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Route Area

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FOREWORD - INSROP WORKING PAPER

INSROP is a five-year multidisciplinary and multilateral research programme, the main phase of which commenced in June 1993. The three principal cooperating partners are Central Marine Research & Design Institute (CNIIMF), St. Petersburg, Russia; Ship and Ocean Foundation (SOF), Tokyo, Japan; and Fridtjof Nansen Institute (FNI), Lysaker, Norway. The INSROP Secretariat is shared between CNIIMF and FNI and is located at FNI.

INSROP is split into four main projects: 1) Natural Conditions and Ice Navigation; 2) Environmental Factors; 3) Trade and Commercial Shipping Aspects of the NSR; and 4) Political, Legal and Strategic Factors. The aim of INSROP is to build up a knowledge base adequate to provide a foundation for long-term planning and decision-making by state agencies as well as private companies etc., for purposes of promoting rational decisionmaking concerning the use of the Northern Sea Route for transit and regional development.

INSROP is a direct result of the normalization of the international situation and the Murmansk initiatives of the former Soviet Union in 1987, when the readiness of the USSR to open the NSR for international shipping was officially declared. The Murmansk Initiatives enabled the continuation, expansion and intensification of traditional collaboration between the states in the Arctic, including safety and efficiency of shipping. Russia, being the successor state to the USSR, supports the Murmansk Initiatives. The initiatives stimulated contact and cooperation between CNIIMF and FNI in 1988 and resulted in a pilot study of the NSR in 1991. In 1992 SOF entered INSROP as a third partner on an equal basis with CNIIMF and FNI.

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1. INTRODUCTION

The main objective of the marine mammal project under INSROP is to establish a database containing information on distribution, abundance, migrations and breeding and feeding areas for selected marine mammals in the Northern Sea Route (NSR) area, and to present a discussion of possible impacts of the projected shipping activity on these species. This information will be used as basis for an Environmental Impact Assessment (EIA). The central point in the EIA is to identify and evaluate the key impacts from the possible NSR activity on the environment represented by the so-called Valued Ecosystem Components (VECs).

A description of the process of selection of VECs and discussion of impact hypothesis is given by Wiig et al. (1996). The present report gives a detailed description of the distribution of the selected VECs: polar bears, walruses, bearded seals, ringed seals, white whales, gray whales and bowhead whales. The report also gives a review of the economic importance of these species in the area and the anthropogenic impacts on them. Place names mentioned in the text are given in Fig. 1 in the appendix. The data are implemented in the INSROP GIS database.

2. POLAR BEARS

2.1. Status

The polar bear (*Ursus maritimus*) is included in the list of rare species in the 'Red Book' of the Russian Federation (1983).

2.2. Geographic variation and distribution of populations

Elemental analyses of skull samples obtained in different regions of the Russian Arctic (Uspenski et al. 1985) distinguish three eco-geographical groups of polar bears:

- · 'western' in the Barents and Kara Seas;
- · 'central' in the Laptev and East-Siberian Seas; and
- · 'eastern' in the Chukchi and Bering Seas.

Analyses of long term observations of polar bears from the drift stations 'Severnyi Polus' and ice patrol not only confirm the existence of these groups but also define their borders more exactly.

Data collected during aerial ice patrols indicate that in the central portion of the East-Siberian Sea there is a natural obstacle for marine mammals including polar bears migrating between the Laptev and Chukchi Seas (Belikov *et al.* 1982). This is the Ayonsk ice massif which consists of solid multi-year ice. However, in years with favorable ice conditions a limited interaction between central and eastern groups is possible.

So, the central portion of the East-Siberian Sea is the zone of division of two populations of polar bears. The zone of division between central and western groups is not completely determined. According to satellite telemetry data, a border may be situated in the eastern or northeastern part of the Kara Sea near the Severnaya Zemlya archipelago (Belikov *et al.* 1995).

Recent radio-tracking data indicate the existence of a local population of polar bears in the region of Svalbard (Spitsbergen) (Wiig 1995).

We assume that the above mentioned groups can be considered natural populations (Belikov 1992). In accordance with the main areas of these groups the following names for the populations are proposed:

- Franz Josef/Novaya Zemlya (western group),
- · Laptev (central group), and
- Chukchi (eastern group).

Apparently the eastern border of the Chukchi population coincides with the eastern border of the Chukchi Sea. According to satellite telemetry data on polar bears captured in the Cape Barrow region, these were animals both from the Chukchi and the Beaufort populations (Amstrup and Durner 1995) while bears captured in the more eastern parts of the Chukchi Sea were only from the Beaufort population.

The distribution of the studied populations in the south is limited by the mainland coastline. Only rarely do polar bears move large distances into the tundra. As a rule these are pregnant females looking for suitable areas for maternity dens.

In the south-western and western Barents Sea the distribution of polar bears is limited by the ice edge. The location of the edge changes seasonally and annually.

The northern areas of these populations include parts of the Arctic Basin. Participants in expeditions to the North Pole occasionally observe polar bears (Belikov 1992). Larsen (1986) reported that in Svalbard there were few tracks of polar bears north of 82°N. Summarized data obtained by ice patrol activity and drifting stations also show that the density of polar bears in the Arctic Basin is much lower than in the more southern areas (Gorbunov *et al.* 1987, Belikov and Gorbunov 1991).

2.3. Distribution and density

The distribution of polar bears in their habitats is not even (see Fig. 2 in the appendix). It is determined by the distribution of prey species (ringed and bearded seals) which is dependent on ice conditions and sea depth (Smith and Stirling 1978, Stirling et al. 1982, Kingsley et al. 1985). Along with the spatial-temporal variation in polar bear distribution, there is a general decrease in polar bear density from the eastern and western areas toward the central part of the Russian Arctic.

Data presented in Table 1 show the general spring distribution of polar bears. However, a preliminary processing of available long-term data indicates that during the other seasons polar bear density is highest in the eastern and western regions. The highest density of the other marine mammals, marine birds and fish as well as the highest biomass of phyto- and zooplankton are observed in the same regions.

A number of studies indicate a strong dependence of polar bear distribution on ice conditions (Lentfer 1972, Larsen 1986, Gorbunov et al. 1987, Amstrup and DeMaster 1988, Garner et al. 1990, 1994, 1995, Belikov and Gorbunov 1991). Based on ice conditions, at least three physical-geographical regions can be determined (Gorbunov et al. 1987): western region

Table. 1. Average density of polar bears in the Arctic seas and in bordering areas of the Arctic Basin in April 1970–1984 according to data of ice patrol (Belikov and Gorbunov 1991).

Marine area	Density (bears/1000 km²)
Barents Sea	0.46
Kara Sea	0.43
Laptev Sea	0.17
East-Siberian Sea	0.28
Chukchi Sea	0.72
Arctic Basin	0.19

(west of Severnaya Zemlya up to Franz Josef Land and Spitsbergen), central region (east of Taimyr Peninsula up to 170°E) and eastern region (east of 170°E).

Western region: One-year ice with a network of channels and leads prevails in the Kara Sea. Such ice conditions are favorable for seals and polar bears. The zone of fast ice along the western Taimyr and Severnaya Zemlya coast is wide. It mostly consists of snow-covered hummock ice. Fast ice around Novaya Zemlya and Franz Josef Land is not so hummocked (Belinski and Istomin 1956, Kupetski 1970).

Central region: In wintertime relatively flat fast ice is found here (Karelin 1952). Such ice conditions are not suitable for breeding of the ringed seal – the main prey species of the polar bear. In the Laptev Sea beyond the fast ice zone there are some wide polynyas and zones of young ice – the so-called 'Great Siberian Polynya'. Beyond these zones, ice cover is presented by one-year ice with numero s channels. However, the density of seals is not high (see sections on ringed and bearded reals).

Eastern region: Inhabited by the Chukchi population of polar bears. Ice conditions differ from those in the western and central regions. The fast-ice zone is not wide, but it is mostly hummocked and snow covered, which is favorable for breeding of the ringed seal. Beyond the fast-ice zone north of Wrangel Island and sometimes west of the island, polynyas appear in the end of winter. The drifting ice in winter is not the same as in the central region. There are few ice-covered channels in the Longa Strait. At the end of winter and at the beginning of spring, ice cover is immovable there for a long period of time (more than a month). At the same time, the ice is hummocked and covered with relatively deep snow. Ringed seals can make lairs in this area.

Tentative analyses of data sets on observations of polar bears in the Kara, Laptev, East-Siberian and Chukchi Seas (Gorbunov et al. 1987, Belikov and Gorbunov 1991) indicate the following distribution patterns:

In the Kara Sea in winter—springtime bears are mostly observed in the southwestern part of the sea and along the eastern coast of Novaya Zemlya and relatively seldom on fast ice along the northwestern coast of the Taimyr Peninsula. In wintertime polar bears are often observed not far from the northern settlements of Amderma and Dikson. In spring 1994 during field work, polar bears were often seen along the edge of the fast ice several hundred kilometers northeast of Dikson.

In the Laptev Sea and in the western part of the East-Siberian Sea, the density of polar bears increases in the area beyond the fast ice zone and in the marine area adjacent to the Severnaya

Zemlya archipelago and along the northeastern and eastern coast of the Taimyr Peninsula as well as along the northern and northeastern coast of the Novosibirsk Islands.

In the eastern area in winter and spring, polar bears are mostly observed in the area of Wrangel and Herald Islands, in the Longa Strait and in the southern part of the Chukchi Sea. In years with hard ice conditions in the Chukchi Sea many polar bears move to the polynya situated north of Wrangel Island. In 1982–1984 registration of polar bear tracks during ice patrols was accomplished. Density of polar bear tracks (tracks per 100 km) varied from 0 to 35.7. The highest density of tracks was found in the Chukchi Sea and in the northern portion of the Bering Sea. A correlation between density of tracks and level of ice cover breaking is found in the eastern region.

The correlation between frequency of observation of tracks and ice is characterized by the following (Gorbunov et al. 1987):

Most (51%) tracks were observed in the zone of channels covered with young ice. A large number of tracks were registered for hummocked one-year ice, probably with seal lairs. There were few (13%) tracks on the relatively flat one-year ice, and there were almost no tracks on old ice. There was a very low density of polar bear tracks in the vast fast-ice zone of the East-Siberian Sea, the eastern portion of the Laptev Sea and in the western part of the Kara Sea. Bears and their tracks were observed most commonly on the fast ice along the coast of the Chukchi Peninsula and on the edge of fast ice in the Yugorski Shar Strait (the Kara Sea).

