



**INSROP WORKING PAPER
NO. 141 - 1999, II.4.3**

Reindeer of the Russian Arctic

By Stanislav E. Belikov and Andrei N. Boltunov

INSROP International Northern Sea Route Programme



Central Marine
Research & Design
Institute, Russia



The Fridtjof
Nansen Institute,
Norway



Ship and Ocean
Foundation,
Japan

International Northern Sea Route Programme (INSROP)

Central Marine
Research & Design
Institute, Russia



The Fridtjof
Nansen Institute,
Norway



Ship & Ocean
Foundation,
Japan



INSROP WORKING PAPER NO. 141-1999

Sub-programme II: Environmental Factors

Project II.4.3: Mapping of valued ecosystem components. Marine Mammals.

Supervisor: Øystein Wiig, Zoological Museum, University of Oslo, Norway.

Title: Reindeer of the Russian Arctic

Authors: Stanislav E. Belikov and Andrei N. Boltunov

Address: All-Russian Research Institute for Nature Protection.
Znamenskoye-Zadki
113629 Moscow
Russian Federation

Date: 6 March 1999

Reviewed by: Professor David R. Klein, Institute of Arctic Biology
University of Alaska Fairbanks, USA.

What is an INSROP Working Paper and how to handle it:

This publication forms part of a Working Paper series from the **International Northern Sea Route Programme - INSROP**. This Working Paper has been evaluated by a reviewer and can be circulated for comments both within and outside the INSROP team, as well as be published in parallel by the researching institution. A Working Paper will in some cases be the final documentation of a technical part of a project, and it can also sometimes be published as part of a more comprehensive INSROP Report. For any comments, please contact the authors of this Working Paper.

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.

The complete series of publications may be obtained from the Fridtjof Nansen Institute.

SPONSORS OF INSROP

- Nippon Foundation/Ship & Ocean Foundation, Japan
- The government of the Russian Federation
- The Norwegian Research Council
- The Norwegian Ministry of Foreign Affairs
- The Norwegian Ministry of Industry and Energy
- The Norwegian Ministry of the Environment
- The Central and Eastern Europe programme
- State Industry and Regional Development Fund, Norway
- Phillips Petroleum Company, Norway
- Kværner a.s.
- Norwegian Federation of Shipowners
- Norsk Hydro
- Fridtjof Nansen Institute

PROFESSIONAL ORGANISATIONS PERMANENTLY ATTACHED TO INSROP

- Ship & Ocean Foundation, Japan
- Central Marine Research & Design Institute, Russia
- Fridtjof Nansen Institute, Norway
- National Institute of Polar Research, Japan
- Ship Research Institute, Japan
- Murmansk Shipping Company, Russia
- Northern Sea Route Administration, Russia
- Arctic & Antarctic Research Institute, Russia
- Norwegian Polar Research Institute
- SINTEF (Foundation for Scientific and Industrial Research - Civil and Environmental Engineering), Norway.

PROGRAMME COORDINATORS

- Yuri Ivanov, CNIIMF
Kavalergardskaya Str.6
St. Petersburg 193015, Russia
Tel: 7 812 271 5633
Fax: 7 812 274 3864
E-mail: cniimf@neva.spb.ru
- Willy Østreg, FNI
P.O. Box 326
N-1326 Lysaker, Norway
Tel: 47 67 11 19 00
Fax: 47 67 11 19 10
E-mail: sentralbord@fni.no
- Hiroyasu Kawai, SOF
Nippon Zaidan Building
15-16 Toranomon 1-chome
Minato-ku, Tokyo 105-0001, Japan
Tel: 81 3 3502 2371
Fax: 81 3 3502 2033
E-mail: sofkawa@blue.ocn.ne.jp

CONTENTS

1. INTRODUCTION.....	3
2. WILD REINDEER.....	3
2.1. ISLAND POPULATIONS	4
2.1.1. Schematic reconstruction of development of area of island reindeer populations.....	4
2.1.2. Present state of the island reindeer populations	5
2.1.2.1. Novaya Zemlya	5
2.1.2.2. Kara Sea - islands and mainland coast	6
2.1.2.3. Arctic islands of Middle Siberia.....	7
2.1.2.3.1. Severnaya Zemlya	7
2.1.2.3.2. Islands near the north-western Taimyr Peninsula.....	8
2.1.2.4. Novosibirsk Islands	8
2.1.2.5. Wrangel Island	8
2.1.2.6. Peculiarities of ecology of island reindeer populations essential for their protection.....	9
2.2. REINDEER OF THE MAINLAND COASTAL AREA AND ADJACENT TUNDRA ZONE.....	9
2.2.1. Russian European North	9
2.2.2. Middle Siberia (Krasnoyarski Krai).....	10
2.2.3. Eastern Siberia (Sakha-Yakutia Republic)	11
2.2.3.1. Bulunskaya population.....	12
2.2.3.2. Yano-Indigirskaya population.....	12
2.2.3.3. Sundrunskaya population	12
2.2.4. Northern Far East.....	13
3. DOMESTIC REINDEER.....	13
3.1. GRAZING GROUNDS OF DOMESTIC REINDEER IN ARCTIC REGIONS OF RUSSIA	13
3.2. Number of domestic reindeer in different parts of the Russian Arctic.....	14
3.2.1. European north of Russia.....	14
3.2.1.1. Murmanskaya oblast	14
3.2.1.2. Arkhangelskaya oblast	14
3.2.2. Western Siberia (Yamalo-Nenetskiy autonomous okrug)	15
3.2.3. Middle Siberia (Taimyrskiy autonomous okrug).....	17
3.2.4. Sakha Republic (Yakutiya)	17
3.2.5. Russian North-East (Chukotskiy autonomous okrug)	18
4. REFERENCES.....	18

1. INTRODUCTION

A realization of plans on development of commercial navigation through the Northern Sea Route will lead to an increase of anthropogenic impact not only on marine but also terrestrial ecosystems especially in the vicinity of sea ports, along roads and gas and oil pipe-lines. Damage of reindeer grazing lands seems quite possible under the circumstances. Disturbance and poaching will follow the industrial development of the Arctic region. Therefore, consistent data on the distribution, number and main migration routes of wild and domestic reindeer have to be considered in the development of plans on INSROP. This review presents such data. The considered area includes archipelagos and islands situated in the Kara, Laptev, East-Siberian and Chukchi seas as well as mainland parts washed by the seas. The taxonomic division of wild reindeer is not properly developed. The existence of the following three subspecies in the area is commonly accepted: *Rangifer tarandus pearsoni* (Novaya Zemlya), *R. t. tarandus* (mainland tundra of European part of the Russian Arctic), *R. t. sibiricus* (tundra zone and islands east of the Yamal Peninsula). Michurin (1965) proposes to distinguish the reindeer of the Taimyr Peninsula as a subspecies *R. t. taimyrensis*.

2. WILD REINDEER

Table 1 presents numbers of reindeer populations inhabiting the NSR area, and Fig. 1 shows where the areas are located.

Table 1. Recent estimates of the size of reindeer populations in the NSR area, and their vulnerability to anthropogenic and natural negative impact estimated on a 1-3 scale (3 = the worst). Numbers of areas correspond to those on the Fig. 1.

