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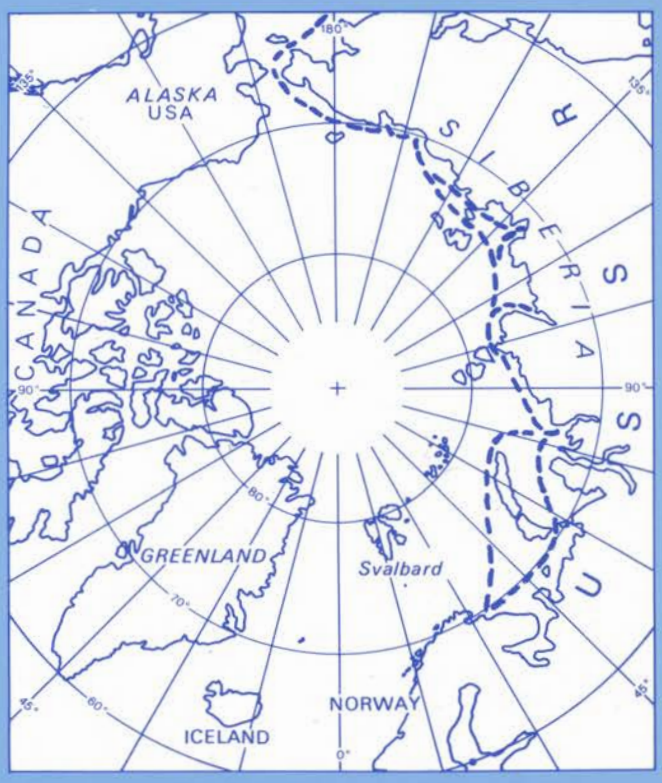
BENTE BREKKE • PER ESPEN FJELD

THE NORTHERN SEA ROUTE PROGRAMME ENVIRONMENTAL FACTORS

Introductory notes on available literature



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SUMMARY

The Northern Sea Route Programme, initiated in 1990, is an international programme assessing the economic, political, and environmental (biological and physical) aspects of increased shipping through the *Northern Sea Route*.

The present report is the result of Pilot Project I, Part B, Environmental Factors (biology). It includes an assessment of existing documentation of Soviet Arctic biology, a brief description of mammals and birds living in the Northern Sea Route, references to publications of Soviet Arctic ecology, and an introduction of personell and institutions within Arctic biology.

Due to commercial interests, biological research by Norwegian, Soviet, and American scientists has in general been extensive in the Barents Sea and Bering Sea Areas. On a lesser scale, biological research, mainly Soviet, has been carried out in the waters between these seas - the Kara, Laptev, East Siberian and Chukchi Seas. Because this research is published in Russian, it has not been accessible for this Pilot Project. Distribution and estimates of populations have only been found for some species, mainly marine mammals, and these are often outdated.

Further literature study is needed, particularly concerning Soviet publications. The Soviet publications must also be translated and made accessible to the Programme.

BACKGROUND OF THE *NORTHERN SEA ROUTE PROGRAMME*

In his political statements in 1987, Mikhail Gorbatsjov presented a policy which opened the possibility of commercial shipping through the Northern Sea Route (Northeast Passage; Fig. 1). As a consequence of this, Igor Orlov and his colleagues from the *USSR Ministry of Merchant Marine*, visited the *Fridtjof Nansen Institute* to discuss the possibility of a cooporative project concerning the environmental, economic, and political aspects of increased shipping through the Northern Sea Route. In 1990 a cooporative project was initiated. The *Central Marine Research and Design Institute* (*CNIIMF*) in Leningrad and the *Fridtjof Nansen Institute* in Oslo are the principal coordinators. The programme was called **THE FUTURE OF THE NORTHERN SEA ROUTE AS AN INTERNATIONAL TRANSPORT AND COMMUNICATIONS LINK** (NSR-project). Three Pilot Projects were formulated, to investigate the environmental (physical and biological), economic, and political factors of the open Northern Sea Route policy. The present report focusses on the results of Pilot Project I, Part B, Environmental Factors.

Pilot Project I, Part B began 1 December, 1990, with a duration of four to six months. Its objective was to present existing ecological data concerning the coast of the Soviet Union, and to assess the possibility of using these data in a later stage of the project. Special care has been taken to present data concerning the distribution and quantity of mammals, birds, fish, benthos and plankton, and also the level of pollution in the area. In addition the report lists Soviet institutions working with Arctic biology.

Project coordinator of the *NSR-project Environmental Factors* is the *Norwegian Polar Research Institute (NP)*.

The NSR-project is financed by:

Norsk Hydro
Royal Norwegian Council for Scientific and Industrial Research
The Ministry of Environment
The Ministry of Foreign Affairs
Finnmark County
The Norwegian Shipowners' Association.

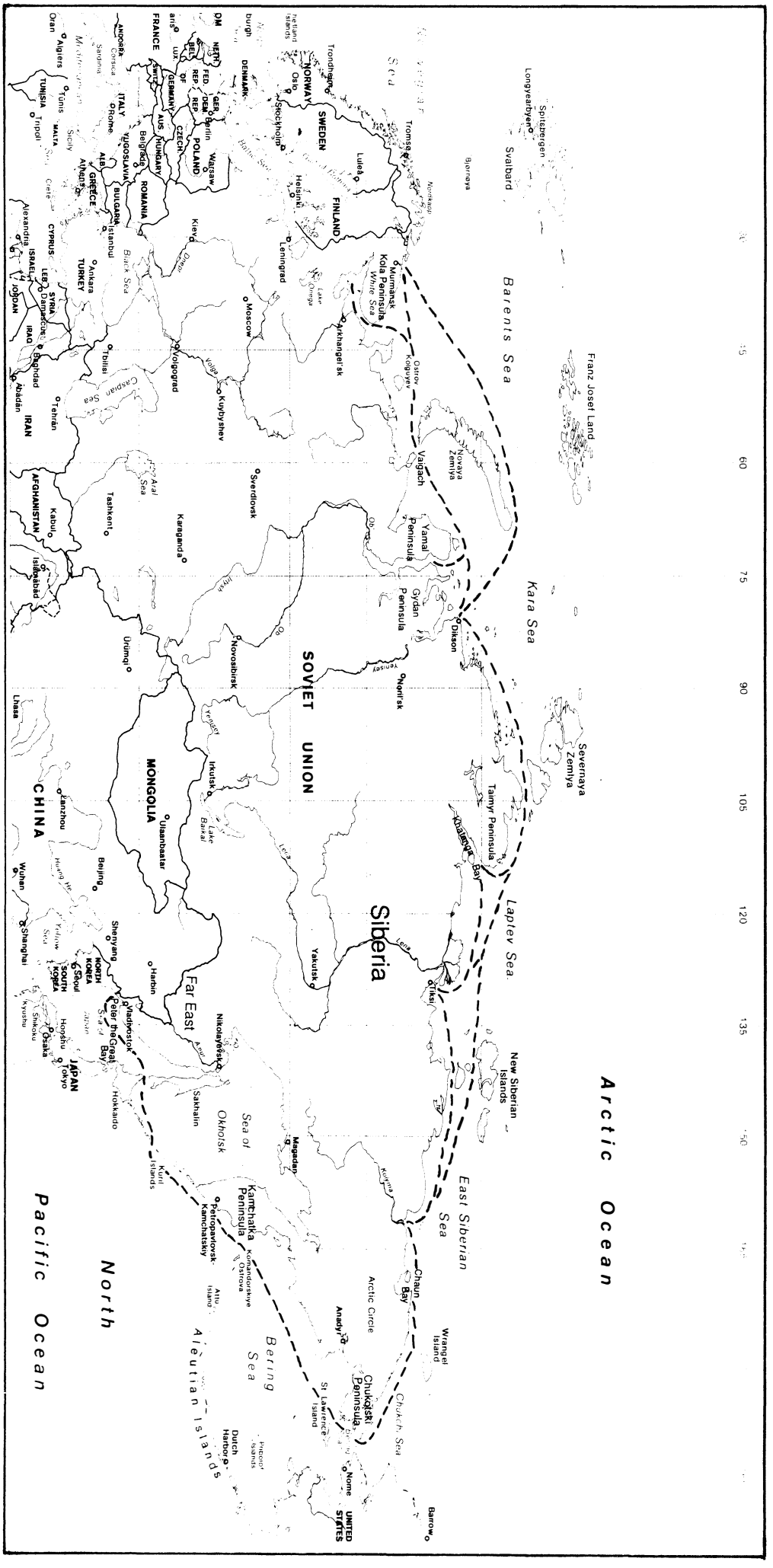

Figure 1 The Northern Sea Route. The most used shipping routes are marked.

BACKGROUND OF PILOT PROJECT I, PART B: *ENVIRONMENTAL FACTORS*

Arctic nature is extremely vulnerable to injury by man due to factors such as low species diversity, a short reproduction season, a low reproduction rate, and severe climatic conditions. Animals and plants living in the Arctic regions are highly specialized for the Arctic climate, and the smallest environmental impact introduced by man may threaten their survival.

The species in Arctic areas are strongly dependent upon each other, and their relationship may be presented in relativly simple food-webs. Significant changes in numbers and distribution of one species may have large impacts on the whole ecosystem (Furness & Monaghan 1987; Kaliakine 1990). We have, during the past few years, seen examples of this in the Barents sea, i.e. with the large reduction of the capelin (*Mallotus villosus*) population.

Plankton - the *primary producers* of the sea - and benthos (bottom living organisms) accumulate pollutants such as heavy metals and hydrocarbons which are products of increasing industrial activity and increased sea traffic (Hart & Fuller 1979). When animals of higher trophic levels in the food-web (i.e. species of mammals and birds) consume plankton/benthos or other animals that feed upon plankton/benthos, they may accumulate contaminants in such quantities that it results in death or supression of vital activity (Savinova 1990). Mammals, birds, and fish may also be directly affected by the noise, disturbing activity, oilspills and garbage dumping that increased shipping may cause (Davis et al. 1990; Madsen 1984; Matishov 1990; Novosolov pers.com., Severinsen 1990). Increased shipping traffic also represent a threat to the human population. When we consume polluted fish, shrimp, whalemeat and moluscs, we accumulate the same pollutants in our bodies.