In the beginning of summer in the eastern region, bears often can be met not far from Wrangel and Herald islands, in the Longa Strait and in the southern portion of the Chukchi Sea. In summer bears following the etreating ice edge distribute along the edge in the northern portion of the Chukchi Sea (Arthur et al. 1993, Garner et al. 1994) and are rarely observed on the islands or on the mainland coast. Bears appear on the islands in spring and autumn during seasonal migration and breeding. This can be illustrated with data on observations of polar bears on Wrangel Island. From 1979 to 1984 1,285 polar bears were registered on the island. Of these, 87.2% were observed in March-May, 9.4% in September-November, and 3.4% in July-August and December-February (Belikov et al. 1986). There was another situation in 1990-1991 (Ovsyanikov 1993) when 76% of 678 bears observed in 1990 were met in September-November, 17.8% in March-May, and 6.2% in July-August and December-February. In 1991 a total of 694 bears and their tracks were registered: 85.2% in September-November, 12.4% in March-May, and 2.4% in July-August and December-February. In 1990 females represented 23.3% of the observed bears, and in 1991 33.9%. There is a strong correlation between ice conditions and the number of bears visiting Wrangel Island in summer and autumn. A high density of polar bears on the island is usually conditional on the presence of not dispersed ice along the coastline (Lutsuk 1978). Sometimes ice can be removed by strong wind. In such cases many bears stay on the island. Under these circumstances in 1990-1992 up to 140 animals stayed in the southwestern part of Wrangel Island (Cape Blossom) (Ovsyanikov 1993).

Undoubtedly, Wrangel Island is not only an important breeding area but also an important feeding area due to a high density of prey (Arsenyev 1935, Nikulin 1940, Belikov *et al.* 1984, Fedoseev 1984, Kochnev 1991).

The distribution patterns of polar bears in the Laptev and East-Siberian seas are based only on multi-year data obtained during ice patrol. In summer-time polar bears can occasionally be

observed in the northern part of the Laptev Sea and in central and eastern parts of the East-Siberian Sea. In autumn and the beginning of winter, polar bear distribution patterns are the same as in summer.

In the Kara Sea bears are usually found all year round. They avoid inlets and bays occurring only in their northern parts. When the whole Kara Sea is covered by ice (November–May) bears keep to the zone between fast ice and drift ice. In summer and autumn a majority of bears stay on the drift ice.

Polar bears in the Russian Arctic spend a majority of their time in the pelagic zone. They can remain for long periods during the summer on land as they do in the Canadian Arctic (Derocher and Stirling 1990). However, large portions of the Russian Arctic are characterized by pelagic ice habitats and bears appear to prefer to remain in contact with the sea ice in these habitats (Garner et al. 1995). The archipelagic habitats of Canada often become ice-free and bears commonly are stranded on land or on fast ice in isolated bays. This stranding also occurs in certain portions of the Russian Arctic according to recent satellite telemetry data, especially in the Barents and Kara seas. These seas include several archipelagos (Svalbard, Frans Josef land, and Severnaya Zemlya) and their associated archipelagic sea ice habitats. Stranding on land is much more rare in the open pelagic ice habitats of the Laptev, East Siberian, and Chukchi seas. Occasionally, under unusual ice conditions (very rapid ice melt) bears have stranded on land in the East Siberian and the Chukchi seas.

2.4. Migrations and local movements

Seasonal migrations of polar bears in the Russian Arctic are highly dependent on seasonal changes of ice conditions (Belikov and Gorbunov 1991, Belikov 1993), especially apparent in the Chukchi and Bering Seas (Garner *et al.* 1990, 1994, Garner and Knick 1991).

In spring the bears occupying the northern portion of the Bering Sea begin to move to the Chukchi Sea. In summer they continue to migrate northwards. Following the retreating ice edge the bears move to the Arctic Basin (Belikov et al. 1984, Garner et al. 1990, Belikov and Gorbunov 1991). In years when the ice cover is more dispersed than usual, polar bear migration is more intensive, because of quick melting ice cover.

In spring and summer some bears move to northwestern parts of the Chukchi Sea, others move to central and northeastern parts of the sea and then to the western Beaufort Sea (Garner et al. 1990).

Data from radio tracking show that the Chukchi population of polar bears occupies vast areas including the Chukchi Sea, the eastern portion of the East-Siberian Sea and the most western part of the Beaufort Sea (Garner and Knick 1991, Arthur *et al.* 1993, Garner *et al.* 1995). Migrations of polar bears may be linked to a major drift of ice or coincide with it.

The area occupied by collared females varies in the Bering and Chukchi Seas from 150,000 to 350,000 km² (Garner *et al.* 1990), in the Beaufort Sea from 10,000 to 270,000 km² (Amstrup 1986), and in the Canadian Arctic archipelago from 2,500 to 23,000 km² (Schweinsburg and Lee 1982).

When the ice forming process begins in the northern Chukchi Sea, polar bears move back south and south-east. Some of them migrate to the northern Bering Sea. In years with strong northerly winds, ice from the Chukchi Sea can be pushed into the Bering Sea. In such years

bears on the ice are moved far to the south, up to the Kamchatka Peninsula (Shubnikova 1978). Bears have to move back across the Chukotka Peninsula.

In the Chukchi Sea, polar bears normally remain in contact with the sea ice throughout the year, based upon recent satellite telemetry data. They retreat to the north with the receding ice during late spring. In early fall, when the sea ice begins advancing south again from a minimum ice cover, polar bears move south with the advancing ice edge. Some bears pass through the Bering Straits in late November and winter in the northern Bering Sea, while other bears remain in the Chukchi Sea throughout the winter. A small number of bears may reach the northern Kamchatka Peninsula during heavy ice years (Shubnikova 1978). Polar bears have also been documented to cross the Chukotka Peninsula in years when the polynya between St. Lawrence Island and the southeast Chukotka Peninsula opens early.

In the Kara, Laptev and East-Siberian Seas, the migration of polar bears correlates with the seasonal changing ice conditions (Kishinski 1969, Marunin and Kishinski 1969). However, migration routes are not so extensive there as in the eastern region. The probable reason is that ice often stays in the seas all year around (Belikov *et al.* 1995).

2.5. Breeding areas

Field research accomplished in the period 1960–1980 in different regions of the Russian Arctic allows us to find and characterize the breeding areas of polar bears.

Chukchi population: Even though the area of the population is shared by Chukotka (Russia) and Alaska (USA), reproduction sites of the population are situated only on Russian territory. This is confirmed by radio-tracking maternity polar bears (Garner et al. 1999, 1994).

Most maternity dens are concentrated on the Wrangel and Herald Islands (Uspenski and Chernyavski 1965, Kischinski and Uspenski 1973). The number of dens there in the 1980s was estimated at about 250 (Belikov *et al.* 1986). About 50–120 maternity dens were reported for the northern coast of the Chukotka Peninsula (Stishov 1991). Only some maternity dens were found on the northwestern coast of Alaska (Amstrup and Gardner 1994).

Laptev population: The breeding area of this population includes Severnaya Zemlya, the Novosibirsk Islands and the mainland coast of the Laptev and East-Siberian seas (Kischinski 1969, Belikov and Randla 1987, Uspenski 1989). There are no concentrations of maternity dens in the region. The number of dens apparently is about 100–200. Few dens (about 10) are known to appear on the north-western coast of the Taimyr Peninsula and on islands in the eastern part of the Kara Sea (Marunin and Kishinski 1969, inquire data).

Franz Josef/Novaya Zemlya population: There are two main breeding areas: Franz Josef Land with 50–150 maternity dens (Parovshikov 1965, Belikov and Matveev 1983), and Novaya Zemlya. Uspenski (1989) reports about 50 maternity dens for Novaya Zemlya. However we assume that the number of dens on Novaya Zemlya exceeds 50 and possibly varies between 100 and 250 dens.

2.6. Numbers

Franz Josef Land/Novaya Zemlya population: Larsen (1986) estimated the population size at the beginning of the 1980s at 3000-5000 for this and the Svalbard population. The survey

methodology used for the estimation was a census of dens and bears on the ice. Alternatively, based only on a census of maternity dens, the population makes up 4,000–6,700 animals.

We also used the second method for the estimation of population size. Summarizing available data (Parovshikov 1965, Belikov and Matveev 1983, Larsen 1986, Uspenski 1989), we assumed that about 250–400 female polar bears den annually. We also assumed that maternity bears in the population make up 8–10% (11% according to Larsen 1986). Taking into consideration sex and age structure of the population and the reproductive rate of adult females, we estimated the population number to be about 2,500–5,000 bears (Belikov 1992).

According to Wiig (1995) there is a relatively isolated population of polar bears in the Spitsbergen (Svalbard) region. The size of this population is assumed to be 1,700–2,200 bears. The Franz Josef Land/Novaya Zemlya population is then assumed to be 2,500–3,500 animals. Apparently about 1,000–1,500 polar bears occupy the Kara Sea.

There are no available data on changes in population size in the period 1980–1990. In the second part of 1980s and in the 1990s, an increase in number of polar bears visiting polar stations and settlements on the coast was registered. However, we do not know the reason: either an increase of the population or less food.

Laptev population: The population number, estimated by using the same method as above, is roughly 800–1,200 animals (Belikov 1992). The estimate was based on data on the number of maternity dens (Karpovich 1969, Uspenski 1989). Summarizing available data, we estimate the number of annually breeding females to be 100–200 animals.

There I is apparently not been any considerable changes in numbers and distribution patterns of this population during the last 30–50 years. This conclusion is based on a comparative analysis of available data provided by ice patrols in 1970–1980 and published data from the 1960s (Kischinski 1969). There is no evidence of decreasing density of prey species in the region.

Chukchi population: The number of annually breeding females of the population makes up 300–400 animals. Based on this number, the total population size is estimated at 3,000–5,000 bears.

According to data obtained by ice patrols in 1970–1984 there was a gradual increase in the population number (Gorbunov et al. 1987). It is possible that this trend still prevails.

Polar bears of the Chukchi population are hunted by Alaskan natives. In recent years the average number of hunted bears makes up about 90 animals per year. At the same time there is a trend of increasing average age of the hunted animals (U.S. F. & W. Service 1994), which can be considered a sign of stability of the population.

2.7. Socio-economic importance

Polar bears used to be hunted occasionally at the polar stations, during expeditions and by local hunters until 1956, when hunting of polar bears was prohibited in Russia.

Non-aboriginal people used to hunt polar bears for fur, while native people also utilized the meat for food, and skulls and teeth for ritual purposes (Uspenski and Kholodova 1973).

Recently, after the question was raised about permission to hunt polar bears in Chukotka, the aboriginal people have become increasingly interested in the polar bear. They hope not only to improve their economic situation, but also to revive their cultural traditions.

2.8. Anthropogenic impact

There are different kinds of anthropogenic impact on polar bears in the Russian Arctic:

- Illegal hunting. Currently this is the most serious kind of human impact on the polar bear, especially on the Chukotka Peninsula. The number of poached bears is unknown, but according to inquest data it is at least a few dozen animals. A trend of increasing poaching is observed.
- Pollution. Large and medium sized rivers bring various pollutants including heavy metals and organochlorines to the Arctic Ocean's basin. These compounds accumulate in polar bear tissues. There are no data on the level of the pollutants in tissues of bears and possible consequences in the Russian Arctic. However, it is known that the level of some organochlorine pollutants in the tissues of polar bears from Spitsbergen is very high (Norheim et al. 1992). Probably the same level of pollutants is found in the eastern Barents Sea including Novaya Zemlya. Also, high levels of some pollutants have been found in seals and bears of the Canadian Arctic (Norstrom et al. 1986, 1988).
- Hydrocarbons. A low level of hydrocarbons has been found in most parts of the Arctic Basin, in the Russian Arctic regions near the estuaries of the Ob and Yenisey rivers. There are plans for developing oil fields in the Barents, Chukchi and Bering Seas. With a implementation of these plans, oil contamination in marine mammals and polar bears inhabiting these regions will increase.
- Disturbance. The most serious negative effect of disturbance is on breeding female polar bears in the denning period (Belikov 1973, 1993). It can be predicted that use of the Northern Sea Route for transit and regional development will cause an increase of disturbance in the INSROP-area.