Area	Vulnerability	Number of reindeer	Reference
Island populations			
1. Novaya Zemlya	2	6,000	Novikov 1983a
2. Kara Sea (islands and mainland coast of western Siberia)	2	3,000-5,000	Belikov and Kalyakin 1989
3. Severnaya Zemlya	3	< 100	Belikov and Randla 1987
4. Novosibirsk Islands	3	5,000-10,000	Kupriyanov, pers. Comm. (1994)
5. Wrangel Island	1	1,800-1,900	Kazmin 1986
Reindeer of the mainland coastal area and adjacent tundra zone			
6. Russian European North	3	3,300	Syroyechkovski 1986
7. Taimyr Peninsula	1	600,000	Kolpashikov, pers. Comm. (1995)
8-10. Sakha-Yakutia	1	147,200	Syroyechkovski 1986
11. North of the Far East	2	16,000-18,000	Chernyavski et al. 1989

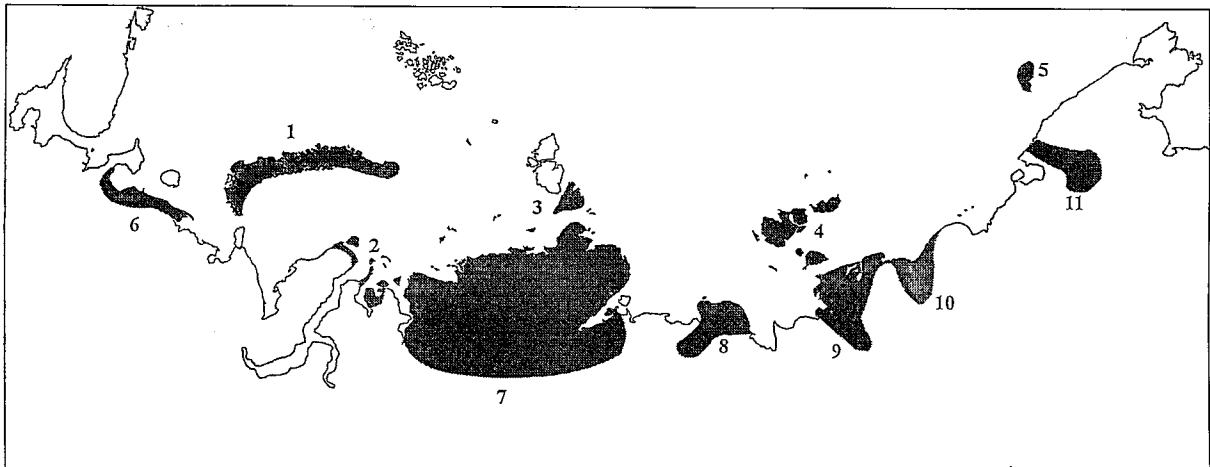


Fig. 1. Ranges of the wild reindeer populations in the Russian Arctic (1: Novaya Zemlya, 2: Kara Sea (islands and mainland coast of Western Siberia), 3: Severnaya Zemlya, 4: Novosibirsk Islands, 5: Wrangel Island, 6: Russian European North, 7: Taimyr Peninsula, 8-10: Sakha-Yakutia, 11: North of the Far East).

2.1. ISLAND POPULATIONS

Reindeer inhabiting the mainland coast and islands of the Russian Arctic form a separate group of the 900,000 reindeer of Russia (Syroyechkovski 1986). Kupriyanov and others (1985) consider the "island" reindeer a specific ecological form of the species. Their range and some ecological peculiarities have been formed under the influence of local and global environmental changes at the end of Pleistocene - up to Holocene in the northern Holarctic.

2.1.1. Schematic reconstruction of development of area of island reindeer populations

It has been discovered that during Pleistocene the level of the world's oceans changed several times from (-300) to 180 m, compared to the present level (Linsberg 1972). When the level was especially low, the Eurasian shelf became land and all the present Arctic islands were included in the continent. Apparently a part of that high latitude land was covered by tundra inhabited by reindeer. Possibly, at that time the populations of reindeer adapted to life in the Arctic tundra and deserts appeared in the coastal areas of the continent.

The world's oceans' transgressions led to a re-isolation of the islands. However, stable ice cover allowed reindeer to move between the mainland and the islands for seasonal change of grazing lands. Such migrations on the marine ice are characteristic for reindeer of the Novosibirsk Islands and Belyi Island. At the same time reindeer of Novaya Zemlya, Severnaya Zemlya, Svalbard and Franz-Josef Land have been isolated from the mainland due to remoteness of the islands and heavy ice conditions in straits. Nowadays reindeer inhabit these archipelagos with the exception of Franz-Josef Land. Presence of reindeer on the archipelago in the past is proved by numerous findings of horns. In 1981 on the Gram Bell Island several antlers were collected; age of two antlers of the collection was determined by radiocarbon method: 2210 ± 120 years and 2680 ± 60 years (Kupriyanov et al. 1985).

2.1.2. Present state of the island reindeer populations

2.1.2.1. Novaya Zemlya

One of the biggest populations of reindeer has inhabited this archipelago. The reindeer has been considered a sub-species *R. t. Pearson*. From the end of the 19th century until the beginning of the 1930s the size of the population varied from about 20,000 to some hundreds of animals (Zubkov 1935). Abrupt changes in numbers have been mostly conditioned by ice-crusting grounds and food conditions (Novikov 1983a).

When the population was especially numerous (the end of the 19th century) the majority of the animals wintered on the Kara side of the Yuzhnyi Island, staying on slopes and mountain crests. Primary summer grounds were also on the Yuzhnyi Island. Severe winters in 1920-21 and 1931-32 led to mass mortality of the reindeer. As a result the population was reduced to 1,000 animals which occurred mostly on the Kara side of the Severnyi Island (Zubkov 1935). Reductions continued till 1950 when only some dozen animals remained (Uspenski 1958). Since 1984 hunting of reindeer on the Novaya Zemlya has been prohibited.

A recovery of the population began after 1950. In 1980, according to Matveev (1981), the population consisted of 4,000-5,000 animals or about 6,000 animals, according to Novikov (1983a). The majority of the reindeer (3,500 animals) were observed in the Gusinaya Zemlya Peninsula of the western Yuzhnyi Island. Animals stayed there in groups of 6-80 specimens. The other herd (about 1,000 animals) occurred on the Mezhdusharski Island, where reindeer formed some groups of 9-50 specimens and two groups of 150 and 200 specimens. For some, subsequent years many reindeer (150-200 animals) continued to use these two areas for wintering (Khakhin, pers. comment.). Few reindeer stay for wintering on the Kara side of the Yuzhnyi Island. 10% of animals observed during an air survey in 1980 had the color of domestic reindeer because in the beginning of the 1930s a herd of domestic reindeer was moved to the Novaya Zemlya, where they mixed with wild animals.

According to an air survey in 1980 (Novikov 1983a), calving are situated at the foot of the mountains of the western and eastern coasts of the Yuzhnyi Island - from the Brandta Bay in the north to the mountain Vtoraya Savina in the south of the island. Mating begins in the second half of September in the southern part of the Severnyi Island.

In 1981-1982 780 reindeer were hunted. The average weight of adult males was 90-160 kg, females - 60-90 kg, one-year old males - 40-50 kg, and one-year old females - 35-45 kg. The sex ratio (male : female) for adult animals was 1:2.5 (Novikov 1983a).

Matveev (1981) assumes that the grazing lands of Novaya Zemlya can feed no more than 4,500 reindeer. Syroyechkovski (1986) does not agree with this opinion. He assumes that the habitats can sustain much more than 4,500 reindeer, and that the main cause of mass mortality is ice-crusting grazing lands conditioned by penetration of humid Atlantic air.

The reindeer of Novaya Zemlya have been harvested since the end of the 19th century, when colonization of the islands by Russians and Nentzs began. Some years up to 3000 reindeer were harvested. As a result of the over-harvesting and some very hard winters that occurred in the beginning of the 20th century, the state of the population was getting dramatically worse. Therefore, the population was included in the Red Book of USSR (1984), and the Red Book of the Russian Federation (1983).

