *south of Maly Zelenets Island on the 14 August. The picture is taken after the birds had spread into a number of smaller flocks and moved south, due to the disturbance of the helicopter. The flock shown contained about 5300 individuals. Photo: Hallvard Strøm.*

The total number of birds in this concentration was estimated at approximately 25 000 individuals, mainly on the basis of photographs. The potential bias in this estimate is, however, considerable. A minimum estimate, based on more detailed photographs taken on the second flight over the area, is 16 000. These photographs did, however, not cover all flocks as the birds at this time had started to spread out and move south. Large concentrations of ducks were seen in the same area south of Maly Zelenets Island during the helicopter flight on 25 August. Large flocks were also seen during the aeroplane transect on 11 August, but then off the island's western, northern and eastern coasts; the area south of the island was not surveyed at this date.

A count of the large flock seen on the first flight over Maly Zelenets Island on 14 August was not possible (neither during the flight nor from the photographs taken). Some of the smaller flocks formed after the large flock had been split up were, however, counted from photographs. One of these flocks accounted for 5300 individuals alone. No species apart from King Eider were identified in the large concentration south of Maly Zelenets Island, but there may also have been other species involved. Studies of photographs allowed determination of the sex-ratio in sections of two of the smaller flocks. The proportion of females was 11% and 17% of 1226 and 690 individuals, respectively.

In addition to the area off the southern Dolgiy Islands, relatively high numbers of King Eiders were found along the southern coast of Kolguev Island both on 11 and 15 August. Approximately 1000-1500 individuals were counted from one side of the aeroplane on each date in this area (Appendix 1, Fig. 1a; the quantitative information displayed on the map may involve flocks counted on both dates). Eider flocks were also recorded along the western coast of the Yugorskiy Peninsula and in Khaypudyrskaya Bay (Appendix 1, Fig. 6a). A considerable proportion of the marine ducks not identified to genus most likely were eiders (see below).

SCOTERS (Common Scoter *Melanitta nigra* and Velvet Scoter *M. fusca*) were found in high numbers on two occasions. A large concentration, consisting of several flocks, roughly estimated at 15000 individuals in total was observed west of Cape Belkovskiy Nos from the aeroplane on 11 August (Appendix 1, Fig. 1b). All birds identified in this concentration were Common Scoters. During the helicopter flight on 14 August several flocks of in total about 600-1000 individuals were recorded between Dolgiy Island and Bol'shoy Zelenets Island (Appendix 1, Fig. 6b). No pictures



A section of a large flock of King Eiders Somateria spectabilis *south of Maly Zelenets Island on 14 August. Photo: Kjell Isaksen.*

were taken of the scoter flocks and the numbers are therefore rough estimates. Scoters were also observed in Pechora Bay, Pakhancheskaya Bay and Khaypudyrskaya Bay, but in relatively low numbers. In addition to these records, quite a few of the ducks not identified to genus may have been scoters (see below).

LONG-TAILED DUCKS *Clangula hyemalis* were only observed along the shore of Dolgiy Island and in the northwestern part of Khaypudyrskaya Bay (Appendix 1, Figs. 1c and 6c). The observed numbers were low with the largest flock consisting of about 50 individuals.

SAWBILLS (Goosander *Mergus merganser* and Red-breasted Merganser *M. serrator*) were found mainly in the easternmost part of the study area (Dolgiy Islands, Yugorskiy Peninsula and Vaygach) (Appendix 1, Figs. 1c and 6c). All observations were made close to the coast and the number of individuals involved was low (the largest flock consisted of 25 individuals). The highest numbers were found in partly ice-covered waters along the eastern coast of Vaygach on 14 August. All birds identified to species were Goosanders.

UNIDENTIFIED DABBLING DUCKS *Anas* sp. were observed in relatively low numbers in coastal areas, mainly in tundra ponds and lakes in the Pechora Bay area.

ALL DUCKS COMBINED. A relatively large proportion of the ducks seen was not identified to either species or genus. Most of these were in dense flocks of dark marine ducks, *i.e.* eiders or scoters. Fig. 2a and Fig. 6d in Appendix 1 combine the information for all species/groups of ducks. This summary shows that the Dolgiy Island area, especially the southern part around Maly Zelenets Island, supported the largest numbers of ducks. Other areas with high numbers of ducks were found off and along the Yugorskiy Peninsula from Cape Belkovskiy Nos to Yugorskiy Shar Strait. Concentrations were also found in Pakhancheskaya Bay, Korovinskaya Bay and along the southern coast of Kolguev.

Geese

A large proportion of the observed 'grey geese' (either Bean Geese *Anser fabalis* or White-fronted Geese *A. albifrons*) were not identified to species. Most of the observations of *Anser* sp. were made during the helicopter flights in the eastern part of the area. The flock size ranged from 2 to 200 individuals, with most flocks consisting of 30-40 geese. Scattered Bean Geese and White-fronted Geese were identified in most parts of the area (Appendix 1, Figs. 2b and 7a). The numbers of identified White-fronted Geese and Bean Geese were 46 (3 records) and 257 (11 records), respectively. Several dense flocks of geese, possibly moulting, were seen at sea close to the coast west of Pakhancheskaya Bay (30 Bean Geese), at Dolgiy Island (about 100 *Anser* sp.) and at Cape Belkovskiy Nos (45 *Anser* sp. and 50 Bean Geese). A flock of 70 adult and young Bean Geese were recorded at sea close to the coast of Bol'shoy Zelenets Island on 14 August.

BARNACLE GEESE *Branta leucopsis* were observed in relatively high numbers on Vaygach during the helicopter transect on 14 August (Appendix 1, Fig. 7b). Five flocks of about 500 individuals in total were observed here, mainly on inland tundra lakes. The largest aggregation, and the only record from Vaygach involving juveniles, was a flock of about 300 adults and juveniles. The only observations of Barnacle Geese outside Vaygach were from Cape Kuznetskiy Nos (south of Kuznetskaya Bay) and Dolgiy Island in the western part of Pechora Bay (Appendix 1, Fig. 2b). On Dolgiy Island two groups of 4 adults and 4 juveniles, and 6 adults, respectively, were observed.

BRENT GEESE *B. bernicla* were only observed during the helicopter flight on 25 August (Appendix 1, Fig. 7b). All observations were of flocks (the largest consisting of 100 individuals) along the shore of Yugorskiy Peninsula and Khaypudyrskaya Bay. Some of the flocks were observed in flight and the geese were obviously on migration. In addition, several flocks totalling about 1700 unidentified geese observed on the coast south of Perevoznaya Bay on 25 August may well have been Brent Geese.

The southern part of Bol'shoy Zelenets Island towards north. Photo: Kjell Isaksen.

Swans

Unidentified swans were observed in relatively high numbers in the area (Appendix 1, Figs. 2c and 7c). Most records were from coastal tundra, but a number of observations was also made during some of the occasional flights over inland areas, for instance on Vaygach. The highest densities were found on the tundra along the western part of Pechora Bay.

It was not possible to identify the observed swans to species from the air and both Bewick's Swans *Cygnus columbianus bewickii* (sometimes regarded as a separate species, *C. bewickii*) and Whooper Swans *C. cygnus* probably were involved.

The number of adults and juveniles was recorded separately for most observations. The mean brood size of 31 pairs with young was 2.9 (5, 13, 6, 5 and 2 pairs with 1, 2, 3, 4 and 5 young, respectively). Some groups of adult and juvenile swans included more (or less) than two adults. Including these groups, assuming that all juveniles in each of these 11 groups belonged to the same brood, the total mean brood size for 42 broods was 2.7. The proportion of juveniles of the total number of swans seen was 27.6% (113 of 410 individuals in 136 observations). Most of the observations of adults without young were of single pairs (65 observations).

Other birds

DIVERS *Gavia* spp. were observed in relatively low numbers in coastal areas (Appendix 1, Figs. 3a and 7d). Most records were from around the Dolgiy Islands and in Khaypudyrskaya Bay during the helicopter flights. Most divers seen were not determined to species, but there were two observations of Black-throated Diver *G. arctica* (Dolgiy Island and Khaypudyrskaya Bay) and one of White-billed Diver *G. adamsii* (Zelenets Islands).

FULMARS *Fulmarus glacialis* had an offshore distribution and were common as single individu-

als or in loose aggregations in the northern and western parts of the study area (Appendix 1, Fig. 3b). No Fulmars were seen in the Pechora Bay or in the areas east or south of the Dolgiy Islands (the species was not recorded at all during the helicopter flights).

WADERS (Charadriidae and Scolopacidae) were seen along the coast in most of the area covered during the flights (Appendix 1, Figs. 3c and 8a). They were concentrated along shallow and muddy beaches. Most records were of small flocks of 10-100 individuals, but there were also several larger flocks of up to 400 individuals.

SKUAS *Stercorarius* spp. were generally seen in low numbers, but relatively high densities were found in the areas close to Kolguev (Appendix 1, Figs. 4a and 8b). Most observations were of one or two individuals. In addition to records of unidentified skuas, there were two observations of Arctic Skua *S. parasiticus* (Kolguev and west of Yugorskiy Shar Strait) and one observation of Pomarine Skua *S. pomarinus* (Pechora Bay).

COMMON GULLS *Larus canus* were only observed along the coast between Russkiy Zavorot Peninsula and Kolokolkova Bay (three records of one or two individuals).

LESSER BLACK-BACKED GULLS *L. fuscus heuglini* were common in most parts of the study area (Appendix 1, Figs. 4b and 8c). Most observations were from coastal areas and from the Pechora Bay, and there were few observations in northern offshore areas. Observations of one to five individuals were most common, but there were some records of larger concentrations of several tens of individuals. The taxonomic placement of this taxon is unclear, and it is sometimes regarded as a separate species (*L. heuglini*) or as a subspecies of Herring Gull (*L. argentatus heuglini*).

GLAUCOUS GULLS *L. hyperboreus* were found both in coastal and offshore areas in most of the area covered during the flights (Appendix 1, Figs. 4c and 8d). The species' distribution largely overlapped that of the Lesser Black-backed Gull, but Glaucous Gulls were less common in the Pechora Bay and more common in northern offshore areas than Lesser Black-backed Gulls.

KITTIWAKES *Rissa tridactyla* were mainly found in the northern offshore areas (Appendix 1, Fig. 5a). No Kittiwakes were seen during the helicopter flights in the eastern parts of the study area nor during aeroplane transects in Pechora Bay. Most records were of one to five individuals, but there were also one record of 70 individuals (at Vkhodnoy Island, Vaygach).

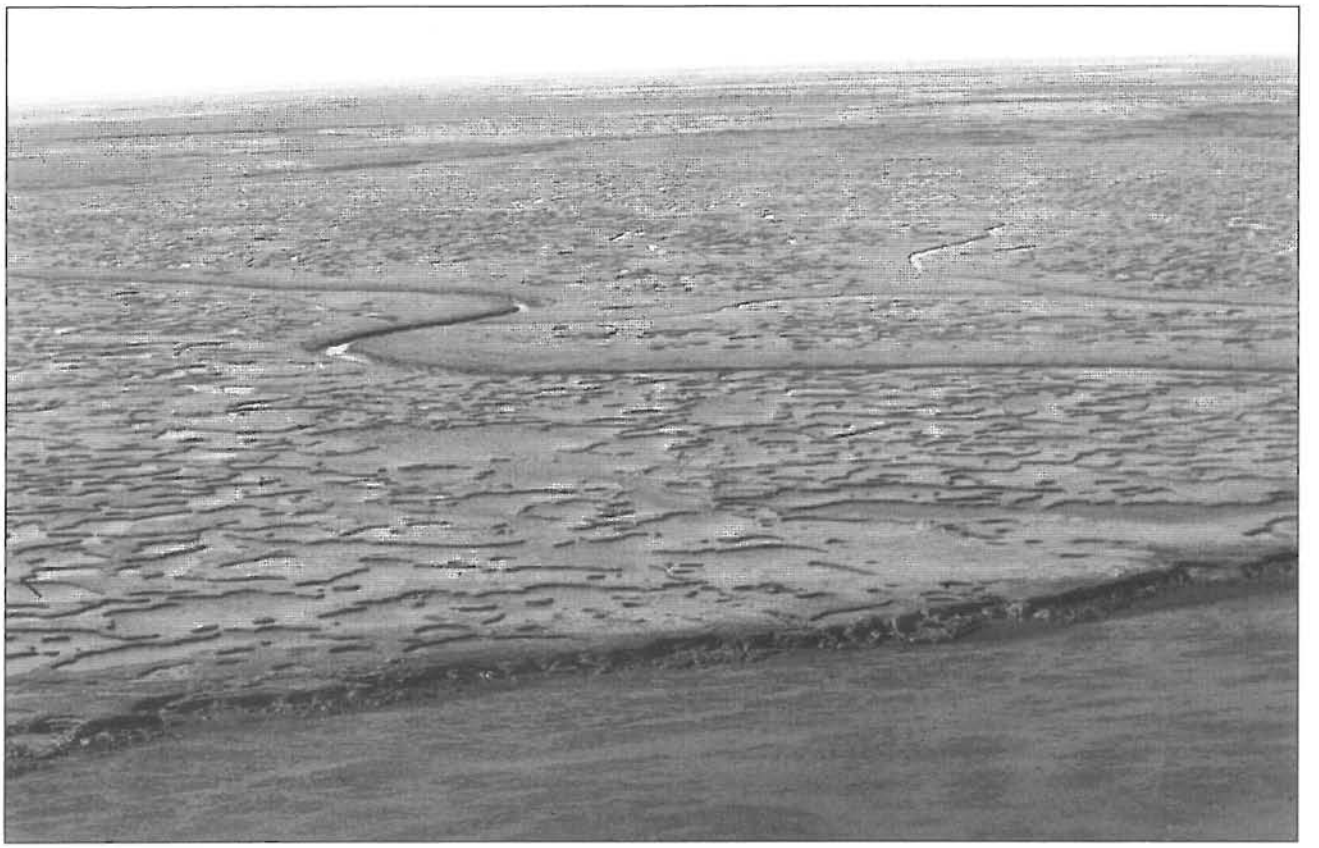
ARCTIC TERNS *Sterna paradisaea* were found to be common both along the coast and at sea in large parts of the area covered (Appendix 1, Figs. 5b and 9a). No records were made in areas close to Kolguev and only one on Vaygach. Most observations were of one or two individuals, but flocks of up to 30 (Pechora Bay) and 50 (northern Dolgiy Islands) individuals were observed.

GUILLEMOTS *Uria* sp. were recorded on five occasions (Appendix 1, Fig. 3c). Most observations were from northern offshore areas, but one observation was made between Matveev and Dolgiy Islands. The highest number recorded was 10 individuals (close to Kolguev). Although no guillemots were identified to species, the observed birds were probably Brünnich's Guillemots *Uria lomvia*.

RAPTORS AND OWLS were occasionally observed during flights along the coast and over land (Appendix 1, Fig. 10). There were three observations of single Golden Eagles *Aquila chrysaetos*, two of single Rough-legged Buzzards *Buteo lagopus*, and ten observations of Snowy Owls *Nyctea scandiaca* involving in total 14 individuals. Most observations were from the eastern areas (Dolgiy Island, Yugorskiy Peninsula and Vaygach).

Marine mammals

WALRUSES *Odobenus rosmarus* were observed on four occasions (Appendix 1, Figs. 5c and 9b): six individuals in the Pechora Sea northeast of Gulyaevskie Koshki Islands on 12 August; four individuals at Matveev Island, north of Dolgiy Island; and one and three individuals at the



Moist coastal tundra in southwestern Khaypudyrskaya Bay on 25 August. Photo: Kjell Isaksen.

northern part of Dolgiy Island. All observations from the Dolgiy and Matveev Islands were from haul-out sites on 14 August.

RINGED SEAL *Phoca hispida* was observed (one individual) on the northeastern coast of Vaygach (Appendix 1, Fig. 9b).

BEARDED SEAL *Erignathus barbatus* was observed (one individual) at sea north of the Dolgiy Islands (Appendix 1, Fig. 5c).

WHITE WHALES *Delphinapterus leucas* were observed on six occasions (Appendix 1, Figs. 5c and 9b). There were five records from coastal areas (three observations of one to three individuals in the same area at southwestern Vaygach; one observation of two individuals at Cape Belkovskiy Nos; and an unknown number at Russkiy Zavorot Peninsula) and one record of a single individual at sea north of Gulyaevskie Koshki Islands.

DISCUSSION

The main goal of this study was to improve the knowledge on spatial distribution of post-breeding and moulting marine ducks in the Pechora Sea area. Because of the low level of knowledge on this subject and because of the considerable size of the area, the study was designed as a rough initial survey only. The intention was to identify areas with high concentrations of ducks, not to make detailed investigations into species-, sex- or age-compositions nor to make overall population estimates for the area.

Fulmar, Kittiwake, Glaucous Gull and Arctic Tern were the most common species observed in the outer, offshore parts of the Pechora Sea. Fewer individuals of these species were recorded in the eastern part of the area (east of ca. 57ºE) off Vaygach than in the middle and western parts north of Russkiy Zavorot Peninsula and towards

Kolguev. Very few auks were recorded, but these relatively small and dark species were probably easily overlooked from the aeroplane. Higher numbers of auks, particularly Brünnich's Guillemots have been found further north, closer to the large colonies along the western coast of Novaya Zemlya (Decker *et al.* 1998, Gavrilo *et al.* 1998a).

The highest numbers of swans were found on the coastal tundra between Pechora Bay and Kolokolkova Bays. This area, included in the Nenetskiy Zapovednik and the Nenetskiy Zakaznik (reserves), is known to be the main breeding area for Bewick's Swans in the European part of the species' distribution range (Mineev 1994b, 1999). The *Anser* species seemed to occur almost along the entire costs of the study area, possibly with somewhat higher numbers in Khaypudyrskaya Bay and Perevoznaya Bay and on Dolgiy Island. The distribution pattern corresponds well with that given by Mineev (1999).

Barnacle Geese were only observed at Vaygach and at Cape Kuznetskiy Nos and Dolgiy Island in the northwestern Pechora Bay. Dolgiy Island represents a new breeding locality for the species, and according to Mineev (1994b) the Barnacle Goose is a rare breeding species in this part of the study area. Barnacle Geese were also observed at the coast east of Khaypudyrskaya Bay (Golovkin *et al.* 2000) and on the northern Yugorskiy Peninsula (see Appendix 2) during the same period. The Barnacle Goose has recently increased in numbers and expanded its breeding range in Northwest Russia. A number of new breeding localities have recently been found along the shores of the Pechora Sea, including in Kolokolkova Bay and on the Medynskiy Zavorot Peninsula (Syroechkovskiy 1995).

The distribution of ducks found in this study was very patchy. A few small areas, especially the areas off the southern part of the Dolgiy Islands, contained a very large proportion of the total number of ducks recorded during the surveys. This seemed especially to be the case for King Eider as well as scoters, which were the most numerous species. The patchy distribution makes traditional transect counts with a predefined transect route and a fixed transect width (see Pihl & Frikke 1992) less suitable. Including or failing to include the concentrations at Maly Zelenets Island and off Cape Belkovskiy Nos during transect counts would have profound impacts on the results if population estimates were to be calculated on the basis of the surveys. Obtaining reliable population estimates for the Pechora Sea would require a finer network of transect lines than what was economically and logistically possible in this study.

The results of the aerial surveys conducted by Golovkin *et al.* (2000) are in general agreement with the results presented here. Their surveys, covering the coastline from Korovinskaya Bay to Khaypudyrskaya Bay, were conducted at about the same time as our surveys (17 and 21 August).

Both the aeroplane (AN-26) and the helicopter (Mi-8) used offered satisfactory observation conditions for this rough survey. Species determination was, however, often difficult, especially from the aeroplane. Eiders/scoters, 'grey geese', divers and waders proved particularly difficult to identify in many situations. The risk of missing birds or failing to identify observed birds was clearly higher from the aeroplane than from the helicopter. An indication of this is for instance given by the difference in the number of divers observed from the two platforms (cf. Appendix 1, Figs. 3a and 7d). This difference is not unexpected since the aeroplane both flew faster and higher than the helicopter. The speed of the aeroplanes recommended by Pihl & Frikke (1992) for surveys of marine birds is 110-160 km/h, which is half of the safe travelling speed of the AN-26. The AN-26 is therefore primarily suitable when a large area is to be searched in a relatively rough survey.