Doubtless, development of the Northern Sea Route will increase the anthropogenic impact on the marine ecosystems. There are reasons to consider oil contamination of marine ecosystems as one of the most dangerous impacts concerning polar bears (Stirling and Calvert 1983, Stirling 1990).

Possible negative effects of NSR exploitation will apparently consist of habitat disturbance, a worsening status of key components of the ecosystems, and direct harm to animals (Stirling and Calvert 1983).

Habitat disturbance: Uncontrollable emissions of oil to sea water will lead to large-scale changes in marine ecosystems. Oil pollutes the water surface and the lower surface of ice which may cause decreased primary production. Higher levels of the ecosystem will be involved in this process.

Oil contamination can affect the polar bear in two main ways (Stirling and Kiliaan 1980): (a) Affected by oil, fur becomes entangled and loses some of its thermoregulatory ability; (b) The polar bear may be poisoned by oil from contaminated seals or from its own fur. Oil contamination is particularly dangerous for cubs (Stirling and Calvert 1983).

Direct and indirect effects of oil on polar bears may appear far from the spill site. For example, in case of an oil spill near the western Chukchi Coast, sea currents will bring the oil along the northern coast to the Bering Strait. In summer and spring walruses and gray whales migrate here and in winter this is the most important habitat for polar bears and ringed seals.

Oil contamination is also very dangerous for the prey species of polar bears. It can cause mass death of these species, like what happened after the Exxon Valdez incident off the western coast of Alaska in 1989 (Frost *et al.* 1994). A decrease in seal numbers will lead to a high mortality of juvenile and adult bears (Stirling *et al.* 1984).

Consequences of small-scale oil emissions to the sea have hardly been studied yet. It is possible that such contamination does not cause considerable harm to large mammals like the polar bear. Apparently small doses of pollutants which are accumulated in tissues of animals are more dangerous. Organochlorines represent a group of such pollutants.

Noise disturbance caused by regular ship traffic and helicopters will first harm seals, which can be negative for polar bears. Moreover, as was mentioned above, breeding females during the denning period are very sensitive to disturbance.

The populations of polar bears are especially vulnerable in aggregation sites. These sites are listed in Table 2.

3. WALRUSES

3.1. Geographic variety

Three sub-species of walruses (Odobenus rosmarus) inhabit the Russian Arctic:

Atlantic walrus (O. r. rosmarus), Laptev walrus (O. r. laptevi), and Pacific walrus (O. r. divergens).

3.2. Atlantic walruses

3.2.1. Status

Included in The Red Book of the Russian Federation (1983).

3.2.2. Distribution and migrations

In the Russian Arctic the Atlantic walrus inhabits the Barents and Kara seas (Bychkov 1978).

Based on material obtained during harvesting of walruses in 1929–1933, Chapski (1941) reported two periods for distribution of walruses in the Kara Sea:

- 1. The end of July-August: walruses stay on ice.
- 2. September and a part of October: walruses move to ice-free water along the main coast and to the coast of the Novaya Zemlya archipelago.

Table 2. High density areas in relation to season of polar bears in the Russian Arctic.

Season	The Chukchi Sea	The East-Siberian Sea	The Laptev Sea	The Kara Sea
Winter	Wrangel** and Herald** Islands North coast of the Chukota Peninsula* Bering Strait Southeastern part of the East- Siberian Sea, southern and southwestern part of the Chukchi Sea and the marine area surrounding Wrangel and Herald Islands. Sites in marine area with broken ice.	Marine area beyond the fast ice zone north of the Novosibirsk Islands. The DeLonga Islands* and the marine area around them	Edge of fast ice and marine area beyond the fast ice zone along eastern and southeastern coast of the Taimyr peninsula and Severnaya Zemlya*	Novaya Zemlya* The southwestern portion of the sea area. The marine area west of Severnaya Zemlya. The western portion of the sea near the eastern coast of Novaya Zemlya.
Spring	The same as in winter	The same as in winter	The same as in winter	The same as in winter
Summer	Edge of drift ice	Edge of drift ice	Edge of drift ice	Edge of drift ice. Marine area surrounding Severnaya Zemlya
Áutumn	The same as winter	Apparently the same as winter	Apparently the same as winter	Apparently the same as winter

* High density of maternity dens, ** Very high density of maternity dens.

In the ice season there was no observation of walruses in the central part of the Kara Sea. Chapski (1941) assumed that this may be explained by the deep waters in the area preventing walruses from feeding. The distribution of walruses in the coastal zone depends to a certain degree on ice conditions as well as on distribution in the previous ice season. The biggest groups in haul-outs consisted of 250–300 animals.

The general distribution and migration patterns in recent 10-25 years are as follows (see Fig. 3 in the appendix):

Winter. Walruses were observed only in the Barents Sea. Mostly they occupy the south-eastern portion of the sea (Mishin et al. 1989) and the Franz Josef Land region (Belikov et al. 1989), where they usually stay in the zone of young ice beyond the fast ice zone, west and south of the archipelago as well as on fast ice in small polynyas between the islands. Occasionally single animals and small groups were observed north of the archipelago in leads in one-year and multi-year ice.

There are no consistent data regarding winter distribution of walruses in the Kara Sea, but few walruses are thought to winter in recurring polynya near the eastern side of the Novaya Zemlya archipelago (Born *et al.* 1995).

Summer. When the south-eastern Barents Sea ice cover melts, some walruses migrate north, others move into the Kara Sea through the Karskie Vorota Strait or around Cape Zhelaniya (Mishin et al. 1989). Probably some walruses wintering in the region of Franz Josef Land migrate by a network of leads and channels into the northern Kara Sea up to the area east of Komsomolets Island (Severnaya Zemlya Archipelago) (Belikov et al. 1990). Walruses spend the summer in these areas and in autumn they return the same way to the wintering areas. Dates of migrations depend on ice conditions.

Observations of walruses in the other parts of the Kara Sea are very rare. West of Severnaya Zemlya and along the north-western Taimyr Peninsula walruses were quite rare in the 1950s (Belkovich and Khuzin 1960) as well as in the 1970–1980s (air ice-reconnaissance data and our observations).

Geptner et al. (1976) reported that walruses stay on ice floes near the western Yamal Peninsula in July—August, however ice patrols observed walruses in the area from the end of May.

3.2.3. Numbers and trends

Beloborodov and Timoshenko (1974) estimated the number of walruses inhabiting the Barents and Kara Seas in the 1930s at 1,200–1,300 animals. In 1978 the number was some hundreds of animals (Bychkov 1978). Doubtless, this estimate is too low. According to surveys accomplished in 1976, 1978 and 1979, the number of walruses only on haul-outs made up 1,800–2,000 animals (Timoshenko 1984a). Haul-outs are reported from Gemskerka Island at the north-eastern coast of Novaya Zemlya (about 200–370 animals), and from Nortbuk Island (about 300 animals) and Zemlya Georga Island (about 1,000 animals) in Franz Josef Land. Recently, Gjertz et al. (1992) have given more specific information on the distribution of walruses in the region of Franz Josef Land.

3.3. Laptev population

3.3.1. Status

Included in The Red Book of the Russian Federation (1983).

3.3.2. Distribution and migrations

Walruses of this population inhabit the Laptev Sea, the area north of Novosibirsk Islands and the Vilkitski Strait (see Fig. 3 in the appendix) (Gorbunov and Belikov 1990).

In 1991–1993 personnel of the polar station Prima flew around the Severnaya Zemlya archipelago and observed walruses east of Komsomolets Island. In 1993 the authors registered some small groups of walruses in the same area in broken one-year ice.

Chapski (1941) characterized the distribution of walruses in a period before the Second World War. According to him, walruses in small numbers occupied the region of the Novosibirsk Islands in summer. The biggest haul-out was on Belkovski Island. The walruses spent the winter north and west of Kotelni Island. In the region of the Medvehzyi Islands and near the estuary of the Kolyma River, walruses were observed occasionally. East of this river near the coastline, walruses used to appear every year in small numbers.

In the 1960s comparatively big haul-outs were registered on Vilkitski Island (near the DeLonga Islands); about 400 walruses were observed on the south-eastern coast of the island, and about 200 walruses were observed on the eastern coast (Pavlinov 1966). In 1953–1954 about 250–300 walruses were counted annually on the haul-out on Peschanyi Island (Popov 1958).

According to data from aerial ice-reconnaissance in the 1970–1980s (Gorbunov and Belikov 1990), walruses were observed beyond the fast ice zone in the Laptev Sea in winter. Mostly they inhabit the southern and central parts of the sea and the areas north of the Novosibirsk Islands. In the northern Laptev Sea (north of 100 m depth) walruses were observed rarely.

As a rule, walruses are observed in leads, covered by young ice. Mostly they stay alone or in small groups (< 20 animals). Only on three occasions have groups of more than 20 animals been observed (Table 3).

Table 3. Frequency of observations of different sized groups (n=56) of walruses in the Laptev Sea in winter (October-May).

Group size	% of observations	
1	33.9	
2	33.9	
3	5.4	
4	5.4	
5	7.0	
6	1.8	
7	1.8	
8	1.8	
9	1.8	
10	1.8	
>10	5.4	

Small groups of sub-adult animals winter in permanent cracks in the fast ice of the Vilkitski Strait (Vishnevskaya 1989, Gorbunov and Belikov 1990).

In the beginning of summer, most walruses are distributed along the ice edge. In August–September walruses appear on haul-outs on Spit Morzhovaya in the Marii Pronchishevoi Bay, on the south-eastern coast of Peschanyi Island, on the northern part of Belkovski Island, on Cape Anisi (Kotelni Island), on the islands the Vilkitskogo, Andreya, Fadeya, Petra, Preobrazheniya and Bolshoi Begichev. Observations show (Vishnevskaya 1989, Gorbunov and Belikov 1990, Bychkov 1991) that the biggest haul-out of Laptev walruses in the second half of summer is situated on Spit Morzhovaya in the Marii Pronchishevoi Bay (up to 600 animals). On the other islands no more than some dozens of walruses were observed. Larger groups of walruses were observed in summer than in winter (Table 4).

The end of the 'coastal' season depends on ice conditions in the marine area surrounding haulouts. However, in October walruses leave haul-outs completely.

	Group size	% of observations	
•	1–5	50.8	
	6–10	17.4	
	11-20	20.3	
	21–50	7.2	
	51-100	-	
	101-200	43	

Table 4. Frequency of different group sizes (n=69) of walruses in the Laptev Sea in summer (June-September).