During the second half of the 20th century poaching become one of the most negative factors for the population. However, after most of the organizations stationed on Novaya Zemlya left the islands during the second half of the 1980s, the pressure of poaching has decreased. Reindeer

have returned to areas where they were not observed for many years, in particular the northern part of the Severnyi Island near Cape Zhelaniya where we registered 18 reindeer in April 1995.

There is a plan to organize a Natural Protected Area on Novaya Zemlya to protect natural life of the islands, including the reindeer and its habitats.

The Vaigach and Kolguyev Islands were inhabited by wild reindeer, however they were pushed out by domestic reindeer (Syroyechkovski 1986).

2.1.2.2. Kara Sea - islands and mainland coast

During the 1920s the population of reindeer inhabiting the Belyi Island and the northern Yamal Peninsula consisted of 8,000 animals (Tyulin 1938). In the summer of 1930 about 5,000 reindeer inhabited the island, in autumn 1935 only 2,179 animals were counted. During the following years the size of the population decreased very fast, and by 1949 no more than 300 reindeer remained on the island (Syroyechkovski 1986). In the mid-1960s the population inhabiting the Belyi Island and the northern Yamal Peninsula consisted of about 500 specimens. Only some dozens of them stayed on the northern Yamal (Skrobov 1975). No migrations of reindeer through the Malygin Strait were observed at that time.

In August 1980 as a result of an air survey of the island, 1,600 reindeer were counted. A survey of 1981 showed almost the same result. Taking into consideration that not the whole island was inspected the number of reindeer on the island was estimated at about 2,000 specimens (Kupriyanov 1983). Herds of some hundred adult females with calves were observed during the survey. Calves of the year made up one-fifth of animals in the herds. According to an approximate estimation, the grassland area of the island was about 150,000-180,000 ha (about 100 ha per deer). In some sites the grazing lands were overgrazed.

In winter reindeer moved as far south along the western Yamal coast as the Sharapovy Koshki. Occasionally some reindeer were met on the eastern slope of the Polar Ural mountains (about 68° N), on the Gydanski Peninsula, and on the Shokalski and Oleniy islands (Syroyechkovski 1986).

According to a 1977 survey, about 200 reindeer stayed on the Gydanski Peninsula, 40 - on the Shokalski Island, 50-120 - on the Oleniy Island, and 50-300 - on the Sibiryakov Island (Bakhmutov and Azarov 1981). By the end of the 1970s the group of reindeer on the Polar Ural had gone, and no more than 60 animals stayed on the far north-western Yamal Peninsula (Bakhmutov and Azarov 1981).

An air survey done in 1988 (Belikov and Kalyakin 1989) showed that about 300 reindeer stayed on the Belyi Island, 50 - on the Neupokoyev Island, 500-600 - on the Sibiryakov Island. 50-100 animals stayed on the Bolshoi Begichev Island in the Laptev Sea near the south-eastern Taimyr Peninsula, while during the 1930s about 2,000-2,500 animals inhabited this island.

According to questionnaire data (Kupriyanov, pers. comm.) about 1,000 reindeer have inhabited the Belyi Island during the 1990s. The number of reindeer in the north-western Yamal has also increased.

At the end of 1980 about 3,000-5,000 reindeer inhabited the extreme north of Western Siberia including the islands (Belikov and Kalyakin 1989).

So, reindeer of the population inhabiting the Belyi, Oleniy, Shokalski islands and the nearest mainland areas on the Yamal and Gydanski peninsulas do not migrate far, and their range is associated with the Arctic tundra.

The exploitation of oil and gas deposits on the Yamal Peninsula could lead to an increase of anthropogenic impacts on reindeer inhabiting the northern part of the peninsula and the Belyi

Island. Therefore it has been proposed to raise the status of their existing refuge, and to pay particular attention to prevent illegal hunting (Belikov and Kupriyanov 1985). If reindeer again begin to migrate through the Malygin Strait, it is necessary to protect their migration routes through the strait.

2.1.2.3. Arctic islands of Middle Siberia

2.1.2.3.1. Severnaya Zemlya

According to available data, reindeer occur on all four of the biggest islands of the archipelago: Bolshevik, October Revolution, Komsomolets, and Pioneer. However, only the Bolshevik and October Revolution islands are, apparently, inhabited by the reindeer the whole year around (Belikov and Kupriyanov 1985). The total number of reindeer on the archipelago is hardly more than some dozen. When the first people settled the Severnaya Zemlya Archipelago in the 1930s, no more than 300 reindeer inhabited it (Ushakov 1990). Such a small population is conditioned by a poor food base on the archipelago. On the other hand, an absence of bloodsucking insects, rarity of ice-crusting, and very seldom occurrence of wolves on the islands are favourable factors for the reindeer. Apparently the population is isolated from the mainland reindeer as far as there are no any registered fact of animals crossing the Vilkitskiy Strait.

Reindeer on the islands were observed in small groups of 3-10 animals, or single. In the beginning of the 1980s reindeer were usually observed in the northern part of the Bolshevik Island in the vicinity of the Telman and Akhmatov bays. On the October Revolution Island reindeer were observed in the area from Matusyevich Fjord to the Nekrasov Cape in the vicinity of the Berg Cape (Belikov and Randla 1987). In 1988 a group of 10 reindeer was observed near the Cape Arkticheski (the northern point of Komsomolets Island, 81°10'N) (Belikov and Kalyakin 1989). Apparently it was one of the most northern observations of reindeer in Eurasia.

In the 1990s single specimens and small groups of reindeer were observed only in the northern part of the Bolshevik Island - near the Akhmatov Bay and in the vicinity of Cape Peschanyi. Observations of reindeer have become more seldom than before, which indicates a decrease in the population.

Up to the 1970s no more than 5-10 reindeer were hunted annually. In the 1980s anthropogenic pressure on the population increased a lot due to uncontrolled hunting and damage of grazing lands by vehicles used in gold mines on the Bolshevik Island. During the last 5-6 years the pressure has decreased due to less human activity on the archipelago. A real threat for the populations still exists only on the Bolshevik Island, where a gold mine is situated. It is hard to control poaching by employees of the mine because of the remoteness of the island.

The small number of reindeer on the archipelago and their limited range constitute a high risk of losing the population. It would impoverish the genofond of the species, because this is the only reindeer population in Eurasia adapted for living in Arctic deserts. The following preventative measures have been proposed (Belikov and Kupriyanov 1985):

- to accomplish air survey of the archipelago to estimate number of reindeer, and find out areas of their concentration; to assess the state of their habitats;
- to organize on the archipelago a natural protected area (National Park or Reserve), where the reindeer would be one of the most protected objects;
- to establish strict control of bringing, keeping and using hunting guns belonging to enterprises based on the archipelago; to prohibit bringing private hunting guns to the archipelago;
- to prohibit low flights (lower than 200 m) of aircraft above reindeer herds;

- to keep strictly to the established order of storing and transporting fuel;
- to install field bases, and roads only in sites where soil and vegetation are absent; to prohibit use of land vehicles in the tundra in summer with the exception of some special routes.

2.1.2.3.2. Islands near the north-western Taimyr Peninsula

Small groups of reindeer (up to some dozen specimens) occur on the islands of the Nordsheld Archipelago. In April 1994 we observed three groups of reindeer (20, 24 and 12 specimens) on the Eastern and W Kamennyi islands. Apparently the reindeer move between islands on the fast ice.

2.1.2.4. *Novosibirsk Islands*

The Novosibirsk Islands are inhabited by the biggest island population of reindeer. The territory of the population includes not only the islands but also the coastal tundra of the adjacent mainland (Skalon 1940; Belikov and Kupriyanov 1985). Migrations are not regular. Sometimes the reindeer not only move within the archipelago and mainland coast, but also reach the other islands, including the De-Long Islands (Novikov 1983a; our data).