Birds are often scared by an approaching aircraft and may react by diving, swimming rapidly away or take to the wing. The type and severity of reaction varies between bird species, the birds' habituation to traffic by aircrafts and other disturbances, time of year (moulting period, winter, breeding period etc.), and the speed, flight altitude and noise characteristics of the approaching aircraft (*e.g.*

Jensen 1990, Mosbech & Glahder 1991, Pihl & Frikke 1992, Frimer 1994a). In a study of post-breeding King Eiders in western Greenland, Mosbech & Boertmann (1999) found that flocks of King Eiders on several occasions dispersed by diving in different directions when the survey aeroplane was still a kilometre away. This behaviour was observed particularly in areas near human settlements and when the aeroplane was flying at high altitudes (600-700 m). The observed correlation between avoidance behaviour and distance to human settlements was probably a function of hunting (Mosbech & Boertmann 1999). Little is known about other species' response to aircrafts, but according to Pihl & Frikke (1992) Common Scoters tend to take to the wings at long distances from the approaching aeroplane (whereas Velvet Scoters tend to stay), and also dabbling ducks often fly away at some distance from the aeroplane. However, in Northwest Russia both species of scoters have been found to remain on the water when approached by the AN-26 at a flight altitude of 150 m a.s.l. (Yu. Krasnov pers. obs.).

No control study of the birds' avoidance behaviour in relation to the approaching aircrafts was made as part of this study. The birds' reaction was, however, observed from the aircrafts during the surveys. These observations do not cover the behaviour of birds more than approximately 500 m in front of the helicopter (the front observer in particular) and less in the aeroplane. Geese (apart from some moulting flocks) and waders often took to flight in front of the aircraft. None of the ducks in the larger flocks (mostly King Eiders) were observed to take to the wing. Most of these birds probably were in wing moult and thus not able to fly (see Cramp & Simmons 1977, Frimer 1994b). Some of the ducks in the flocks often dived at some distance from the helicopter, but extensive diving activity involving a large proportion of the birds in a flock did only seem to occur when the helicopter was flying at low altitude over or close to the birds. These incomplete observations indicate that the King Eiders' avoidance behaviour in this study was weaker than what has been reported from some areas in Greenland (Mosbech & Boertmann 1999), possibly due to lower hunting pressure. It is assumed that the ducks' avoidance behaviour has had no significant impact on the estimates presented here.

Mosbech & Boertmann (1999) found that the foraging activity (diving) of moulting King Eiders was higher in the morning than in the middle of the day (50% and 20% of undisturbed birds submerged, respectively). But they also found indications that the birds showed less avoidance diving in the morning when they apparently were taken by surprise and ceased diving during the aeroplane approach. They therefore found it preferable to conduct surveys in the morning. The surveys in the present study were mainly conducted in the middle of the day, between 1100hrs and 1600hrs local time (GMT + 3h). As the birds' avoidance response seemed to be weaker in this study than in the one from Greenland, the timing of the surveys may also be less important.

Frimer (1994b) conducted a detailed study of the progress of moult in King Eiders in West Greenland. The eiders arrived in two waves in the moulting area. Post-breeding males arrived from July with a peak in early August and undertook wing moult between mid-August and late September. The females arrived from mid-August, with peak numbers in the second half of August, and undertook wing moult from late August into October (Frimer 1994b). The timing of the moult may be somewhat different in the Pechora Sea due to different climatic conditions and differences in the distance between breeding and moulting areas. Male King Eiders have been found to leave the breeding areas at the tundra on Vaygach, Kolguev and the mainland south and east of the Pechora Sea for the moulting sites at sea from late June to mid-July (Karpovich & Kokhanov 1963, Mineev 1987, Ponomareva 1992). Extensive northward movement of male King Eiders was recorded in the vicinity of the Medynskiy Zavorot Peninsula on 26 July 1995 (A. Sukhotin pers. comm.). Breeding female King Eiders are known to moult while they are with their young in the breeding areas. Males, non-breeding females and females that have failed breeding have been observed moulting at sea from mid-July to mid-September, with peak numbers in August (Karpovich & Kokhanov 1963; see also Dementjev & Gladkov 1952).

One of several oil-drilling rigs on the coastal tundra of eastern Khaypudyrskaya Bay. Photo: Kjell Isaksen.

All records of eiders were made within approximately three kilometres from land, most within one kilometre from land. This corresponds with findings from other areas. During aerial surveys in western Greenland, Mosbech & Boertmann (1999) found that nearly all King Eiders were observed within 1 km of the coast. Scoters, on the other hand, were in our study found to be less bound to the coastline and were several times observed at distances up to 10-20 kilometres from land. The Pechora Sea is very shallow and the whole area south of a line from the middle part of Vaygach to Russkiy Zavorot Peninsula is less than 35 metres deep (DMA 1984, Terziev *et al.* 1990). Also the scoters were thus observed in shallow waters. The main King Eider and scoter concentrations around the Maly and Bol'shoy Zelenets Islands were found in areas with less than 5 m depth.

The benthic fauna of the Pechora Sea is rich and is dominated by polychaets and suspension-feeding bivalves (Pogrebov *et al.* 1997, Dahle *et al.* 1998).The total biomass of benthos recorded at the Kolguev shallow and in the Kara and Yugorskiy Shar Straits exceed 500 mg/m^2 and are the highest values found in the Barents Sea (Antipova 1987, Pogrebov *et al.* 1997).

Both eiders and scoters are known to feed at benthos, particularly molluscs, at relatively shallow depths (Dementjev & Gladkov 1952, Cramp & Simmons 1977, Bustnes & Erikstad 1988, Frimer 1997). Frimer (1994a) recorded a maximum diving depth of moulting King Eiders of about 30 metres in western Greenland, whereas Bustnes & Lønne (1997) found a mean diving depth of about 20 metres for wintering King Eiders on the Norwegian coast.

Moulting areas are often traditional and used year after year. The number of birds using these areas may, however, vary between years depending on breeding success, and moulting areas may also be abandoned due to a high level of disturbance or reduction in the availability of food. High num-

bers of moulting ducks have previously been observed at several of the same localities as found in this study, for instance at the Dolgiy Island area and southern Kolguev (see *Introduction*). The moulting period extends over several months (July-September) and the moulting areas probably also have an important function as areas where the ducks build up fat reserves before the autumn migration.

Ducks moulting at sea are vulnerable to disturbance and oil pollution. They are not able to fly and therefore have reduced ability to escape from an oil slick or a source of disturbance. At a population level, species that tend to aggregate in large flocks are more vulnerable than species distributed more evenly over a larger area. Both scoters and eiders have been found to be highly vulnerable to oil spills, especially in the moulting period (Anker-Nilssen *et al.* 1988, Williams *et al.* 1994, Gavrilo *et al.* 1998b, Isaksen *et al.* 1998).

In summary, several areas with main aggregations of post-breeding ducks were identified in this study. These were located in shallow coastal areas and the density of ducks was generally low in areas several kilometres off the coast. A minimum of 40 000 ducks, mainly King Eiders and scoters, stayed in the surveyed area in the second half of August. Although concentrations of ducks have been recorded earlier in several of the areas identified as important in this study, quantitative information on duck numbers and more detailed distribution patterns have not been available. The results support Mineev's (1999) listing of the Dolgiy Island area as a Key Ornithological Area, because of the area's importance for ducks in the post-breeding period. The results also show that the shallow coastal areas of southern Kolguev are important for post-breeding King Eiders, confirming previous observations of Trevor-Betty (1895) and Fedorov (1926). The large duck aggregations along the western Yugorskiy Peninsula were found for the first time during the present surveys. The high number of scoters recorded show that this species group stay in the Pechora Sea in considerable numbers in the post-breeding period.

More detailed studies are needed to more accurately estimate the size of the populations present, the turnover in the populations during the season, and to clarify whether the distribution found during the present study is representative also for other years and for other stages in the post-breeding period. Further studies should focus on the coastal areas identified in this study and preferably use a smaller and slower aeroplane or a helicopter with the observers positioned in the front, in combination with observations from land and from a boat in the high-density areas.

The survey team, together with the flight crew, in front of the AN-26 BRL, a two-propeller Russian aeroplane. Photo: Hallvard Strøm.

REFERENCES

Anker-Nilssen, T., Bakken, V. & Strann, K.-B. 1988. Konsekvensanalyse olje/sjøfugl ved petroleumsvirksomhet i Barentshavet sør for 74º30'N. *Viltrapport 46*, Direktoratet for naturforvaltning. 98 pp. + app. (In Norwegian).

Antipova, T. V. 1987. New data on the bivalve fauna from the Kolguev island area (Barents Sea). Pp. 108-110 in: *Molluscs: results and perspectives of their exploitation.* VIII All-Union meeting on mollusc studies. Abstracts. Nauka, Leningrad. (In Russian).

Belopolskiy, L. O. 1957. *Ecology of colonial seabirds of the Barents Sea.* Acad. Sci. of the USSR Publ., Moscow-Leningrad. 460 pp. (In Russian).

Bianki, V. V. & Krasnov, Yu. V. 1987. Materials to the knowledge on birds in the Pechora Delta (Nonpasserines). *Ornitologia 22*: 148-155. (In Russian).

Borkin, I. V., Chernook, V. I., Ponomarev, Ya. I., Bogomolov, V. Yu. & Gavrilo, M. V. 1992. Results of aerial survey of seabirds in the Barents Sea. Pp. 205-216 in: *Research interelationships of populations of fishes in the Barents Sea: materials of 6 Soviet-Norwegian Symposium, Murmansk.*

Bustnes, J. O. & Erikstad, K. E. 1988. The diet of sympatric wintering populations of Common Eider *Somateria mollissima* and King Eider *S. spectabilis* in Northern Norway. *Ornis Fennica 65*: 163-168.

Bustnes, J. O. & Lønne, O. J. 1997. Habitat partitioning among sympatric wintering Common Eiders *Somateria mollissima* and King Eiders *Somateria spectabilis. Ibis 139*: 549-554.

Chimbulatov, F. M. & Firsov, A. V. 1998. Conditions, problems and perspectives of oil resource prospecting in the NAO. Pp. 77-81 in: *Arctic town and environment. Proc. of the Second International Conference, Syktyvkar.* (In Russian).

Cramp, S. & Simmons, K. E. L. (eds.) 1977. *The birds of the Western Palearctic, vol. I.* Oxford Univ. Press, Oxford. 913 pp.

Dahle, S., Denisenko, S. G., Denisenko, N. V. & Cochrane, S. J. 1998. Benthic fauna in the Pechora Sea. *Sarsia 83*: 183-210.

Decker, M. B., Gavrilo, M., Mehlum, F. & Bakken, V. 1998. Distribution and abundance of birds and marine mammals in the eastern Barents Sea and the Kara Sea, late summer 1995. *Norsk Polarinstitutt Meddelelse 155*. 83 pp.

Dementjev, G. P. & Gladkov, N. A. (eds.) 1952. *Birds of the Soviet Union. Vol. 4.* Nauka, Moscow. 683 pp. (Translated to English and published by Israel Program for Scientific Translations, Jerusalem in 1967).

DMA 1984. TPC C-3B Tactical Pilotage Chart. Defense Mapping Agency, St. Louis, Missouri, USA.

Dmokhovskiy, A. V. 1933. Birds of the middle and lower parts of the Pechora River. *Bulletin of Moscow Society of Nature Explorers (MOIP). Department of Biology 42 (2)*: 214-242. (In Russian).

Doré, A. G. 1995. Barents Sea geology, petroleum resources and commercial potential. *Arctic 48(3)*: 207-221.

EPPR 1997. Review need for future action on transport of oil by ships. Report. Emergency, Prevention, Preparedness and Response (EPPR). Moscow. 24 pp.

Estafiev, A. A. 1991. *Fauna and ecology of the waders of the Bol'shezemelskaya tundra and Yugor Peninsula.* Nauka, Leningrad. 146 pp. (In Russian).

Estafiev, A. A., Voronin, R. N., Mineev, Yu. N., Kochanov, S. K. & Beshkarev, A. B. 1995. *Fauna of the European North-East of Russia. Avifauna. Nonpasseriformes. Vol. 1, Part 1.* Nauka, St. Petersburg. 325 pp. (In Russian).

Fedorov, A. 1926. Kolguev Island. Ukrainian hunter and fisherman. Pp. 6-9. (In Russian).

Frimer, O. 1994a. The behaviour of moulting King Eiders *Somateria spectabilis. Wildfowl 45*: 176-187.

Frimer, O. 1994b. Autumn arrival and moult in King Eiders (*Somateria spectabilis*) at Disko, West Greenland. *Arctic 47*: 137-141.

Frimer, O. 1997. Diet of moulting King Eiders *Somateria spectabilis* at Disko Island, West Greenland. *Ornis Fennica 74*: 187-194.

Gavrilo, M., Decker, M.-B., Bakken, V. & Mehlum, F. 1998a. Bird distribution in the marine habitats of the Pechora Sea during ice-free period. P. 87 in: *Conserving our common heritage of the Arctic. Abstracts of the Willem Barents Memorial Arctic Conservation Symposium, Moscow.*

Gavrilo, M., Bakken, V., Firsova, L., Kalyakin, V., Morozov, V., Pokrovskaya, I. & Isaksen, K. 1998b. Oil vulnerability assessment for marine birds occurring along the Northern Sea Route area. *INSROP Working Paper No. 97.* 50 pp.

Golovkin, A. N., Shchadilov, Yu. M. & Morozov, Yu. V. 2000. Waterfowl censuses in coastal waters of the Pechora Sea. In: Strøm, H., Isaksen, K. & Golovkin, A. N. (eds.). Seabird and wildfowl surveys in the Pechora Sea during August 1998. *Norwegian Ornithological Society. NOF Rapportserie. Report No. 2-2000.* (This volume).

Gurtovaya, E. N. 1997. Breeding conditions of the Barnacle Goose on Vaygach Island in 1996. *Bulletin of Geese Study Group of Eastern Europe and Northern Asia 3*: 109-111. Moscow. (In Russian.).

Isaksen, K., Bakken, V. & Wiig, Ø. 1998. Potential effects on seabirds and marine mammals of petroleum activity in the Northern Barents Sea. *Norsk Polarinstitutt Meddelelse 154*. 66 pp.

Jensen, K. C. 1990. Responses of moulting Pacific black brant to experimental aircraft disturbance in the Teshekpuk Lake Special Area, Alaska. Ph.D. Thesis. Texas A&M University, Texas. 69 pp.

Kalyakin, V. N. 1986. About distribution and ecology of Barnacle Goose *Branta leucopsis* on Vaygach Island and Yugor Peninsula. Pp. 93-104 in: *Actual problems of ornithology*. Nauka, Moscow. (In Russian).

Kalyakin, V. N. 1987. The swans of the north-western Yugor Peninsula and Vaygach Island. Pp. 93-104 in: *Ecology and migration of swans in the USSR*. Nauka, Moscow. (In Russian).

Kalyakin, V. N. 1993. Fauna of birds and mammals of the Novaya Zemlya region and an assessment of their condition. *Proceedings of the Marine Arctic Complex Expedition. Novaya Zemlya 2 (3)*: 23-90. Moscow. (In Russian).

Karpovich, V. H. & Kokhanov, V. D. 1963. Count of the number of game birds on Vaygach Island. Pp. 91-99 in: *Management and survey methods for birds and harmful rodents.* AN SSSR, Moscow. (In Russian).

Karpovich, V. N. & Kokhanov, V. D. 1967. The bird fauna on Vaygach Island and the north-eastern part of the Yugor Peninsula. *Proceedings of Kandalaksha Reserve 5*: 268-335. Murmansk. (In Russian).

Krasnov, Yu. & Chernook, V. I. 1999. Seabirds as indicators of biologically productive zones during conducting of autumn aerial survey in open portions of the Barents Sea. Pp. 95-106 in: *Instrumental methods of fishery research. Collection of scientific papers.* PINRO Publishers, Murmansk. (In Russian).

Krasnov, Yu. V. & Nikolaeva, N. G. 1996a. Seabird distribution in the south-eastern Barents Sea in July 1993. Pp. 98-104 in: *Ecosystems, biological resources and anthropogenic pollution of the Pechora Sea.* Apatity. (In Russian).

Krasnov, Yu. V. & Nikolaeva, N. G. 1996b. Recent distribution of colonial seabirds in the Barents Sea. Pp. 101-113 in: *Pelagic zone ecosystems of the Western Arctic Seas.* Apatity. (In Russian).

Litvin, K. E. & Syroechkovskiy, E. V. 1996. Breeding biology of Tundra Bean Goose (*Anser fabalis rossicus*) in the north-east of European Russia. *Bulletin of Geese Study Group of Eastern Europe and Northern Asia 2*: 132-145. Moscow. (In Russian).

Midttun, L. & Loeng, H. 1987. Climatic variations in the Barents Sea. Pp. 13-27 in Loeng, H. (ed.): *The effect of Oceanographic conditions on distribution and population dynamics of commercial fish stocks in the Barents Sea. Proceedings of the third Soviet-Norwegian Symposium, Murmansk, 26-28 May, 1986.* Institute of Marine Research, Bergen.

Mineev, Yu. N. 1975. Spring migration and moulting grounds of waterfowl in the Bol'shezemelskaya tundra. Pp. 215-217 in: *Materials of the All-Union Conference on bird migrations.* Academy of Science Publ., Moscow. (In Russian).

Mineev, Yu. N. 1981. Seasonal distribution and abundance of waterfowl in the Malozemel'skaya tundra. *News of the Academy of Science of the Soviet Union, Geographical Series 4*: 119-122. (In Russian).

Mineev, Yu. N. 1982. Distribution and abundance of geese on the tundra of the European North. Pp. 35-42 in: *Fauna of the Urals and adjacent areas.* Sverdlovsk. (In Russian).

Mineev, Yu. N. 1983. Habitat distribution and abundance of waterfowl of the Bol'shezemelskaya tundra. *Proc. of the Komi Branch of the Academy of Science of the USSR 62*: 63-78. Syktyvkar. (In Russian).

Mineev, Yu. N. 1987. *Waterfowl of the Bol'shezemelskaya tundra. Fauna and ecology.* Nauka, Leningrad. 110 p. (In Russian).

Mineev, Yu. N. 1994a. *Waterfowl of the Yugorskiy Peninsula.* Komi Sci. Centre, Ural Branch RAS, Syktyvkar. 104 pp. (In Russian).

Mineev, Yu. N. 1994b. Birds of the State Reserve "Nenetsky" (North-East of Malozemelskaya tundra). *Russian Journal of Ornithology 3:* 319-336. (In Russian with English summary).

Mineev, Yu. N. 1995. The White-fronted Goose (*Anser albifrons*) on the tundra of the Nenets Autonoumus Area. *Bulletin of Geese Study Group of Eastern Europe and Northern Asia 1*: 121-128. Moscow. (In Russian).

Mineev, Yu. N. 1999. *Anseriformes of the North-Eastern tundras (distribution, population dynamics and protection)*. Abstract of Thesis for Dr. Sci. Dissertation, Moscow. 54 pp. (In Russian).

Moe, K. A. & Semanov, G. S. 1999. Environmental Assessment. Pp. 121-220 in Østreng, W. (ed.): *The Natural and Societal Challenges of the Northern Sea Route. A Reference Work.* Kluwer Academic Publishers, Dordrecht.

Morozov, V. V. 1995. Recent distribution and numbers of Barnacle Goose (*Branta leucopsis*) on the Yugor Peninsula. *Bulletin of Geese Study Group of Eastern Europe and Northern Asia 1*: 51-55. Moscow. (In Russian).

Mosbech, A. & Boertmann, D. 1999. Distribution, abundance and reaction to aerial surveys of post-breeding king eiders (*Somateria spectabilis*) in Western Greenland. *Arctic 52*: 188-203.

Mosbech, A. & Glahder, C. 1991. Assessment of the impact of helicopter disturbance on moulting Pink-footed Geese *Anser brachyrhynchus* and Barnacle Geese *Branta leucopsis* in Jameson Land, Greenland. *Ardea 79*: 233-238.

Piatt, J. F., Lensink, C. J., Butler, W., Kendziorek, M. & Nysewander, D. R. 1990. Immediate impact of the 'Exxon Valdez' oil spill on marine birds. *Auk 107*: 387-397.

Piatt, J. F., Carter, H. R. & Nettleship, D. N. 1991. Effects of oil pollution on marine bird populations. Pp. 125-141 in White, J. (ed.): *The effects of oil on wildlife: Research, rehabilitation, and general concerns.* Proc. Oil Symposium Herndon, Virginia, October 16-18, 1990. Sheridan Press, Hanover, Pennsylvania.