3.3.3. Numbers and trends

The Laptev population of walruses has never been large. The total size of the population is estimated at several thousands (Bychkov 1991). Apparently in the 1980s the state of the population became worse. Haul-outs in the delta of the Lena river, on the islands Kuba-Aryta, Dunai and Aerosyemki disappeared. Quite rarely do walruses now appear on haul-outs on Preobrazheniya and Begichev Islands (Kuzmin 1991).

3.4. Pacific walruses

3.4.1. Status

This population is harvested by Chukchan and Alaskan natives.

3.4.2. Distribution and migrations

The distribution area of the population includes the eastern East-Siberian Sea, the Chukchi Sea and the northern portion of the Bering Sea (see Fig. 3 in the appendix). The western limit of the area is situated in the region of Chaunskaya Bay in the East-Siberian Sea. Near the northern coast of Alaska walruses occur up to Cape Barrow. The summer distribution of walruses in the Chukchi Sea depends heavily on ice conditions. In years with hard ice the distribution to the west is limited by the Longa Strait, and to the north by 70°–71°N. If ice conditions are light, walruses move into the East-Siberian Sea, and can reach 74° N (Fedoseev 1979, Belikov *et al.* 1984).

Pacific walruses spend the winter in the broken pack-ice of the northern Bering Sea. Only a small number winter in the Chukchi and East-Siberian Seas. They stay in the polynya north of Wrangel Island and in permanent cracks near the entrance to Chaunskaya Bay (Kudryavtsev 1979; Belikov *et al.* 1984, 1989).

In April—May females, calves and sub-adults begin to move north, appearing near the southern and eastern coast of the Chukotka Peninsula. Mass migration of walruses through the Bering Strait continues till the end of May—beginning of June as the ice retreats. They then move into the western Chukchi Sea and eastern East-Siberian Sea. Other walruses migrate east along the northern coast of Alaska. Adult males move towards terrestrial haul-outs, primarily south of the Bering Strait.

In years with favorable ice conditions some walruses can reach Wrangel Island at the end of July and move west along the coast to Billings Cape. In the end of August-beginning of September walruses have been observed moving north and north-east of Wrangel Island. In years when the western portion of the Chukchi Sea is covered with ice for a long period, most of the walruses move into the eastern Chukchi Sea to the Alaskan coast. In the second half of summer, some of them move back to the western part of the sea. In years with lighter ice cover walruses migrate to the western and eastern Chukchi Sea (Fedoseev 1990).

In autumn walruses migrate in two directions: from the region of Shalourov Island (the East-Siberian Sea) and the most western portion of the Chukchi Sea they move south-east; from the regions west and south of Wrangel Island they move through the Longa Strait to Cape Vankarem and then east to the Bering Strait (Fedoseev 1982).

If most of the Chukchi Ser. s free of ice, walruses aggregate in the region of Wrangel Island and in the Longa Strait in September-October (Krylov 1962, Fay 1982). In such years large walrus haul-outs are situated on Cape Blossom and Spit Somnitelnaya at Wrangel Island (Kochnev 1991, 1995). According to observations performed in 1991–1994 the majority of walruses on these haul-outs were females with calves while only about 9% of hauled out walruses were adult males (Kochnev 1995).

The ice conditions in the Chukchi Sea were very special in 1990. The ice edge retreated as far north as 75°N. Almost all of the Chukchi Sea and the eastern East-Siberian Sea were free of ice. During autumn air-surveys in 1990 four haul-outs were observed on the northern coast of the Chukotka Peninsula: Inchoun, Cape Inkigur, Koluchin Island and Cape Serdse-Kamen (Fedoseev 1992). In total about 21,000 walruses were counted there. On Wrangel Island four haul-outs, including a new one on Cape Gavai, were found. The total number of walruses was about 113,000 animals. On Herald Island a haul-out with about 1,300 animals was observed on Cape Dezhnev.

3.4.3. Numbers and trends

The total minimum number of the Pacific population of walruses is estimated at 200,000 animals (Fedoseev 1992). After 1956, when the hunting of Pacific walruses was prohibited, the population has increased (Popov 1984). By 1980 the population was estimated at 200,000 animals (Fedoseev 1984). In the beginning of the 1980s it made up 270,000–290,000 animals (Kibalchich 1984). Presently, a decrease in the population is observed. Apparently it is caused by natural factors.

3.5. Socio-economic importance

The walrus traditionally has been very important for the subsistence of coastal settlements of indigenous people Natives in the Russian Arctic. Walruses provide food (meat and fat) and material for making boats, ropes (skin) and clothes. Walrus tusks are the most valuable item, used for making a variety of traditional domestic things, hunting equipment and art. Since 1956, when the harvesting of walruses was prohibited, only natives inhabiting the eastern Arctic coast are allowed to hunt some thousand walruses annually for subsistence.

3.6. Anthropogenic impact

Walruses are very sensitive to disturbance. As mentioned above, they have disappeared at some haul-outs that existed until recently. The Pacific population is an exception. In 1960–1980 it not only increased, but also inhabited its previous area, including coastal haul-outs.

At least two cases of mass death of walruses caused by low-flying aircraft are documented. Both of them occurred at a big haul-out situated on Cape Blossom (Wrangel Island). The last case was in 1991; more than 100 walruses of different sex and age died in a rush (Ovsyanikov et al. 1994).

Doubtless a negative effect can be caused by various pollutants brought to the ocean by rivers. However, we do not have any available data on harm caused by the pollutants. It is known that tissues of Pacific walruses hunted in 1981–1984 contained high levels of cadmium and mercury (Taylor *et al.* 1989).

Analyses of liver and kidney samples of walruses hunted in different sites of the northern Bering Sea in 1991 show that levels of cadmium in tissues are as high an in previous years, which might lead to damage of the kidney (Seagers et al. 1994).

4. RINGED SEALS

The circumpolar ringed seal (*Phoca hispida*) is the most abundant Arctic pinniped, but substantial information on its numbers in the Russian Arctic is available only for a few regions (see Fig. 4 in the appendix).

The ringed seal is uniquely adapted to living and breeding in the fast ice, in which it maintains breathing holes throughout the winter. Although there are indications that ringed seals can breed on pack ice (Finley et al. 1983), such cases have not been reported for the Russian Arctic. Areas of winter prime habitat are used mainly by older adults. Younger animals that are reproductively active are generally consigned to areas where the ice conditions are less predictably suitable. Sub-adult ringed seals primarily inhabit the shear zones between the land fast ice and drift ice, shore lead systems, polynyas and unconsolidated offshore pack ice (Geptner et al. 1976, Stirling et al. 1981, Starikov 1990).

There are no consistent data about extensive migrations of ringed seals in the Russian Arctic. If food is less abundant, seals may respond by reproducing at a lower rate or by leaving the area (Smith and Stirling 1978). For example, in the Kara Sea, local migrations of ringed seals are determined by appearance of masses of spawning Arctic cod (*Boreogadus saida*) near the coast (Geptner *et al.* 1976).

4.1. Geographic variety

There is no evidence of the existence of different sub-species of the ringed seal in the Russian Arctic. Because extensive migrations have not been reported for the ringed seal, we assume that different regions are inhabited by different populations of this species.

4.2. Population of the Kara Sea

4.2.1. Status

The most harvested marine mammal.

4.2.2. Distribution and migrations

The density of the ringed seal varies in different regions of the Kara Sea. Mostly it inhabits areas not far from the coastline from Novaya Zemlya to the Vilkitski Strait and Severnaya Zemlya including almost all bays and inlets; the Baydaratskaya Inlet, the Obskaya Inlet with large parts of the Tazovskaya Inlet and the Gydanskaya Inlet (Geptner *et al.* 1976).

Recent data on the distribution of ringed seals in the sea are available only for waters adjacent to the Yamal and Gydan peninsulas (Starikov 1990, Anon. 1996). In June 1996 the highest density (2.285/km²) in the area was found on fast ice in the Malygin Strait, while the lowest (0.008/km²) on fast ice in the Obskaya Inlet north of Tazovskaya and Obskaya inlet confluence. An average density in the whole area was 0.395/km².

It is necessary to point out that no special investigations on the ringed seal migrations (marking, recapturing, and telemetry) were carried out in the seas of the Russian Arctic. It is commonly accepted that long and mass migrations are not characteristic for the species. Its local migrations are determined basically by food abundance. Observations of great amounts of ringed seals in particular regions correlated positively with the mass run of fish (Geptner et al. 1976, Timoshenko 1984b, Mishin et al. 1989, Ushakov 1990).

More or less regular migrations of ringed seals apparently occur only in the western region of the Russian Arctic. When the ice period comes, the seals migrate from the Kara Sea to the Barents Sea via the Karskiye Vorota and Yugorskiy Shar straits. These are not only feeding, but also reproductive migrations, because the conditions in the south-eastern part of the Barents Sea are most optimal for seal reproduction. A group of seals occupy this region in winter and spring. In late spring and summer the animals follow the northward and eastward withdrawal of the ice edge and move to the northern areas of the Barents Sea and to the Kara Sea (Geptner *et al.* 1976, Lukin 1981). Only a small number of seals remain in the south-east of the Barents Sea for summer (Golenchenko 1963, Lukin 1981).

According to Rutilevskiy (1939), many ringed seals appear in the Vilkitskiy Strait in the last ten days of May, coming from the east. The peak of herd formation is observed there in the second half of June. In the end of summer, after the first ice appears in the strait, the seals undertake reverse migrations. The animals leave the region in late March, when the whole strait is covered by ice.

4.2.3. Numbers and trends

A recent census of ringed seals in the Kara Sea was done in a marine area adjacent to the Yamal and Gydan peninsulas (Starikov 1990, Anon. 1996). The number of ringed seals inhabiting this area is estimated at 25,000 (min.) - 70,000 (max.) animals.

4.3. Population of the Laptev Sea

4.3.1. Status

The most harvested marine mammal.

4.3.2. Distribution and migrations

The Laptev Sea is not considered an area where the ringed seal is abundant. The distribution of the ringed seal in the sea is quite uneven. Ringed seals inhabit the area along the eastern Taimyr, Khatanga Bay (high density is registered in the region of Begichev Island and southwest of it), Nordvik Bay, Anabar and Olenek Bays and east along the mainland coast. Ringed seals are common in eastern parts of the sea especially in the Novosibirsk Island region, and near the entrances to the Dmitri Laptev Strait and the Sannikov Strait (Geptner et al. 1976).

4.3.3. Numbers and trends

There is no available information on the numbers and trends of the ringed seal stock inhabiting the Laptev Sea.

4.4. Population of the East-Siberian Sea

4.4.1. Status

The most harvested marine mammal.

4.4.2. Distribution and migrations

In the East-Siberian Sea ringed seals inhabit the marine area along the mainland coast including all bays and inlets and the zone of drift ice reaching the Novosibirsk and DeLonga Islands.

Ringed seals in the East-Siberian Sea are much more abundant east of the Medvezhyi Islands than west of them. The highest density is registered in the Chaunskaya Bay and along the coast (Geptner et al. 1976).

Ognetov (1990) reported that in June in the area between the Indigirka River and Ayon Island ringed seals stay solitary near holes and cracks. The distance between seals was 500–2,000 m. Occasionally groups of 3–4 and 6–7 animals were observed.