Nature conservation and protection programmes require comprehensive knowledge about the components of nature and the effect of human impact upon them. The aim of the extended *Environmental Factors Project* is to produce an environmental atlas for the marine and near-shore parts of the Northern Sea Route, and to assess man made impacts and disturbances caused by increased traffic in the area. Nature conservation and management in this region should be based on experience from similar developments in similar areas.

ENVIRONMENTAL FACTORS

The Northern Sea Route, translated from Russian, is the name the Soviet people use to refer to their Arctic waters. In this report the Northern Sea Route is used as an indication of locality.

To be able to consider our present biological environmental knowledge of the Northern Sea Route, the present project attempts to map previous ecological research carried out in the marine and near-shore parts of the area. With this information it will be possible to evaluate the need of future fieldwork necessary to make an environmental atlas of the Northern Sea Route. In this Pilot Project, both the area and the number of species considered to be affected are broadly defined. In a continued *Northern Sea Route Programme*, affected species will be selected from this presentation, among other reasons in light of their abundance, their vulnerability to increased shipping, and existing protection measures. The affected area will also be more precisely defined.

In order to make an environmental impact assessment, several aspects need to be clarified, for example the present status of species diversity and distribution, population number and seasonal changes, and the species vulnerability and existing management.

Pollutants are known to spread globally by way of air and water currents, and by watercourses. They have been found in high Arctic regions remote from human activity, transported from industrial areas several thousand kilometers away (Melnikov 1990). Military activity such as nuclear test explosions and the dumping of military waste products in the sea may have caused additional stress on the environment. The effects of present pollutants may not be visible to us until after several years. To be able to determine cause and effect in the case of environmental change after increased shipping traffic, it is therefore important to know the present level of pollution in the Arctic environment.

The first stage in an environmental impact assessment is to search for and evaluate current data on biological components and pollutants. This has been the objective of Pilot Project I, Part B, *Environmental Factors*. The results are presented in this report.

A project plan for a full scale environmental impact assessment has not yet been made, but a preliminary plan and budget for a five-year period is presented in Appendix 1. Concrete preparations have been made concerning vessel and land based field groups. Agreements have been made with Soviet scientists and institutions, and field work can be initiated at short notice. Central in the organisation of field work within the Soviet Union is the Polish Academy of Sciences. This institute is preparing a biological map which will present fauna and human impact data form the Barents Sea, collected by Matishov, *Murmansk Marine*

Biological Institute. Although not completed in time to be included in this report, this map holds information of importance to the *Northern Sea Route Programme*. It marks areas of marine mammals, bird cliffs, fish stocks, shell scraping, nuclear test explosions, military waste dumping, among others.

METHODS

To view our current knowledge about the biological environment and to learn about future plans within biological research in the Northern Sea Route the *Environmental Factors Pilot Project* was divided into three sub-divisions:

- a literature study,
- interviews with Soviet scientists working with Arctic biology,
- the distribution of questionnaires to Arctic biologists in several countries.

Literature study

Bibliographies and English language or translated Russian articles from scientists working at the *Norwegian Polar Research Institute*, were used as a starting point for the literature study. Arctic biologists were also contacted for ideas of further contacts and they contributed with a number of articles, reports and manuscripts of interest. There has not been room for translations of Soviet papers into English in this Pilot Project, and I have therefore concentrated the literature study on publications in English.

Interviews with Soviet Arctic biologists

Soviet Arctic biologists were interviewed about

- what they are, and have been working with,
- what their colleagues are, and have been working with,
- what biological research has to date been carried out in the Soviet Arctic,
- their recommendation as to whom should be contacted for further information.

The interviewer travelled to Moscow, Leningrad and Murmansk. 13 institutions were visited and 28 scientists were interviewed (Appendix 2). Unfortunately, most of these meetings were arranged at short notice so that the scientists had little time to prepare a presentation of their work and literature lists covering biological research in the Soviet Union.

Distribution of questionnaires to Arctic biologists

Questionnaires (Appendix 3) were distributed to reach as many Arctic biologists as possible. In general, they had the same aim as the interviews. They were issued to researchers in Norway, Denmark, Finland, Great Britain, Poland, Germany, the United States (Alaska in particular), Canada, Japan, and in the Soviet Union. The questionnaires given to the Soviet scientists were in Russian, while the rest received English forms. Appendix 4 lists the Soviet scientists who received questionnaires. This list is incomplete since names and adresses written in Russian have not been included.

RESULTS

The Soviet Union has until recently placed restrictions on research results from the high Arctic, probably because the high Arctic is considered a military area. Though Arctic biological research has been published in Russian journals, little has appeared in foreign journals. During the past few years the number of publications by Soviet scientists in foreign journals has increased, as well as the degree of cooperation between Soviet researchers and researchers from other countries. However, the fact that most biological data are either published in Soviet journals or protected in some way has rendered collection of data about the biological environment of the Northern Sea Route problematical.

Literature study

A number of articles, reports, manuscripts, and references to articles have been found. These report on abundance and distribution during different seasons througout the Northern Sea Route of most cetaceans and pinnipeds, of the polar bear, and of the sea otter. Major recent collections of papers such as **Marine mammals** (Aristov et al. 1990) are unfortunately written in Russian and are thus inaccessible for this pilot project. Some papers used to view the general fauna may therefore be somewhat out of date. Papers reporting the status of seabirds and near-shore terrestrial birds and mammals (waders, geese, swans, reindeer, wolf, artic fox) seem to be poorly represented, as are papers on the ecology of fish, benthos and plankton species. Following is a short description of the mammals and birds living in and near the Arctic waters of the Soviet Union. Information about fish, benthos and plankton is limited and will not be presented here.

Fish species of the Soviet Arctic waters are described in Andriyashev's book *Fishes of the Northern Seas of the USSR*. In addition to a description of the morphology, brief information on life history and distribution is given. In general, little is known about fish stocks, and only areas where commercial fishing occurs and which are thus of economical impotance have been investigated. The Barents Sea fish stocks

are as such investigated mainly by Norwegian and Soviet institutions, with annual reports about population and catch sizes. Except for the above mentioned book, no documentation of fish stocks inhabiting waters east of the Barents Sea have been found. Documentation probably also exists concerning fish stocks in the North Pacific/Bering Sea area.

Benthos and plankton investigation has generally only been carried out in the Barents Sea and in the Seas south of the Bering Strait. Water samples for contamination analysis have often been taken in connection with plankton research.

Appendix 5 lists references to papers and books dealing with the biological environment of the Northern Sea Route.

A brief description of the mammalian and bird life of the Northern Sea Route region follows below. Distribution and population numbers are given if they were found in the literature. References are given at the end of each section.

MARINE MAMMALS

Marine mammals include cetaceans, pinnipeds, the polar bear and the sea otter.

CETACEANS

Toothed whales

Of cetaceans inhabiting the Northern Sea Route, the **Beluga whales** ***Delphinapterus leucas*** have been particularly well-investigated. They are the most common cetaceans of Arctic waters, and are found along the coasts of the Soviet Union, Alaska and Canada during summer. They are presumed to move offshore during the period mid-July to October. Wintering areas are located near the ice edge or in polynyas where they can breathe. Recognized wintering areas of the Northern Sea Route are the Barents, Bering, Chukchi and Okhotsk Seas. In March, April and May they move from offshore wintering areas toward coastal summering areas. Breeding takes place in late winter and early spring areas. (Belikov et al. 1989; Belikov et al. 1984; FAO 1978; Kotlyakov & Sokolov 1990; Lentfer 1988).

Narwhales ***Monodon monoceros*** and **Killer whales** ***Orcinus orca*** inhabit Arctic waters. While the Narwhale is a strictly Arctic species, often seen in the waters of northern Canada, Killer whales are more often found further south. Both have been observed occasionally in the waters around Franz Josef Land. Research on

these species in the Northern Sea Route seem to be poor. (Belikov et al. 1989; Belikov et al. 1984; FAO 1978; Kirkevold & Lockard 1986).

Baleen whales

Bowhead whales *Balaena mysticetus* have been found in two regions of the Northern Sea Route.

1) The waters around Franz Josef Land, Novaya Zemlya and Severnaya Zemlya: These animals might be remnants of the Svalbard population believed to be extinct. Accidental observation, and are not known to inhabit this area.
2) The Chukchi, Bering and Beaufort Seas: These animals move northwards in spring and southwards in autumn. Census studies of spring migration of this population are annually conducted in Pt. Barrow, Alaska, but some animals also move north along the Soviet coast.

The species has been poorly studied. No recent population estimates. (Belikov et al. 1989; Belikov et al. 1984; FAO 1978; Kotlyakov & Sokolov 1990).

The **Blue whale *Balaenoptera musculus*** was exploited almost to extinction in the past, and has been completely protected in the North Atlantic and Arctic since 1960. There is little information on this species. In the Atlantic Ocean they range, or have ranged, from the ice edge in the north to the Cape Verde Islands off the west coast of Africa in the south. Discrete breeding populations have been recognized in the waters of the Greenland, the Barents and the Norwegian Seas. No recent population estimates. (FAO 1978).

In the North Atlantic Ocean, **Fin whales *Balaenoptera physalus*** have been observed as far south as 20°N, and north to 80°N, 11°E in the Greenland Sea. They undoubtedly migrate north during spring and south during autumn, but have been caught simultaneously in the summer months off the coast of Portugal and at the ice edge in the high Arctic. Several breeding populations exist. In the Northern Sea Route region they breed in the Arctic eastern North Atlantic and off north Norway and further west off east Greenland and west Iceland. Blue whales migrate to Arctic (and Antarctic) waters during spring, returning to more temperate waters during autumn. No recent population estimates. (FAO 1978).