Pihl, S. & Frikke, J. 1992. Counting birds from aeroplane. Pp. 8-23 in Komdeur, J., Bertelsen, J. & Cracknell, G. (eds): Manual for aeroplane and ship surveys of waterfowl and seabirds. *The International Waterfowl and Wetlands Research Bureau (Slimbridge, UK), Special Publication No. 19.*

Pogrebov, V. B., Ivanov, G. I. & Nekrasova, N. N. 1997. Macrobenthic communities of the Pechora Sea: the past and the present on the threshold of the Prirazlomnoe oil-field exploitation. *Marine Pollution Bulletin 35*: 287-295.

Pokrovskaya, I. V. & Gavrilo, M. V. 1998. Modern distribution of the Barnacle goose in Russia. *Conservation problems of resources of little studied rare animals. Materials for the Red Data Book.* Part 1. Pp. 92-100. Moscow. (In Russian).

Ponomareva, T. S. 1992. On number and distribution of some waterfowl species on islands in the White and Barents Seas. *Bulletin of Moscow Society of Nature Explorers (MOIP). Department of Biology 97 (4)*: 31-35. (In Russian with English summary).

Ponomareva, T. S. 1994. Nesting of some waterfowl species on northern Vaygach and adjacent islands. *Bulletin of Moscow Society of Nature Explorers (MOIP). Department of Biology 99 (6)*: 66-71. (In Russian).

Poot, M., Beekman, J., Andersen-Harild, P. & Mineev, Yu. N. 1993. The biology of growth and reproduction in arctic breeding swan species, the Bewick's Swans *Cygnus columbianus bewickii*. RWS-Report, Groningen. 29 pp.

Rogacheva, E. V., Lappo, E. G., Volkov, A. E., Syroechkovski, E. E., Jr. & Kjellén, N. 1995. Fauna and zoogeography of Eurasian arctic birds. Pp. 156-164 in Grönlund, E. & Melander, O. (eds.): *Swedish-Russian Tundra Ecology-Expedition -94. Tundra Ecology -94. A Cruise Report.* Swedish Polar Research Secretariat, Stockholm.

Romanov, A. A. 1989. On the distribution and numbers of some species of Anseriformes on the Vaygach Island. Pp. 78-82 in: *Vegetation and wildlife of protected islands*. Moscow. (In Russian).

Sdobnikov, V. M. 1937. Distribution of mammals and birds, according to the types of habitats in the Bol'shezemelskaya tundra and on the Yamal Peninsula. *Trans. of the Arctic Institute 92*: 1-76. Glavsevmorputi, Leningrad. (In Russian).

Shchadilov, Yu. M. & Orlov, V. A. 1984. Swan numbers, distribution and ecology in the breeding period in the North of the Nenetskiy Autonomous Okrug. Pp. 77-85 in: *Ecology and migration of swans in the USSR*. IWRB, Slimbridge, UK.

Syroechkovskiy, E. E., Jr. 1995. News on the distribution of Barnacle Goose in Russia. *Bulletin of Geese Study Group of Eastern Europe and Northern Asia 1:* 39-46. Moscow. (In Russian).

Syroechkovskiy, E. V., Litvin, K. E., Kalyakin, V. N. & Morozov, V. V. 1995. Investigation of the ecology of geese and swans on Novaya Zemlya and Vaygach Island. *Bulletin of Geese Study Group of Eastern Europe and Northern Asia 1*: 157-163. Moscow. (In Russian).

Terziev, F. S., Girdyuk, G. V., Zykova, G. G. & Dzhenyuk, S. L. (eds.). 1990. *Hydrometeorology and hydrochemestry of the seas of the USSR. Vol. 1. Barents Sea. Issue 1. Hydrometeorological condidtions.* Gidrometeoizdat Publishing House, Leningrad. 276 pp. (In Russian).

Trevor-Betty, A. 1895. *Ice bound on Kolguev*. Westminster, UK. 290 pp.

Uspenskiy, S. M. 1965. Birds of the eastern parts of the Bol'shezemelskaya tundra, Yugorskiy Peninsula and Vaygach Island. *Proceedings of the Ural branch of Academy of Science of the USSR 38*: 65-102. Sverdlovsk. (In Russian).

Uspenskiy, S. M. 1972. Waterfowl of the Khaypudyrskaya Bay shores (north of Bol'shezemelskaya tundra). Pp. 40-41 in: *Waterfowl resources of the USSR. Abstract of III All-Union Conference.* Moscow. (In Russian).

Williams, J. M., Tasker, M. L., Carter, I. C. & Webb, A. 1994. A method of assessing seabird vulnerability to surface pollutants. *Ibis 137 suppl. 1*: 147-152.

Østreng, W. (ed.). 1999. *The Natural and Societal Challenges of the Northern Sea Route. A Reference Work.* Kluwer Academic Publishers, Dordrecht. 466 pp.

APPENDIX 1 - DISTRIBUTION MAPS

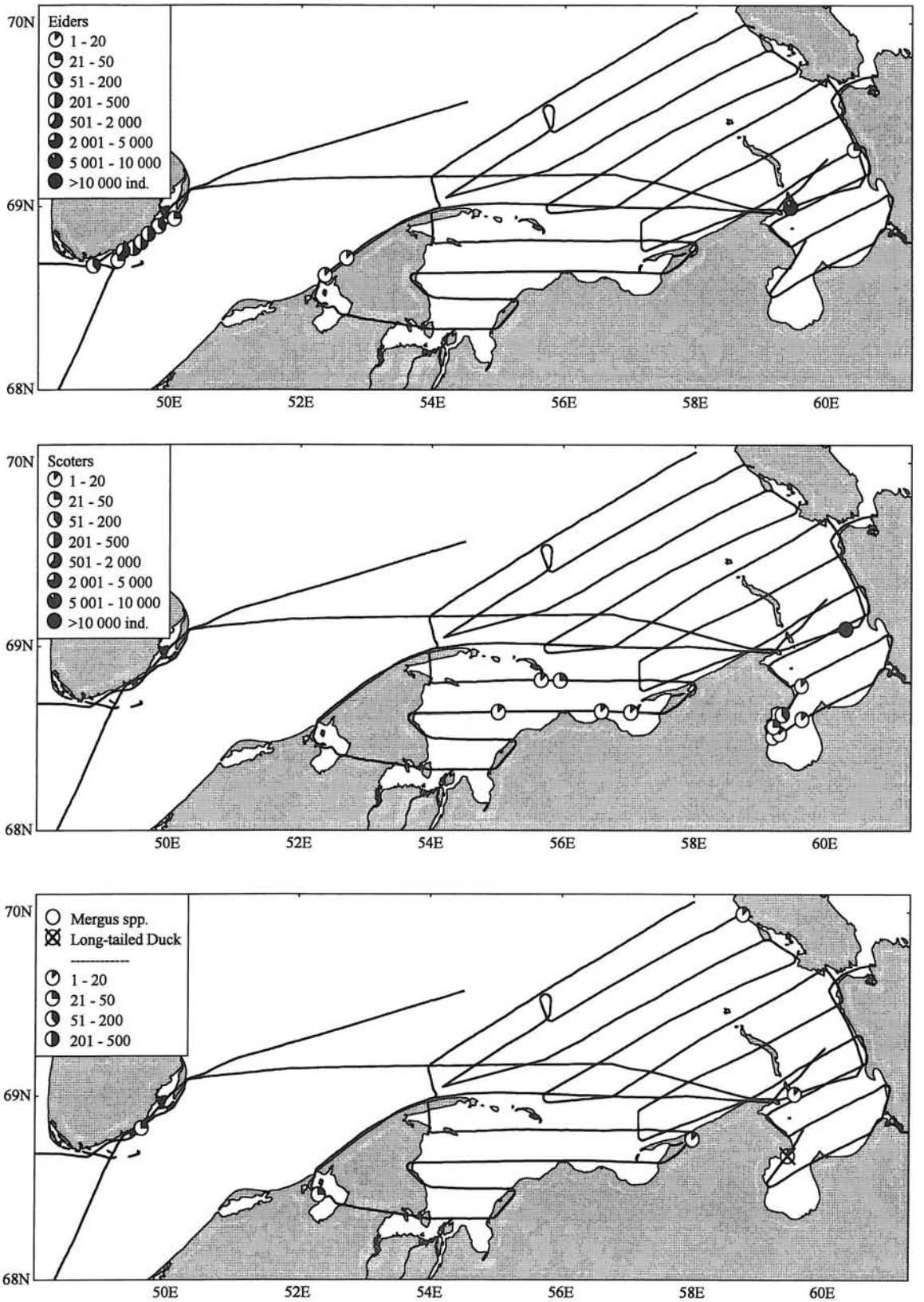


Fig. 1a-c. *The distribution of (a) eiders* Somateria *spp., (b) scoters* Melanitta *spp., and (c) sawbills* Mergus *spp. and Long-tailed Duck* Clangula hyemalis *found during aeroplane transects (transect lines shown). Note that the scale of the symbols is not proportional.*

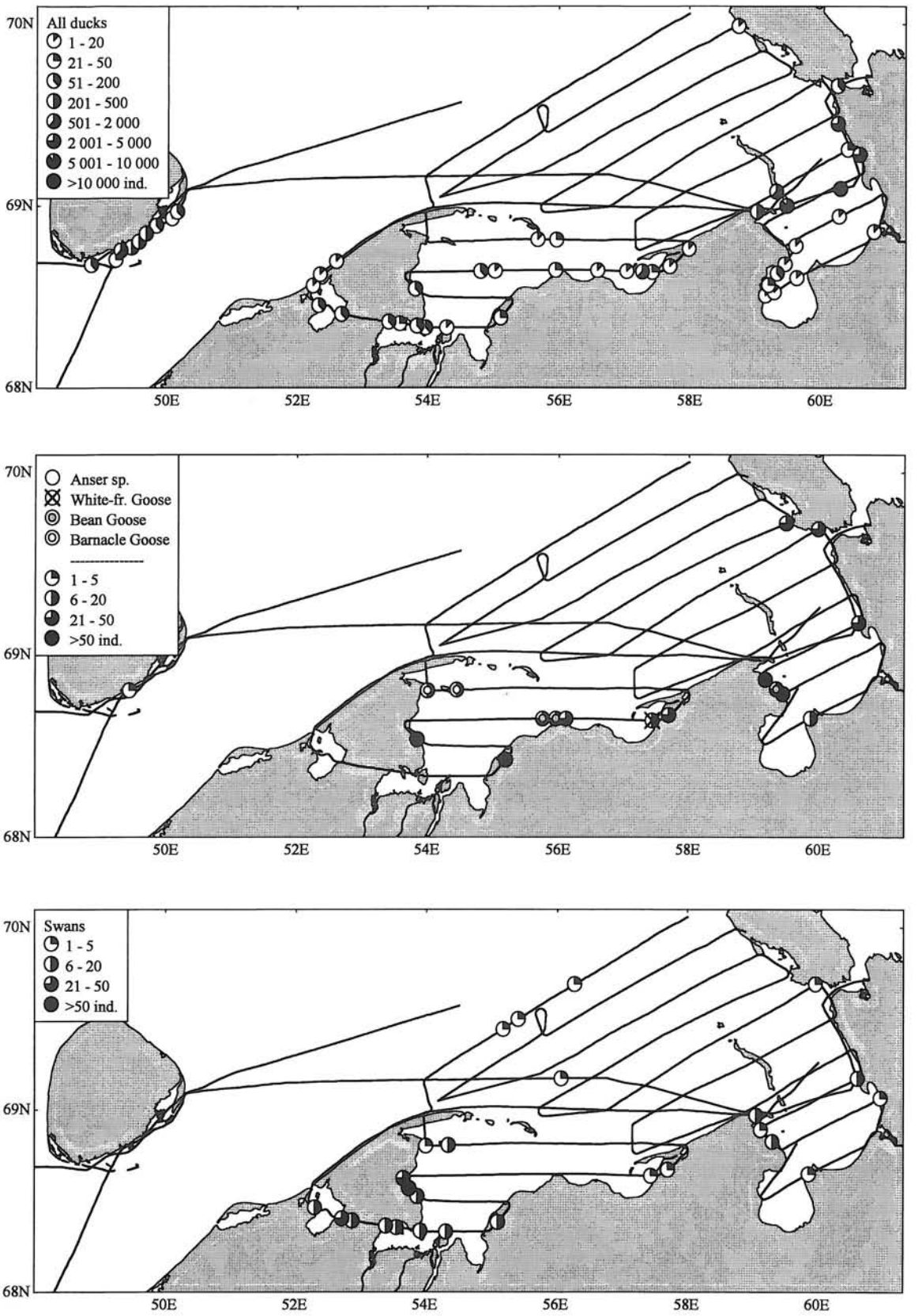


Fig. 2a-c. *The distribution of (a) all species of ducks combined; (b) geese (unidentified 'grey' geese* Anser *sp., White-fronted Goose* Anser albifrons*, Bean Goose* Anser fabalis*, and Barnacle Goose* Branta leucopsis*); and (c) swans* Cygnus *spp. found during aeroplane transects (transect lines shown). Note that the scale of the symbols is not proportional.*

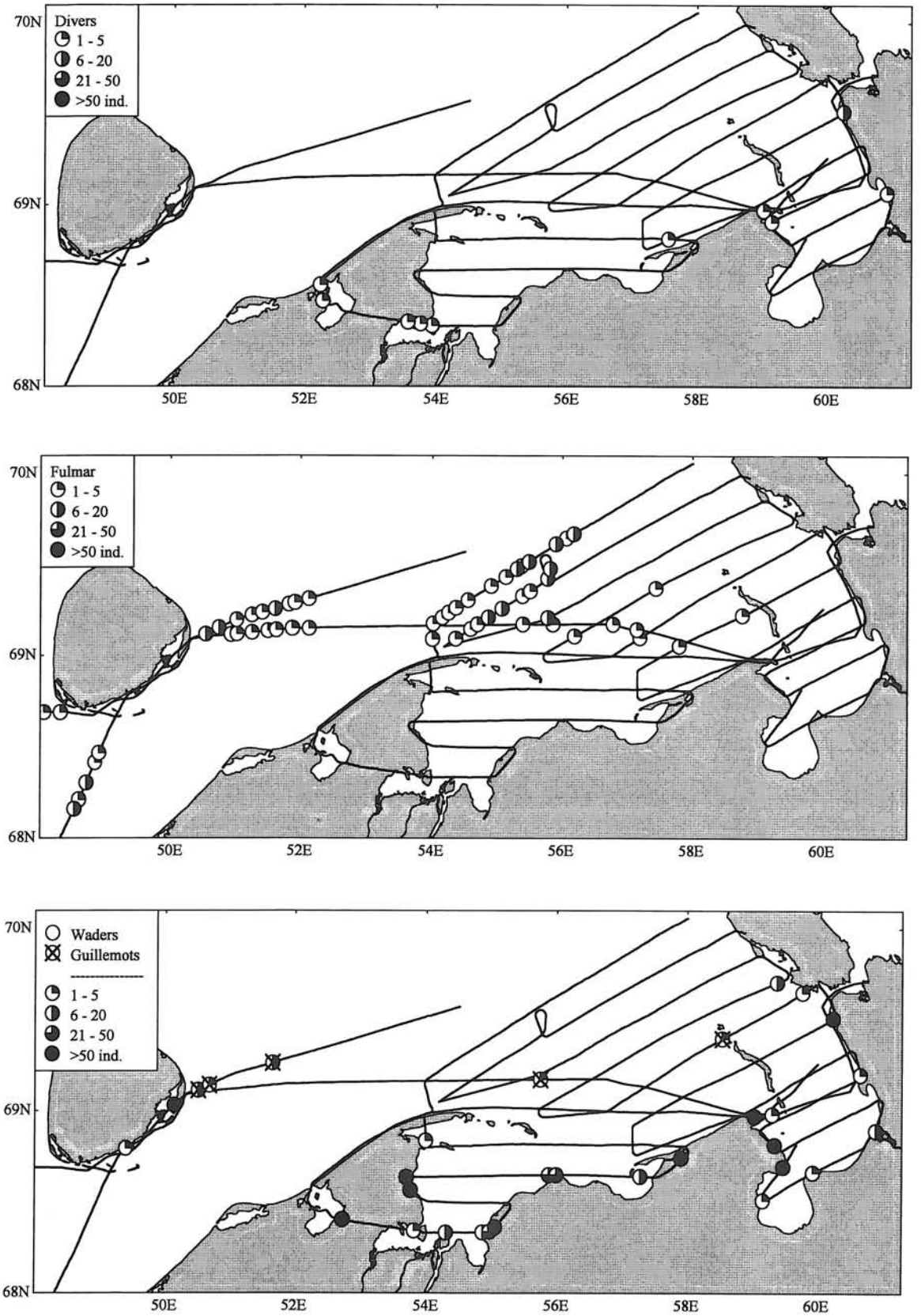


Fig. 3a-c. *The distribution of (a) divers* Gavia *spp., (b) Fulmar* Fulmarus glacialis, *and (c) waders and guillemots* Uria *sp. found during aeroplane transects (transect lines shown). Note that the scale of the symbols is not proportional.*

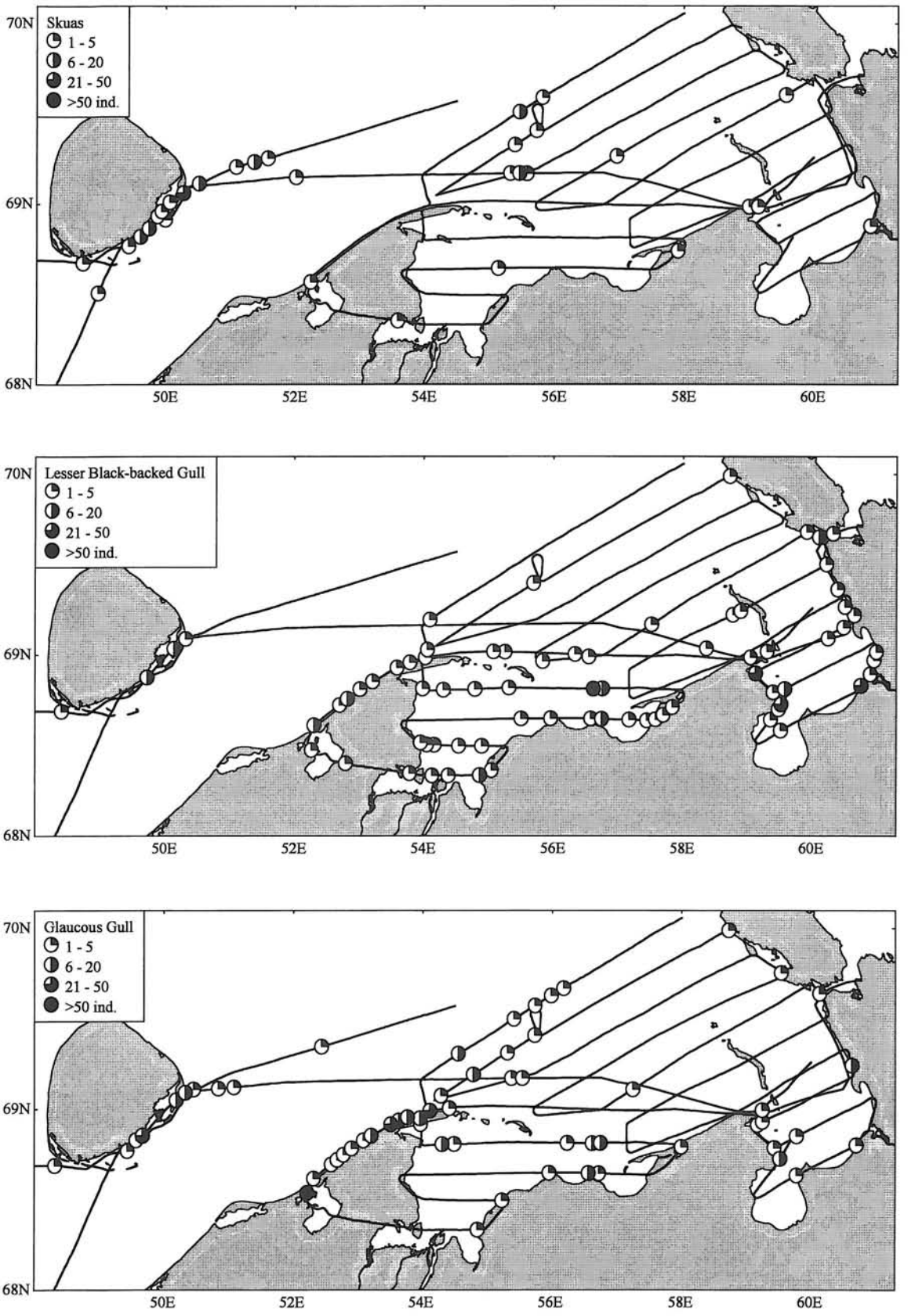


Fig. 4a-c. *The distribution of (a) skuas* Stercorarius *spp., (b) Lesser Black-backed Gull* Larus fuscus heuglini, *and (c) Glaucous Gull* Larus hyperboreus *found during aeroplane transects (transect lines shown). Note that the scale of the symbols is not proportional.*