4.4.3. Numbers and trends

Consistent data on numbers of ringed seals inhabiting the East-Siberian Sea are available only for the area from the Indigirka River to Ayon Island. Air-surveys of ringed seals were here accomplished in June 1989 (Ognetov 1990). Daily 157 to 308 ringed seals were counted. Density varied from 0.05/km² in the north of the studied area, to 0.66/km² in the south-east of the area.

The following data on density of ringed seals were obtained during the survey:

- Estuaries of the Indigirka and Kolyma Rivers: 0.06–0.10/km²;
- Central part of the studied area (20-30 km from the coast): 0.12-0.23/km²;
- Region of the Medvezhyi Islands: 0.35–0.55/km²; and
- Region of Ayon Island -0.56-0.66/km².

The estimated total number of ringed seals in the region was 27,000–36,000 individuals.

4.5. Population of the Chukchi Sea

4.5.1. Status

The most harvested marine mammal.

4.5.2. Distribution and migrations

The distribution pattern of ringed seals in the Chukchi Sea is mainly determined by hydrological conditions. Inlets, bays and lagoons of the sea with the exception of the Kolyuchinskaya Inlet are shallow and in winter they are frozen to a large extent which is unfavorable for the ringed seal. Because of this, ringed seals in the Chukchi Sea mostly occur in marine areas along shore avoiding bays, inlets and lagoons.

The highest density is registered in the region of the Serdtse-Kamen Cape, the entrance to the Kolyuchinskaya Inlet and north-west of Kolyuchin Island (Fedoseev 1966, Geptner *et al.* 1976).

Air surveys accomplished in 1970–1974 and a joint Soviet-American expedition in 1973 showed the existence of considerable aggregations of ringed seals far from shore (areas east of Wrangel Island and south of Herald Island and north-west of Cape Barrow). Fedoseev and Goltsov (1975) assumed the existence of separate populations of ringed seals there.

4.6. Economic importance

Ringed seals have traditionally provided a portion of the subsistence needs of all settlements along the Arctic coast. They remain a dependable and basic source of food.

4.7. Anthropogenic impact

4.7.1. Habitat disturbance

The lactation period lasts about a month. Often it is interrupted by natural and anthropogenic causes: destruction of shore fast ice by storms, currents or ice-breakers; and thaw causing destruction of the snow cover of maternity lairs. In such cases females leave the pups. As a result such pups die (Potelov 1986).

4.7.2. Noise

Ringed seals do not seem to be very sensitive to noise. Burns and Harbo (1972) reported that even in areas of intensive seismic disturbance ringed seals were not appreciably displaced.

4.7.3. Pollution

Oil contamination seems to be quite dangerous for ringed seals. Results from research about the direct impact of oil on the ringed seal indicate grave conditions for the animals (from transient eye problems to changing of some blood parameters and death) caused by oil (Geraci and Smith 1976).

5. BEARDED SEALS

5.1. Geographic variety

Two sub-species (populations) of the bearded seal (Erignathus barbatus) are determined:

Atlantic bearded seal (E. b. barbatus)

Pacific bearded seal (E. b. nauticus)

5.2. Atlantic bearded seals

5.2.1. Status

This population is harvested.

5.2.2. Distribution and migrations

In the Russian Arctic, Atlantic bearded seals inhabit the shallow zone of the White, Barents, Kara and Laptev Seas and the western portion of the East-Siberian Sea (see Fig. 5 in the appendix). In general they avoid solid ice cover. However aerial surveys of marine mammals performed in June 1996 (Anon. 1996) show that bearded seals can stay on fast ice. As a rule the bearded seal sticks to marine areas up to 50–60 m depth because of its feeding habits (Potelov 1971, Atlas of Marine Mammals of USSR 1980). Data obtained by ice reconnaissance confirm that distribution of the population in the east is limited by the western portion of the East-Siberian Sea (Belikov *et al.* 1982).

The bearded seal is considered a resident animal (Atlas of Marine Mammals of USSR 1980). However, according to (Geptner et al. 1976) a part of the Barents Sea stock migrates through the Karskie Vorota Strait to the western Kara Sea in spring—summer. In autumn they move back.

According to the Atlas of Marine Mammals of the USSR (1980) bearded seals can reach the region of the North Pole, which has been confirmed by data from ice reconnaissance (Belikov et al. 1990). In March—May seals have been observed in leads and on ice.

Generalized data on the distribution and number of bearded seals in a period up to the 1970s are presented in a book 'Marine mammals of the Soviet Union' (Geptner et al. 1976). According to this source bearded seals occur everywhere in the Kara Sea. However, they mostly inhabit the region of Yugorski Shar, shallow water between Vaigach Island and the Yamal Peninsula, the Baidaratskaya Inlet, the marine area north of Belyi Island and along the eastern coast of Novaya Zemlya. Occasionally they may be seen in the mouth of big rivers (Yenisei, Ob and others).

In the eastern Kara Sea bearded seals occur north of Dikson Island, north of the Piasinski Bay, in the region of Minin Skerries, east of Arctic Archipelago Islands, in the region of the Nordensheld Archipelago and west of Severnaya Zemlya (west of Shokalski Strait and near Pioner Island).

Data about bearded seals in the Laptev Sea are very poor. Usually seals occur only in the Vilkitski Strait, especially in spring and summer. Bearded seals are to a less degree observed along the eastern Taimyr Peninsula, near Begichev Island and near Preobrazheniya Island.

Bearded seals usually stay single or in small groups of 2–3 animals (Potelov 1966, Sokolov 1979). Haul-outs are mostly situated on rocks and on sandbanks.

In the 1980s an increased density of bearded seals was registered in the Karskie Vorota Strait, Baidaratskaya Inlet, near Belyi Island, in Minin Skerries, along the western Nordensheld Archipelago and south-western Severnaya Zemlya (Mishin *et al.* 1989). Considerable aggregations of the seal have been observed in autumn. Khuzin (1960) reported that many bearded seals occur along the eastern coast of Novaya Zemlya. He supposed that the region had a favorable feeding base for marine mammals.

5.2.3. Numbers and trends

The only survey was done in June 1996 (Anon. 1996) in a marine area adjacent to the Yamal and Gydan peninsulas. A total of 845 bearded seals was counted. The number was estimated at 1,000 (min.) - 2,500 (max.) animals. Nothing is known about trends.

5.3. Pacific bearded seals (lakhtak)

5.3.1. Status

The population is harvested.

5.3.2. Distribution and migration

In the INSROP-area bearded seals of this stock inhabit the eastern portion of the East-Siberian Sea, the Chukchi Sea and the Bering Strait (see Fig. 5 in the appendix).

According to Geptner et al. (1976) bearded seeds occur everywhere in the Chukchi Sea, but mostly they occupy one-year drift ice and marine areas along the mainland coast. In the East-Siberian Sea the bearded seal has been observed but nothing is known about its distribution. Fedoseev (1984) reported that this animal has often been observed in the region of the Chaunskaya Inlet.

There are no available data about distribution of the bearded seal in the seas from the last 20 years.

According to Fedoseev (1984) bearded seals migrate to the Chukchi Sea in summer. Air surveys conducted in September 1960 in the Chukchi and East-Siberian seas showed that seals occur in the region from 70° to 74°N and from 170° to 180°W. The animals stayed single near the coast. Many bearded seals were observed in the region of the Chaunskaya Inlet.

Bearded seals, together with ringed seals, were also observed 30–35 miles north of Wrangel Island and in the region of Herald Island.

5.3.3. Numbers and trends

Nothing is known about numbers in the population.

5.4. Economic importance

Bearded seals are harvested everywhere from Amderma in the western Russian Arctic to Uelen in the east, and along the eastern Chukotka Peninsula.

Meat from the bearded seal is used as food. The hide is used for making foot-wear and sometimes clothes and souvenirs.

The bearded seal is a valuable component of the marine ecosystem of the Russian Arctic.

5.5. Anthropogenic impact

The same anthropogenic factors that were discussed for the ringed seal are essential for the bearded seal. In winter—springtime they are found in the drift-ice zone, so activity on the shore fast ice will only influence the ringed seal.

6. WHITE WHALES

6.1. Geographic variety

The geographic variety of white whales inhabiting the Russian Arctic is insufficiently studied. Currently it is supposed that the Russian Arctic is inhabited by three sub-species of the white whale (*Delphinapterus leucas*, *D. l. meris-albi* and *D. l. dorofeevi*).

We assume that these sub species may be considered populations. Since only two of them inhabit the INSROP area, we will only describe the Barents Sea and the Bering Sea populations (see Fig. 6 in the appendix).

6.2. Barents Sea population

6.2.1. Status

Harvested.

6.2.2. Distribution and migrations

Most of the white whale population seasonally occupying the Barents and Kara seas winter in the south-eastern part of the Barents Sea (Kleinenberg et al. 1964, Geptner et al. 1976, Ognetov and Potelov 1984). A number of researchers propose that a few white whales can winter in the Kara Sea. Kleinenberg et al. (1964) believe that white whales are able to surface and breathe in splits, clearings and coastal polynyas, even under 9/10 ice over conditions and winter in the sea close to their summering areas. According to Geptner et al. (1976) white whales winter in the polynyas of the Obskaya Inlet and the Yenisei Bay, and in other ice-free areas of the sea. Mishin et al. (1989) suppose that animals can stay for a winter in the north-eastern part of the Kara Sea. It is emphasized by Kleinenberg et al. (1964) that the lighter the ice conditions in the Kara Sea in winter are, the more white whales stay there for the winter. More of them are also found there in summer, when they follow the Arctic cod (Boreogadus saida), which approaches the mainland coast. Based on data of 20 year observations Ognetov and Potelov (1984) presumed that it is quite unlikely that the whales winter every year in the Kara Sea.

It is commonly accepted that spring migration of white whales from the Barents to the Kara Seas begins in April—May (Kleinenberg et al. 1964, Geptner et al. 1976, Ognetov and Potelov 1984). The first migrating whales move through the Karskie Vorota Strait and north of Cape

Zhelaniya. Less commonly and in smaller numbers, some whales migrate through the Yugorski Shar Strait, which becomes free of ice later. In some years many whales are observed near Cape Menshikov and near the Amderma settlement. In the Obskaya Inlet the first whales appear in the end of May, in Yenisei Bay in June. In May and June white whales, migrating east by the northern point of Novaya Zemlya, enter the northern and north-eastern Kara Sea, following leads and channels in the ice. In some years they reach Severnaya Zemlya and waters of the Laptev Sea east of the archipelago as early as May.

In summer (July-August) white whales continue on to the Kara Sea from the Matochkin Shar Strait and distribute near the south-eastern coast of Novaya Zemlya (Kleinenberg *et al.* 1964). According to Geptner *et al.* (1976) white whales reaching the Obskaya Inlet usually move into this inlet by the eastern shore as far as the prevailing north-eastern wind forms open water near this shore, while the other side of the inlet is closed by ice. The majority of white whales stay in the area of the Obskaya and Tazovskaya inlet conjunction. Kleinenberg *et al.* (1964) note that white whales can move 150 km into the Taz River.