The ecology of **Sei whales *Balaenoptera borealis*** and **Minke whales *Balaenoptera acutorostrata*** are poorly documented in literature. Both species inhabit the North Atlantic Ocean and seas north of this. While Sei whales do not usually range north of 72°N, the Minke whales inhabit northern waters and are limited in the north by the ice edge. Very little is known about breeding populations of Sei whales, while Minke whales are known to range in the east Greenland-Iceland-Jan Mayen area and the region from Svalbard, the Barents Sea, and along the Norwegian coast. Different populations may occur in northern North

Atlantic waters during the summer feeding migration. Most data on their distribution are catches from whalers log-books. No recent population estimates. (FAO 1978).

There are two **Grey whale** ***Eschrichtius robustus*** populations in the Pacific Ocean, the *Californian* and the *Korean*. The last individual of the Korean population was seen in 1974, so it might be extinct. The Californian population, however, numbers about 11.000 (±2.000) animals. They spend their summer mostly in the northern Bering Sea, the southern Chukchi Sea and the southwestern Beaufort Sea. The greatest threat to the stock at present is the increasing industrial development and vessel traffic in the calving lagoons. No recent observations elsewhere in the Northern Sea Route. Poorly investigated. (FAO 1978; Kotlyakov & Sokolov 1990).

The **Sperm whales** ***Physeter macrocephalus*** are found in both the North and the South Pacific Ocean. In the North Pacific, three populations are assumed to exist, the western, central, and eastern. In the Northern Sea Route, Sperm whales inhabit Japanese coastal waters and waters off the Aleutians. The information on this species is limited. No population estimates. (FAO 1978).

PINNIPEDS

Walruses ***Odobenus rosmarus*** are generally divided into two subspecies, the **Pacific walrus** ***O. r. divergens*** (about 80% of the world walrus population) primarily inhabiting the Chukchi and Bering Seas, and the **Atlantic walrus** ***O. r. rosmarus*** found from Hudson Bay and the eastern Canadian Arctic to Greenland, Svalbard, and the Barents and Kara Seas. A third subspecies is recognized by some Soviet scientists, namly the **Laptev walrus** ***O. r. laptevi*** which inhabits the Laptev Sea. This subspecies is otherwise included in the Pacific walrus subspecies because of morphological similarities.

The Laptev walrus population is the most numerous, estimated at about 140.000 animals. The Canadian/west Greenland population is estimated at about 10.000 individuals, the east Greenland, Svalbard, Barents and Kara Seas population to a few thousand animals, and the Bering-Chukchi population holds somewhat more than 3.000 walruses.

The pattern of walrus migration is generally assosiated with movments of the pack ice on which walrus spend the winter near the ice edge or polynyas. During the Arctic spring, when the ice breaks up, the walruses move towards the coast where they stay the entire summer, partly in water, partly resting on haul-out sites. They gather in huge herds on the haul-out sites. In early July 1984 59.000 walruses were counted on the Rudder and Meechken haulouts in the Anadyr Gulf. Walruses leave the haul-out sites in the autumn when the sea ice freezes, moving towards their wintering areas near the ice edge. (Belikov et al.

1989; Belikov et al. 1984; FAO 1978; King 1983; Kotlyakov & Sokolov 1990; Lentfer 1988; Nazarenko 1982).

Ringed seals ***Phoca hispida*** are probably the most abundant seal in the Arctic Ocean, and separate populations have been divided into several subspecies. They inhabit all seas of the Soviet Arctic (Barents, White, Kara, Laptev, East Siberian, Chukchi, and Bering Seas) and the Sea of Okhotsk in the south. They are observed in coastal areas as well as in areas of drift ice of the central Arctic and along the coast of small islands and large archipelagoes. The distribution and abundance of ringed seals in the East Siberian and Chukchi Seas are poorly known. They are observed near the ice edge during winter. During the winter pupping period they are mainly found on the sea ice. When the ice withdraws, the seals stay along coastal inlets, spending much time in the water. They tend to be solitary in distribution, but they congregate during the moulting period in mid to late June. (Belikov et al. 1989; Belikov et al. 1984; FAO 1978; King 1983; Kotlyakov & Sokolov 1990; Lentfer 1988; Nazarenko 1982).

The **Harp seal** ***Phoca groenlandica*** is distributed off the coasts of European USSR, Greenland, and Canada. Three populations are recognized, breeding on the pack ice in the White Sea, around Jan Mayen, and around Newfoundland. During January-February the White Sea population concentrate in huge herds on the ice in the White Sea. During reproduction and moulting they migrate passively with the drifting ice from the middle part of the White Sea into the Barents Sea. In spring (middle/end of May) they leave the ice and migrate actively into the Barents and Kara Seas. During summer to autumn they stay in the pre-fringe zone of ice in the Barents and Kara Seas. Groups of animals are found in the waters of western Svalbard, in gulfs and straits of Franz Josef Land, off northern Novaya Zemlya and in straits of Severnaya Zemlya. Autumn migrations are located mainly along the eastern and western shores of Novaya Zemlya, and late autumn migrations near the coast of the Kapin Peninsula. Estimates of the White Sea population vary between 500.000 and 800.000 animals. (FAO 1978; King 1983; Kotlyakov & Sokolov 1990; Lavigne & Kovacs 1988).

Several subspecies of the **Harbour seals** ***Phoca vitulina***, also known as **Common seals**, are recognized: the eastern and western Atlantic Harbour seals, and the two Pacific Harbour seals. Information about the status and distribution along the north coast of the Soviet Union is limited. The Atlantic Harbour seals do not breed in the Soviet Union. The two Pacific sub-species of the harbour seal differ from one another by their degree of ice-contact. ***P. v. richardsi*** never has ice contact. It occurs along the coast from California to Alaska, the Aleutian Islands, and in the eastern Bering Sea it reaches the Pribilof Islands and Bristol Bay. The total population from California to Alaska is estimated to be 300.000 animals. ***P. v. kurilensis*** may have contact with ice in the spring, and occurs from the north of Hokkaido, northward along the Kuril Islands and eastern Kamchatka to the Komadorskiye Island. (FAO 1978; King 1983; Kotlyakov & Sokolov 1990; Lentfer 1988).

Larga seals (or **Spotted seals**) ***Phoca largha*** are by some scientists regarded as a separate species, by others as a sub-species of the Harbour seal (King 1983; Lentfer 1988). They are found in the Bering and Chukchi Seas, the Arctic coast of Alaska and the Sea of Okhotsk. As far as is known, breeding is restricted to the Bering and Okhotsk Seas and the Po Hai Sea. Larga seals haul-out on drift ice for breeding and moulting mainly in the eastern Bering Sea and northern Sea of Okhotsk. During the breeding season the seals migrate passively with the ice. Before moulting they actively search for firm ice flows. When the ice melts, they move nearer to the coast. In autumn, they form rockeries on shore that sometimes number as many as 2.000-3.000 animals. With the first appearance of ice they move offshore again. Current knowledge about the population size is poor. Estimates have varied between 133.000 and 250.000 for the Bering population, and 135.000-200.000 for the Sea of Okhotsk. No data has been found for the Po Hai Sea population. (FAO 1978).

Hooded seals ***Cystophora cristata*** breed west and east of Greenland, 80-90% of the total population in the Jan Mayen area east of Greenland. The total population estimate is 500.000-600.000 individuals. In Soviet waters they breed in negligible numbers around the White Sea. The Hooded seals congregate in June and July, disperse at the end of summer and are apparently solitary until the pupping period the following March. (FAO 1978; King 1983; Lavigne & Kovacs 1988).

The **Ribbon seal** ***Phoca fasciata*** is a poorly studied seal species that is found in the North Pacific Ocean. They are most common in the Bering and Okhotsk Seas, but also range into the Chukchi, East Siberian and western Beaufort Seas. They breed only on the pack ice of the Bering and Okhotsk Seas, and seem to prefer clean (white) ice. They tend to be 50-250 km offshore during the pupping and nursing periods in April and May, and they move closer to the shore during the moult in May to mid-July. During summer, ribbon seals disappear from the Sea of Okhotsk, but increase in numbers in the Bering Sea. It has been speculated that they migrate northward into the Chukchi and Beaufort Seas in spring, and southward in autumn, or that they become pelagic mainly in the Bering Sea during summer. The population of ribbon seals is about 240.000. The Bering Sea population holds about 100.000 animals, and the Sea of Okhotsk 140.000. (FAO 1978; King 1983; Kotlyakov & Sokolov 1990; Lentfer 1988).

The **Bearded seals** ***Erignathus barbatus*** are common in Arctic waters, and circumpolar in distribution. They are present in all waters of the Northern Sea Route. They are generally found in shallow waters that at least are seasonally ice covered. During winter they are mostly found in broken pack ice and in some areas they also inhabit shorefast ice. During summer they haul out on land in the Okhotsk, Laptev and White Seas. Breeding takes place in March and April, moulting from the end of April to the beginning of August. Estimates for the Bering population (East Siberia, Chukchi, Bering, Okhotsk and Japan Seas) vary from 250.000 to 450.000 animals. There are no estimates for the rest of the stock. (FAO 1978; King 1983; Kotlyakov & Sokolov 1990; Lentfer 1988).

The **Grey seal** *Halichoerus grypus* population of the Soviet Arctic is at about 1.000-2.000 animals, and is located on the Murman coast near the mouth of the White Sea. They congregate during the breeding season in spring, and disperse afterwards. They show no migratory movements. (FAO 1978; King 1983).

The **Alaskan** or **Northern fur seal** ***Callorhinus ursinus*** inhabits the North Pacific Ocean. Five populations have been recognized, and these breed on the Pribilof Island (pop. est. 1.300.000), the Commander Island (pop. est. 265.000), the Robben Island (pop. est. 165.000), the Kuril Islands (pop. est. 33.000) and the San Miguel Island (pop. est. 2.000). Generally, the fur seal move south to wintering areas in autumn, and back north in spring. (FAO 1978; King 1983; Kotlyakov & Sokolov 1990).