The size of the population has varied considerably from some hundreds to 20,000-30,000 animals (Yegorov and Krechmar 1967; Kishinski 1971; Novikov 1983a). The number varied a lot (from 75,000 to 16,000) in different assessments done by the mid-1980-s. No data are available on the number for the last 10 years.

According to Kupriyanov (pers. comm.) 5,000-10,000 reindeer inhabit the Novosibirsk Islands. The archipelago was partly surveyed in 1994 when the biggest group of reindeer was observed on the Fadeevski Island. A few groups of reindeer were observed in the north-eastern part of Kotelnyi Island.

Similar to the other island reindeer populations, the Novosibirsk population has been under the pressure of hunting, especially illegal hunting. However, in recent years human activity on the islands has been reduced considerably, which has led to a reduction of the pressure.

To improve protection and management of the population it is required to estimate the size, survey grazing lands, mating and calving areas, and primary migrating routes. These measures would help us find out which areas are most important for the reindeer. Such areas should be taken into consideration in the planning of any human activity on the islands. A list of measures aimed to protect island reindeer populations is included in the chapter on the Severnaya Zemlya population, and is also relevant for the Novosibirsk population.

According to inquest data, wolves are not numerous on the islands and do not cause any considerable pressure on the reindeer. However, in years when the number of reindeer decreases, the wolf population should be controlled.

2.1.2.5. *Wrangel Island*

Reindeer may have inhabited Wrangel Island in the remote past (Cherniavskiy 1984). Mineev (1946) mentioned antlers found before domestic reindeer were introduced on the island. The present reindeer population descends from a herd of about 150 domestic reindeer brought to Wrangel Island from the Chukchi Peninsula in 1947, 1948, and 1952. In the 1980s the number of reindeer inhabiting the island was about 2,000. Before 1976, when the Wrangel Island Reserve was organized, certain zootechnical work on the correlation of the sex ratio in the herd was carried out. The aim was to maintain the ratio characteristic for herds of domestic reindeer. The

work was unsuccessful and the sex structure of the population remains characteristic for wild reindeer (1 m : 2.8 f).

During the first eight years that reindeer inhabited the island, the population growth rate was about 22%. During the following years the rate decreased a little but was comparatively high. Favorable food conditions and an absence of bloodsucking insects and wolves caused not only a high rate of population growth, but also a change in the reindeer constitution. The Wrangel reindeer appeared to be the largest on the Eurasian tundra. For example, in 1962 the average weight of adult animals was about 130 kg (Kazmin 1986). The situation changed by the beginning of the 1970s: some domestic reindeer with bot invasion were brought to the island (Ovsyukova and Novikov 1983). As a result all of the island's reindeer were attacked by bots, which has led to a worsening of their state - the population growth rate decreased, and the animals did not grow as large.

Since the Wrangel Island Strict Nature Reserve was organized, zootechnical work on the reindeer was stopped and just an annual correction of the population number has been accomplished (it is recommended to maintain the population number about 1,500 animals). According to the census of 1983, about 1,800-1,900 reindeer inhabited the island (Kazmin 1986).

The introduction of reindeer on Wrangel Island has changed a balance in the island's biocenosis, and conditioned the appearance of new species (botfly, wolf, and wolverine) on the island (Kazmin 1986).

2.1.2.6. Peculiarities of ecology of island reindeer populations essential for their protection

In designing measures for protection of the island's reindeer, it is necessary to take into consideration the following peculiarities of their biology and ecology (Kishinski 1971, Druri 1949, Belikov and Kupriyanov 1985):

- absolute, or almost absolute isolation from reindeer of the mainland;
- abrupt changes in numbers caused by the state of the grazing lands;
- movements (seasonal and annual) of animals are usually local. Only considerable worsening of food conditions (overgrazing, or ice-crust on grazing lands) forces reindeer to move to the nearest islands or mainland.

2.2. REINDEER OF THE MAINLAND COASTAL AREA AND ADJACENT TUNDRA ZONE

Only those reindeer populations whose territories include the tundra zone of the mainland coast are considered in the review below.

2.2.1. Russian European North

By the mid-1950s wild reindeer were pushed out of most of the Russian North by domestic reindeer. Wild reindeer now inhabit only a small area near the Cheshskaya Bay. In the 1970s the size of this population increased and by 1972 about 3,300 reindeer inhabited the area of 35,000 km². (Syroyechkovski 1986). The reindeer of this population winter on the tundra, and in April migrate south to the forest zone.

To protect this small population it has been proposed to establish a refuge in the area that it inhabits (Syroyechkovski 1986).

2.2.2. Middle Siberia (*Krasnoyarski Kray*)

Reindeer populations inhabiting the northern parts of the Yamal and Gydanski peninsulas and the islands of the Kara Sea are described above. Reindeer of these populations do not migrate south of the tundra zone, because their movement to the south is limited by domestic reindeer grazing. However, long migrations are characteristic for reindeer of the Taimyr Peninsula. This population (about 500,000 reindeer) is the largest in Russia.

The size of the Taimyr population has changed considerably. Syroyechkovski (1986) presumes that historically 600,000-800,000 reindeer inhabited the peninsula. An abrupt decrease in numbers began at the end of the 19th century (Popov 1948) and lasted till the 1950s. Table 2 shows the dynamics of the population size since 1959 when the first survey of the population was accomplished.

This population was studied by many researchers (Pavlov et al. 1976, 1985; Yakushkin and Pavlov 1981; Pavlov and Zyryanov 1981; Kolpashikov 1979; Kolpashikov et al. 1983). Syroyechkovski (1986) has summarized available data in his monograph. We have used data from this monograph and some later sources to describe the population.

Regular surveys of the population have been done since 1966. Until 1978 the surveys were accomplished every three years, later - annually.

Big herds (200,000-250,000 reindeer) were observed on the summer grazing lands at the peak density of bloodsucking insects. A gradual increase of the population size has been registered since the time of the first air survey. However, after 1975 the increase has been slow because of a regular harvesting of the reindeer. According to Kolpashikov's (1982) estimate the food base of the habitats is enough to support 820,000-850,000 reindeer.

Table 2. Dynamics of the size of the reindeer population of the Taimyr Peninsula

Year	Number	Sex ratio (adults) M:F	Reference
1959	110,000		Syroyechkovski 1986
1966	252,000		Syroyechkovski 1986
1969	333,000	1:3	Syroyechkovski 1986
1972	386,000	1:2.4	Syroyechkovski 1986
1975	449,000	1:1.9	Syroyechkovski 1986
1978	475,000	1:2.3	Syroyechkovski 1986
1979	420,000 (470,000)	1:2.3	Syroyechkovski 1986
1980	485,000	1:1.9	Syroyechkovski 1986
1981	510,000	1:2	Syroyechkovski 1986
1982	525,000		Syroyechkovski 1986
1984	575,000		Pavlov et al. 1985
1986	595,000	1;2.2	Pavlov et al. 1989
1995	about 600,000		Kolpashikov, pers. comm.

The population has been regularly harvested since 1971. From 1971 to 1981 a total of 500,000 reindeer were hunted. At the same time about 700,000 reindeer were killed illegally. By the mid 1980s the population number was stabilized, i. e. the yield has become equal to the population growth.

The reindeer of the population inhabit a vast area migrating from the Arctic tundra to the northern taiga. The extent of the migration routes can be up to 1,500 km. The largest aggregations of reindeer are observed in summer, when about 90% of the population concentrate on a comparatively small area of tundra and forest-tundra on the western Taimyr, in the lower Piasina River, and on the coast of the Yenisey Gulf. Sometimes gatherings of 80,000-100,000 animals are observed there. Areas of summer concentrations change depending on the meteorological conditions. The summer grazing lands of the reindeer have not always been on the western Taimyr Peninsula. In the 1930s most of the population spent the summer on the north-eastern Taimyr, and migration routes lay mostly on the eastern and central Taimyr Peninsula. Kolpashikov (1982) presumes that change of grazing areas is one of the ways to keep population homeostasis, aimed at an even use of grazing lands.