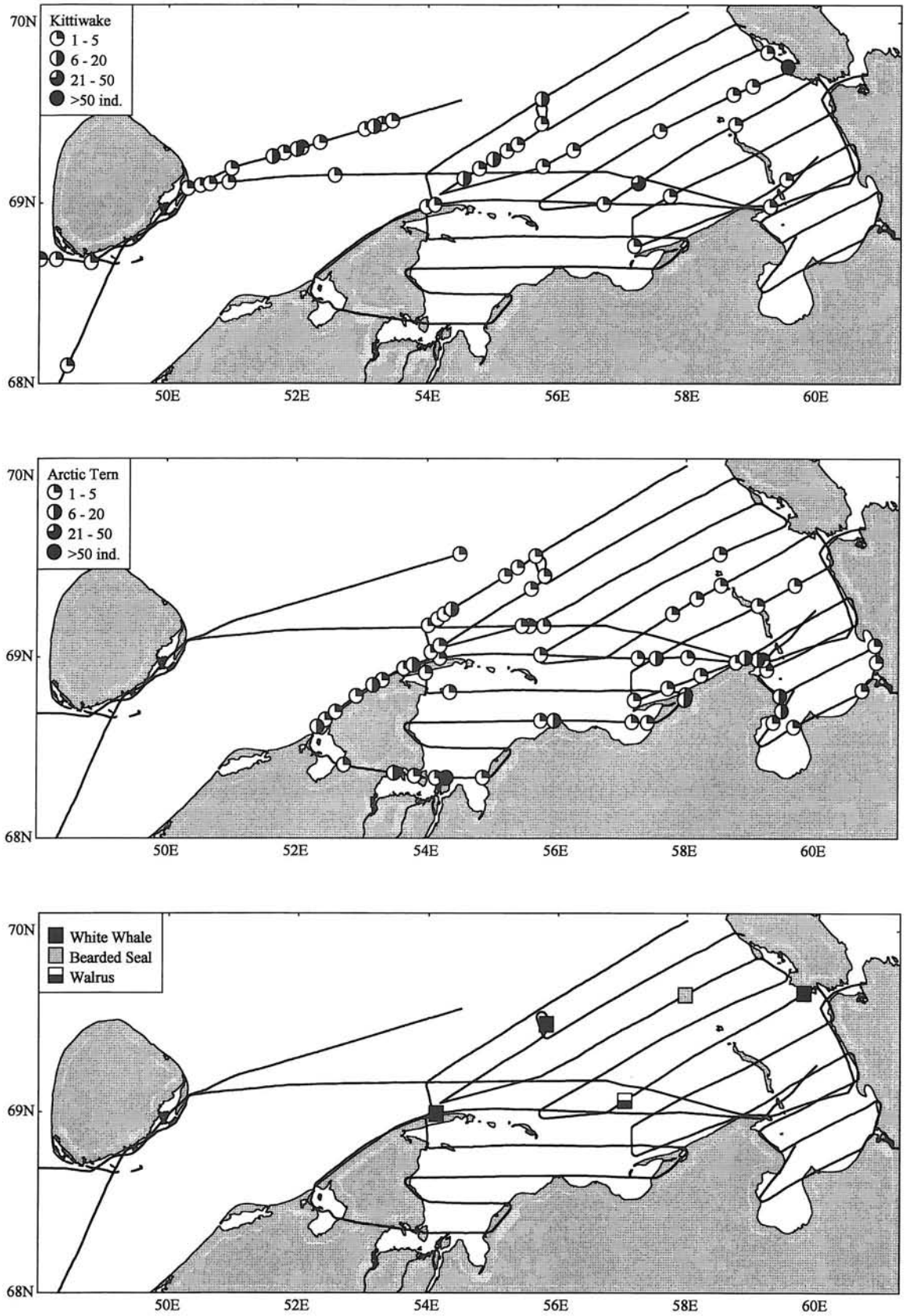


Fig. 5a-c. *The distribution of (a) Kittiwake* Rissa tridactyla*; (b) Arctic Tern* Sterna paradisaea*; and (c) White Whale* Delphinapterus leucas*, Bearded Seal* Erignathus barbatus *and Walrus* Odobenus rosmarus *found during aeroplane transects (transect lines shown). Note that the scale of the quantity symbols is not proportional.*

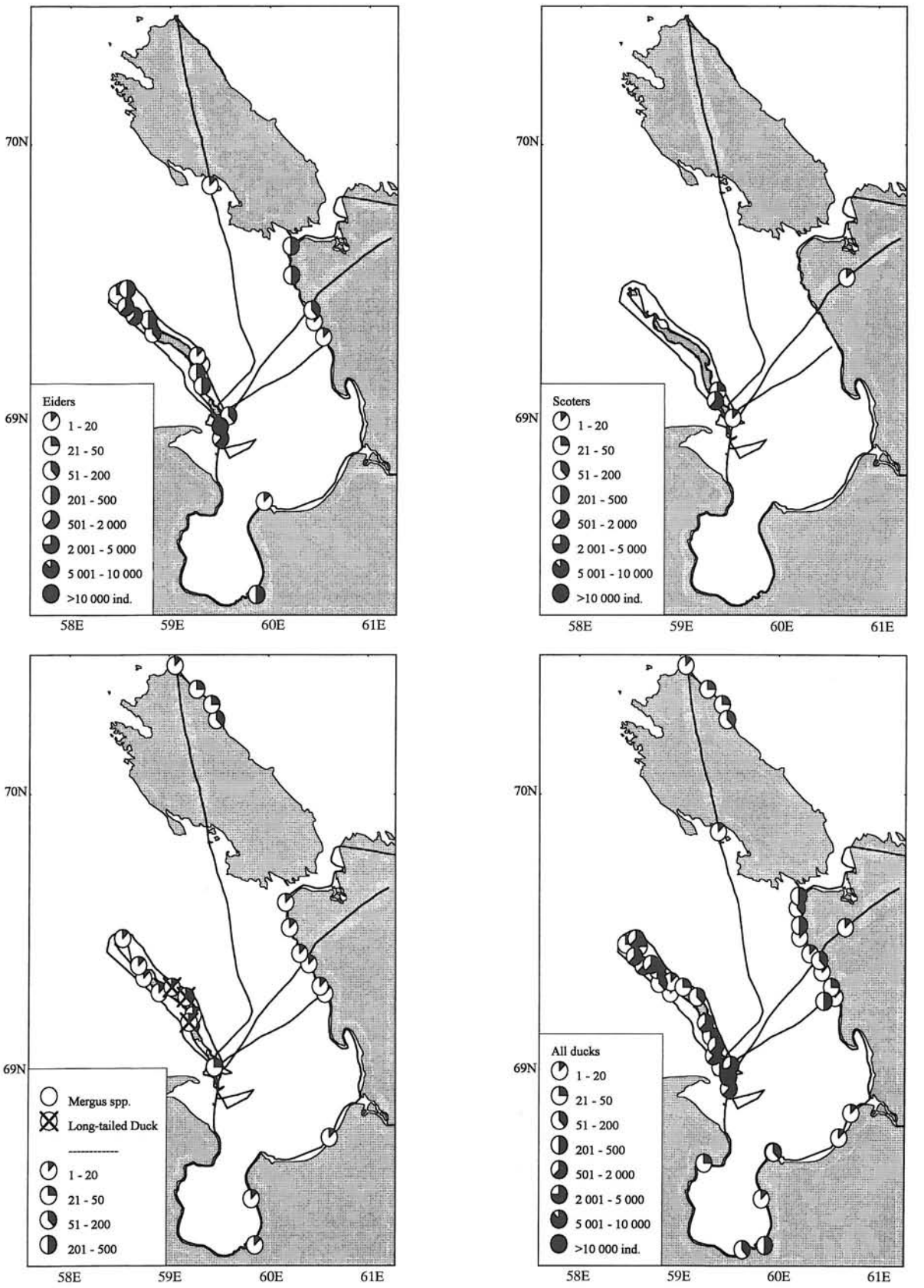


Fig. 6a-d. *The distribution of (a) eiders* Somateria *spp.; (b) scoters* Melanitta *spp.; (c) sawbills* Mergus *spp. and Long-tailed Duck* Clangula hyemalis*; and (d) all species of ducks combined found during helicopter flights (flight routes shown). Note that the scale of the symbols is not proportional.*

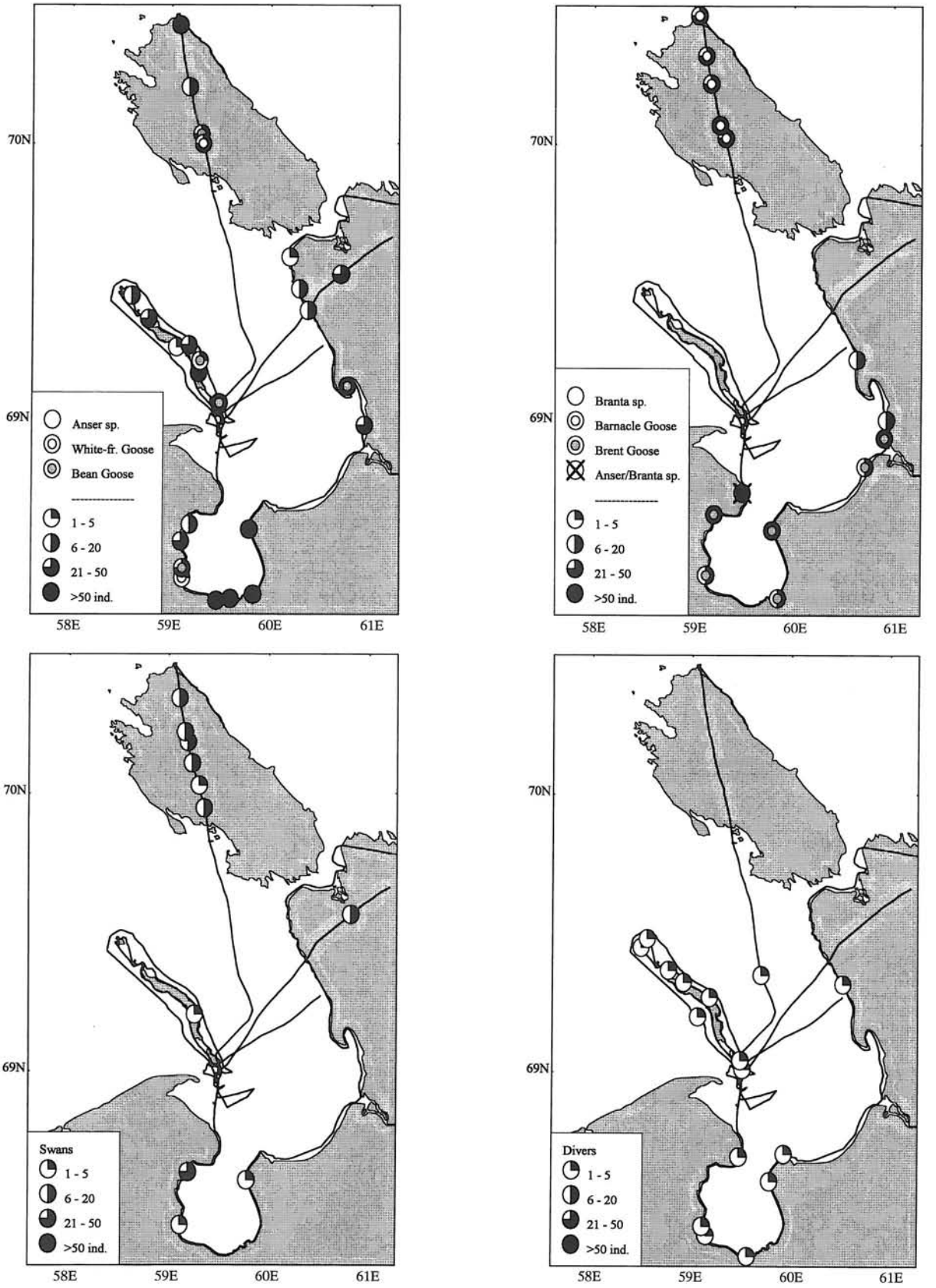


Fig. 7a-d. *The distribution of (a) unidentified 'grey' geese* Anser *sp., White-fronted Goose* Anser albifrons *and Bean Goose* Anser fabalis*; (b)* Branta *sp., Barnacle Goose* Branta leucopsis*, Brent Goose* Branta bernicla *and* Anser/Branta *sp.; (c) swans* Cygnus *spp.; and (d) divers* Gavia *spp. found during helicopter flights (flight routes shown). Note that the scale of the symbols is not proportional.*

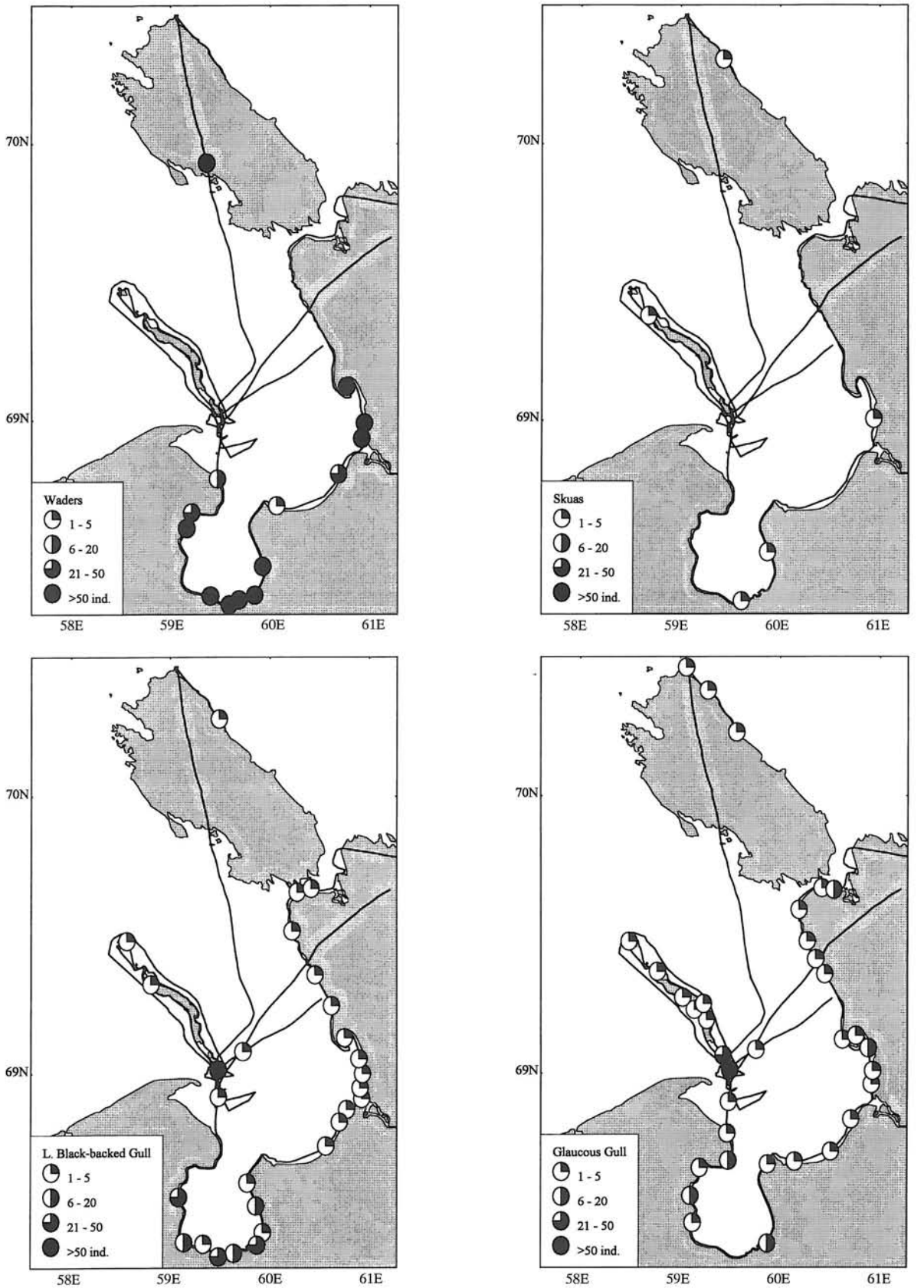


Fig. 8a-d. *The distribution of (a) waders, (b) skuas* Stercorarius *spp., (c) Lesser Black-backed Gull* Larus fuscus heuglini, *and (d) Glaucous Gull* Larus hyperboreus *found during helicopter flights (flight routes shown). Note that the scale of the symbols is not proportional.*

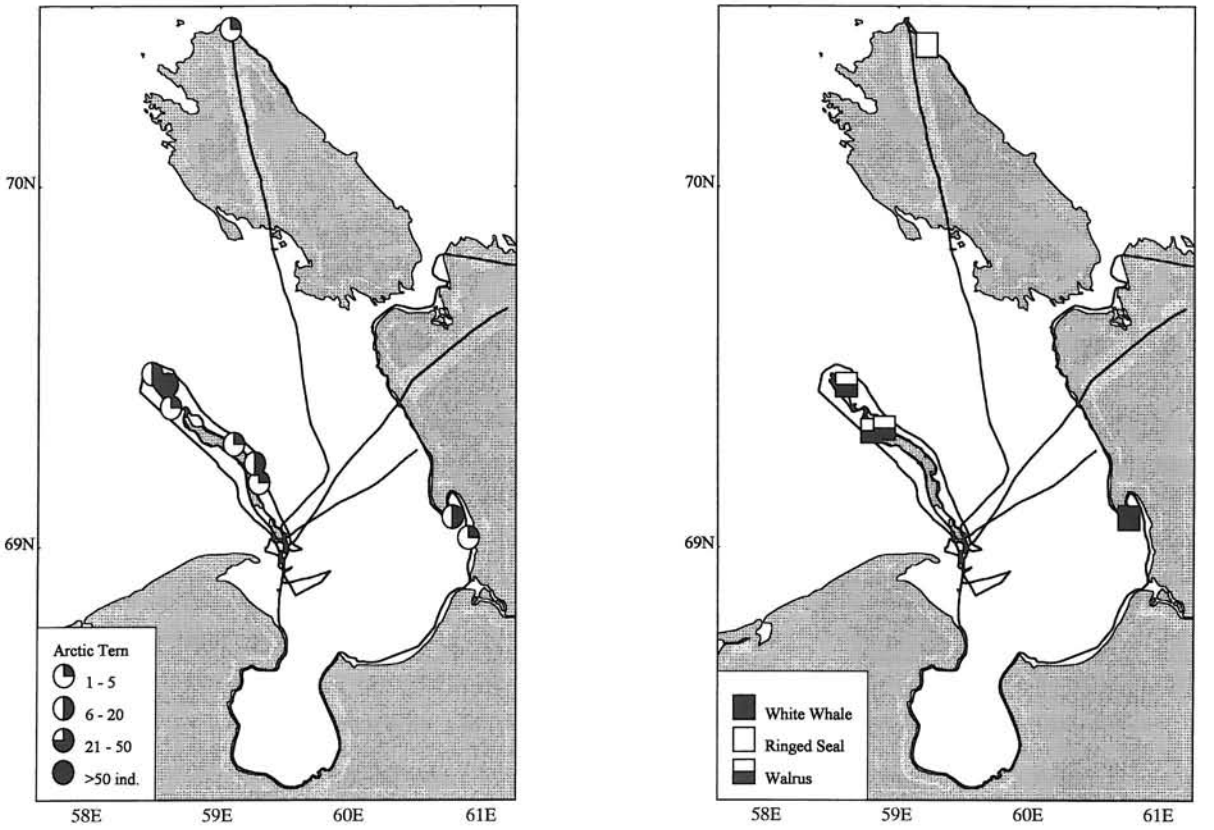


Fig. 9a-b. *The distribution of (a) Arctic Tern* Sterna paradisaea *and (b) White Whale* Delphinapterus leucas, *Ringed Seal* Phoca hispida *and Walrus* Odobenus rosmarus *found during helicopter flights (flight routes shown). Note that the scale of the quantity symbols is not proportional.*