Northern (Steller) sea lions ***Eumetopias jubatus*** range throughout the Pacific rim from the Channel Islands off southern California, and northern Honshu, Japan, and Korea, northward to the Bering Strait. The northernmost breeding colonies are found on Walrus Island in the Pribilof Islands. The sea lions are highly gregarious, and use traditional haul-out sites and rockeries, usually on remote and exposed islands. In the Northern Sea Route area, they breed from the Kuril Islands, north and west through the Aleutian and Pribilof Islands. The greater part of the breeding population is found in the Aleutian Islands. Breeding occurs between the end of May and late July. Dominant males establish breeding territories on rockeries in early May. Births occur from mid-May to mid-July, peaking in June, generally taking place at sites above high water and away from territorial males. Moulting begins the last week of July, and ends in early December. The most recent minimum estimate for the total Northern sea lion population is 230.000 animals (1984), about 200.000 of which are in Alaska. Unconfirmed estimates of the Soviet population are between 20.000 and 50.000 sea lions. (FAO 1987; King 1983; Lentfer 1988).

The **Californian sea lion** ***Zalophus californianus*** has inhabited the Sea of Japan, but may now be extinct in those waters. However, it still inhabits Californian waters and waters around the Galapagos Islands. The three populations have been given subspecific names. (FAO 1978).

SIRENIANS

The total population of **Steller sea cows** ***Hydrodamalis gigas*** was hunted to extinction within 30 years of their discovery in the Bering Sea in 1741. (FAO 1978).

MARINE-TERRESTRIAL MAMMALS

The **Sea otter** ***Enhydra lutris*** is a marine member of the family Mustelidae. It inhabits shallow coastal waters of the North Pacific Ocean and the southern Bering Sea. Sea otters were hunted almost to

extinction during the 17- and 1800's, but protection in this century allowed some remnant groups to increase. The population is now estimated to number between 112.000 and 164.000 animals (estimations by several scientists between 1976 and 1987). The distribution data for many areas are not recent and should be viewed cautiously.

Sea otters occupy the southeast coast of Sakhalin Island, the north coast of Hakkaido, the Kurils, the Commander and Medny Islands, the Aleutian Islands, the Alaskan Peninsula, Kodiak Island, Prince William Sound, the west coast of Canada, and the coast of Monterey, California. 90% of the population lives in coastal Alaskan waters. (FAO 1978; Lentfer 1988).

Polar bears *Ursus maritimus* are solitary, migratory animals. They are circumpolar in distribution, and have been reported as far north as 88°N and as far south in the eastern Bering Sea as St. Matthew Island and the Pribilof Islands. In winter/spring they are commonly found in shorefast ice with deep snow drifts along pressure ridges, at the floe edge, and in areas of moving ice with 7/8 or more ice cover.

Three ecological-geographical groups are recognized:

The western group inhabits the Barents, Kara and Greenland Seas including the Svalbard, Franz Josef Land and Novaya Zemlya archipelagoes, apparently also the western part of Severnaya Zemlya. The population numbers between 3.000 and 5.000 animals. The main hibernation areas are located near the archipelagos, where the females also bear their pups and near the edge of the drift ice. On King Karl Land (Svalbard) 100-125 dens are recognized, on Franz Josef Land 100-150 dens and on Novaya Zemlya about 50 dens. In spring (April-May) the bears migrate to the north and east, during summer their distribution within the area is almost even, and in autumn (September-October) they mass migrate to the wintering areas. The western population of polar bears has increased in number within the last 10-15 years due to their complete protection in the USSR (1956) and Norway (1973).

The central group inhabits the Laptev Sea and western part of the East-Siberian Sea. This population is believed to be smaller than the western and eastern group. The main wintering area is near the Great Siberian Polynia (in the Laptev Sea). About 30-50 pregnant female dens are found on the Severnaya Zemlya islands, about 30 dens on the coast of the Taimyr Peninsula and adjacent islands, about 50 dens on the north New Siberian Islands, and about 20 dens on the inland coast of Yakutia and nearby islands. During summer the animals are distributed evenly within the area.

The eastern group inhabits the eastern part of the East-Siberian Sea, the Chukchi Sea and the northern part of the Bering Sea. The population numbers between 2.500 and 7.000 individuals. During winter the animals are concentrated near Wrangel Island, the Long Strait, and the southern part of the Chukchi Sea.

Main denning areas for pregnant females are Wrangel Island with about 200 dens, Herald Island with about 50 dens, and the coast of the Chukchi Sea and adjacent islands with about 60 dens. In spring (April-May) they migrate towards north-west, and return to the wintering areas in September-October. (Belikov et al. 1988; Lentfer 1988; Nazarenko 1982; Uspensky & Belikov ?).

TERRESTRIAL MAMMALS

Of terrestrial mammals, only species living in the coastal areas and the archipelagoes are considered. These are the reindeer, the wolf, and the arctic fox.

Reindeer ***Rangifer tarandus*** inhabit Novaya Zemlya (6.000-7.000 animals; Sage 1986), Severnaya Zemlya, and the New Siberian Islands (7.500-16.300 animals; Sage 1986) year round, but they are absent from Franz Josef Land, Wrangel Island, De-Long Islands, and some small islands along the coast of the Kara Sea. There is some migration between the islands and the mainland. Continental animals may during spring move north onto the islands, while insular animals sometimes move south in late autumn or early winter. Sometimes wolves drive reindeer away from their islands during winter. They also inhabit the Arctic tundra coast of the USSR mainland.

From 1900 to 1925 masses of reindeer (as many as 2.000 animals) migrated from the mainland to the New Siberian Island to spend the summer there. The number of summer migrating animals then decreased and by the end of the thirties there was practically no migration at all. Why the migration ceased is not clear, but increased hunting and the introduction of several research stations in the area may have had some influence. (Rutilevskij 1970).

The **wolf** ***Canis lupus*** is present on all islands except Franz Josef Land, the De-Long Islands, small islands of the Kara Sea and is practically absent from the Wrangel Island. In general they stay on the islands during the light time of year, moving south to wintering areas on the mainland in the autumn. Small numbers of wolves remain on the southern island of Novaya Zemlya, on Vajgac and on the New Siberian Islands. They feed mainly on reindeer, and may cause major decimation in reindeer populations of small islands like the Bel'kovskij Island. Wolves are shy animals vulnerable to human activity. (Rutilevskij 1970).

During the autumn, winter, and spring, **Arctic foxes** ***Alopex lagopus*** feed on reindeer carcases or follow polar bears, feeding on left-overs of their meals. In the summer they are often found underneath bird cliffs, where they eat eggs and chicks that fall out of the nests. During the autumn and winter months they occur practicaly everywhere; on land, on the ice of marginal seas, they are somtimes found even in the Central Arctic several hundred kilometers from nearest dry land. They have a high degree of adaptability to human activity. (Rutilevskij & Uspenskij 1957).

BIRDS

The following lists as far as possible the sea and near-shore birds of the Soviet Arctic. All information is from *Birds of the USSR* (Flint et al. 1984). Only areas of the Northern Sea Route are mentioned here, but most bird species are also found in other regions of the USSR. The place names given are areas of breeding, if not otherwise stated. The *Red Data Book* referred to for some species is the *Red Data Book* of the USSR, published in the Soviet Union. It lists threatened species of animals the Soviet Union. This book is different from both the *IUCN (International Union for Conservation of Nature and Natural Resources) Red Data Book series* and the *ICBP (International Council for Bird Preservation) Red Data Book*, covering the whole world.

GAVIA

Red-throated loon *Gavia stellata*

Northern part of European USSR, northern half of Siberia up to the the Chukotski and Kamchatka Peninsulas, Franz Josef Land, Novaya Zemlya, New Siberian and Wrangel Islands. Lakes in tundra and taiga. Often feeds in the sea (fish). Migratory.

Black-throated loon *Gavia arctica*

Northern half of the European USSR, Siberia (except southern regions), southern Novaya Zemlya. Lakes on tundra, forests, forest-steppe, steppe. Often feeds in the sea (fish). Migratory. Winters near shores of Kamchatka Peninsula, Sakhalin and Kuril Islands.

Yellow-billed loon *Gavia adamsi*

Northern regions of Siberia, southern Novaya Zemlya. Tundra and forest-tundra. Often feeds on fish in the sea. Now and then found in the Barents Sea during winter.

FULMARUS

Fulmar *Fulmarus glacialis*

Rocky sea coasts and islands, in open sea during nonbreeding season. Franz Josef Land, northern island of Novaya Zemlya, Sakhalin Island, Komandorskiye Islands, Kurils and a group of small islands in the basin of the Pacific Ocean. In many northern and eastern seas during migration. Common in places.

OCEANODROMA

Leach's storm-petrel *Oceanodroma leucorrhoa*
Inhabits islands and seashores. Offshore during migration. Kuril and Komandorskiye Islands. Winters in the Pacific Ocean. Uncommon.

Swinhoe's storm-petrel *Oceanodroma monorhis*
Islands in Peter the Great Bay near Vladivostok. Winters on the Pacific Ocean.

Fork-tailed storm-petrel *Oceanodroma furcata*
Islands, open sea during migration and winter. Sakhalin, Komandorskiye, Kuril, and some other islands of the Pacific Ocean. Winters in the Pacific. Common.

PHALACROCORAX

Great cormorant *Phalacrocorax carbo*
Near seas, large lakes and rivers. Shores of the southern Soviet Far East, northern coast of the Kola Peninsula.

Temminck's cormorant *Phalacrocorax capillatus*
Seashores of the Soviet Far East, Sakhalin Island and southern Kuril Islands. Feeds exclusively in the sea. Common in places.

Pelagic cormorant *Phalacrocorax pelagicus*
Shores of Chukotski Peninsula, Bering and Okhotsk Seas, Wrangel, Komandorskiye, Kuril and Sakhalin Islands. Feeds on fish and crustaceans in the sea. Common in places.

Red-faced cormorant *Phalacrocorax urile*
Shores of Komandorskiye Islands. Relatively rare.