Some years large numbers of white whales may be observed in the Yenisei Bay especially in the vicinity of Dikson Island. According to Ognetov and Potelov (1984) the first appearance of white whales in the area can be as early as the beginning of May to as late as mid-August, which strictly depends on appearance and width of coastal pylon in the area. It was noted that white whales approach the Dikson area from north and north-east.

White whales approach estuaries of the big rivers and enter the Obskaya Inlet and the Yenisei Bay for feeding on Arctic cod and white fish (Coregonidae). Concentrations of Arctic cod in certain regions depends on food abundance. In the Arctic seas a high abundance of zooplankton is reported for areas near river estuaries where rivers bring out organic substance. Considerable aggregations of Arctic cod are common in the southern Kara Sea, near Severnaya Zemlya Archipelago, and near the north-western coast of the Taimyr Peninsula (Kleinenberg et al. 1964).

Large numbers of white whales stay in the whole Kara Sea, including the north-eastern part of the sea (Potelov et al. 1986, Mishin et al. 1989). During the last 10 years white whales were common in summer and autumn in the marine area west of the Severnaya Zemlya archipelago and near the western and north-western Taimyr Peninsula.

In autumn groups of animals could be met in different sites along the north-western Taimyr and near the Sedov Archipelago. Some years whales were numerous near Novaya Zemlya.

A comparison of patterns of white whales distribution observed in September and October shows a redistribution of animals from the eastern to the western Kara Sea, which indicates the beginning of autumn migration. In October–November white whales migrate to the Barents Sea.

Laptev Sea: Available data on the white whales of the Laptev Sea are few and do not allow a description of seasonal distribution and number of animals. Some investigators believe that white whales can winter in a polynya north of the Novosibirsk Islands (Kleinenberg et al. 1964, Geptner et al. 1976). According to the same authors animals occur east of the Severnaya Zemlya archipelago, in the Velkitski Strait and in the south-western part of the sea, including Khatanga Bay, and the estuaries of such rivers as Anabar, Olenek and Lena in summer. Large numbers of whales were registered south-west of Bolshoi Lyakhovski Island

(Novosibirsk Islands) in mid-August. The earliest observations of white whales in the Laptev Sea are known from May when animals are seen east of Severnaya Zemlya. From July observations become more frequent. White whales have usually been observed in the southeastern part of the Laptev Sea and north of the Novosibirsk Islands including adjacent waters of the East-Siberian Sea. Animals also occur in other parts of the sea although they are quite rare south of the Novosibirsk Islands. Apparently many white whales come to the Laptev Sea from the Kara Sea.

See Table 5 for a summary of distribution.

6.2.3. Numbers and trends

There are no available data on numbers and trends of the Barents population of white whales.

6.3. Bering Sea population

6.3.1. Status

Harvested.

6.3.2. Distribution and migrations

The area occupied by the Bering Sea population of white whales during the minimum ice-cover season includes the Bering and Chukchi seas and partly the East-Siberian Sea. According to Fedoseev (1986) spring migration begins in the second half of May and continues to June. However, in the Chukchi Sea, white whales appear in April—May. Large numbers have been regist red near Cape Serdse-Kamen and the Koluchinskaya Inlet. The number decreased near Cape Shmidt.

After June white whales are common and numerous in the Chukchi Sea and in the eastern portion of the East-Siberian Sea. Data from long term ice patrols show that distribution patterns in the area vary annually. In some years many whales have been seen near Wrangel Island. Fedoseev (1966) observed single whales along the mainland coast from the Kolyma River to the Chaunskaya Inlet, and groups of 500 whales in the Longa Strait.

The autumn migration from the feeding grounds to the Bering Sea continues from the second half of October until the end of November. There is no evidence of white whales wintering in the Chukchi and East-Siberian seas.

See Table 5 and Fig. 6 in the appendix for a summary of distribution.

6.3.3. Numbers and trends

The number of white whales has been estimated only for the Chukchi Sea and was found to be 3,000–4,000 whales (Berzin and Vladimirov 1986).

6.4. Economic importance

No more than some dozens of white whales are harvested annually in the INSROP area. Meat from harvested animals serves as food for dogs and in fur farming, fat is used in pharmacology.

Table 5. High density areas of white whales in relation to season in the Russian Arctic.

Season	The Chukchi Sea	The East-Siberian Sea	The Laptev Sea	The Kara Sea
Winter	1	ľ	ı	I
Spring	Bering Strait and area near Cape Serdtse-Kamen and the Koluchinskaya Inlet	I	1	Yuogorski Shar and Karskiye Vorota Straits, near Vaigach Island.
Summer	Region of Wrangel Island Marine area along the coastline from the Bering Strait to Cape Serdtse- Kamen	The region of Shalaurov Cape. Marine area adjacent to Wrangel Island Maybe along drift ice edge	Western and south-western parts of the sea including the Velkitski Strait, estuaries of the Lena, Khatanga, Olenek Rivers and maybe other large and medium-sized rivers	Near Vaigach Island and northern coast of Yugorski Peninsula, north-western Baidaratskaya Inlet, Obskaya Inlet. Near the western and north-western Taimyr Peninsula and Dikson Island.
				In the Severnaya Zemlya region. Near the south-eastern coast of Novaya Zemlya.
Autumn	Marine area adjacent to Bering Strait	T	Velkitski Strait	Severnaya Zemlya area. Karskiye Vorota Strait, near the south-eastern coast and of Novaya Zemlya.
				Obskaya Inlet. Near the western and northwestern Taimyr Peninsula including the region of Dikson Island.

6.5. Anthropogenic impact

It is well known that estuaries of large rivers are among the most contaminated areas in the Russian Arctic. There is no information on the negative effects of pollution on the white whale. Apparently commercial sailing will lead to an increase in the anthropogenic impact on this species.

Heightened oil contamination of sea water as well as contamination by waste are registered in the regions of such relatively large sea ports as Amderma, Dikson, Tiksi and Cape Shmidt. Every year white whales appear near these ports and run the risk of toxic impacts.

7. GRAY WHALES

7.1. Geographic variety

The area of INSROP-activity is inhabited only by the Chukchi-Californian population of gray whale (*Eschrichtius robustus*).

7.2. Chukchi-Californian population

7.2.1. Status

The population is included in the Red Book of the Russian Federation and the IUCN.

7.2.2. Distribution and migrations

The gray whales of the Chukchi-Californian population spend the winter and give birth in the waters off California. In February they begin migrating north along the western coast of America. Whales move to the Beaufort, Chukchi and Bering Seas which are their primary feeding grounds (Blokhin 1984, Wynne 1992).

Migrating gray whales appear first near the eastern coast of the Chukotka Peninsula (in the region of Cape Chaplin) in the last part of May (see Fig. 7 in the appendix). Most of the migrating whales move north along the south-eastern coast of Chukotka in June (Blokhin 1986, 1995).

Gray whales inhabit the Chukchi Sea from the end of May until the beginning of November (Sleptsov 1965, Blokhin 1984, Popov 1990). The largest number of whales occupy the Chukchi Sea in August—September (Tomilin 1962). The northern and western limits of the population habitat in summer is determined by the edge of the drift ice. Whales have been seen in the eastern portion of the East-Siberian Sea, in the Longa Strait, and as far north as Wrangel Island. From June gray whales occupy the whole Chukchi Sea, though concentrating in sites with a high density of their main prey; benthic crustaceans.

Other years, up to 1,500–2,000 gray whales were observed in this region. Results of the census accomplished in 1986 indicate that more than half of the population feed in the Chukchi Sea (Blokhin 1984, Popov 1990). In August 1986, 1,450 gray whales were counted in the Chukchi Sea limited in the north by 68°30' N, in the west by 173°30' W and in the east by 169° W (6,275 sq. miles). The total number of gray whales that occupied the research area

(about 11,000 sq. miles) in July-August 1986 was estimated at 5,500 animals. The whales in this period move slowly and feed intensively (Blokhin 1988). Kim and Oliver (1989) have concluded that stomach contents, feeding excavations, feeding behavior, mud plumes, and distribution of gray whales clearly indicate that the southern Chukchi Sea and especially the northern Bering Sea constitute the primary feeding ground for this species. Blokhin (1988) reported that in the second half of August numerous juvenile gray whales stay in big groups in the southern portion of the Chukchi Sea.

Considerable aggregations of gray whales appear near the northern coast of the Chukchi Peninsula in autumn. In 1980 a joint Soviet-American expedition for the study of cetaceans in the Arctic was accomplished. From September 18 until November 15 the western Chukchi Sea, the eastern East-Siberian Sea and the northern Bering Sea were inspected. Large groups of gray whales were observed in the Chukchi Sea in the region of Dvukh Pilotov Cape, and lesser groups near Cape Shmidt and in the area with co-ordinates 67°40' – 68°15'N and 164°40' – 172°10'W. During four days 588 whales were counted there. In total about 2,000 gray whales were observed in the region. In recent years the population has increased and its distribution area has expanded to the west (Popov 1990).

The gray whale is a benthic-feeding whale; it dredges through mud and uses baleen to filter out bottom-dwelling amphipods and crustaceans. They rarely feed during winter (Wynne 1992). The life of gray whales is closely associated with shallow coastal waters and lagoons. During autumn and spring migrations they move along the coastline (within 30 km) (Blokhin 1984).

7.2.3. Numbers and trends

According to Blokhin (1988) and Popov (1990) the number of gray whales occupying the most south-eastern portion of the East-Siberian Sea, the Chukchi and the northern Bering Seas is about 5,500 animals. The number is believed to be increasing.

7.2.4. Economic importance

Gray whales are harvested by native Chukchans (9 settlements on the eastern coast of the peninsula) and Alaskans. The current annual harvest is 180–200 for native subsistence (Blokhin 1984, Wynne 1992).

The gray whale of the Chukchi-Californian population is represented in the NSR area during a possible sailing season, and should be considered a VEC. Particular attention should be paid to summer feeding areas and to sites of autumn aggregation.

According to available data, we propose to determine the following two key areas:

- The southern portion of the Chukchi Sea: the major feeding area of gray whales of the Chukchi-Californian population from August to October. Northern limit: 68°30'N; western: 173°30'W; and eastern: 169°W.
- A marine area (up to 100 km wide) along the northern coast of the Chukchi Peninsula from Vankarem Cape to Dezhnev Cape in a period from September to November where whales aggregate before and during autumn migration.

7.3. Anthropogenic impact

7.3.1. Pollution

Because gray whales occupy areas free of ice or with rare ice cover, emissions to ice do not seem significant for them. This species, as well as all marine species, is particularly vulnerable to emissions to the sea.

Oil contamination: Results of research concerning oil contamination on ringed seals indicate a grave condition for the affected animals (from transient eye problems to changing of some blood parameters and death) caused by oil (Geraci and Smith 1976). Cetacean skin seems to be more active metabolically than the skin of other mammals and may be more sensitive to damage from oil (Tinyakov et al. 1973, Dargoltz et al. 1978). Slow moving gray whales appearing in areas contaminated by oil will inevitably be damaged. Whales breathing in oil-covered leads, with no alternative areas for surfacing could be seriously at risk (Stirling and Calvert 1983). Depending on date, place and level of contamination few animals or a part of the population may be affected.