At the end of July - beginning of August big herds of reindeer disperse and the animals begin to move south by certain migration routes. These routes can change from year to year. In the mid 1980s the main route lay between the Piasino Lake and the Volchanka settlement ("western corridor"); on the eastern Taimyr migration was not so massive and went east of the Volchanka settlement and Khatanga.

In recent years reindeer of the population have migrated in the three main directions: the usual southern route; the western route, crossing the Yenisey River and occupying the eastern Gydanski Peninsula; the south-eastern route, occupying an area east of the Kotun River (Yakutiya) (Kolpashikov, pers. comm.).

In August - September reindeer herds continue to disperse and small groups of animals occur in the vast area of the southern tundra and forest-tundra. In winter reindeer move to the sub-zone of the typical northern taiga down to 65° N. Some years many animals go to the left bank of the Yenisey River, but since the gas pipeline "Messoyakha-Norilsk" was built and navigation on the Yenisey River was prolonged, it has become difficult for reindeer to go by this route. Few animals (about 1,000) winter on the coast of the Kara Sea in the vicinity of the Dikson settlement and near the Taimyr Lake.

Spring migration begins in March, increases in April and continues in June. Animals move north-west and north. Pregnant females go first, they are followed by separate groups of adult males, and by young animals with dry adult females. Pregnant females move to the calving areas in the high latitude tundra. They fawn in the second half of June. In some areas calving females form gatherings of 10,000-15,000 specimens.

To protect the Taimyr population of reindeer it is necessary to reduce the pressure of illegal hunting, optimize harvesting and protect habitats against anthropogenic disturbance. Taimyrski, Putoranski, and the Great Arctic Strict Nature Reserves include the considerable part of the population habitats.

2.2.3. Eastern Siberia (Sakha-Yakutia Republic)

Only the size of the Taimyr population of reindeer is larger than the number of reindeer inhabiting north-eastern Siberia. Syroyechkovski (1986) presumes that no less than 600,000-800,000 reindeer used to inhabit the region before the beginning of 19th century. In the 19th century and the first half of the 20th century the number of reindeer in the region decreased gradually because of hunting and domestic reindeer grazing.

Since 1950 a recovery of the population has begun. In 1983-1984 the population numbered 240,000-250,000 animals, about 150,000 of them inhabited the tundra zone, the rest inhabited the forest. The number of tundra reindeer doubled in the period 1965-1975. The population growth rate was 10% (Kaigasov 1983). The increase was caused by a stabilization of the domestic reindeer stock in the region, and by the settling of domestic reindeer-breeders in certain areas, which led to localization of domestic reindeer grazing (Yegorov 1965, 1971).

In the 1960s in the Yakut tundra zone three comparatively isolated populations of reindeer formed: the Bulunskaya, Yano-Indigirskaya, and Sundrunskaya populations (Novikov 1983b).

2.2.3.1. Bulunskaya population

During the first half of the 20th century this population inhabited the delta of the Lena River, wintering in the upper reaches of the Olenek River and between the Olenek and Lena Rivers (Druri 1949).

During the second half of this century the number and range of this population have increased. In the mid 1960s the population numbered 55,000 (Novikov 1983b). At that time the population growth rate was on average 8.5%; by the mid 1980s the rate was not more than 2% (Syroyechkovski 1986). The decrease was caused by poaching and inappropriate organization of harvesting.

Until 1973-1974 reindeer of this population inhabited a few islands in the delta of the Lena River, wintering on the right bank of the Olenek River near the forest edge. Since the beginning of the 1980s the population has inhabited the whole delta of the Lena River, migrating for wintering to the area between the Olenek and Lena rivers.

2.2.3.2. Yano-Indigirskaya population

Until 1972-1973 this population inhabited the area between the Yana and Khroma rivers, wintering in the upper reaches of the Sillonnyakh and Uindino rivers. During the following 10 years the range of the population increased 10 times (Kaigasov 1983). However, Syroyechkovski (1986) presumes that the extension of the range was not caused by an increase in the size of the population, since the yield was not less than the population growth rate.

2.2.3.3. Sundrunskaya population

The reindeer of this population occupy the area east of the Indigirka River. According to Novikov (1983b), this is either the remains of a population that existed in the past big Kolyma herd, or a separate part of the Yano-Indigirskaya population. This population as well as the Yano-Indigarskaya one was over-harvested with the use of aircraft, which caused the decrease of its numbers from 27,600 down to 14,100 specimens. In 1980 - 1981 the population included three herds: Chukchi-Indigirsk (2,000), Kondalovsk (11,000), and Indigiro-Alasiysk (1,200) (Syroyechkovski 1986).

The dynamics of the size of the considered Yakut populations is shown in Table 3..

Table 3. Dynamics of the size of the considered Yakut populations (by Syroyechkovski 1986)

Population	Population number			
	1963-1965	1975	1978	1980-1981
Bulunskaya	20,000	49,500	52,600	61,000
Yano-Indigirskaya	49,500	109,000	81,600	55,300
Sundrunskaya	10,000	21,500	27,600	14,100
Novosibirsk Islands	17,800		2,900	16,800
TOTAL	97,300	180,000	169,700	147,200

According to the table the size of the Bulunskaya population increased three times in a 20-year period. At the same time size of the Yano-Indigirskaya and Sundrunskaya populations increased in the beginning of the period, but finally decreased down to the initial values. First of all this was conditioned by over-harvesting, poaching, and killing of females in spring. One of the most important limiting factors for populations of wild reindeer in Yakutia is the grazing competition with domestic reindeer (Novikov 1983b; Syroyechkovski 1986). Another factor affecting the number of reindeer in Yakutia is the migration of reindeer from the Taimyr peninsula.

2.2.4. Northern Far East

In the northern Far East of Russia domestic reindeer grazing began at the end of 18th century and led to an almost complete disappearance of wild reindeer. Some of them remained in some remote areas not covered by domestic reindeer grazing (Syroyechkovski 1986).

During the second half of the 20th century three separate herds of reindeer remain in Chukotka. Only one of them, inhabiting the vicinity of the Elgygytgyn Lake (central Chukotka), lives in the tundra zone. Migrating reindeer of the population reach the coast of the East-Siberian Sea near the Noldta Inlet.

Research done in 1985-1987 (Chernyavski et al. 1989) showed that the area inhabited by reindeer in Chukotka was not divided into three parts but was one single common area. For most of the year the reindeer stay on the tundra and from October-November they move to the tundra-forest zone. The calving area of the population is located east of the Elgygytgyn Lake. According to an aerial survey done in autumn 1987, the population had 16,000-18,000 animals.

3. DOMESTIC REINDEER

3.1. GRAZING GROUNDS OF DOMESTIC REINDEER IN ARCTIC REGIONS OF RUSSIA

Due to historical and ethnic reasons the distribution of reindeer-keeping in the extreme north of Russia is not even. The majority of domestic reindeer population (60-70%) is concentrated on the tundra and the semi-forest zones of the north-western regions of the Russian North (European

North and Western Siberia), and in the tundra zone of Chukotskiy Autonomous Okrug¹ (Druri 1955).

Six periods are distinguished in the grazing cycle of domestic reindeer - winter, early spring, late spring, summer, early autumn, late autumn (Druri 1955, Ustinov 1956, Dobrinskii 1995). The periods have peculiarities in different parts of the Russian Arctic and their alternation and duration are determined by the following major factors:

- seasonal changes in weather conditions;
- vegetation cycle and availability of pastures;
- life cycle of reindeer;
- life cycle of bloodsucking insects.