European shag *Phalacrocorax aristotelis* (Red Data Book)
Northern shores of the Kola Peninsula.

CYGNUS

Whooper swan *Cygnus cygnus*

Northern regions of European USSR, western and eastern Siberia. Winters in the Barents and Okhotsk Seas. Noted near coast during migration. Not numerous.

Bewick's swan *Cygnus bewickii* (Red Data Book)

From Pechora Bay on the Kola Peninsula in the west to Chukotski Peninsula in the east. Winters on the Kamchatka Peninsula, Kuril Islands, southern Novaya Zemlya. During nonbreeding season prefers seas and large inland bodies of water. Migratory.

ANSER

Emperor goose *Anser canagicus* (Red Data Book)

Low seaside tundras, during nonbreeding season found on seashores. Migratory, very rare. Chukotski Peninsula (12.000-15.000 ind. in 1974; Sage 1986). Winters on the Aleutian Islands.

Snow goose *Anser caerulescens*

Greater *A.c.atlanticus* and Lesser *A.c.caerulescens* Snow goose. Wrangel Island. Winters in California. During migration on seashores. Rare, but common in places. Breeding colonies protected.

Greater white-fronted goose *Anser albifrons*

Tundras and forest-tundras in the European and Asian regions of the USSR, southern Novaya Zemlya. On seashores during migration. The most common goose in the USSR.

Lesser white-fronted goose *Anser erythropus*

Tundra and forest-tundra; also along the coast during migration. In northern European and Asian regions of the USSR.

Bean goose *Anser fabalis*

North in European USSR and West Siberia, southern Novaya Zemlya. During migration on seashores.

BRANTA

Brent goose *Branta bernicla*

Shores and islands of the Arctic Oceans from Novaya Zemlya to Chukotski Peninsula (all islands), shores of the Bering Sea. During migration on flat seashores. Protected.

Barnacle goose *Branta leucopsis* (Red Data Book)

Southern island of Novaya Zemlya, Vaigach and Kolgujev Islands. During migration on seashores.

Red-breasted goose *Branta ruficollis* (Red Data Book)

Southern regions of the Taimyr, Gydan and Yamal Peninsulas. During migration on seacoasts, inland water or steppe. Breeds only in the USSR. 22.000-27.000 ind. in 1978 and 1979 (Sage 1986).

ANAS

Green-winged teal *Anas crecca*

Greater part of the USSR, southern Novaya Zemlya. During migration on seashores. One of the most common ducks in the USSR.

SOMATERIA

Common eider *Somateria mollissima*

Seashores and islands of the northern European USSR including Novaya Zemlya and Franz Josef Land; in East Siberia: New Siberian Islands and Wrangel Island, shores of the Bering and Okhotsk Seas. Winters in the North, Barents, and Bering Seas.

King eider *Somateria spectabilis*

Found in seaside tundra, during nonbreeding season in open sea. Shores and islands of the Arctic Ocean. Winters on northern shores of Western Europe, on the Barents and Kara Seas, waters of the northern Pacific Ocean.

Spectacled eider *Somateria fischeri*

Near seaside tundra on mainland and some islands. Coastal tundra of northeastern Siberia from the Lena delta to Mys Schmidta. Winters in the Bering Sea and further south.

Steller's eider ***Somateria stelleri***

Tundra near seashore from the Khatanga Bay to Chukotski Peninsula, New Siberian Islands. Occasionally nests on shores of Kola Peninsula. Winters on Bering Sea, coast of Kamchatka Peninsula, the Kuril Islands, Murman coast and Finland.

AYTHYA

Greater scaup ***Aythya marila***

Northern European USSR, Siberia, Kamchatka Peninsula, Kuril Islands. Winters on the shores of Sakhalin Peninsula and the Kuril Islands.

MELANITTA

White-winged scoter ***Melanitta fusca***

Sakhalin, Kuril Islands. Winters on the Komandorskiye and Kuril islands.

Black scoter ***Melanitta nigra***

Kola Peninsula, northern part of southern Novaya Zemlya, Kamchatka Peninsula. Winters on the Aleutian and Kuril islands, and the Kamchatka Peninsula.

HISTRIONICUS

Harlequin duck ***Histrionicus histrionicus***

Winters on the Komandorskiye and Kuril islands.

CLANGULA

Long-tailed duck ***Clangula hyemalis***

North of European USSR and Siberia, Novaya Zemlya, New Siberian Islands, Wrangel Island. Winters on waters of the Barents Sea and shores of Kamchatka Peninsula, Kuril Islands, northern Sea of Okhotsk, Sea of Japan and west coast of North America.

BUCEPHALA

Common goldeneye *Bucephala clangula*
Winters on the Komandorskiye and Kuril Islands and Sea of Japan.

MERGUS

Red-breasted merganser *Mergus serrator*
Winters on shores of the Kamchatka Peninsula, the Komandorskiye and Kuril islands.

Common merganser *Mergus merganser*
Winters on shores of the Kamchatka Peninsula and Kuril Islands.

PANDION

Osprey *Pandion haliaëtus* (Red Data Book)
Settles near large bodies of water: lakes, seas, rivers. Feeds primarily on fish. Soviet Far East.

HALIAËETUS

White-tailed sea-eagle *Haliaëetus albicilla* (Red Data Book)
Among other places on sea and lake shores with trees or rocks. Along the coast of European USSR, Chukotski Peninsula, coast of Bering Sea, Kamchatka Peninsula, Sea of Okhotsk and the Soviet Far East.

Steller's sea-eagle *Haliaëetus pelagicus* (Red Data Book)
Found near seashores or wooded river valleys. Kamchatka Peninsula, Sakhalin Island and shores of the Sea of Okhotsk. Winters on shores of Kamchatka, the Kuril Islands and shores of Primorski Krai.

BUTEO

Rough-legged buzzard *Buteo lagopus*
Chukotski Peninsula, Kamchatka Peninsula, shores of Sea of Okhotsk.

FALCO

Peregrine falcon *Falco peregrinus* (Red Data Book)

Throughout the USSR except on islands of the Arctic Oceans. On Novaya Zemlya.

Gyrfalcon *Falco* (Red Data Book)

On Arctic islands and seashores, tundra, forest-tundra and forest. Northern part of Kola Peninsula to Chukotski Peninsula, Kamchatka, Komandorskiye Islands.

SHOREBIRDS

PLUVIALIS

Gray plover *Pluvialis squatarola*

Tundra of northern European USSR and Siberia, Wrangel Island, and islands near the coast. Sandy and rocky seashores during migration.

Greater golden plover *Pluvialis apricaria*

Tundra of northern European USSR and northwest Siberia. On seasides during migration.

Lesser golden plover *Pluvialis dominica*

Northern Siberian tundra. On open shores of lakes and rivers during migration.

CHARADRIUS

Greater ringed plover *Charadrius hiaticula*

Usually along seashores, lakes or rivers. Common or numerous. Along the north coast (excluding some of Yamal, Severnaya Zemlya, Wrangel Island, Franz Josef Land, Northern Novaya Zemlya).

Kentish plover *Charadrius alexandrinus*

Found in open, low-lying shores of salt and fresh-water bodies. Common/numerous. Soviet Far East, Kuril Islands.

Mongolian plover *Charadrius mongolus*

Found in high-mountain tundra, on the Komandorskiye Islands in sand dunes. Chukotski Peninsula, Kamchatka Peninsula, Magadan Oblast. Rare, in places common.

Eurasian dotterel ***Charadrius (Eudromias) morinellus***
Kola Peninsula, southern island of Novaya Zemlya, northern shores of East Siberian from Taimyr to Chukotski Peninsula.

VANELLUS

Northern lapwing ***Vanellus vanellus***
Southern Soviet Far East

ARENARIA

Ruddy turnstone ***Arenaria interpres***
Shores and islands of the Arctic Oceans and northern seas. The entire coast of northern USSR, southern Novaya Zemlya, New Siberian Islands, Wrangel Island.

Black turnstone ***Arenaria melanocephala***
Obtained on Wrangel Island and Chukotski Peninsula. Does not breed in the USSR.

CALIDRIS

Curlew sandpiper ***Calidris ferruginea***
Tundra of northern Siberian shores from Taimyr Peninsula to the Kolyma Delta in east, New Siberian Islands.

Dunlin ***Calidris alpina***
Tundra of European USSR and Siberia as far east as Chukotski Peninsula, Novaya Zemlya, Wrangel Island.

Little stint ***Calidris minuta***
Tundra of European USSR and Siberia as far east as Chukotski Peninsula, southern Novaya Zemlya, New Siberian Islands.

Rufous-necked stint ***Calidris ruficollis***
Tundra from Taimyr to the Chukotski Peninsula.

Long-toed stint *Calidris subminuta*

Isolated populations nest in vicinity of Magadan, Chukotski Peninsula, Komandorskiye and Kuril Islands.

Temminck's stint *Calidris temminckii*

Numerous. Tundra of European USSR and Siberia from Kola Peninsula and shores of the White Sea to Chukotski Peninsula.

Western sandpiper *Calidris mauri*

Chukotski Peninsula.

Baird's sandpiper *Calidris bairdii*

Chukotski Peninsula.

Pectoral sandpiper *Calidris melanotos*

Tundra from Taimyr to Chukotski Peninsula, Wrangel Island.

Sharp-tailed sandpiper *Calidris acuminata*

Tundra of northern Yakutia between the rivers Yana and Kolyma.

Sanderling *Calidris alba*

Tundra of Taimyr Peninsula, Severnaya Zemlya, New Siberian Islands.

Red knot *Calidris canutus*

Taimyr tundras, New Siberian Islands, Wrangel Island.

Purple sandpiper *Calidris maritima*

Kola Peninsula, Novaya Zemlya, Franz Josef Land, northern shores of Taimyr, Chukotski Peninsula, Komandorskiye and Kuril Islands. Birds nesting on Chukotski Peninsula and Komandorskiye Islands are currently viewed as a separate species: Rock Sandpiper *Calidris ptilochemis*.