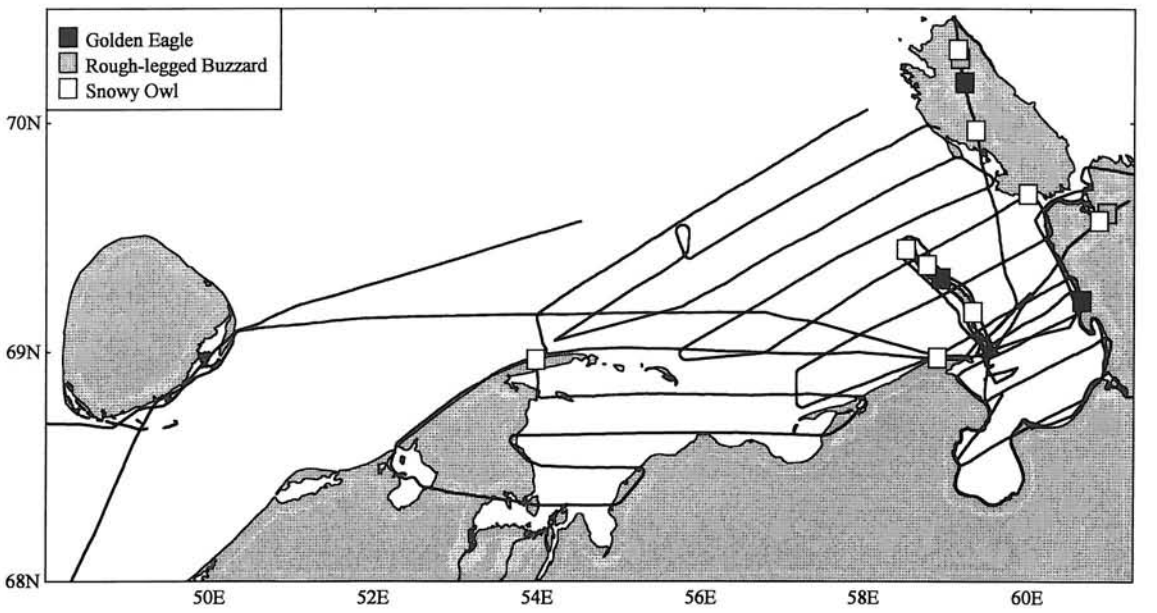


Fig. 10. *The distribution of Golden Eagle* Aquila chrysaetos, *Rough-legged Buzzard* Buteo lagopus *and Snowy Owl* Nyctea scandiaca *found during both aeroplane transects and helicopter flights (flight routes shown).*

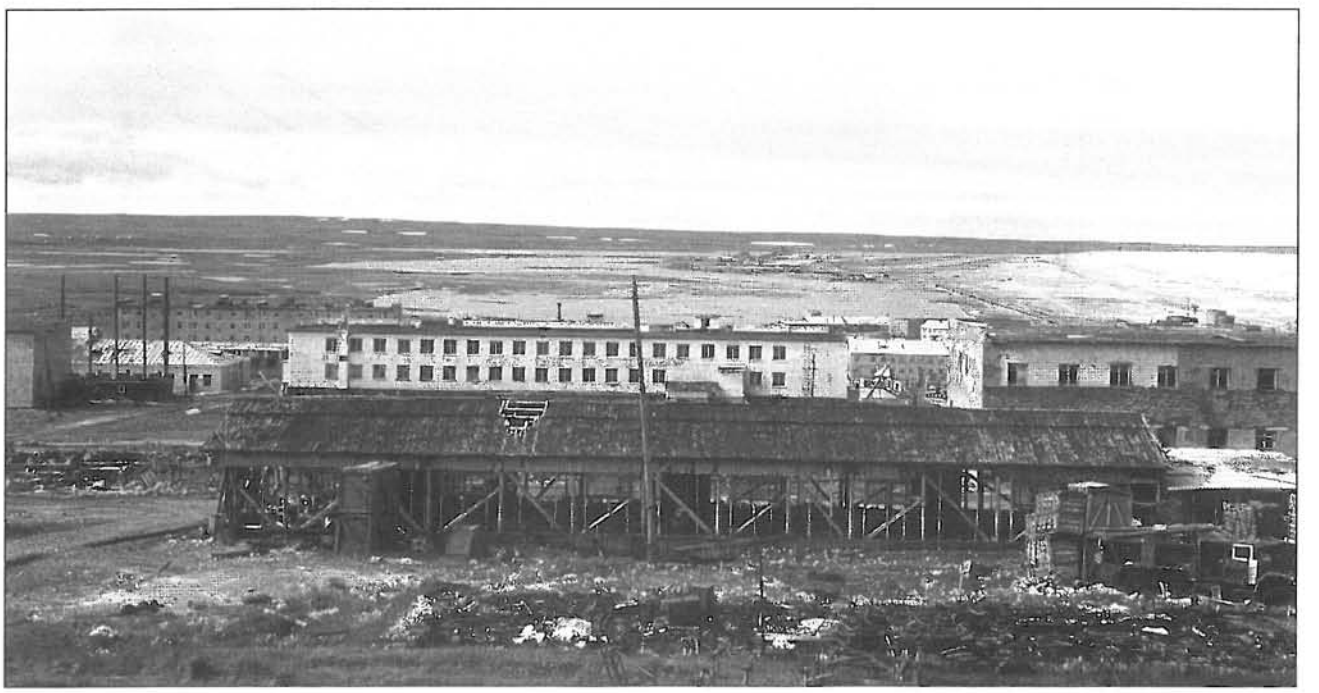
APPENDIX 2 - BIRDS AND MAMMALS RECORDED IN THE VICINITY OF AMDERMA

Records were made of birds and mammals observed during the stay in Amderma (northeastern Yugorskiy Peninsula, 69º45'N 61º37'E) in the period 11 August - 25 August 1998. The following longer excursions on the tundra around Amderma were made (in addition to shorter walks within and around the settlement):

- Bolshoe Toenato Lake on 16 August (tundra southeast of the lake);
- Amderma Lagoon on 20 August (mudbanks and coastal tundra along southwest shore of the lagoon);
- Amderma Lagoon on 21 August (tundra southeast of the lagoon);
- Skalisty Cape on 22 August (coast and coastal tundra); and
- First Peschanaya Lagoon on 23 August (mudbanks in the shallow lagoon and tundra southwest of this).

In addition to our own observations, some data on migration of waterfowl in the Amderma area after our departure has been included. The data was collected at our request by Michail Sobolev, deputy chief of Amderma airport.

The area around Amderma is comprised of relatively flat tundra. The shore has narrow beaches under steep, but low cliffs. Higher cliffs are only found in the northernmost part of the area closer to the Yugorskiy Shar Strait. There are several river mouths with deposits forming shallow lagoons. The low-lying maritime tundra around the lagoons is abundant on small lakes. There are also several larger lakes in the area.



The settlement of Amderma with the Amderma Lagoon and the airport in the background. Photo: Kjell Isaksen.

First Peschanaya Lagoon, northeast Yugorskiy Peninsula. Photo: Kjell Isaksen.

SPECIES ACCOUNTS

BLACK-THROATED DIVER *Gavia arctica*
Most birds were observed on small lakes on coastal tundra, with a maximum of 8 individuals on a small lake southeast of the airport on 21 August. Black-throated Divers were also recorded at sea with for instance 5 individuals on water and 3 individuals flying close to the shore west of Amderma on 22 August. Movements of birds between tundra lakes and the sea were noted. All divers determined to the species level were Gavia arctica.

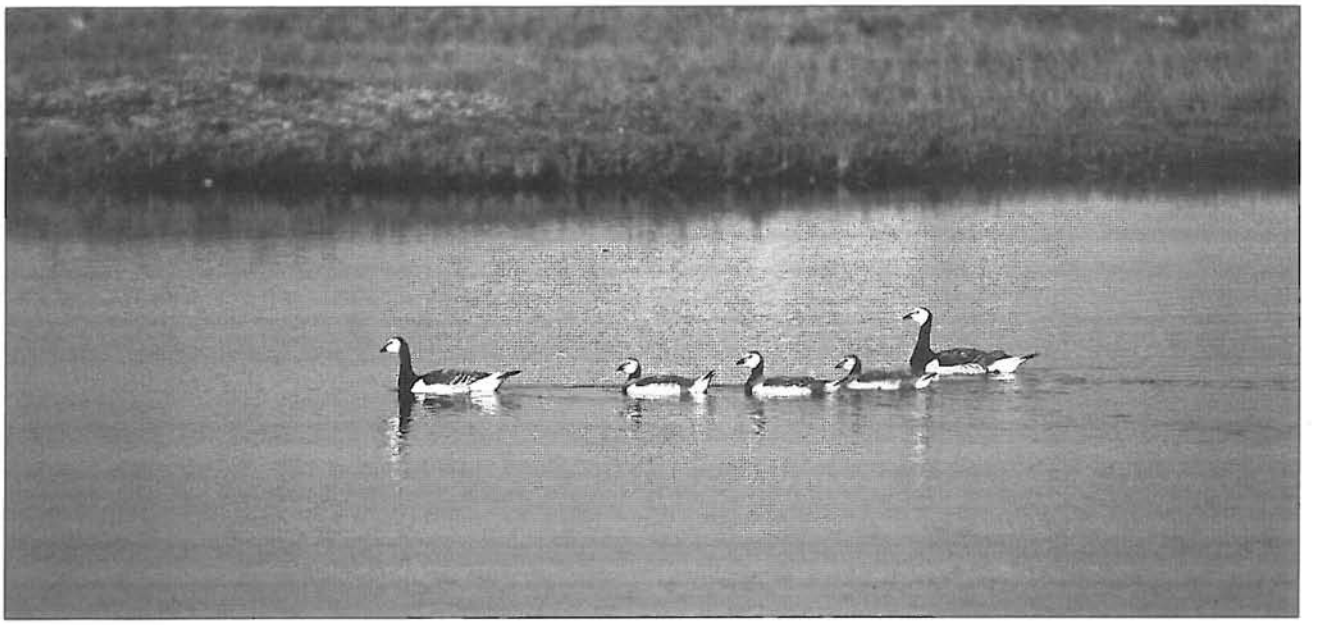
BEWICK'S SWAN *Cygnus columbianus bewickii*
Two individuals on a small lake southeast of the airport on 21 and 24 August. One wearing a neckband (yellow 766A). Two pairs (including one with one young) of unidentified swans, most probably also Bewick's Swans, were seen at long range in First Peschanaya Lagoon on 23 August.

BEAN GOOSE *Anser fabalis*
Eighteen individuals at Chernoe Lake, south of First Peschanaya Lagoon, on 23 August.

BARNACLE GOOSE *Branta leucopsis*
One flock of 17 ad. and 8 juv. at sea close to the shore west of Skalisty Cape on 22 August. One pair with 3 large juv. on a small lake west of Skalisty Cape on 22 August.

BRENT GOOSE *Branta bernicla*
Flocks of 45 and 13 individuals flew up from First Peschanaya Lagoon and towards west on 23 August. The first wave of migration past Amderma was recorded on 25 August. and lasted for three days (M. Sobolev pers. comm.).

COMMON TEAL *Anas crecca*
Ten individuals in female plumage on a small pond close to the airport on 20 August.



A Barnacle Goose Branta leucopsis *pair with young on a small lake west of Skalisty Cape, north Yugorskiy Peninsula. Photo: Kjell Isaksen.*

PINTAIL *Anas acuta*
Several small flocks (7, 5 and 4 individuals) of female-plumaged individuals on small ponds southwest of the airport on 20 August. Five birds on a small pond in First Peschanaya Lagoon on 23 August.

SCAUP *Aythya marila*
One female with 5 downy young on a small lake close to Bolshoe Toenato Lake on 16 August. Two females with 5 and 8 young respectively (approximately 2-3 weeks old) on a small lake southeast of the airport on 21 August. One female with 6 young (3/4 of female size) on a small lake southwest of First Peschanaya Lagoon on 23 August.

COMMON EIDER *Somateria mollissima*
One crèche of 3 females and at least 13 young (2/3 of the females' size), and a single female with 4 downy young (10-14 days old) at sea close to Skalisty Cape on 22 August.

KING EIDER *Somateria spectabilis*
No King Eiders were seen during our stay in Amderma. According to local people, single King Eiders were observed at tundra lakes in the area until 7-10 September, and flocks of 5-8 birds were observed together with Long-tailed Ducks among pack ice at sea in Morozova Strait, northwest of Amderma, on 12 September (M. Sobolev pers. comm.). Flocks of 15 and 50 migrating eiders, probably King Eiders, and two flocks of 70 and 40 large undetermined marine ducks were seen near Amderma flying over the sea towards Yugorskiy Shar Strait on 13 August.

LONG-TAILED DUCK *Clangula hyemalis*
One female with 3 young (about one week old) on a small lake near the airport on 15 August, and one female with 3 young (less than two weeks old) on a small lake close to Bolshoe Toenato Lake on 16 August. Six individuals and two flocks of 3 males on small lakes near the settlement of Amderma on 15 and 21 August. In total 6 individuals on small lakes southwest of First Peschanaya Lagoon on 23 August. The species was numerous, with flocks of 50-60 birds at sea among pack ice in Morozova Strait, northwest of Amderma on 12 September (M. Sobolev pers. comm.).

COMMON SCOTER *Melanitta nigra*
Two females close to the shore at Skalisty Cape on 22 August.

VELVET SCOTER *Melanitta fusca*
One female close to the shore at Skalisty Cape on 22 August.

GOOSANDER *Mergus merganser*
Eight individuals at sea by Skalisty Cape on 22 August.

ROUGH-LEGGED BUZZARD *Buteo lagopus*
Relatively abundant species. One nest with 1 live and 3 dead large young found close to Bolshoe Toenato Lake on 16 August. The cause of death for the young is not known. One nest with 3 young along the road to Bolshoe Toenato Lake on 16 August. One pair with at least 1 large young close to Skalisty Cape on 22 August. Several other anxious pairs indicate breeding. Many of the observed birds did, however, not seem to be breeding.

A large Rough-legged Buzzard Buteo lagopus *young in the nest on the tundra close to the Bolshoe Toenato Lake. Photo: Hallvard Strøm.*

MERLIN *Falco columbarius*
One individual seen chasing flocks of waders and successfully catching one bird, probably a Little Stint, southwest of the airport on 20 August. One individual east of Amderma on 23 August.

PEREGRINE FALCON *Falco peregrinus*
One individual seen chasing flocks of waders and successfully catching one bird in First Peschanaya Lagoon on 23 August.

WILLOW GROUSE *Lagopus lagopus*
One female with young by Bolshoe Toenato Lake on 16 August.

RINGED PLOVER *Charadrius hiaticula*
A common, but not numerous, species often observed as single individuals or together with other waders along the seashore, on mudbanks as well as within the settlement of Amderma. Four broods were seen in Amderma on 11 August; the chicks were still flightless in at least one of the broods.

GOLDEN PLOVER *Pluvialis apricaria*
Seen or heard on the tundra on about 10 occasions. Maximum number recorded was 10 individuals southwest of the airport on 20 August.

SANDERLING *Calidris alba*
One individual on the shore west of the airport on 22 August.

LITTLE STINT *Calidris minuta*
Found to be the most numerous wader species in the area. The highest number was observed along the southwestern shore of Amderma Lagoon on 20 August. Flocks of up to 50 birds foraged in this area. The total number seen here may have been as high as 1000, and the species comprised about half of the number of waders recorded in the area. One individual with downy feathers on the neck was observed on the tundra in the same area. Several hundred birds were observed in First Peschanaya Lagoon on 23 August.

TEMMINCK'S STINT *Calidris temminckii*
Several individuals were recorded in the Amderma settlement and on the seashore on 13 August, as well as in the Amderma Lagoon on 20 August.

The species was also seen migrating along the shore adjacent to First Peschanaya Lagoon on 23 August.

CURLEW SANDPIPER *Calidris ferruginea*
Numerous in mixed flocks with Dunlins in First Peschanaya Lagoon on 23 August; in total at least 100 individuals seen. At least 20 individuals together with Little Stints and Dunlins along the southwestern shore of Amderma Lagoon on 21 August. A flock of 14 individuals flying over the sea near Skalisty Cape and a single bird at the shore of a small lake nearby on 22 August.

DUNLIN *Calidris alpina*
Together with Little Stint, the most numerous wader species seen. Several hundred individuals foraged on the mudbanks in First Peschanaya Lagoon on 23 August. A smaller number, including juvenile birds, was seen along the southwestern shore of Amderma Lagoon on 20 August.

RUFF *Philomachus pugnax*
Frequently observed in small numbers in rich, moist tundra habitats. About 50-100 birds seen in total in Amderma and First Peschanaya Lagoons on 20 and 23 August, respectively.

COMMON SNIPE *Gallinago gallinago*
Single individuals seen on several occasions in moist grassy habitats.

SPOTTED REDSHANK *Tringa erythropus*
A single juvenile seen among other waders in First Peschanaya Lagoon on 23 August.

WOOD SANDPIPER *Tringa glareola*
A few individuals observed at small ponds within the settlement of Amderma, including a flock of 7 individuals on 12 August and a fully-fledged juvenile on 13 August.

RED-NECKED PHALAROPE
Phalaropus lobatus
Common and relatively numerous on lakes on coastal tundra. Highest number seen was 28 individuals on a small lake southwest of First Peschanaya Lagoon on 23 August and totally up to 30-50 phalaropes in Amderma Lagoon on 20 August. Ten individuals seen at sea close to the shore west of the airport on 22 August.

POMARINE SKUA Stercorarius pomarinus
The most numerous skua in the area around Amderma. Adults with one or two fledged chicks were observed on 3 occasions: by Bolshoe Toenato Lake on 16 August, southwest of the airport on 20 August, and southwest of First Peschanaya Lagoon on 23 August. A slight westward migration by single birds and groups up to 3 individuals was observed. Of 21 non-breeding skuas sighted, 20 were adults of the light morph and one immature bird of the dark morph.

ARCTIC SKUA *Stercorarius parasiticus*
Five individuals by First Peschanaya Lagoon on 23 August. One or two individuals on several other occasions. No indications of breeding observed. All birds were adults of light morph.

LONG-TAILED SKUA *Stercorarius longicaudus*
One individual by Bolshoe Toenato Lake on 16 August.

LESSER BLACK-BACKED GULL
Larus fuscus heuglini
Common in coastal habitats; a concentration of birds in Amderma Lagoon. Slight migration observed along the sea shore and across the Yugor Peninsula near Skalisty Cape. The age structure of the birds observed, i.e. the proportion of adults/immatures/juveniles, was 4/1/1. No signs of breeding were observed.

GLAUCOUS GULL *Larus hyperboreus*
Occurrence similar to that of Lesser Black-backed Gull, but in somewhat lower numbers. Several small flocks seen flying towards west along the coast, possibly on migration. The highest concentration was observed in Amderma Lagoon with 32 individuals A territorial pair with anxious behaviour was observed southwest of Amderma.

SNOWY OWL *Nyctea scandiaca*
Numerous in all areas visited. Highest number seen simultaneously was 17 individuals (within a distance of 2 km and 180° angle of sight) on the tundra by Bolshoe Toenato Lake on 16 August.

A Snowy Owl Nyctea scandiaca *close to the settlement of Amderma. Photo: Kjell Isaksen.*

Twenty-three individuals observed along one side of the road on the approximately 11 km drive from Bolshoe Toenato Lake to Amderma on 16 August. The birds were not territorial, they did not occur in pairs, and no indications of breeding were observed. The sex ratio was biased towards males at a ratio of approximately 2 to 1 (n=54). The high number of owls in the area must be related to the high density of small mammal prey. It is not known why no pairs seemed to be breeding, but the delayed summer season may provide a likely explanation. Old, dry pellets found indicate that some owls had been present at least since spring.

SHORE LARK *Eremophila alpestris*
Single birds and small flocks seen on several occasions in dry habitats. Two juveniles seen by Bolshoe Toenato Lake on 16 August.

MEADOW PIPIT *Anthus pratensis*
Observed in the areas around Amderma.

RED-THROATED PIPIT *Anthus cervinus*
Observed in the areas around Amderma.

WHITE WAGTAIL *Motacilla alba*
A relatively common bird observed in the settlement of Amderma, on the airport and by Bolshoe Toenato Lake. Some birds were also seen on the beaches.

BLUETHROAT *Luscinia svecica*
One individual seen within the settlement of Amderma on 19 August.

WHEATEAR *Oenanthe oenanthe*
One or two birds seen on several occasions both close to Amderma and in rocky habitats near Skalisty Cape.

FIELDFARE *Turdus pilaris*
Three observations, all close to Amderma: 1 individual on 13 August, 2 individuals on 19 August, and 1 individual on 24 August.