The general scheme of the grazing cycle in the tundra zone is as follows: Wintering grounds are situated in inland areas usually in the semi-forest zone. In spring herds move north following the development of vegetation. The northern grazing areas including the shoreline of the Arctic seas which are used only in short summer period from July to mid-August or September. In this part of the year seaboard pastures are of high value because bloodsucking insects are not so numerous as they are in inland areas. However, the islands in the NSR area are not mentioned in literature as pastures for domestic reindeer (Sambuk 1933, Druri 1955, Ustinov 1956, Kurilyuk 1982, Novikov 1983a, and Dobrinskii 1995). The only exception is Aion Island which is quite close to the shore in Chaunskaya Bay of the East-Siberian Sea (Ustinov 1956). The islands of Vaigach and Dolgiy situated in the south-eastern corner of the Barents Sea mentioned by P. Semerikov (1933) as summer pastures for domestic reindeer. After the summer period of grazing reindeer herds are moved to inland pastures providing more food and not so exposed to strong winds and blizzards.

3.2. Number of domestic reindeer in different parts of the Russian Arctic

According to Syroyechkovski (1986) in the beginning of the 1980s about 2,200,000 of domestic reindeer were bred in Russia. Table 4 shows the number of domestic reindeer in the Arctic zone of Russia based on unpublished official material.

3.2.1. European north of Russia

3.2.1.1. Murmanskaya oblast

Domestic reindeer grazing has existed in the area no less than 2,000 years. Reindeer were kept in small herds. The total number of domestic reindeer grazing in this region in 1970-1980 was stable and averaged 70,000 animals (Table 4). In 1990s the number has increased.

3.2.1.2. Arkhangelskaya oblast

In Arkhangelskaya oblast most of the reindeer grazing lands are situated within the limits of Nenetskiy autonomous okrug (Table 4). One-third of these grazing lands are situated in the tundra zone where the Nenets graze domestic reindeer. The number of reindeer in the Nenetskiy autonomous okrug has been comparatively stable during the whole examined period (Table 4).

¹ Okrug is a basic Russian administrative unit along with oblasts, republics, and krays. Republics, krays, oblasts and okrugs are further divided into districts. Republics (which have higher status than other units) and okrugs usually were established according to resident nationalities

Domestic reindeer-keeping has appeared in the European tundra zone many centuries ago, when ancestors of the Nenets came from the Altai-Sayan region (South of mid Siberia). On Novaya Zemlya domestic reindeer were brought in during the 1930s, but during the 1950s all economic activity was closed due to the establishment of a nuclear range. Still, hybrids of domestic and wild reindeer could be seen up to recent years (Kalyakin pers. com.).

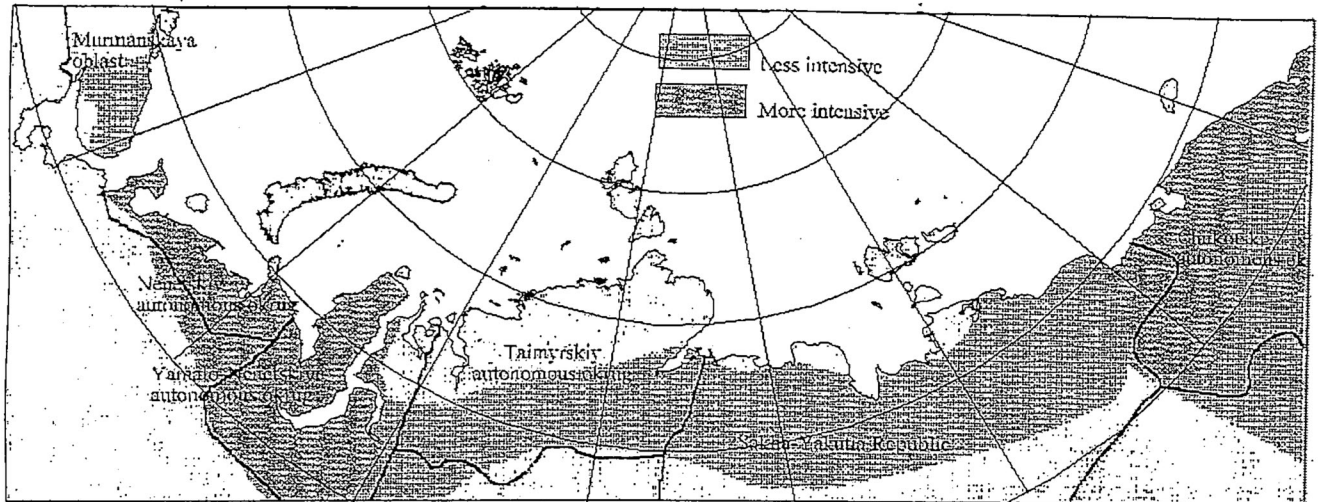


Fig. 2. Zones of reindeerkeeping in the Russian Arctic

3.2.2. Western Siberia (*Yamalo-Nenetskiy autonomous okrug*)

Yamalo-Nenetskiy autonomous okrug includes 8 administrative districts, 2 of them are situated in the tundra zone, the others - in semi forest and forest zones. Table 5 presents data on the number of domestic reindeer in two representative districts: Yamalskiy district is a typical tundra district, and Purovkiy is a typical forest one.

Most of the Yamalo-Nenetskiy autonomous okrug is situated in tundra and semi-forest. Since the 10-11th century domestic reindeer grazing has been the livelihood for the indigenous people (Nenets and Selkups) of the region. Before that time only wild reindeer inhabited the region.

Until the 17th century people used reindeer only for transport purposes. Since the 17th century the number of domestic reindeer in the region has increased.

Syroyechkovski (1986) wrote: "In 1914 on the north of the Western Siberia 445,000 domestic reindeer were registered. This number of domestic reindeer in the region has been maintained until the present time. Considerable decreases in the number were registered in 1926 - down to 344,000 animals, and in 1945 - down to 270,000. By 1955 the size was restored, with numbers reaching 433,000 animals. The maximum (452,000 - 485,000) was achieved in 1968-1975... In 1981 up to 34% of all domestic reindeer fell to private property. According to data from 1984, some Nenets families possessed up to 600 reindeer (Pika pers. com.)". In 1995 the number of domestic reindeer exceeded 500,000 (table). In recent years 55-75% of domestic reindeer in the region have been private. Grazing lands are overgrazed especially on the Yamal Peninsula.

Table 4. Number (thousands) of domestic reindeer in the Arctic regions of the Russian Federation

Year	Region																	
	Nenetskiy autonomous okrug (Arkhangel'skaya oblast)			Murmanskaya oblast			Yamalo-Nenetskiy autonomous okrug (Tyumenskaya oblast)			Taimyrskiy autonomous okrug (Krasnoyarskiy kray)			Chukotskiy autonomous okrug (Magadanskaya oblast)			Sakha republic (Yakutiya)		
	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
1970	189.5	163.0	26.5	81.9	77.4	4.5	414.1	266.8	147.3	123.2	106.6	16.6	587.0	553.1	33.9	356.3	328.6	27.7
1975	176.6	154.1	22.5	65.6	62.6	3.0	384.6	245.6	139.0	97.4	83.5	13.9	530.5	508.2	22.3	371.9	338.0	33.9
1980	184.4	162.9	21.5	66.0	62.8	3.2	363.2	231.9	131.3	88.1	75.1	13.0	565.5	542.5	23.0	375.8	342.0	33.8
1985	186.8	163.6	23.2	70.9	68.3	2.6	418.5	252.7	165.8	75.6	61.5	14.1	484.3	464.5	19.8	369.5	332.8	36.7
1986	191.7	167.6	24.1	72.1	69.2	2.9	455.1	284.0	171.1	76.1	61.1	15.0	490.1	470.5	19.6	377.9	338.8	39.1
1987	193.2	167.8	25.4	75.7	72.2	3.5	471.4	281.4	190.0	74.0	58.1	15.9	500.0	480.5	19.5	373.9	335.7	38.2
1988	193.5	166.6	26.9	76.2	72.7	3.5	502.7	283.4	219.3	77.8	60.0	17.8	508.4	485.9	22.5	375.9	335.5	40.4
1990	186.0	?	?	77.0	?	?	490.0	?	?	77.0	?	?	491.0	?	?	361.0	?	?
1991	?	159.3	?	?	73.9	?	?	226.1	?	?	54.4	?	?	397.6	?	?	283.9	?
1992	?	149.5	?	?	77.7	?	?	228.4	?	?	44.4	?	?	339.9	?	?	219.9	?
1993	?	149.3	?	?	69.3	?	?	216.1	?	?	37.7	?	?	235.2	?	?	210.2	?
1994	186.0	?	?	78.0	?	?	490.0	?	?	56.0	?	?	281.0	?	?	299.0	?	?
1995	180.0	?	?	78.0	?	?	508.0	?	?	49.0	?	?	236.0	?	?	247.0	?	?