White-rumped sandpiper *Calidris fuscicollis*

Obtained on Franz Josef Land. Does not breed in the USSR.

TRYNGITES

Buff-breasted sandpiper *Tryngites subruficollis*

Wrangel Island.

PHILOMACHUS

Ruff ***Philomachus pugnax***
Northern half of European USSR, northern Siberia as far east as Chukotski Peninsula.

LIMICOLA

Broad-billed sandpiper ***Limicola falcinellus***
Taiga and tundra of northern European USSR and Siberia.

EURYNORHYNCHUS

Spoon-billed sandpiper ***Eurynorhynchus pygmaeus***
Chukotski Peninsula.

LIMNODROMUS

Long-billed dowitcher ***Limnodromus scolopaceus***
Tundra from lower Yana River to Chukotski Peninsula. During migration on seashores.

TRINGA

Green sandpiper ***Tringa ochropus***
White Sea and Soviet Far East.

Greater greenshank ***Tringa nebularia***
North European USSR, Kamchatka Peninsula, coast of Sea of Okhotsk.

Common redshank ***Tringa totanus***
Western Kola Peninsula, Soviet Far East.

Spotted redshank ***Tringa erythropus***
European USSR and Siberia except Yamal, Taimyr and eastern tip of Chukotski Peninsula.

Spotted greenshank *Tringa guttifer*
Southern Sakhalin Island.

ACTITIS

Common sandpiper *Actitis hypoleucos*
Seashores during migration. Western Kola Peninsula, coast of White Sea, Kamchatka Peninsula, shores of Sea of Okhots, Sakhalin Island, Soviet Far East.

LIMOSA

Black-tailed godwit *Limosa limosa*
Chukotski Peninsula, Soviet Far East.

Bar-tailed godwit *Limosa lapponica*
Locations of tundra from Kola Peninsula to Chaun Bay.

NUMENIUS

Whimbrel *Numenius phaeopus*
North European USSR, Chaun Bay.

Eastern curlew *Numenius madagascariensis*
West Kamchatka Peninsula, Soviet Far East.

PHALAROPUS

Red-necked phalarope *Phalaropus lobatus*
Northern regions of European USSR and Siberia, Kamchatka Peninsula.

Red phalarope *Phalaropus fulicarius*
Northern Siberia, Novaya Zemlya, New Siberian Islands, Wrangel Island, Chaun Bay.

SCOLOPAX

Eurasian woodcock ***Scolopax rusticola***
Southern coast of White Sea, Soviet Far East and Sakhalin Island.

GALLINAGO

Common snipe ***Gallinago gallinago***
Coast of European USSR, part of northern Siberian coast, Sakhalin Island, Komandorskiye Island.

Pin-tailed snipe ***Gallinago stenura***
Coast of Sea of Okhotsk.

Solitary snipe ***Gallinago solitaria***
Soviet Far East.

LYMNOCRYPTES

Jack snipe ***Lymnocryptes minimus***
Northern European USSR and Siberia.

HAEMATOPUS

Common oystercatcher ***Haematopus ostralegus***
Kola Peninsula, coasts of White and Kara Seas, Kamchatka Peninsula.

SEABIRDS

STERCORARIUS

Parasitic skua ***Stercorarius parasiticus***
Tundra of European and Asian USSR, shores of Bering and Okhotsk Seas, Kamchatka Peninsula, Novaya Zemlya, Wrangel Island.

Long-tailed skua ***Stercorarius longicaudus***

Tundra of European and Asian USSR, shores of Bering and Okhotsk Seas, Kamchatka Peninsula, Novaya Zemlya, Wrangel Island.

Pomarine skua ***Stercorarius pomarinus***

Tundra along shores of Arctic Oceans, Novaya Zemlya, New Siberian Islands, Wrangel Island.

PAGOPHILA

Ivory gull ***Pagophila eburnea***

Franz Josef Land, Severnaya Zemlya, north of New Siberian Islands. Winters on Arctic Oceans.

RISSA

Black-legged kittiwake ***Rissa tridactyla***

Shores of the Barents Sea, Novaya Zemlya, Severnaya Zemlya, New Siberian Islands, Wrangel Island, Chukotski and Kamchatka Peninsulas, Komandorskiye Island, Bering Sea, Sea of Okhotsk.

Red-legged kittiwake ***Rissa brevirostris***

Komandorskiye Island. Winters in the northern Pacific.

RHODOSTETHIA

Ross's gull ***Rhodostethia rosea***

Tundra of north Yakutia from Khroma River to Kolyma River. Feeds primarily on insects in summer. Winters on Arctic and Pacific Oceans.

XEMA

Sabine's gull ***Xema sabini***

Taimyr, Wrangel Island, northern Yakutia, Chaun Bay, lower Anadyr River. Feeds on insects in summer. Winters on Arctic Oceans.

LARUS

Great black-backed gull *Larus marinus*
Shores and islands of the Barents Sea, Kanin Peninsula.

Slaty-backed gull *Larus schistisagus*
Sea of Okhotsk, Kamchatka Peninsula, Sakhalin, Shantarskiye and Kuril Islands. Nonmigratory.

Black-tailed gull *Larus crassirostris*
Sakhalin, Kuril Islands, coastal Soviet Far East. Winters further south on the Pacific. Nonmigratory.

Lesser black-backed gull *Larus fuscus*
Kola Peninsula.

Herring gull *Larus argentatus*
Along the entire north coast of USSR, New Siberian Islands, Kamchatka Peninsula and shores of Sea of Okhotsk.

Mew gull *Larus canus*
Kola and Kamchatka Peninsula (west coast of the Bering Sea), Sakhalin Island.

Glaucous gull *Larus hyperboreus*
Shores and islands of Arctic Oceans, Novaya Zemlya, Franz Josef Land, Severnaya Zemlya, New Siberian Islands, Wrangel Island.

Glaucous-winged gull *Larus glaucescens*
Komandorskiye Island, Kamchatka Peninsula.

Black-headed gull *Larus ridibundus*
Kamchatka Peninsula, Soviet Far East, Sakhalin Island.

Little gull *Larus minutus*
Northern part of European USSR.

CHLIDONIAS

White-winged tern ***Chlidonias leucopterus***
Southern Soviet Far East

Whiskered tern ***Chlidonias hybrida***
Southern Soviet Far East.

STERNA

Common tern ***Sterna hirundo***
Kamchatka Peninsula, Kuril Islands, Sakhalin Island, Soviet Far East.

Arctic tern ***Sterna paradisaea***
Tundra from Kola Peninsula to Chukotski Peninsula, Novaya Zemlya, New Siberian Islands, shores of Bering and Okhotsk Seas.

Aleutian tern ***Sterna aleutica***
Southwestern Kamchatka Peninsula, Sakhalin Island.

Caspian tern ***Sterna caspia***
Soviet Far East.

CEPPHUS

Black guillemot ***Cepphus grylle***
Shores and islands of White and Barents Seas, all archipelagoes of Arctic Oceans, Chukotski Peninsula, Komandorskiye and Kuril Islands. Winters on open seas. Migratory or nonmigratory.

Spectacled guillemot ***Cepphus carbo***
Shores of Okhotsk Sea, Kamchatka Peninsula, Sakhalin Island, Soviet Far East. Winters in open waters. Nonmigratory and not numerous.

ALCA

Razorbill ***Alca torda***
Shores of Barents and White Seas.

PLAUTUS

Dovekie ***Plautus alle***
Franz Josef Land (250.000 pairs), northern island of Novaya Zemlya (10.000-50.000 pairs), Severnaya Zemlya (75.000 pairs; Sage 1986). Winters in waters of the Barents Sea.

URIA

Common guillemot ***Uria aalge***
Shores of Barents Sea, Novaya Zemlya, shores of Kamchatka Peninsula, the Selichova Golf, Kuril and Sakhalin Islands. Winters in open waters near breeding area.

Brünnich's guillemot ***Uria lomvia***
Shores of Barents Sea, Novaya Zemlya, Franz Josef Land, Severnaya Zemlya, New Siberian Islands, Wrangel Island, Chukotski Peninsula, shores of Kamchatka, the Selichova Golf, Kuril Islands, Sakhalin Island. Winters in open waters near breeding area. Population estimates (pairs): Murman coast of Barents Sea: 19.000, West Novaya Zemlya: 1.000.000, Franz Josef Land: 100.000, Kara Sea (eastern Novaya Zemlya): 25.000, East Siberian Sea: 45.000, Chukchi Sea: 19.000 (Sage 1986).

BRACHYRAMPHUS

Marbled murrelet ***Brachyramphus marmoratus***
Kamchatka, Kuril and Sakhalin Islands, shores of Sea of Okhotsk. Winters in open waters near breeding area.

Kittlitz's murrelet ***Brachyramphus brevirostris***
Shores of Chukotski Peninsula. Winters on coastal Kamchatka Peninsula, Kuril Islands. Very rare.

SYNTHLIBORAMPHUS

Ancient murrelet *Synthliboramphus antiquus*

Shores of Kamchatka Peninsula, Sakhalin and Kuril Islands, shores of Soviet Far East. Winters south to Taiwan.

AETHIA

Crested auklet *Aethia cristatella*

Shores of Chukotski Peninsula, Komandorskiye and Kuril Islands, Sakhalin Island. Winters in open water near breeding area.

Whiskered auklet *Aethia pygmaea*

Komandorskiye and Kuril Islands. Winters in open water near breeding area.

Least auklet *Aethia pusilla*

Shores of Chukotski Peninsula. Winters on shores of Sakhalin, Komandorskiye and Kuril Islands.

CYCLORRHYNCHUS

Parakeet auklet *Cyclorrhynchus psittacula*

Shores of Chukotski and Kamchatka Peninsulas, Sea of Okhotsk, Komandorskiye and Kuril Islands. Winters on coast of Japan.