Accumulation of toxic chemicals: The real danger for gray whales as well as for other marine mammals is caused by pollutants such as heavy metals, DDT and polychlorinated biphenyls (PCBs). Increasing levels of pollution are inevitable because many of these compounds are stable and will continue to cycle through the ecosystem with increased concentration at higher trophic levels (Stirling and Calvert 1983). A joint Russian-American expedition found high levels of chlororganic pollutants in samples of plankton and benthos. However, the same levels of the compounds have been reported from some other Arctic areas, which indicates that the main sources of pollution are not local.

The accumulation of toxic materials in the tissues of marine mammals significantly reduces the reproductive rate, causes a high abortion rate, birth deformities and still births in mammals (DeLong et al. 1973; Helle et al. 1976a, b; Newby 1978). There is no evidence about a particular danger of these compounds for the gray whale, however, all high levels of the marine ecosystem are equally endangered.

Industrial waste is the main source of pollution. So, from an operational point of view, proper use of the NSR should not lead to a significant increase in the level of such compounds in sea water. Such an increase can be caused by development of shore infrastructure, coastal settlements and sea ports.

7.3.2. Noise

Migrating gray whales are very sensitive to noise from ships. Experiments have indicated that during migration about 10, 50 and 90% of gray whales showed avoidance when exposed to noise levels of 110, 117 and 122 dB respectively (Malme *et al.* 1983, 1984). In the feeding areas noise caused by regular ship traffic can force whales to leave sites with a high concentration of prey.

7.3.3. Physical disturbance

Because distribution patterns of whales in the Arctic seas are strictly determined by ice conditions, changes in ice cover can lead to changes in the temporal and spatial distribution of animals. The last migrating gray whales leave the Chukchi Sea simultaneously with the

advancing ice edge. In such situations the existence of leads and channels made by ship traffic may attract some whales to stay there, and cause their death in so-called 'ice traps'. Such cases are reported for white whales (Stirling *et al.* 1984). However, it should be noted that the majority of the population leaves the Chukchi Sea before the ice edge advances. Because of this fact, the death of a considerable number of gray whales under these circumstances seems unlikely.

8. BOWHEAD WHALES

The bowhead whale (*Balaena mysticetus*) is a slow swimmer. It can break through 1–2 ft of thick ice with its head. Bowhead whales are usually found single or in groups of 3 animals, but aggregations of 50–60 and more may occur at feeding grounds and during migrations. This whale is highly vocal during migration (Sokolov 1990, Wynne 1992).

8.1. Geographic variety

The area of INSROP activity is inhabited by the Bering-Chukchan population of the bowhead whale. Occasionally single whales of the East Atlantic population are observed in the northeastern portion of the Kara Sea.

8.2. Bering-Chukchan population

8 3.1. Status

The population is included in the Red Book of the Russian Federation and the IUCN.

8.2.2. Distribution and migrations.

The Bering-Chukchan population of bowhead whales occupies the Chukchi Sea in

summer (see Fig. 8 in the appendix) (Tomilin 1962).

Winter areas: The population spends the winter in the Bering Sea. A part of the population (more than 200 animals) stays in the Sirenikovskaya polynya and in the polynya situated south to south-west of St. Lawrence Island. Because juveniles appear there in March–April, it is possible that whales give birth there (Bogoslovskaya et al. 1984).

Spring migration: Usually spring migration begins from the first half of April at three sites:

- Near south-western St. Lawrence Island,
- · Near south-eastern St. Lawrence Island, and
- Region of Sirenikovskaya polynya.

Migrating bowhead whales move along the coastline approaching some capes as close as 100–200 m. Most of the population migrate eastwards along the Alaskan coast, the rest follow leads in the ice (2–3 km from the coastline) turning west after the Bering Strait. In the beginning of May they are usually observed near the coastal settlement of Inchoun. Spring migration is interrupted and consists of different age groups and continues until May (Bogoslovskaya et al. 1984).

Summer areas: According to Sleptsov (1961), the population area in summer has the following limits: Longa Strait – Wrangel Island – Herald Island – Cape Barrow. Tomilin (1957) designated the eastern East-Siberian Sea as the western limit of the population. Material from last century's whaling allows us to conclude that bowhead whales begin to move from the northern coast of Alaska and the Beaufort Sea to the western portion of the Chukchi Sea in the end of July (Berzin and Rovnin 1984). Popov (1990) also reported that in the end of July until the beginning of August bowhead whales stay in the Beaufort Sea and are very rare in the Chukchi Sea. According to Popov (1990) they appear at the beginning of September near the northern coast of the Chukotka Peninsula, but in 1991 aerial ice patrol observed bowhead whales in the area in July.

Autumn migration: Before autumn migration bowhead whales aggregate along the northern coast of the Chukotka Peninsula. East of Cape Vankarem whales are usual in autumn. Along the coastline between Cape Serdtse-Kamen and the settlement of Uelen bowhead whales are usual from the middle of October until the middle of November (Bogoslovskaya et al. 1984).

In 1980 a Soviet-American research expedition surveyed bowhead whales:

19 Sept. - Cape Serdtse-Kamen: 32 whales,

20 Sept. - Kolyuchinskaya Inlet: 23 whales,

21 Sept. - Cape Vankarem: 200 whales. (At that time there were no bowhead whales west of 179°40'E), and

26 Oct. - Cape Serdtse-Kamen: 70 whales.

A total of 608 bowhead whales were counted uring the expedition, more than half of them were observed near Cape Vankarem (Berzin an Rovnin 1984).

In the second half of October 1979 bowhead whales concentrated along the shore-fast ice edge from Cape Vankarem to the Kolyuchinskaya Inlet. According to a rough estimate about 1,500 bowhead whales at that time occupied the region including Wrangel and Herald Islands (Popov 1990).

Autumn migration is divided into two parts: the first part around the 20th of September, the second one in the middle of October. The last bowhead whales leave the Chukchi Sea with the advancing ice edge (the end of October – the beginning of November) (Popov 1990).

Available material shows that the bowhead whales of the Bering-Chukchan population are found in the Chukchi Sea in summer—autumn, and aggregate along the northern coast of the Chukotka Peninsula in autumn, and along the eastern coast of the peninsula during spring migration. Therefore the bowhead whale of the Bering-Chukchan population should be considered a VEC in relation to INSROP. Particular attention is required for areas of high concentration and mass migrations.

Based on the available data we propose to define two key regions for the bowhead whale (Fig. 8):

• The marine area along the northern coast of the Chukchi Peninsula between Cape Vankarem and Cape Uelen in the period from the middle of September until the end of October. This is the area where bowhead whales aggregate before and during autumn migration.

• The marine area in the Bering Sea along the eastern coast of the Chukchi Peninsula between Provideniya Bay and Cape Dezhnev from the beginning of April until the middle of May. Formally, this region is not included in the INSROP area, but before the mentioned period the majority of the population migrate north there. Consequently, the population is quite vulnerable in this limited area.

8.2.3. Numbers and trends

According to Berzin and Vladimirov (1986) the stock inhabiting the Chukchi Sea consists of 3,000–3,500 whales. The populations are probably increasing.

8.3. Economic importance

The current harvest is limited to subsistence use by the native Alaskan population who are allowed to harvest about 50 whales per year (Wynne 1992).

8.4. Anthropogenic impact

8.4.1. Pollution

It should be noted that in summertime the bowhead whale distribution in the Chukchi Sea is more even than the distribution of gray whales, they are therefore less vulnerable to local seawater contamination.

Oil contamination: The same effects as on the gray whale.

Accumulation of toxic chemicals: The same effects as on the gray whale.

8.4.2. Noise

Bowhead whales, as well as the other cetaceans, are highly vocal, their sounds being used in social organization. Noise which interferes with signals or damages receptors could cause serious problems for the whales (Stirling and Calvert 1983). In a special experiment the behavior of bowhead whales exposed to underwater playbacks of recorded drill ships and dredge noise were studied (Richardson *et al.* 1990). Some (but not all) bowhead whales oriented away when exposed to noise characteristics comparable to those several km from actual drill ships and dredges. During some playback tests, call rates decreased, feeding ceased and cycles of surfacing, respiration and diving may have changed. Roughly half responded when the received level of noise was the same as 3–11 km from a drill ship and dredge.

Apparently noise from regular ship traffic and aircraft servicing navigation in the areas of whale concentrations could cause serious damage for the species. As a result, distribution patterns and periods of migration can change and cause negative consequences for the population.

8.4.3. Physical disturbance

The distribution of the bowhead whale population in the Chukchi Sea is strictly determined by the ice edge. Bowhead whales are often observed in ice-filled waters. Because of this, it seems possible that bowhead whales move in channels made by ship traffic. As a result whales can die in so-called 'ice traps'. Bowhead whales are exposed to this risk to an even greater degree

than gray whales because they move broader (along the ice edge) searching for food. On the other hand, the appearance of artificial channels in spring before migration (the beginning of April) could attract whales wintering in the Sirenikovskaya polynya. In such cases many juveniles could be among the animals in the 'ice trap'.

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APPENDIX

Maps showing the Northern Sea Route area. The indicated seasonal distribution of marine mammal species are rough approximations based on available data.

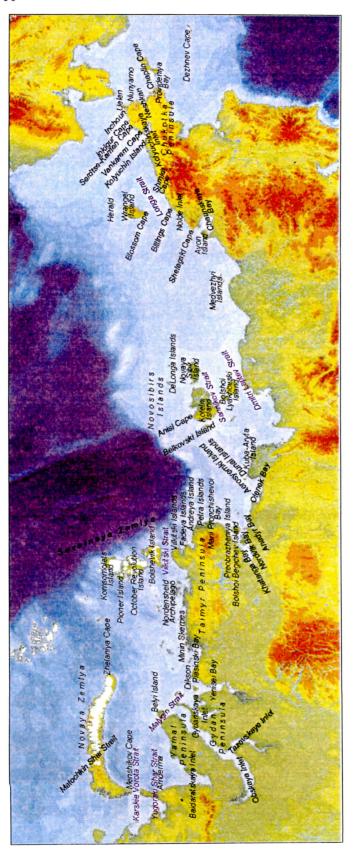


Fig. 1. The Northern Sea Route area with most place names mentioned in the text.