1 - total; 2- number of reindeer in state and collective farms; 3- number of private, ? - data are not available.

3.2.3. Middle Siberia (*Taimyrskiy autonomous okrug*)

Domestic reindeer grazing has been known in this area since 18th century. By the end of the 18th century the herd of domestic reindeer on the Taimyr Peninsula numbered no more than 10,000 animals (Syroyechkovski 1986). During the 19th century and the first half of the 20th century the number of domestic reindeer in the region increased but then it begun to decrease. In 1995 the number was 49,000 reindeer. Grazing lands on the peninsula do not include seaboard pastures.

Table 5. Number (thousands) of domestic reindeer in the Yamalo-Nenetskiy autonomous okrug (figures in brackets - number of private reindeer)

Year	Administrative district		Total in the okrug
	Purovskiy	Yamalskiy	
1930	no data	118.8	346.3 (302.2)
1940	21.9	142.9	362.2 (262.7)
1950	27.6	76.9	287.0 (104.5)
1960	29.7	103.1	335.9 (104.2)
1970	38.5	128.7	414.2 (147.7)
1980	29.8	135.7	363.2 (131.3)
1986	31.1 (6.4)	153.1 (68.1)	431.1 (177.1)
1987	no data	no data	no data
1988	34.1 (8.7)	166.4 (83.9)	472.6 (219.3)
1989	34.9 (9.7)	177.4 (97.2)	495.9 (243.9)
1990	33.9 (9.6)	175.3 (97.3)	490.5 (245.1)
1991	35.4 (9.3)	178.4 (102.4)	506.3 (265.0)
1992	36.6 (9.3)	167.7 (92.8)	477.1 (248.7)
1993	31.7 (9.2)	170.1 (100.0)	481.6 (262.7)
1994	no data	no data	489.9 (285.6)
1995	no data	no data	507.8 (306.3)

3.2.4. Sakha Republic (*Yakutiya*)

Until the beginning of the 19th century domestic reindeer were used by the indigenous people mainly for transport purposes. In the beginning of the 19th century the development of reindeer grazing began. In 1917 the total number of domestic reindeer in Yakutiya was 120,000, in 1940 - 200,000, in 1960 - 340,000 (Syroyechkovski 1986). Until the beginning of the 1990s the number remained on the same level as in 1960. In recent years the negative trend in reindeer numbers has been observed, and in 1995 it was on average two times as small as in 1960-1980s.

3.2.5. Russian North-East (*Chukotskiy autonomous okrug*)

Until the end of the 18th century domestic reindeer grazing was not well developed in the region despite of rich grazing lands. The indigenous people of the region were hunters of marine mammals and wild reindeer. A considerable reduction in wild reindeer caused by over-hunting led to the development of domestic reindeer grazing. By the beginning of the 20th century domestic reindeer grazing became well developed (Syroechkovski 1986).

In 1970-1990s the number of domestic reindeer in Chukotka has shown a negative trend. By 1995 the number decreased twice comparing to the beginning of 1970s (Table 4).

4. REFERENCES

- Bakhmutov, V.A., Azarov, V.I. 1981. Distribution, number and migrations of wild reindeer on the north of Tyumenskaya Oblast. Pp. 19-26 in Number and distribution of terrestrial vertebrates of Yamal and adjacent territories. Sverdlovsk, 1981. In Russian.
- Belikov, S.E., Kalyakin, V.N. 1989. The basic factors threatening welfare of reindeer populations. Pp.164-165 in Ecology, morphology, use and protection of wild ungulate. Theses of All-Union Conference. Moscow. In Russian.
- Belikov, S.E., Kupriyanov, A.G. 1985. Protection and use of reindeer on the Arctic islands. Pp. 46-54 in Ecology, protection and use of wild reindeer. Novosibirsk. In Russian.
- Belikov, S.E., Randla, T.E. 1987. Fauna of birds and mammals of the Severnaya Zemlya. Pp. 18-28 in Fauna and ecology of birds and mammals of the Middle Siberia. Moscow, Nauka Press. In Russian.
- Cherniavskiy, F.B. 1984. Mlekopitayushiye krainego severo-vostoka Sibiri [Mammals of the extreme north-west of the Siberia]. Krivosheev, V.G. (ed.). Nauka, Moscow. 388 p. In Russian.
- Dobrinskii, L.N. (ed.). 1995. The nature of Yamal. Nauka, Ekaterinburg. 435 p. In Russian with English summary.
- Druri, I.V. 1949. Wild reindeer of the Soviet Arctic and sub-Arctic. Proceedings of Arctic Institute. M., L., GUSMP. Vol. 200. 40 p. In Russian.
- Druri, I.V. 1955. Olenevodstvo [Reindeer keeping]. I.Ye. Red'kin (ed.). Moscow - Leningrad, Selkhozgiz. 255 p. In Russian.
- Kaigasov, V.B. 1983. Protection and sustainable use of reindeer resources in Yakutskaya ASSR. Pp. 86-94 in Wild reindeer. Ecology, problems of protection and sustainable use. Moscow. In Russian.
- Kazmin, V.D. 1986. Reindeer (*Rangifer tarandus*) on Wrangel Island. Pp. 114-126 in Biological problems of the North. Animal world of Wrangel Island. Vladivostok. Russian.
- Kishinski, A.A. 1971. Present status of the reindeer (*Rangifer tarandus*) on the Novosibirsk Islands. Pp. 117-125 in Zoological Journal. Vol. 50, issue 1. In Russian.
- Kolpashikov, L.A. 1979. Winter grazing lands use by reindeer. Pp. 19-28 in Problems of protection and use of the wild animal resources of the Yenisei's North. In Russian.
- Kolpashikov, L.A. 1982. Wild reindeer of the Taimyr (Peculiarity of ecology, and sustainable use of resources). Norilsk, NIISKh of the Extreme North. 23 p. In Russian.