CERORHINCA

Rhinoceros auklett *Cerorhinca monocerata*

On small islands covered with grassy vegetation: Kuril, Shantarskiye (island north west of Sakhalin), Moneron (small island west of southern tip of Sakhalin) and Sakhalin Islands Stays on unfrozen patches of sea during nonbreeding season. Winters south to Japan. Common in places.

FRATERCULA

Atlantic puffin *Fratercula arctica*

Shores of Barents Sea (Kola Peninsula), Novaya Zemlya. Winters in open water near breeding area.

Horned puffin *Fratercula corniculata*
Shores of Chukotski and Kamchatka Peninsulas, Komandorskiye, Kuril, Shantarskiye and Sakhalin Islands. Winters in open water near breeding area.

LUNDA

Tufted puffin *Lunda cirrhata*
Shores of Chukotski anmd Kamchatka Peninsulas, Komandorskiye, Kuril and Sakhalin Islands, continental shores of Okhotsk Sea. Winters in open water near breeding area.

Interviews with Soviet Arctic biologists

In the event of an extended NSR-programme, there will be a need for extensive biological fieldwork. This fieldwork should as far as possible be carried out by Soviet scientists in cooperation with scientists from other countries. The biologists contacted in the USSR were in general interested in joining the *Environmental Factors* project.

Following is a brief description of the scientists interviewed in the USSR, who were specially interesting for the *Environmental Factors Project* (se also Appendix 2).

Dr. Stanislav Belikov has for many years been cooperating with scientists at the *Norwegian Polar Research Institute*. This collaboration has resulted in the participation of one biologist from the *Norwegian Polar Research Institute (NP)* in an expedition to Severnaya Zemlya in May 1991. The objective of the expedition is to attach radio transmitters to 10-15 polar bears as well as carry out fauna and flora observations.

Irene Golubera, a chemist, detects industrial pollution on the Taimyr Peninsula, where the heavily industrially polluted river Yenisey runs out. She claims that all parts of the Soviet Arctic are polluted in some way, either by airborne pollutants or pollutants dissolved in water/tied up in ice. The polluted state of the Arctic is a matter of general concern among biologists in the USSR. Golubera has invited *NP* to Norilsk, where she works.

Galiana Saenko, also a chemist, works at the Department of Chemistry, Institute of Oceanology, USSR Academy of Sciences. She determines the level of heavy metals in algaes and has worked in the waters around Svalbard, Japan, and parts of the Antarctic Ocean.

Vladimir Kalyakin is chief of *The Nature Preservation Department* of *The State Committee of the Social and Economic Development of the North Region.* This department has recently initiated a project investigating different aspects of the social, economic and ecological development in the Northern Region. The department is interested in cooperation with the *Northern Sea Route Programme.*

There are only two biologists working at the Arctic and Antarctic Research Institute (AARI) in Leningrad, namely ornithologist **Maria Gavrilo** and ecologist **Yuri Gorbunov**. Yuri Gorbunov and Stanislav Belikov have carried out biological observations from ice drift stations in the Central Arctic Basin for many years, but this data is currently inaccessible outside AARI.

Data on the marine algae flora of the waters around Murmansk, Novaya Zemlya, Franz Josef Land, Severnaya Zemlya, New Siberian Islands, and Thukot can be found at the Botanical Institute, USSR Academy of Sciences by contacting **Kira Vinograda**. Most of the data is published in Russian books.

NP initiated cooperation with the **Murmansk Marine Biological Institute** (MMBI) in 1990. Director **Matishov** is also interested in joining the NSR-programme. Of special interest among the scientists here is **Tatjana Savinova**, an ornithologist working with problems of pollution. **Fjodorov**, the deputy director of MMBI has offered to prepare an English list of references to papers of Soviet Arctic biological research for sales (Weslawski, pers.comm.). Preparation of such a list will take some time, but the list should be valuable in a future Northern Sea Route programme.

At the **Meteorological Institute** in Murmansk extensive monitoring of the water quality in the Barents Sea has been carried out. Here the level of i.e. CO, SO2, heavy metals, oil products, and radioactivity has been determined year round for several decades. Apparently this has not been done in any other part of the Soviet Arctic Ocean. The findings have been published in annual reports. An English summary can be prepared for the NSR-programme at some cost.

PINRO is the main Soviet institute working with fish stocks of Soviet Arctic waters. The institute, which only investigates areas where commercial fishing occurs, has connections with the *Institute of Marine Research* in Norway. PINRO has about 500 employees, of which the project interviewer only met a few, including the director, **Georgy Luka**. **Sergei Belikov** works with pelagic fish mainly in the Barents Sea, and has some contacts with Norwegian scientists. **Sergei Novosolov** investigates the influence of human activity on Arctic ecosystems, concentrating on plankton, benthos and fish. In future research he wishes to include mammals and birds.

The **Ecological Center** consists of a group of young biological consultants. The Center is newly formed and has departments in Murmansk, Dikson, and Magadan, in addition to the main office in Leningrad. For the

time being the main research areas are oceanology and climatology, but the center also carries out some biological research. Marine biological research will be interesting for the center later, but in the time being it might be interested in orders, such as establishing a databank for biological information of the Northern Sea Route.

The project interviewer did not meet **Nicolay Smolininov** personally, but he is said to be *the* expert on databases in the Soviet Union. He works for the **All-Union Institute of System Studies** in Moscow. Any biological data at this institute is state property and probably difficult to acquire.

Distribution of questionnaires to Arctic biologists

Response to the questionnaires has been poorer than expected. Of a total distribution of about 120 forms (about 60 to the Soviet Union), only 20 were returned (11 from the Soviet Union, all except one completed and given to the project interviewer during her stay in the USSR). The forms received contain information about the following: white and bowhead whales; walrus; Northern sea lion; ringed, harbour, bearded, ribbon and largha seals; polar bear; arctic fox; and some species of birds, fish, benthos and plankton, mainly in the Bering Sea area.

CONCLUSION

Areas

In general, there has been and is being carried out, extensive Norwegian and Soviet research in all fields in the Barents Sea, which is located in the westernmost area of the Northern Sea Route. This also applies to the ecology of the Bering Sea, located at the easternmost part of the Northern Sea Route, but here the main countries are USA (Alaska) and the USSR. Joint expeditions are increasing in number. The waters between these two outer points have been poorly investigated.

Species

Documentation on marine mammals is good, but for several species recent population estimates are missing. These might be found by again contacting Arctic marine biologists. Documentation on terrestrial mammals and all birds inhabiting the Soviet Arctic seems poor. This is also the case regarding plankton and benthos.

Pollution

The pollutive state of the Soviet Arctic Seas has been and continues to be investigated. It is a matter of concern among Soviet Arctic biologists. Again, the Barents Sea and waters south of the Bering Strait are

the best investigated. However, research is also carried out along the Siberian coast where great rivers, heavily polluted by industy, run out.

Further literature study is needed, espesially concerning birds. Soviet biologists should again be contacted in order to obtain the information they have accumulated. This information has been promised but has not been made available to the project yet. Most of it is written in Russian, and efforts must be made to translate it into English when it is available. Soviet biological research seems to be extensive. A better overview of Soviet literature should therefore bring valuable information to the project. It might be wise to engage a Soviet scientist to locate the literature.

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APPENDIX 1

THE NORTHERN SEA ROUTE PROGRAMME

PLAN AND BUDGET FOR THE ENVIRONMENTAL FACTORS PROJECT

Per Espen Fjeld & Bente Brekke
Norwegian Polar Research Institute

THE *ENVIRONMENTAL FACTORS PROJECT*

The following five-year plan is meant as an intended proposal, not as a fixed plan.

A duration of five years is proposed for the *Northern Sea Route programme: Environmental Factors*, which will involve the continued search for existing environmental data, the selection of important species, extensive fieldwork, the analysis of nature vulnerability, and the impact on the environment of increased shipping activities. In order to ease the collaborative work with institutions in the USSR, a group from the Polish Academy of Science will be engaged as a connecting link. The project will be international.

The five-year project plan with appurtenant budget is presented below.

First year

- Employees, full year:
  Project director, responsible for the project and progression made.
  Computer expert, working with Geographical Information System (GIS).
  Secretary, responsible for continuous evaluation of incoming data about the environment in the NSR.
  (These three persons will be engaged during all five years of the project.)

- **International Advisory Group** of experts (approx. 10 persons) to be called on to clear up following points:
  - What animals/plants should be considered the most important (based on the model of "The Assessment System for the Environment and Industrial Activities in Svalbard").
  - Evaluation of existing materials followed by field project proposals prior to first fieldseason..

- Contracts/agreements with external/internal groups/institutions, regarding data acquisition and fieldwork (i.e. *Murmansk Marine Biological Institute, All-Union Research Institute of Nature Conservation, USSR Academy of Science, Arctic and Antarctic Research Institute, Ecological Center, PINRO, USA institutions, Norwegian Institute for Nature Research (NINA), Norwegian Polar Research Institute (NP)*)

- Connections to other programs regarding fieldwork (e.g. *The Rovaniemi-process, The Terrestrial Nature Monitoring Program of the Norwegian Directorate for Nature Research (DN), NINA/SAGA Petroleum*)

Second year

- Spring and summer fieldwork
- Reports from the fieldwork within the turn of the year
- Organisation of the information for the final presentation (see fifth year)
- Call on the **International Advisory Group** for evaluation of the existing data and suggestions for next season's field work.

Third year

- As **second year**
- Progress report with initial environmental evaluation

Fourth year

- As **third year**

Fifth year

Synthesis:

- Call on the **International Advisory Group** for evaluation of existing information and discussion of
  - environmental sensitivity assessment, and
  - analysis of impacts of increased shipping on the environment.