REDWING *Turdus iliacus*
Two individuals within the settlement of Amderma on 13 August, 1 individual east of the town on 19 August, and 1 individual south of the town on 24 August.

LAPLAND BUNTING *Calcarius lapponicus*
A common bird in the area. Frequently seen in small flocks on the tundra.

SNOW BUNTING *Plectrophenax nivalis*
Frequently seen in small flocks on the tundra as well as along the coast. The species seemed to be somewhat less abundant than the Lapland Bunting.

MOUNTAIN HARE *Lepus timidus*
Scats found in several places, but no animals seen.

BROWN LEMMING *Lemmus sibiricus*
One dead specimen collected at a Rough-legged Buzzard nest close to Bolshoe Toenato Lake on 16 August. One individual captured by hand in the same area. Two nest containing young, probably of this species, were found by First Peschanaya Lagoon on 23 August. One adult captured by hand nearby.

ARCTIC FOX *Alopex lagopus*
Three large young observed at a distance at a probable denning site southwest of First Peschanaya Lagoon on 23 August. A recently used den was found nearby.

RINGED SEAL *Phoca hispida*
Single individuals were seen swimming close to the shore on several occasions.

DISCUSSION

The spring was late in the region around Amderma in 1998. According to people in Amderma, the season (snow melt and development of vegetation) was about one month delayed compared to a 'normal' or average year.

The average air temperature in Amderma in August was +5.5ºC, with a minimum of -1ºC on 15 August and a maximum of +21ºC on 19 August (data from Amderma Polar Station). Temperatures below zero were recorded during the period 15-21 August. The most anomalous feature of the 1998 summer season was the heavy ice conditions at sea. There was still pack ice close to Amderma in the beginning of September, whereas the pack ice in other years normally disappears around 4 August (M. Sobolev pers. comm.).

Rodent density had obviously been high in the area in spring. This judged from the high number of burrows, runways and droppings found on the tundra. However, only a few rodents were observed, and it is possible that the rodent population(s) had recently decreased. Only one Snowy Owl was observed during the ca. one hour helicopter flight over the tundra from Amderma to Vorkuta in south on 25 August. Fog prevented observations during the first 1/3 of the flight. Compared to the high number of owls observed in the areas around Amderma, this indicates that the Snowy Owls were aggregated in the northern areas around Amderma, and that rodent density may have been higher here than in the more southern areas.

The delayed season and the high availability of small mammal prey clearly influenced the abundance of several species. Snowy Owls, Rough-legged Buzzards and Pomarine Skuas were common, although (especially for Snowy Owl) the proportion of non-breeding birds seemed to be high. Relatively few ducklings were observed, and the clutch sizes of the ducks seemed to be low. This impression was shared by local people in Amderma and is probably explained by the delayed breeding season.

WATERFOWL CENSUSES IN COASTAL WATERS OF THE PECHORA SEA

Alexander N. Golovkin, Yuri M. Shchadilov & Yuri V. Morozov

ABSTRACT

Between 17th and 21st August aerial counts of seabirds were carried out along the coast of the Pechora Sea (southeastern part of the Barents Sea). The counts were carried out from an Mi-2 helicopter. The coastal strip was surveyed along a 550 km stretch of coast, from the eastern side of Khaypudyrskaya Bay in the east, to the middle of Korovinskaya Bay in the west. The distribution and numbers of seabirds was as to be expected in the pre-migratory period.

A total of 6610 birds, representing 14 taxonomic groups (11 species and 3 additional genera), were recorded during the survey, including 2339 individuals within the transect band. The remaining birds were observed on tundra lakes during the flight over Medynskiy Zavorot Peninsula and in big flocks at sea out of transect. Mean bird numbers were 4.3 individuals per km and their mean density in the area covered by the survey was 23.6 individuals per km^2. The distribution of waterfowl and seabirds was by no means uniform with some parts of the transect containing flocks of hundreds of birds and others with no birds at all. The Scaup *Aythya marila*, Long-tailed Duck *Clangula hyemalis* and Lesser Black-backed Gull *Larus fuscus heuglini* were the most common species recorded during the survey. The two former ones accounted for 60% of the total sight records in coastal waters, whereas the Lesser Black-backed Gull was almost ubiquitous (occurred in 85% of the sectors into which the census route was divided). The highest species diversity occurred in the western part of area between Cape Konstantinovskiy and Cape Dvoynichniy Nos and also on the Gulyaevskie Koshki Shallow.

Ground counts were carried out in the littoral zone of Pakhancheskaya Bay where mostly waders were found.

BACKGROUND

The coastal waters of the Bol'shezemelskaya and Malozemelskaya tundras within the Nenets autonomous okrug (district) constitute one of the most important areas for waterfowl migrating between Scandinavia and the European part of Russia. They are also part of the Eurasiatic migratory route of many bird species (Estafiev et al. 1995; Mineev 1987, 1994). The large intertidal zone in this area provides important feeding areas for large populations of waterfowl. Large quantities of fresh water is brought into the area by numerous rivers (Korovinskaya, Bolvanskaya, Pakhancheskaya and Khaypudyrskaya Bays). These waters are important for staging waterfowl during their spring and autumn passage.

In 1998, birds were censused along the shore-line of the Pechora Sea. The rationale of autumn surveys in the coastal zone is the presence of large concentrations of local seaducks in the post-breeding period when young birds learn to live in open sea and pre-migratory flocks are formed. Of primary importance is the possibility for the birds to use this narrow strip of shallow water as a staging site to replenish their fat reserves before migration.

STUDY AREA

Coastal waters of the southeastern Barents Sea

The study area comprises the southeastern coast of the Barents Sea between the Pechora River

Delta in the west and the western side of the Yugorskiy Peninsula in the east (Fig. 1). The coast is dominated by typical low-lying tundra with an extensive network of pools and lakes alternating with sedge-grass meadows and intersected by river channels. The overall aspect of the territory is reminiscent of the marshlands on the southern coast of the North Sea (Western Europe). Numerous river deltas are an important element of the tundra landscape, the largest rivers (from west to east) being Pechora, Neruta, Chernaya, More-Yu, Korotaikha. Vast sandy shallows formed in the estuaries by particulate material deposited from outflowing water are very unstable and their location varies between years. The shallow intertidal zone is sometimes a few kilometres wide, the broadest areas can be seen in the Bolvanskaya, Pakhancheskaya and Khaypudyrskaya Bays, close to the Chernaya River mouth, along the eastern coast of Medynskiy Zavorot Peninsula and along the southwestern coast of the Yugorskiy Peninsula. Wherever the coast line is steep, its height does not exceed a few meters. Human population is sparse and largely concentrated in small settlements of 10-20 houses. Most of them are in the western part of the study area. Varandey used to be the largest of them, but it now falls into decay and harbours only a few tens of people. There is practically no resident population east of Varandey. In summertime, those areas are visited by fishermen who sometimes reach the most distant sites.

Protected areas

Parts of the territory have status as protected natural areas (Fig. 2). In 1997, Nenetskiy Zapovednik was established to encompass Zakhar'in Bereg (coast) of the Pechora Bay (Russkiy Zavorot Peninsula), lower reaches of the Pechora Delta, a part of the Neruta Delta along the southern side of the Bolvanskaya Bay, Gulyaevskie Koshki Islands, and a number of small islands in the eastern part of the Barents Sea (Matveev, Golets, Dolgiy, Bol'shoy Zelenets and Maly Zelenets) as well as the entire area of the Korovinskaya, Srednyaya and Kuznetskaya Bays, a part of the Bolvanskaya Bay, as well as a 10 km wide strip along Zakhar'in Bereg, and a 2 km wide zone around the aforementioned off-shore islands. A state nature zakaznik (sanctuary) will soon be established on the Yugorskiy Peninsula to include a large part of western coast of the peninsula. Some areas (the Russkiy Zavorot Peninsula, Khaypudyrskaya Bay, and Varandeyskaya Lapta Peninsula) are listed as Important Bird Areas in Europe (Grimmett & Jones 1989). It is worthy to note that recent strengthening of the regulations have greatly promoted nature conservation in these coastal areas. Equally important is the fact that the responsibility for the protection of marine biological resources now rests with the Federal Frontier Agency.

STATE OF KNOWLEDGE

The bird fauna of the study area has, until recently, been poorly known. The available data are incomplete because most of them were collected incidentally by investigators doing more specific studies (Brown 1877; Seebohm 1880; Zhuravskiy 1906; Dmokhovskiy 1933; Uspenskiy 1965, 1973). The most ambitious survey of waterfowl in the Bol'shezemelskaya tundra including the Barents Sea coast was undertaken in the 1970's and 1980's by expeditions from the Komi Institute of Biology, Russian Academy of Sciences, led by Yu. N. Mineev (Mineev 1975, 1979, 1987, 1994, 1995). They carried out aerial bird counts (using Mi-4 helicopters and AN-2 planes) in the coastal areas of the Bol'shezemelskaya tundra both in the summer (5-20 August 1973-1975) and in the autumn (18-23 September 1976 and 1983). However, the survey transects did not always follow the shore-line, being primarily designed to cover inland tundra rather than coastal waters. The census method was virtually the same as employed in the present study except the transect width which was 250 m on each side of the aircraft. Mineev obtained basic information about population density, distribution, and numbers of waterfowl and seabirds in the Bol'shezemelskaya tundra. In the early 1980's, Yu. M. Shchadilov and V. A. Orlov conducted an aerial survey of waterfowl between the Pechora Delta and Khaypudyrskaya Bay, largely over the mainland tundra (Shchadilov & Orlov 1984).

Fig. 1. *The study area with place names used in the text.*

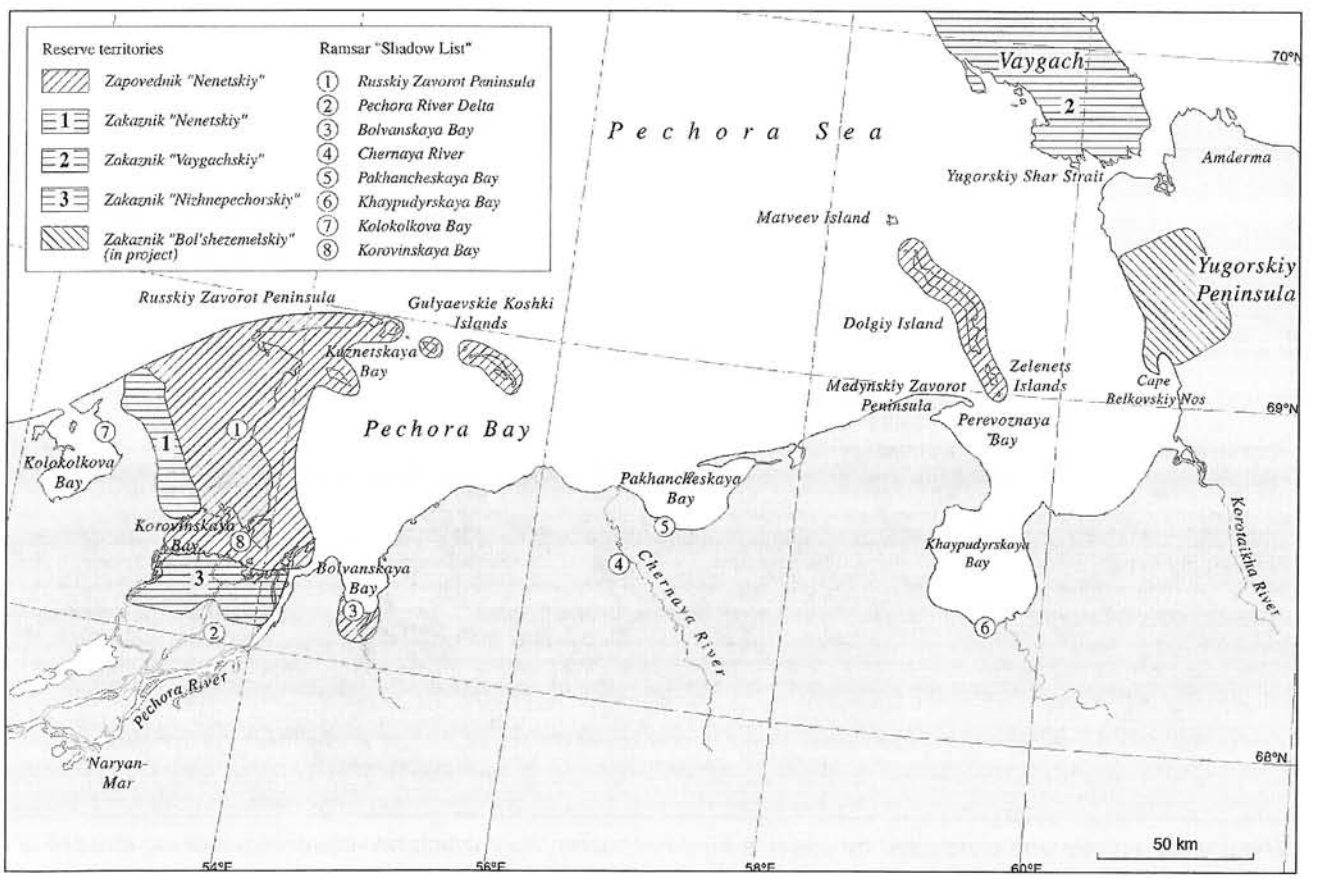


Fig. 2. *Protected areas*

METHODS

The survey included both aerial and ground counts of birds along the coast-line. The work was performed in compliance with international standardised methods (Komdeur *et al.* 1992), with slight modifications. The aircraft used was a Mi-2 helicopter from which two observers looking forward at the right and left sides simultaneously recorded birds and entered counts onto dictaphones. The third member of the counting team acted as the navigator and monitored the route with a map and a hand-held GPS receiver to obtain geographic coordinates every 10 minutes. The survey altitude was 100 m. Marks were placed on the helicopter windows to ensure bird recording at an angle of 45 degrees and thus help the observers to keep the same width of the transect throughout the survey. The transect width was chosen to be equal to survey altitude, i.e. 100 m minus 'aircraft shadow' which was assumed to be 10 m on either side. Average survey speed was 150 km/h on the first day and 132 km/h on the second day. The aerial survey was carried out in two stages because of problems with transportation.

The eastern part of the study area was covered by an aerial survey on 17 August (total length 330 km). The route was laid along the shore line to the East from Varandey, crossing Khaypudyrskaya Bay from Medynskiy Zavorot Peninsula to Sinkin Nos Cape and to Pyrteykhard. After that the course turned back along the coast of the bay till Syarnasalya Cape. From this point to Varandey our route crossed the Medynskiy Zavorot Peninsula over the mainland. Birds on the tundra lakes were also counted, but only on the right side of the helicopter. The final point of the first-day census was Bachurka west of Varandey (Pakhancheskaya Bay). The second aerial survey was performed on 21 August. The counts were performed along the coast from Bachurka westward to Korovinskaya Bay. The total length of this route was 220 km. Weather conditions were ideal for aerial surveys. A complete cloud cover excluded glare on the water and windows without interfering with good visibility. The sea was calm and the north-easterly wind rather weak. The total census area was 550 km long and 0.18 km wide (99 km^2).

The coastal survey was conducted by use of a Mi-2 helicopter, from which two observers looking forward at the right and left sides simultaneously recorded birds. Photo: Yuri M. Shchadilov.

The ground surveys was undertaken on 18-20 August at the Pakhancheskaya Bay coast including an adjacent stretch of maritime tundra. During the ground surveys birds in the littoral zone were counted by an observer walking along the shore-line during the lowest ebb tide. A few study plots were established for the purpose, measuring 0.13 km^2 each (a semicircle with a radius of 200 m). In addition, total counts of birds found on tundra lakes and pools were made. Birds were identified using a pair of 12x binoculars.

RESULTS

A total of 6610 birds representing 14 taxonomic groups (11 species and 3 additional genera) were recorded during the survey. Most of the birds (5739) were observed on the sea including 2339 individuals within the transect band. The remaining 871 birds were recorded on tundra lakes during the flight over the Medynskiy Zavorot Peninsula. A large flock of Scaup *Aythya marila* consisting of 4000 birds was recorded in the Korovinskaya Bay; 600 of them were within the transect band.

Coastal aerial surveys

Mean bird numbers were 4.3 per km; from this figure their density in the area covered by the survey was calculated to be 23.6 per km^2 (Table 1). However, the distribution of waterfowl and seabirds was by no means uniform, with certain parts of the area containing seaduck flocks of 100 or more individuals and others containing no birds at all. Scaup, Long-tailed Duck *Clangula hyemalis* and Lesser Black-backed Gull *Larus fuscus heuglini* were the most common species recorded during the survey. The two former ones accounted for 60% of the total number recorded in coastal waters, whereas the Lesser Black-backed Gull was almost ubiquitous (occurred in 85% of the sectors into which the census route was divided), and its mean population density was rather high (Table 1). Scaup, Long-tailed Duck, Arctic Tern *Sterna paradisaea* and Glaucous Gull *Larus hyperboreus* were recorded in half of the sectors. Marine ducks dominated in number over other species; they usually occurred in large flocks, and their density during the study period was high. The density of Glaucous Gulls and Arctic Terns was only one tenth of that of Scaup and Long-tailed Duck.

Table 1. *Abundance, distribution and density of seabirds along the sea-shore of Bol'shezemelskaya tundra (aerial counts on 17 and 21 August 1998).*

Species	Number of birds counted		Sectors with birds		Density
	N	%	N	%	(ind/km^2)
Black-throated Diver	6	0.3	3	15	0.1
Swans unidentified	30	1.3	3	15	0.3
Barnacle Goose	200	8.6	1	5	2.0
Geese unidentified	91	3.9	5	25	0.9
Pintail	15	0.6	1	5	0.2
Scaup	813	34.8	8	40	8.2
Common Eider	23	1.0	5	25	0.2
Long-tailed Duck	691	29.5	10	50	7.0
Velvet Scoter	37	1.6	3	15	0.4
Arctic Skua	5	0.2	3	15	0.1
Lesser Black-backed Gull	299	12.8	17	85	3.0
Glaucous Gull	77	3.0	9	45	0.8
Arctic Tern	49	2.1	9	45	0.5
Guillemot unidentified	1	<0.1	1	5	<0.1

One unidentified guillemot *Uria* sp., a flock of Barnacle Geese *Branta leucopsis*, and a Pintail *Anas acuta* flock were recorded at one site each. Their mean densities were below 1 individual per km^2. Glaucous Gulls and Arctic Terns frequently occurred in many sectors of the census route even though they were far less numerous than Lesser Black-backed Gulls. The western coast of the Khaypudyrskaya Bay and a large part of the Korovinskaya Bay harboured more birds than any other sector of the area covered by the survey. Large gatherings of Scaups and Long-tailed Ducks, flocks of Velvet Scoters *Melanitta fusca* and Pintails as well as groups of unidentified swans *Cygnus* sp. were recorded in the Korovinskaya Bay. The highest species diversity occurred in the coastal region between Cape Konstantinovskiy and Cape Dvoynichniy and also the Gulyaevskie Koshki Shallow.

Inland aerial survey

The helicopter crossed the Medynskiy Zavorot Peninsula from Cape Syarnasyalya to Varandey. This provided an opportunity to count ducks on inland lakes and ponds. Bird numbers turned out to be relatively high: 871 individuals per 60 km including 853 ducks (78.9 per km^2). In fact, all ducks occurred in 15 flocks of which 6 contained 3-10 birds, 6 flocks contained 20-50 birds, and the remaining 3 flocks were as large as 150-250 birds each. Long-tailed Ducks prevailed; only one large Scaup flock of about 200 birds was recorded. In addition, a few small groups of swans were located (one pair with young, three pairs without young, two groups of 3 birds each, and one solitary bird).

Ground counts

Ground counts in the littoral zone demonstrated that this area is extensively used by several species, especially waders (Table 2). The density of birds on the counting plots varied from 738 to 2,054 individuals per km^2. Certainly, the data collected during this study are insufficient to make a definitive conclusion, but it is worth mentioning that randomly selected sites in the littoral zone about 1 km apart were not significantly different in terms of the total bird number even though their species composition was not identical.