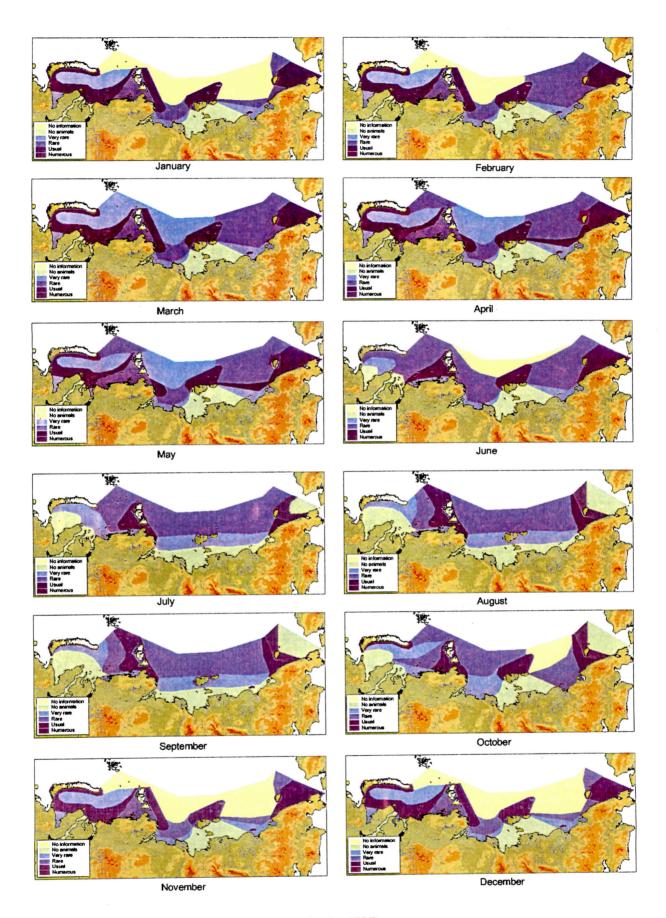


Fig. 2. Seasonal distribution of polar bears in the NSR area.

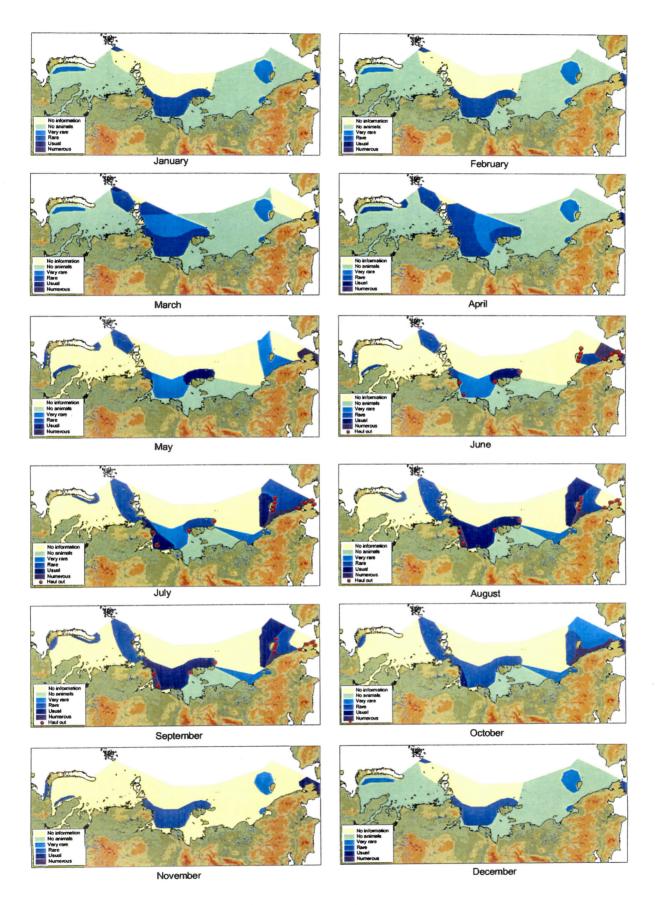


Fig. 3. Seasonal distribution of walruses in the NSR area.

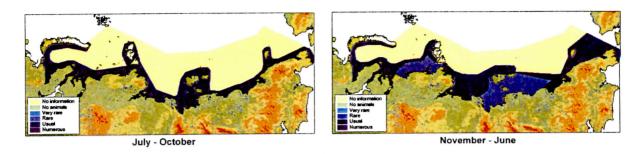


Fig. 4. Seasonal distribution of ringed seals in the NSR area.

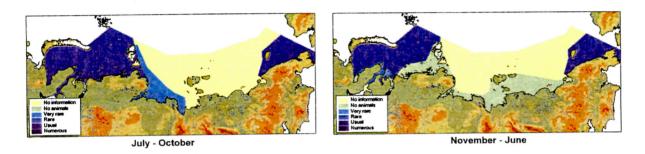


Fig. 5. Seasonal distribution of bearded seals in the NSR area.

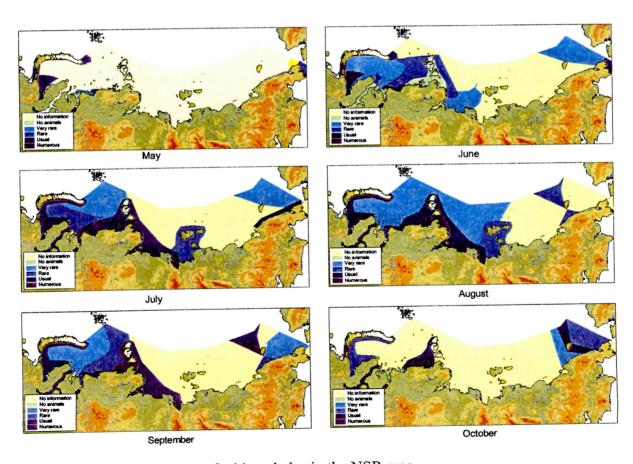


Fig. 6. Seasonal distribution of white whales in the NSR area.

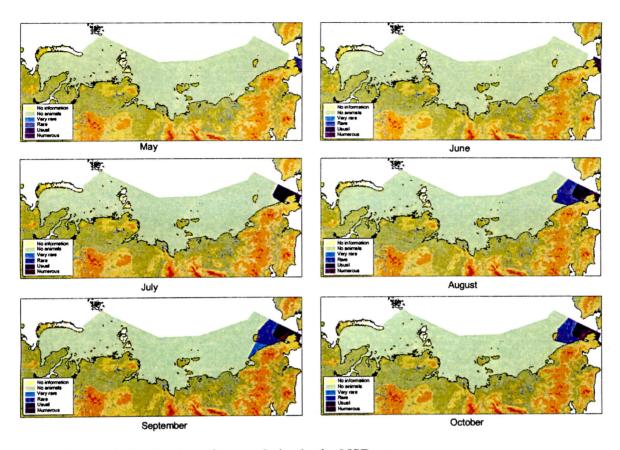


Fig. 7. Seasonal distribution of gray whales in the NSR area.

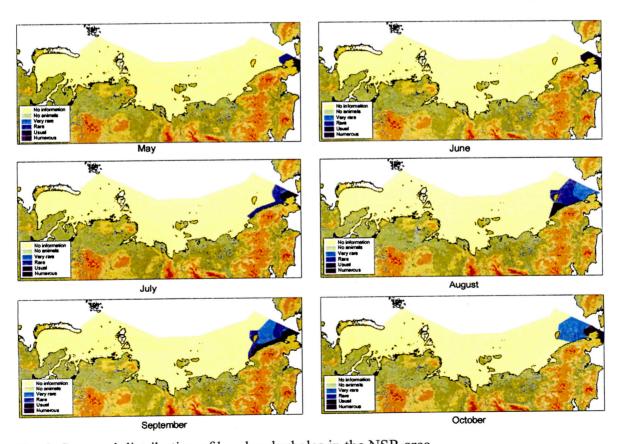
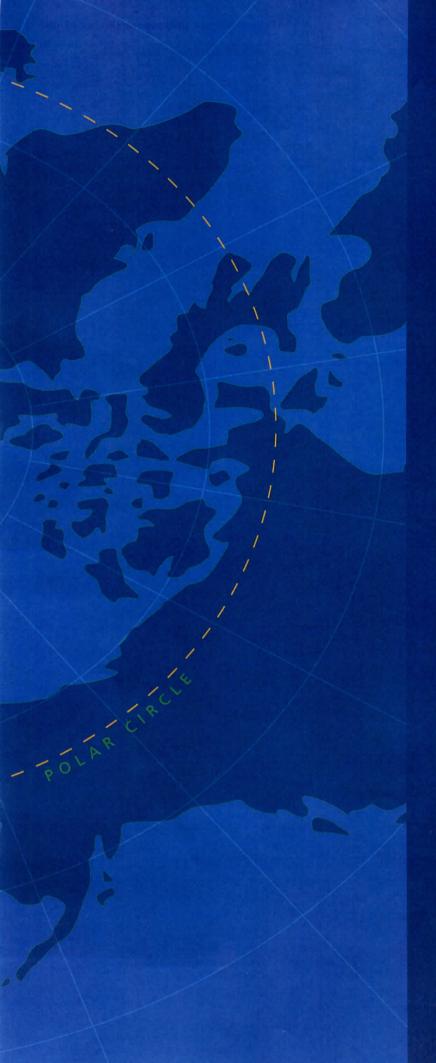


Fig. 8. Seasonal distribution of bowhead whales in the NSR area.

Results of review on the papers submitted to the International Northern Sea Route Program are shown as follows.

- 1. The distribution of selected marine mammals in the Northern Sea Route Area. By Stanislav Belikov et al.
- 1. The paper is well documented and keep quality to introduce general information on some species of marine mammals in the Northern Sea Route Area. Particularly, information from Russian paper is very much limited despite of their enormous conduction of research in the area. Thus it is worth publishing.
- 2. The paper is a kind of review work on the existing information and well cited in general. However, there is no citation of the original information about the TABLES. If they were summarized by the authors, it is strongly advised to mention as summarized information on in the table explanation.
- 3. As to figures, there are no good accordance of figure no. in the text and actual figures prepared for this paper. Authors need to reexamine the figure no. in the text.
- 4. I checked the references in the text and reference list and found many mistakes. Some were not listed in the references and some were missed in the text. Therefore authors are requested to re examine the references both in the text and the list.
- 5. There are some serious problem as indicated above, yet I strongly recommend to editors to publish this paper if above are reexamined and revised properly.
- 6. I directly pointed other problems in the text. Please check it.



The three main cooperating institutions of INSROP



Ship & Ocean Foundation (SOF), Tokyo, Japan.

SOF was established in 1975 as a non-profit organization to advance modernization and rationalization of Japan's shipbuilding and related industries, and to give assistance to non-profit organizations associated with these industries. SOF is provided with operation funds by the Sasakawa Foundation, the world's largest foundation operated with revenue from motorboat racing. An integral part of SOF, the Tsukuba Institute, carries out experimental research into ocean environment protection and ocean development.



Central Marine Research & Design Institute (CNIIMF), St. Petersburg, Russia.

CNIIMF was founded in 1929. The institute's research focus is applied and technological with four main goals: the improvment of merchant fleet efficiency; shipping safety; technical development of the merchant fleet; and design support for future fleet development. CNIIMF was a Russian state institution up to 1993, when it was converted into a stockholding company.



The Fridtjof Nansen Institute (FNI), Lysaker, Norway.

FNI was founded in 1958 and is based at Polhøgda, the home of Fridtjof Nansen, famous Norwegian polar explorer, scientist, humanist and statesman. The institute spesializes in applied social science research, with special focus on international resource and environmental management. In addition to INSROP, the research is organized in six integrated programmes. Typical of FNI research is a multidisciplinary approach, entailing extensive cooperation with other research institutions both at home and abroad. The INSROP Secretariat is located at FNI.