- Presentation of final product proposed to constitute ten volumes of an Environmental Atlas for the Northern Sea Route:
  - Vol. I Marine Mammals
  - Vol. II Marine Mammals
  - Vol. III Near-shore Terrestrial Mammals
  - Vol. IV Seabirds
  - Vol. V Near-shore Terrestrial Birds
  - Vol. VI Fish
  - Vol. VII Marine Invertebrates and Primary Production
  - Vol. VIII Environmental Status with respect to Pollution
  - Vol. IX Environmental Summary (regarding Animals and Primary Production)
  - Vol. X Environmental Sensitivity and Impact Assessment

Need of personnel:

	1 year	2	3	4	5
Director	+	+	+	+	+
GIS-expert	+	+	+	+	+
Secretary	+	+	+	+	+
Zoologist/marine biologist	–	–	+	+	+
Engaged biologist	–	–	–	–	+
Desk work assistance	–	–	–	+(1/2)	+(1/2)

BUDGET

All amounts are given in Norwegian *kroner*, NOK.

First year:

1) Salary to three employees including social expenses and overheads	1.140.000
2) GIS work station	150.000
3) GIS user's licence	205.000
4) Annual maintenance work GIS work station	25.000
5) Annual maintenance work GIS user's licence	25.000
6) Three Personal Computers (of 60.000)	180.000
7) Part of plotter connected to GIS system (the other part paid by *NP*)	250.000
8) International Advisory Group meeting (approximately 10 persons)	250.000
9) Connecting link between NP and Soviet inst. (Polish Academy of Science)	100.000
10) Travels/meetings	200.000
11) Interpretation/translation of literature	200.000
12) Literature/data acquisition	500.000
13) Telephone calls/postage	100.000
14) Various	100.000
Total	3.425.000

Second year:

1) Salary to three employees including social expenses and overheads	1.140.000
2) Annual maintenance work GIS work station	25.000
3) Annual maintenance work GIS user's licence	25.000
4) International Advisory Group meeting (approx. 10 persons)	250.000
5) Fieldwork [1]	3.000.000
6) External organisation (Polish Academy of Science)	200.000
7) Travels/meetings	300.000
8) Interpretation/translation of literature	200.000
9) Telephone calls/postage	150.000
10) Various	200.000
Total	5.490.000

Third and fourth year:

1) Salary to **four** employees including social expenses and overheads	1.520.000
2) Salary to desk work assistance 1/2 year, including social expenses and overheads	190.000
3) Annual maintenance work GIS work station	25.000
4) Annual maintenance work GIS user's licence	25.000
5) One Personal Computer	60.000
6) International Advisory Group meeting (approx. 10 persons)	200.000
7) Fieldwork	3.000.000
8) External organisation (Polish Academy of Science)	200.000
9) Travels/meetings	400.000
10) Interpretation/translation of literature	200.000
11) Telephone calls/postage	150.000
11) Various	200.000
Total 2 x	6.170.000

[1] The cost of fieldwork could be higher, depending on number of field groups, price of vessel hire, equipment, etc.

Fifth year:

1) Salary to four employees including social expenses and overheads	1.520.000
2) Salary to engaged biologist including social expenses and overheads	380.000
3) Salary to desk work assistance 1/2 year, including social expenses and overheads	190.000
4) Annual maintenance work GIS work station	25.000
5) Annual maintenance work GIS user's licence	25.000
6) International Advisory Group meeting scenarios (approx. 10 persons)	500.000
7) Travels/meetings	400.000
8) Interpretation/translation of literature	200.000
9) Telephone calls/postage	150.000
10) Printing of Vol I-X	1.500.000
11) Production of maps	500.000
12) Various	200.000
Total	5.590.000

Total for the five year project: NOK 26.845.000 (approx. 4.500.000 USD)

APPENDIX2

INTERVIEWED SCIENTISTS

All-Union Research Institute of Nature Conservation, Moscow

Stanislav E. Belikov
Mammals (polar bear, walrus)

Irene Golubera
Chemist, works with industrial pollution on the Taimyr Penninsula.
Place of work: Norilsk.
Invites *NP* to visit them in Norilsk.

Mila Bogdan
Ornithologist, senior expert.

Irene Poprovskaya
Ornithologist, nature conservation, fieldwork in Svalbard.

USSR Academy of Sciences, Institute of Oceanology, Moscow

Galiana Saenko
Department of Chemistry.
Heavy metals in algaes at: Svalbard, 'The Far East' → Japan, Antarctic.

The State Committee of The Social and Economic Development of The Northern Region, Mocow

Vladimir Kaliakine
Chief of the Nature Preservation Department.
At present: 6 mth. project: social, economic and ecological development in the North Region.

USSR Academy of Scienses, Institute of Geography, Moscow

Roman Zlotin
Head of Laboratory of Biogeography.
Worked in Magadan, Svalbard.

USSR Academy of Sciences, Zoological Institute, Leningrad

Alexey V. Neyelov
Chief of Laboratory of Ichthyology.

Boris Sirenko
Ichthyologist.

L.V. Firsova
Ornithologist.

Ecological Center, Leningrad

Wiktor Subbotin
Climatologist.

Sergei Wolf
Oceanologist.

Mark Dolgin

The Ecological Center is a private consultancy firm. Three departments: Murmansk, Dikson and Magadan, plus the office in Leningrad. They were obliging and interested in orders. Some information can and will be dilivered to us without charge, further cooperation must be paid for.

Arctic & Antarctic Research Institute, Leningrad

Maria Gavrilo
Ornithologist.

Yuri A. Gorbunov
Biological observations from 1954 till today (together with S. Belikov), given in tables, more than 200 pages: birds, mammals. To be published in a book (takes at least two years).

Leonid Beljakov
Hydrologist.

White Sea Biological Station of Zoological Institute, Leningrad

Ja. Berger
33 years of monitoring plankton in the White Sea.
Works with plankton/benthos/fish.
Stations along the entire coast of the White Sea.

Academy of Sciences, Botanical Institute, Leningrad

Kira Vinograda
Marine algaes in the Soviet Arctic: Murmansk, Novaya Zemlya, Frans Josef Land, Novaya Sibirsk, East Sibirean Sea, Thukot.

Yuri Okolodkov
Plankton in the Kara, Laptev, East Siberian and Chukchi Seas.

Leningrad State University, Physiological Institute, Leningrad

O.L. Christoforov
Polar cod (*Boreogadus saida*).
Atlantic salmon (*Salmo salar*).

Irene Murza
Atlantic salmon

Murmansk Marin Biological Institute, Murmansk

Feodorov
Deputy director. May prepare an English reference list containing "all" Russian biological publications concerning the Arctic area.

Denisenko
Benthos.

Petrov
Geophysicist; geophysical prospects and influence on biota; Frans Josef Land, New Siberian Islands, Svalbard.

Tatjana Savinova
Seabirds, contamination.

Meteorological Institute, Murmansk

Anatoly Semeonov
Extensive investigation of contamination in the Barents Sea:
CO, SO_2, NO_x, dust, heavy metals (3 times a day from 6 stations along the coast of the Kola Peninsula).
Oil products, oxides, biogenic poll., detergents, pesticides, heavy metals, radioactivity, water quality (frequent investigations from vessels during spring, summer, autumn).
Benthos, plankton (zoo-/phyto); species composition as indicator or level of pollution.
Yearly publications (in Russian) for 20 years from 20 stations in the Barents Sea. Possible to buy an English summary of these annual reports.

PINRO, Murmansk

Georgy Luka
Director

Sergei Belikov
Pelagic fish: capelin, herring, mackerel, blue whiting, polar cod, haddock.
Research concentrated to areas with commercial fishing → no research west of Novaya Zemlya.

Vladimir Kileozhenko
Investigates only ecosystems of economic importance.
Pollution in water, sediments, benthos, fish, plankton; ecological monitoring.
Cooperation with 'Havforskningsinstituttet i Bergen' for one year.

Sergei Novosolov
Head of laboratory of ecological predictions.
Works with influence of human activity (shipping, oil, gas) on ecosystems (plankton, benthos, fish). Wishes to include mammals and birds in future research.
Has data proving influence on fish stocks caused by ice-breakers.

Polish Academy of Science, Gdansk, Poland
Contact person: Jan Marcin Weslawski; Works with marine biology, mainly benthos and plankton, and human influence on Arctic ecosystems. The Academy also plays a central role in organizing projects and fieldwork in the Soviet part of the Northern Sea Route.

APPENDIX3

THE NORTHERN SEA ROUTE PROJECT

ENVIRONMENTAL FACTORS

mammals, birds and fish

Species (*latin name*)	
Data coverage - Location (*area or coordinate*) - Time periode (*research periode*)	

Data type
- Population monitoring:
  - Time of year (*seasons/months*)
  - Population activity (*breeding, wintering, etc.*)
  - Population size estimated?
- Pollution level:
  - Pollutants in body
  - Pollutants in habitat
  - Source of pollution identified?
- Other	

Population trend (*increasing/stable/decreasing/ unknown*)	
Data reliability (*good/medium/poor*) - Population monitoring - Pollution level - Other	
Data format (*published, unpublished, database, etc.*): - Population monitoring - Pollution level - Other	
If not published: Data availability (*open/restricted*) - Population monitoring - Pollution level - Other	
Data source (*institution, department etc.*)	
Contact person (*name, address, telephone, telefax, telex*)	
Comments	

THE NORTHERN SEA ROUTE PROJECT

ENVIRONMENTAL FACTORS

plankton and benthos

Key-species (*latin name(s)*)	
Data coverage - Location (*area or coordinate*) - Time periode (*research periode*)	
Data type - Population monitoring: - Time of year (*seasons/months*) - Research field (*breeding, migration, % coverage, recruitment etc.*) - Pollution level: - Pollutants in body - Pollutants in habitat - Pollution source identified? - Other	
Population trend (*increasing/stable/decreasing/ unknown*)	
Sampling methods	
Data reliability (*good/medium/poor*) - Population monitoring - Pollution level - Other	
Data format (*published, unpublished, database etc.*): - Population monitoring - Pollution level - Other	
If not published: Data availability (*open/restricted*) - Population monitoring - Pollution level - Other	
Data source (*institution, department etc.*)	
Contact person (*name, address, telephone, telefax, telex*)	
Comments:	

To be returned to:

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APPENDIX 4

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