Table 2. *Results of bird counts in fixed plots (0.13 km^2) in the littoral zone in the area of Bachurka, Pakhancheskaya Bay ('m'=morning and 'e'=evening).*

	Plot 1	Plot 2			
	19.08 (m)	19.08 (m)	19.08 (e)	20.08 (m)	20.08 (e)
Ringed Plover	–	12	–	–	6
Temminck's Stint	263	83	112	117	91
Ruff	–	–	–	4	–
Spotted Redshank	–	1	–	–	–
Wood Sandpiper	–	–	1	2	–
Arctic Tern	4	–	–	4	–
Total	267	96	113	127	97

A survey of two large lakes on the maritime tundra revealed the presence of birds typical for the area. One of them harboured 2 Black-throated Divers *Gavia arctica*, 4 Lesser Black-backed Gulls, 1 Glaucous Gull, 4 Arctic Terns, 1 Arctic Skua *Stercorarius parasiticus*, 1 Long-tailed Duck with 7 flightless young, and 80 Temminck's Stints *Calidris temminckii.*

SELECTED SPECIES ACCOUNTS

Black-throated Diver *Gavia arctica*

Divers were seen on only three occasions during the aerial survey; once in the northeastern part of the Khaypudyrskaya Bay (near Cape Sinkin Nos) and twice in the southeastern Pechora Bay (Appendix 1, Fig. 1a). All were single birds in shallow water habitats. Two other birds were sighted on a lake during a ground survey. According to Mineev (1987), non-breeders and immature birds leave the tundra for the sea in late July. The number of birds along shallow coasts, in deltas and in coastal lakes further increased in September. At this time, transient flocks of 15-20 birds could be seen on their feeding and staging grounds. However, the highest density of divers was recorded on the maritime tundra (2.8 ind. per km2 in autumn 1978).

Swans *Cygnus* sp.

Bewick's Swans *Cygnus columbianus bewickii* are the predominant swan species in the study area, although Whooper Swans *C. cygnus* may occasionally use the territory in autumn. It is impossible to distinguish between the two species from an aircraft. Therefore, all records are collectively referred to as 'swans'. The swans observed kept to shallow waters in the western part of the Pechora Delta, Korovinskaya Bay, Bolvanskaya Bay and Khaypudyrskaya Bay (Appendix 1, Fig. 1b). They were all young non-breeding birds either alone or gathered in small flocks (the largest flock contained 11 individuals). The majority of these birds were found on submerged pondweed (*Potamogeton* sp.). No movement to the sites where swans congregate prior to migration was observed during the study period. Whooper Swans appear to favour forest-tundra. Mineev (1987) maintains that a small number of Whooper Swans follow the coast towards west in the area in autumn. Large pre-migratory gatherings of Whooper Swans have been recorded in the Pechora Delta and at shallow coasts of the Pechora Bay. Bewick's Swans tend to keep to maritime tundra. During the breeding season, a small number of these swans choose to feed on coastal shallows especially at low water. The number of Bewick's Swans in coastal waters build up during autumn migration to reach a maximum in September (Mineev 1987). Mineev (1987) observed Bewick's Swans in shallow bays in September and October (over 29% of the population). According to Beekman (1992), the number of birds in the Korovinskaya Bay in September 1992 amounted to 15,000.

Geese *Anser* sp.

This group consists of two species, White-fronted Goose *Anser albifrons* and Bean Goose *A. fabalis*, which were virtually indistinguishable during the aerial censuses. These geese occurred in the river mouths west of the Pakhancheskaya Bay (Appendix 1, Fig. 1c). They were mostly seen flying towards the sea in flocks of about 40 birds or less. According to Mineev (1995), both post-moulting geese and broods move to the coast and coastal meadows in autumn (30% of White-fronted Geese and 20% of Bean Geese). These habitats are used by pre-migratory flocks and serve as stop-over sites after the migration begins. The autumn migration westward follows the Arctic coast in mid-September.

Barnacle Goose *Branta leucopsis*

This goose was encountered only once in a large flock of approximately 200 birds at the mouth of the Talotayakha River, east of the Khaypudyrskaya Bay (Appendix 1, Fig. 2a). The compact flock kept to shallow water close to the shore. The species has never been recorded in this area before. Its nearest breeding site on the mainland has been reported to lie some 150 km northward in the catchment of the Bol'shaya Oyu and Limbadayaga Rivers, Yugorskiy Peninsula, where the density of birds varies from 0.4 to 0.8 per km^2 (Mineev 1995, Morozov 1995). Breeding has also been recorded about 50 km to the northwest, at the northern coast of the Medynskiy Zavorot Peninsula (Syroechkovskiy 1995). According to Mineev

Coastal tundra in the Pakhancheskaya Bay, close to the Bachurka village. Photo: Yuri M. Shchadilov.

(1995), the spring passage of Barnacle Geese follows the shore-line of the Pechora Sea between the Russkiy Zavorot Peninsula and the Khaypudyrskaya Bay (Medynskiy Zavorot Peninsula). The migration route in this area in autumn is not known.

Pintail *Anas acuta*

The only Pintail flock was recorded during the survey in the northern part of the Korovinskaya Bay, moving from the inland tundra towards the sea. In autumn, Pintails are known to concentrate on maritime meadows and small tundra pools (Mineev 1995).

Scaup *Aythya marila*

A common species in the coastal zone. It was found to be rather uniformly distributed except in Bolvanskaya and Korovinskaya Bays where large flocks were located (Appendix 1, Fig. 2b). A congregation of approximately 4,000 birds was encountered in the Korovinskaya Bay. They were probably moulting birds which are known to gather in shallow sea areas in autumn. Similar concentrations of Scaup in this area have been described by Mineev (1987).

Common Eider *Somateria mollissima*

During the study period, Common Eiders occurred in small numbers. Most birds were recorded on coastal shallows between Pakhancheskaya and Bolvanskaya Bays (Appendix 1, Fig. 2c). Moreover, a pair of eiders was sighted at the eastern side of the Khaypudyrskaya Bay off Cape Sinkin Nos. Other birds were either solitary or formed small flocks. The distribution of Common Eiders in the study area remains to be clarified. Mineev (1995) described them as common in the Bol'shezemelskaya tundra in the northern part of the Medynskiy Zavorot Peninsula, and at Dolgiy, Matveev, and Bol'shoy Zelenets Islands. A small number of these birds were recorded along the coast-line of the Russkiy Zavorot Peninsula. No data are available on the migration of Common Eiders in the study area.

Long-tailed Duck *Clangula hyemalis*
These ducks were very common both in coastal waters and on tundra lakes of the Medynskiy Zavorot Peninsula (Appendix 1, Fig. 3a). At sea, they were seen either alone or in small groups of up to 5 birds. Moreover, bigger flocks (20-80 birds) were located in the mouths of the Takhotayakha and Dresvyanka Rivers. A large congregation of around 500 birds found in the Korovinskaya Bay accounted for more than 70% of the Long-tailed Ducks counted in the coastal zone. It may be supposed that, during the study period, most birds remained on inland lakes and were not yet ready to move to the sea. However, Mineev (1987) observed pre-migratory groups leaving their tundra habitats in late July and early August. Many Long-tailed Ducks (653 ind.) were seen during the 50 km long inland aerial survey across the Medynskiy Zavorot Peninsula. This figure is comparable with the number (691 ind.) recorded along the 550 km transect in the coastal zone. Flocks on tundra lakes normally contained from 10 to 250 birds.

Velvet Scoter *Melanitta fusca*
This survey revealed the presence of the Velvet Scoter only in the Korovinskaya and Khaypudyrskaya Bays, that is in the western and eastern parts of the study area (Appendix 1, Fig. 3b). Mineev (1987, 1995) describes the Velvet Scoter as a common bird on the lakes of the Bol'shezemelskaya tundra. In early spring, it is regularly seen on the ice-free sea. The numbers vary considerably between years. Data on post-breeding distribution and migratory routes are scarce.

Arctic Skua *Stercorarius parasiticus*
Four skuas were sighted at the western coast of the Pakhancheskaya Bay and one more off Farikha (Appendix 1, Fig. 3c).

Lesser Black-backed Gull *Larus fuscus heuglini*
The Lesser Black-backed Gull was the most common gull along the coast of the Pechora Sea. No true flocks of Lesser Black-backed Gulls was seen, but they formed large gatherings in the mouths of the Khil'chuyu, Kamenka, Alekseevka, Chernaya and Talotayakha Rivers (Appendix 1, Fig. 4a). The density of individuals in these areas was 2-4 times the mean value. In Russian literature, the taxon *heuglini* is normally regarded as a sub-species of Herring Gull *Larus argentatus* or as a separate species. Here the western tradition is followed, placing it as a subspecies of *Larus fuscus.*

Glaucous Gull *Larus hyperboreus*
This gull was recorded in almost half of the sectors along the aerial survey transect, but mostly in the western part of the Pechora Sea (Appendix 1, Fig. 4b). In the eastern part of the study area, these gulls were recorded only at the eastern coast of the Khaypudyrskaya Bay. They were frequently seen in the vicinity of human settlements either alone or in small flocks together with Lesser Black-backed Gulls.

Arctic Tern *Sterna paradisaea*
This species was found in most parts of the study area. It was most numerous in the western and easternmost parts of the area (Appendix 1, Fig. 4c). As in the case of gulls, Arctic Terns could be seen in small flocks.

Guillemot *Uria* sp.
One bird was recorded in the Korovinskaya Bay close to the mainland and very far from the breeding colonies of these species. The observation was made in the period when the migratory route of guillemots lay over open sea far to the north.

DISCUSSION

The data obtained in this survey provide a basis for evaluating the autumn status of the waterfowl and aquatic bird populations along the narrow coast-line of the Pechora Sea. Aerial surveys revealed the presence of 14 species/species groups in 3 orders. Anseriformes contributed most to the species diversity. The species composition of the avian fauna was typical of the season and the study area. The total number of birds, especially ducks, was relatively low, probably because the study was conducted when most ducks in the region still remained at breeding grounds on the tundra. This inference is confirmed by the large number of ducks sighted on inland lakes during aerial and

Coastal tundra in the Pakhancheskaya Bay, close to the Bachurka village. Photo: Yuri M. Shchadilov.

ground surveys. Ducks recorded in the coastal zone are thought to be non-breeding birds. Their distribution was characterised by concentrations near river mouths in the western part of the Pechora Sea (Chernaya, Alekseevka, Dresvyanka, Neruta and Pechora Rivers). Lesser Black-backed Gulls and Glaucous Gulls tended to gather in the vicinity of certain coastal settlements inhabited by fishermen. Such distribution patterns are supposed to be related to the more favourable feeding conditions at these sites. The northern coast of the Medynskiy Zavorot Peninsula and the outer part of the Khaypudyrskaya Bay had a sparse bird fauna with few ducks. It is worthwhile to note that the total number of birds recorded during the survey in the eastern part of the study area was significantly lower than in the western part.

POTENTIAL THREATS TO BIRD POPULATIONS

Oil pollution

Oil pollution in the coastal and littoral zones is a major threat to seabird populations. The nearest oil fields that are commercially exploited are in Bol'shezemelskaya tundra about 100 km from the coast. However, oil and natural gas deposits have recently been discovered at sea in the area, and their development may be expected in the near future (*e.g.* Prirazlomnoye oil field). Pollution of seabirds and their habitats may result from oil spills caused by drilling operations, tanker accidents, and damage to pipelines, terminals and floating reservoirs. The results of our study suggest that oil pollution may be especially detrimental for pre-migratory seaduck congregations in the Korovinskaya, Bolvanskaya, Pakhancheskaya and Khaypudyrskaya Bays, and in the Chernaya, Alekseevka and Dresvyanka river mouths where the birds annually gather in large numbers. This is in agreement with the observations of Mineev (1987). Korovinskaya Bay and a part of Bolvanskaya Bay that now lie within the bounds of the 'Nenetskiy' nature reserve are also at risk from oil pollution. Birds inhabiting this area are especially vulnerable to pollution because the bays run deep inland and oil would not be readily washed down by local currents or winds. In the

event of a spill, contaminants may be expected to accumulate in the wide littoral zone and in submerged vegetation within the two bays which provide the preferred feeding habitat for many ducks.

Fishing and hunting

Indigenous people traditionally practise subsistence fishing in the coastal zone. In autumn, illegal fishing is widespread. Large nets used for this purpose are known to catch many seaducks. It appears from interviews with local residents that on the average 2-3 ducks (largely young birds) die in each net during the fishing season. The estimated annual loss amounts to 8-12 thousand birds. Seaducks are not heavily hunted. The waterfowl hunting season is limited to 10 days in spring and 1.5 months in autumn. Local hunters prefer shooting geese whereas ducks are killed only incidentally. The legal size of the hunting bag for the spring season is 20 geese and 20 male ducks for each hunter. Nobody checks how many birds each hunter actually takes and it is therefore impossible to estimate the number of ducks and geese killed annually. However, hunting does not seem to have a serious impact on seaduck populations in the area.

REFERENCES

Beekman, J. H. 1992. Report of the first Dutch-Russian Bewick's Swan expedition, Pechora Delta, 14 July-22 September 1992. Unpubl. Report. Zool. Lab., Univ. of Groningen.

Brown, H. J. 1877. On the distribution of birds in North Russia. *Ann. Mag. Nat. Hist. Ser. 4, Vol. 19 (112)*: 277-290.

Dmokhovskiy, A. V. 1933. Birds of the Middle and Lower Pechora. *Bull. MOIP, otd. biol. 42 (2)*: 214-242. (In Russian).

Estafiev, A. A., Voronin, R. N., Mineev, Yu. N., Kochanov, S. K. & Beshkarev, A. B. 1995. *Fauna of the European North-East of Russia. Avifauna. Vol. 1, Part 1. Nonpasseriformes.* Nauka, St. Petersburg. 325 pp. (In Russian).

Grimmett, R. F. A. & Jones, T. A. 1989. *Important Bird Areas in Europe.* International Council for Bird Preservation, Technical Publication No. 9. Cambridge, UK. 888 pp.

Komdeur, J., Bertelsen, J. & Cracknell, G. (eds.). 1992. Manual for aeroplane and ship surveys of waterfowl and seabirds. IWRB Special Publication No. 19. Slimbridge, UK, 37 pp.

Mineev, Yu. N. 1975. Spring migration and moulting grounds of waterfowl in the Bol'shezemalskaya tundra. Mater. Vsesoyuzn. Conf. on Bird Migration, Moscow. Pp. 215-217. (In Russian).

Mineev, Yu. N. 1979. Waterfowl numbers and distribution in the Bol'shezemelskaya tundra. *Bull MOIP, otd. biol. 84 (3)*: 48-53. (In Russian).

Mineev, Yu. N. 1987. *Waterfowl of the Bol'shezemelskaya tundra. Fauna and Ecol.* Nauka, Leningrad. 109 pp. (In Russian).

Mineev, Yu. N. 1994. *Waterfowl of the Yugorskiy Peninsula*. Syktyvkar. 102 pp. (In Russian).

Mineev, Yu. N. 1995. Order Anseriformes. In: *Fauna of the North-East European Russia. Birds. Vol. 1, Part 1*. Nauka, St. Petersburg. 319 pp. (In Russian).

Morozov, V. V. 1995. Recent distribution and number of Barnacle Goose (*Branta leucopsis*) on Yugorskiy Peninsula. *Geese Study Group Bulletin of Eastern Europe and Northern Asia 1*: 51-56. (In Russian).

Seebohm, H. 1880. *Siberia in Europe: A visit to the valley of the Pechora in North-East Russia*. London. 311 pp.

Shchadilov, Yu. M. & Orlov, V. A. 1984. Swan numbers, distribution and ecology in the breeding period in the North of the Nenetskiy Autonomous Okrug. Pp. 77-85 in: *Ecology and migration of swans in the USSR*. IWRB, Slimbridge, UK.

Syroechkovskiy, E. E. Jr. 1995. New data on the distribution of Barnacle Goose in Russia. *Geese Study Group Bulletin of Eastern Europe and Northern Asia 1*: 39-46. (In Russian).

Uspenskiy, S. M. 1965. Birds of the eastern part of the Bol'shezemelskaya tundra, Yugorskiy Peninsula, and Vaygach Island. *Tr. Inst. biol. UNTs AN SSSR 38*: 65-102. (In Russian)

Uspenskiy, S. M. 1973. *Waterfowl of Khaypudyrskaya Bay. Pp. 40-41 in: Waterfowl resources in USSR, their replenishment, and utilisation*. Moscow. (In Russian).

Zhuravskiy, A. V. 1906. The route of the Bol'shezemelskaya expedition. *Ezhegodnik Zool. Mus. 11*: 18-33. (In Russian).

APPENDIX 1 - DISTRIBUTION MAPS

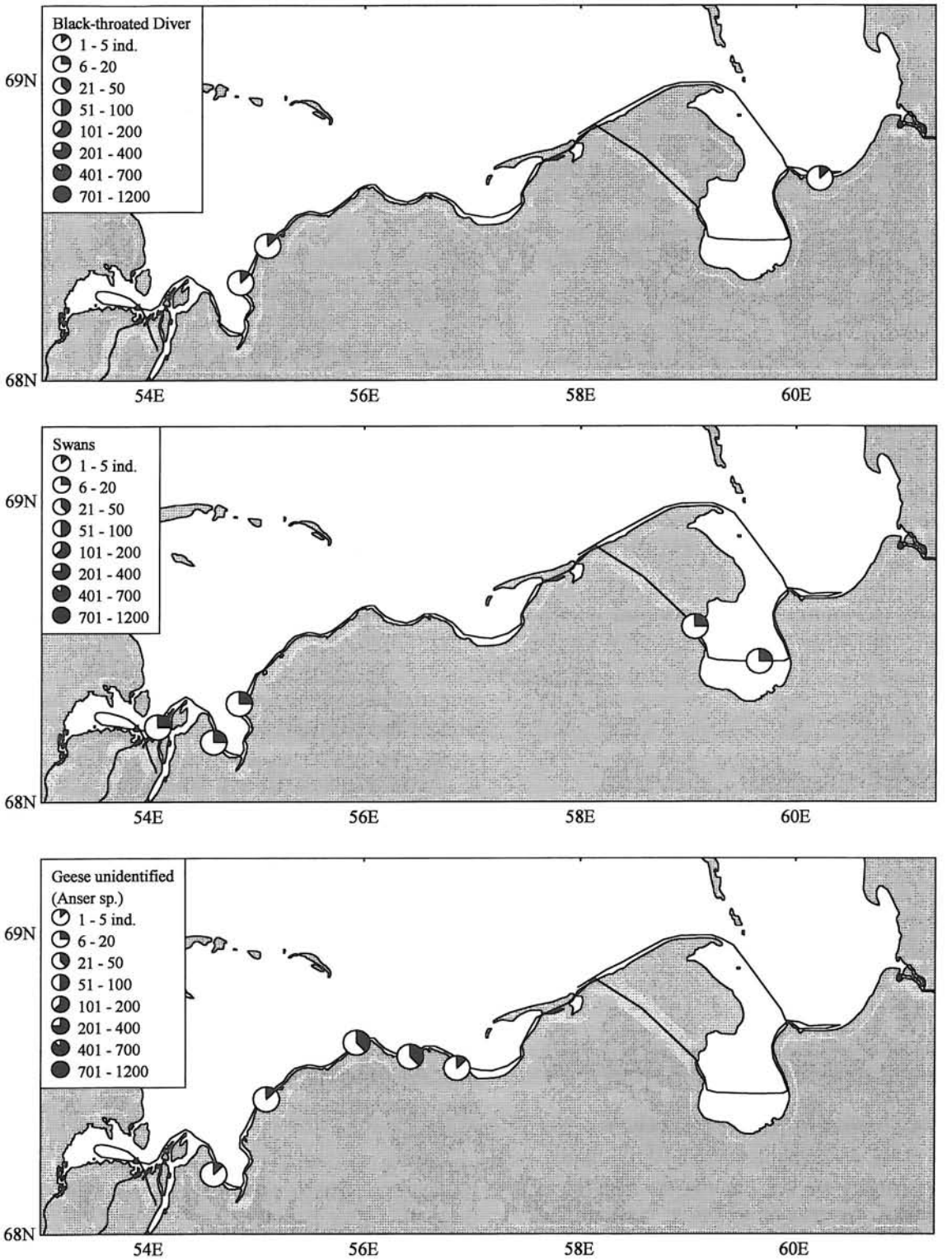


Fig. 1a-c. *The distribution of (a) Black-throated Diver* Gavia arctica*, (b) swans* Cygnus *spp., and (c) unidentified 'grey' geese (White-fronted Goose* Anser albifrons *or Bean Goose* Anser fabalis*) found during helicopter flights (flight routes shown). Note that the scale of the symbols is not proportional and that the positions of the symbols on the map not necessarily reflect the exact position where the observations were made (see text).*

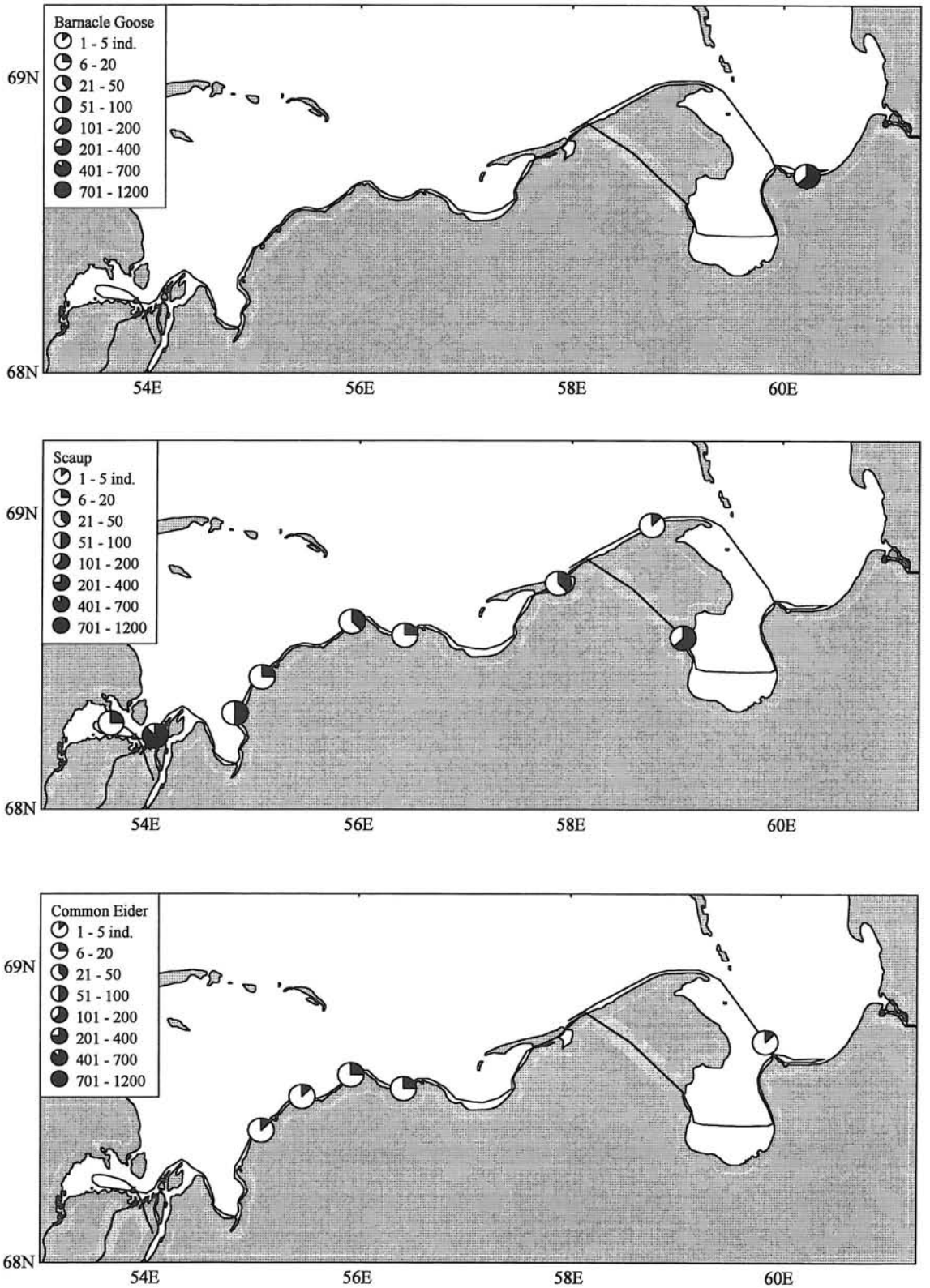


Fig. 2a-c. *The distribution of (a) Barnacle Goose* Branta leucopsis, *(b) Scaup* Aythya marila, *and (c) Common Eider* Somateria mollissima *found during helicopter flights (flight routes shown). Note that the scale of the symbols is not proportional and that the positions of the symbols on the map not necessarily reflect the exact position where the observations were made (see text).*

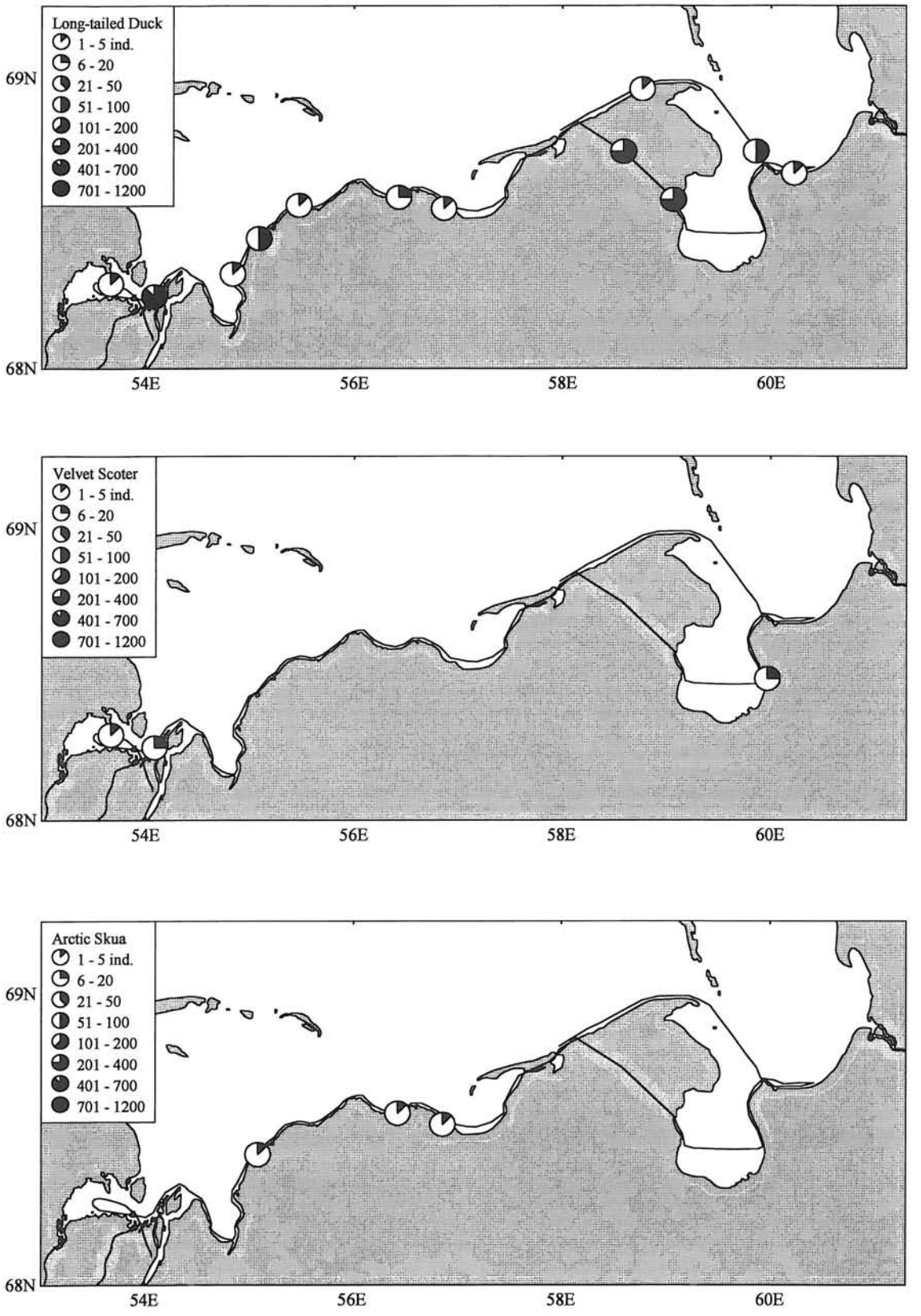


Fig. 3a-c. *The distribution of (a) Long-tailed Duck* Clangula hyemalis, *(b) Velvet Scoter* Melanitta fusca, *and (c) Arctic Skua* Stercorarius parasiticus *found during helicopter flights (flight routes shown). Note that the scale of the symbols is not proportional and that the positions of the symbols on the map not necessarily reflect the exact position where the observations were made (see text).*

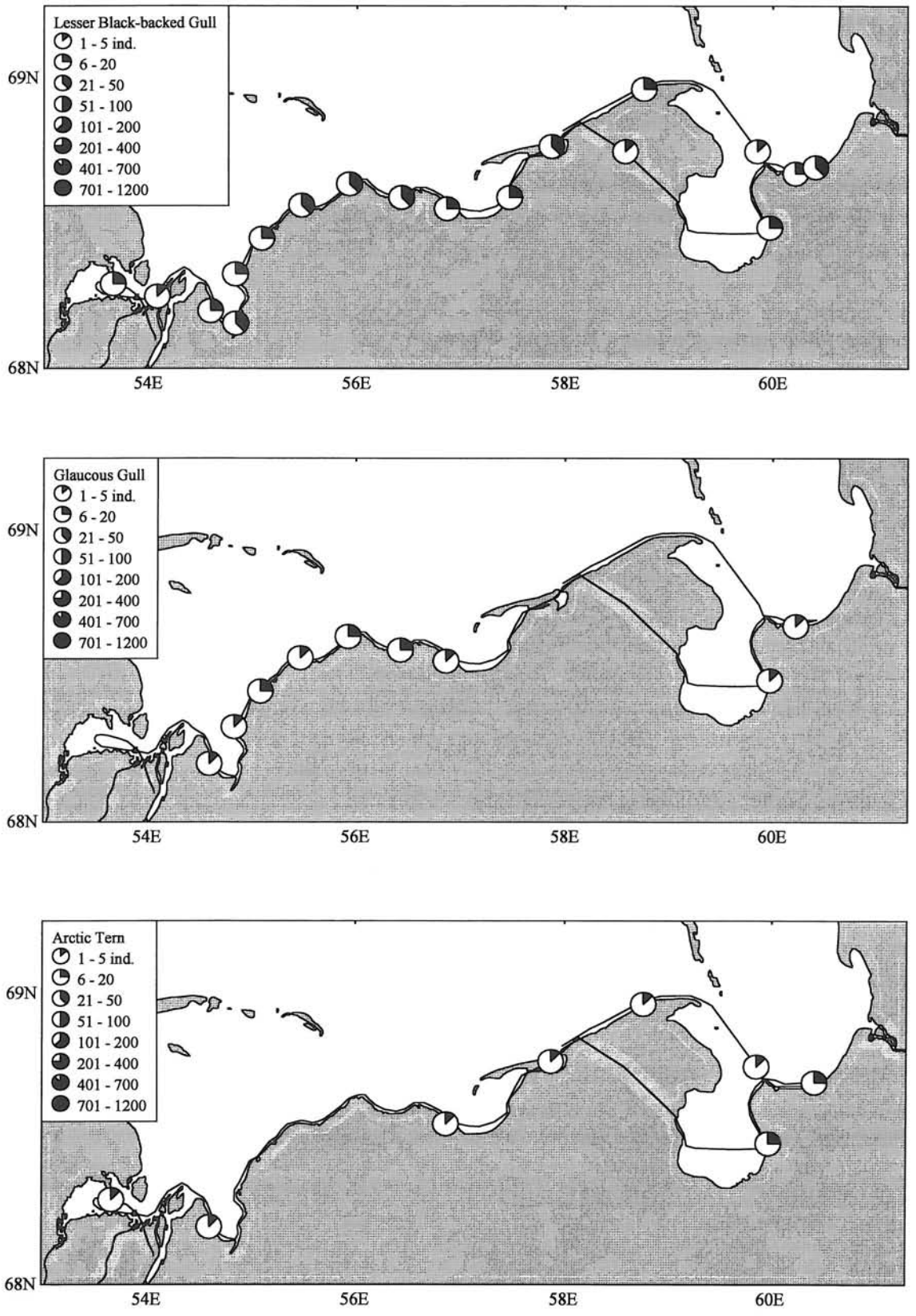


Fig. 4a-c. *The distribution of (a) Lesser Black-backed Gull* Larus fuscus heuglini, *(b) Glaucous Gull* Larus hyperboreus, *and (c) Arctic Tern* Sterna paradisaea *found during helicopter flights (flight routes shown). Note that the scale of the symbols is not proportional and that the positions of the symbols on the map not necessarily reflect the exact position where the observations were made (see text).*

APPENDIX 1 - SPECIES OF BIRDS AND MAMMALS MENTIONED IN THIS REPORT

(English - scientific - Norwegian - Russian)

DIVERS - GAVIIFORMES - LOMMER - GAGROOBRAZNYE
Black-throated Diver - *Gavia arctica* - Storlom - Chernozobaya gagara
White-billed Diver - *Gavia adamsii* - Gulnebblom - Beloklyuvaya gagara

TUBENOSES - PROCELLARIIFORMES - STORMFUGLER - TRUBKONOSYE
Fulmar - *Fulmarus glacialis* - Havhest - Glupysh

WILDFOWL - ANSERIFORMES - ANDEFUGLER - PLASTICHATOKLYUVYE
Bewick's Swan - *Cygnus columbianus bewickii* - Dvergsvane - Maly lebed
Whooper Swan - *Cygnus cygnus* - Sangsvane - Lebed'-klikun
Bean Goose - *Anser fabalis* - Sædgås - Gumennik
White-fronted Goose - *Anser albifrons* - Tundragås - Belologby gus'
Barnacle Goose - *Branta leucopsis* - Hvitkinngås - Beloshchekaya kazarka
Brent Goose - *Branta bernicla* - Ringgås - Chyernaya kazarka
Common Teal - *Anas crecca* - Krikkand - Chirok-svistunok
Pintail - *Anas acuta* - Stjertand - Shilikhvost'
Scaup - *Aythya marila* - Bergand - Morskaya chernet'
Common Eider - *Somateria mollissima* - Ærfugl - Obyknovennaya gaga
King Eider - *Somateria spectabilis* - Praktærfugl - Gaga-grebenushka
Long-tailed Duck - *Clangula hyemalis* - Havelle - Moryanka
Common Scoter - *Melanitta nigra* - Svartand - Sin'ga
Velvet Scoter - *Melanitta fusca* - Sjøorre - Turpan
Red-breasted Merganser - *Mergus serrator* - Siland - Dlinnonosy krokhal'
Goosander - *Mergus merganser* - Laksand - Bol'shoy krokhal'

HAWKS - ACCIPITRIFORMES - HAUKEFUGLER - YASTREBINYE
Rough-legged Buzzard - *Buteo lagopus* - Fjellvåk - Mokhnonogiy kanyuk
Golden Eagle - *Aquila chrysaetos* - Kongeørn - Berkut

FALCONS - FALCONIFORMES - FALKER - SOKOLINYE
Merlin - *Falco columbarius* - Dvergfalk - Derbnik
Peregrine Falcon - *Falco peregrinus* - Vandrefalk - Sapsan

GAMEBIRDS - GALLIFORMES - HØNSEFUGLER - KUROOBRAZNYE
Willow Grouse - *Lagopus lagopus* - Lirype - Belaya kuropatka

WADERS, GULLS, AUKS & ALLIES - CHARADRIIFORMES - VADE-, MÅKE- & ALKEFUGLER - RZHANKOOBRAZNYE
Ringed Plover - *Charadrius hiaticula* - Sandlo - Galstuchnik
Golden Plover - *Pluvialis apricaria* - Heilo - Zolotistaya rzhanka
Sanderling - *Calidris alba* - Sandløper - Peschanka
Little Stint - *Calidris minuta* - Dvergsnipe - Kulik-vorobey

Temminck's Stint - *Calidris temminckii* - Temmincksnipe - Belokhvosty pesochnik
Curlew Sandpiper - *Calidris ferruginea* - Tundrasnipe - Krasnozobik
Dunlin - *Calidris alpina* - Myrsnipe - Chernozobik
Ruff - *Philomachus pugnax* - Brushane - Turukhtan
Common Snipe - *Gallinago gallinago* - Enkeltbekkasin - Obyknovenny bekas
Spotted Redshank - *Tringa erythropus* - Sotsnipe - Shchyegol'
Wood Sandpiper - *Tringa glareola* - Grønnstilk - Fifi
Red-necked Phalarope - *Phalaropus lobatus* - Svømmesnipe - Kruglonosy plavunchik
Pomarine Skua - *Stercorarius pomarinus* - Polarjo - Sredniy pomornik
Arctic Skua - *Stercorarius parasiticus* - Tyvjo - Korotkokhvosty pomornik
Long-tailed Skua - *Stercorarius longicaudus* - Fjelljo - Dlinnokhvosty pomornik
Common Gull - *Larus canus* - Fiskemåke - Sizaya chayka
Lesser Black-backed Gull - *Larus fuscus heuglini* - Sildemåke - Vostochnaya klusha/Serebristaya chayka
Glaucous Gull - *Larus hyperboreus* - Polarmåke - Burgomistr
Kittiwake - *Rissa tridactyla* - Krykkje - Moevka
Arctic Tern - *Sterna paradisaea* - Rødnebbterne - Polyarnaya krachka
Brünnich's Guillemot - *Uria lomvia* - Polarlomvi - Tolstoklyuvaya kayra

OWLS - STRIGIFORMES - UGLER - SOVOOBRAZNYE
Snowy Owl - *Nyctea scandiaca* - Snøugle - Belaya sova

PASSERINES - PASSERIFORMES - SPURVEFUGLER - VOROBYINOOBRAZNYE
Shore Lark - *Eremophila alpestris* - Fjellerke - Rogaty zhavoronok
Meadow Pipit - *Anthus pratensis* - Heipiplerke - Lugovoy konyek
Red-throated Pipit - *Anthus cervinus* - Lappiplerke - Krasnozoby konyek
White Wagtail - *Motacilla alba* - Linerle - Belaya tryasoguzka
Bluethroat - *Luscinia svecica* - Blåstrupe - Varakushka
Wheatear - *Oenanthe oenanthe* - Steinskvett - Obyknovennaya kamenka
Fieldfare - *Turdus pilaris* - Gråtrost - Ryabinnik
Redwing - *Turdus iliacus* - Rødvingetrost - Belobrovik
Lapland Bunting - *Calcarius lapponicus* - Lappspurv - Laplandskiy podorozhnik
Snow Bunting - *Plectrophenax nivalis* - Snøspurv - Punochka

RABBITS & HARES - LAGOMORPHA - HAREDYR - ZAITSEOBRAZNYE
Mountain Hare - *Lepus timidus* - Hare - Zayats-belyak

RODENTS - RODENTIA - GNAGERE - GRYZUNY
Brown Lemming - *Lemmus sibiricus* - Sibirlemmen - Obskiy lemming

CARNIVORES - CARNIVORA - ROVDYR - KHISHCHNYE
Arctic Fox - *Alopex lagopus* - Fjellrev - Pesets
Walrus - *Odobenus rosmarus* - Hvalross - Morzh
Ringed Seal - *Phoca hispida* - Ringsel - Kol'chataya nerpa
Bearded Seal - *Erignathus barbatus* - Storkobbe - Morskoy zayats

WHALES & DOLPHINS - CETACEA - HVALER - KITOOBRAZNYE
White Whale - *Delphinapterus leucas* - Hvithval - Belukha

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NORWEGIAN - RUSSIAN ENVIRONMENTAL CO-OPERATION THE SEABIRD EXPERT GROUP

The Agreement on Environmental Co-operation between Norway and USSR was signed in 1988 and later renegotiated between Norway and Russia in 1992. The Commission - the Joint Norwegian- Russian Commission on Environmental Co-operation - is chaired by the Ministry of Environment of the two parties and has annual meetings.

Working groups on different topics have been established in order to contribute to increased collaboration on environmental problems in general, and carry out programmes and projects on different fields (e.g. air pollution, the marine environment, radioactive pollution). The seabird expert group is part of the Working Group on Biodiversity.

The initial aim of the seabird expert group was to establish contact and collaboration between Norwegian and Russian research and management institutions. The expert group aims at contributing to the harmonisation and development of scientific methodology and databases. Furthermore, mapping of important seabird colonies, studies of threatened species and the conditions related to seabird habitats, e.g. environmental pollutants and food resources, are important items for the group. Several projects related to joint approaches have been initiated within the framework of the expert group during the last years.

Annual meetings the seabird expert group have been arranged since 1989. The delegations from the two countries involve seabird experts from several institutions. From Norway, the Norwegian Directorate for Nature Management has the co-ordinating role in the collaboration and chairs the delegations. From Russia, VNII Priroda plays the corresponding role. The expert group is chaired by:

Alexander Golovkin - VNII Priroda
Morten Ekker - Directorate for Nature Management

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