- Kolpashikov, L.A., Kuksov, V.A., Pavlov, B.M. 1983. Ecological basis for maximum number of Taimyr population of reindeer. Pp. 3-14 in Ecology and sustainable use of terrestrial vertebrates of the Northern Middle Siberia. Norilsk. In Russian.
- Kupriyanov, A.G. 1983. Reindeer on the Belyi Island. Pp. 79-80 in Biological problems of the North. Proceedings of the 10th symposium. Magadan. In Russian.
- Kupriyanov, A.G., Belikov, S.E., Randla, T.E. 1985. Severnyi olen' na ostrovakh Arctiki [Reindeer on the Arctic islands]. Priroda, 3: 46-51. In Russian.
- Kurilyuk, A.D. 1982. Olenevodstvo Yakutskoy ASSR [Reindeer keeping of Yakutskaya ASSR]. V.N. Andreev (ed.). Yakutskoye knizhnoye izdatelstvo. Yakutsk. 162 p. In Russian.
- Linsberg, G.U. 1972. Big fluctuations of the World Ocean's level in the Recent. Nauka, Leningrad. 548 p. In Russian.
- Matveev, L.G. 1981. Reindeer of the Novaya Zemlya. Okhota i okhotnichiye khoziaistvo [Hunt and hunting economy], 1: 22-23. In Russian.
- Michurin, L.N. 1965. Dikiy severnyi olen' Taimyrskogo poluostrova i ratsionalnoye ispolzovaniye ego zapasov [Wild reindeer of the Taimyr Peninsula and its sustainable use]. Norilsk, NIISKh of the extreme North. 20 p. In Russian.
- Mineev, V.A. 1946. "Ostrov Vrangelya" [The Wrangel Island]. Chernenko, M.B. and T.D. Selyavina eds. Glavsevmorputi, Moscow – Leningrad. 432 p. In Russian.
- Novikov, B.V. 1983a. Sovremennoye sostoyaniye ostrovnukh populyatsiy severnogo olenya v Sovetskom sektore Arktiki [Present state of island reindeer populations in the Soviet sector of the Arctic]. Pp. 101-107 in N.K. Noskova (ed.). Dikiy severnyi olen' (Ekologiya, voprosy okhrany i ratsionalnogo ispolzovaniya) [Wild reindeer (Ecology and problems in protection and sustainable use)]. Sbornik nauchnykh trudov CNIL Glavokhoty RSFSR. Moscow. In Russian..
- Novikov, B.V. 1983b. Wild reindeer of Yakutskaya ASSR, number, problems of protection and research. Pp. 94-100 in Wild reindeer (Ecology, problems of protection and sustainable use). Moscow. In Russian.
- Ovsyukova, N.I., Novikov, B.V. 1983. Analysis of parasite fauna of some mammals of the Wrangel Island. Pp. 77-80 in Parasitological research in nature reserves. M., CNIL "Glavokhoty" RSFSR. In Russian.
- Pavlov, B.M., Kuksov, V.A., Savelyev, V.D. 1976. Sustainable use of resources of Taimyr reindeer population. Method. recommendations NIISKh of the Extreme North. In Russian.
- Pavlov, B.M., Mikhailov, V.V., Zyryanov, V.A., Kolpashikov, L.A. 1985. Complex analysis of balance of Taimyr population of reindeer. Pp.54-63 in Ecology, protection and use of wild reindeer. Novosibirsk. In Russian.
- Pavlov, B.M., Zyryanov, V.A. 1981. The role of hunting in managing quality composition of the Taimyr reindeer population. Science-technical bulletin of NIISKh of the Extreme North. 40 p. In Russian.
- Popov, A.A. 1948. The Nganasans. M. L. AN USSR press. 122 p. In Russian.
- Red Book of Russian Federation. Animals. 1983. M., Rosselkhoz. 453 p. In Russian.
- Red Book of USSR. 1984. Vol.1. M., "Lesnaya promyshlennost" press. 392 p. In Russian.
- Sambuk, F.V. (ed.). 1933. Olen'i pastbischa Severnogo Kraya [Reindeer grazing lands of the Northern Region]. Sbornik II. AN SSSR. Leningrad. 229 p. In Russian.

- Semerikov, P.P. 1933. Olenevodstvo tundr Nenetskogo okruga [Reindeer keeping in the tundras of Nenetskiy okrug]. S.N. Anisimov (ed.). Severnoye krayevoye izdatelstvo. Arkhangelsk. 40 p. In Russian.
- Skrobov, V.D. 1975. Anthropogenic impact on the reindeer. Pp. 99-103 in Wild reindeer of USSR. Moscow. Soviet Russia press. In Russian.
- Syroyechkovski, Ye.Ye. 1986. Severnyi olen [Reindeer]. Ye.A. Bashmakov (ed.). Agropromizdat press. Moscow. 255 p. In Russian.
- Skalon, V.N. 1940. Wild reindeer of the Novosibirsk Islands. Priroda, 2: 113-114 In Russian.
- Tyulin, A.N. 1938. Game fauna of the Belyi Island. Proceedings of NII for polar agriculture, stock-breeding, and hunting. Issue 1. Leningrad. In Russian.
- Treshnikov, A.F. (ed. in chief). 1985. Atlas Arktiki [The Atlas of the Arctic]. Glavnoye upravleniye geodezii i kartografii pri sovete ministrov SSSR [Chief Department of geodesy and cartography under the Council of Ministers of the USSR. 204 p. In Russian with summary in English.
- Ushakov, G.A. 1990. Ostrov meteley. Po nekhozhennoy zemle. [The Island of snowstorms. On the untrodden land]. Leningrad. Gidrometeoizdat Press. 574 p. In Russian
- Uspenski, S. M. 1958. Wealth and protection of the animal world of the Soviet Arctic. Pp. 221-228 in Problems of the North. Issue 1. In Russian.
- Ustinov, V. 1956. Olenevodstvo na Chukotke [Reindeer keeping in Chukotka]. L.N. Stebakova (ed.). Magadanskoye knizhnoye izdatelstvo. Magadan. 159 p. In Russian.
- Yakushkin, G.D., Pavlov, B.M. 1981. Present status of number and harvesting of the Taimyr reindeer population. Pp. 3-8 in NTB NIISKh of the Extreme North. N.48. In Russian.
- Yegorov, O.V. 1965. Wild ungulates of Yakutia. Nauka, Moscow. 259 p. In Russian.
- Yegorov, O.V. 1971. Wild reindeer. Pp. 567-590 in Mammals of Yakutia. Nauka, Moscow. In Russian.
- Yegorov, O.V., Krechmar, A.V. 1967. Status of resources and perspectives for the use of reindeer on the Novosibirsk Islands. Pp. 296-299 in Love and protect the Nature of Yakutia. Yakutsk. In Russian.
- Zubkov, A.I. 1935. Reindeer grazing and grass-lands on the Novaya Zemlya. Pp. 7-34 in Proceedings of Arctic Institute. Issue 22. In Russian

Fairbanks, Alaska, 5 January 1999

**Review of the INSROP report
“Reindeer of the Russian Arctic” by Belikov et al.**

I have reviewed the manuscript REINDEER OF THE RUSSIAN ARCTIC by Belikov et al. that you sent to me. It is an interesting review of previous published reports, as well as an attempt to include the current status of reindeer in Russia using contacts with people in the various regions. Although it suffers from incomplete current information due to the lack of any official effort to determine numbers and status of reindeer under the present deterioration of governmental activities in much of Russia, and especially in the north, it nevertheless is a valuable contribution and worthy of publication.

It is relatively well written, although in need of editing for spelling and sentence structure. The few specific comments that I have, referenced via sections are:

1) 2.1.1. When sea levels were lowest during the Pleistocene glaciation there was likely ice covering what are now Arctic islands. If tundra existed in the high Arctic it was probably in low lying areas that are now covered by the sea. The conclusion that reindeer may have adapted to life in the Arctic tundra in the region at this time is, however still valid.

2) Table 1. The term vulnerability should be defined. Does it mean vulnerability to random natural climatic variation or to human disturbance and hunting?

3) 2.1.2.1. Novaya Zemlya. It should be mentioned that although considered a separate subspecies, the reindeer there were at a low population (ca. 1000) when domestic reindeer were introduced, therefore the present population is a hybrid population with domestic reindeer. This is acknowledged indirectly by the statement that 10 percent of the animals observed in 1980 had the color of domestic reindeer. Since domestic reindeer are variable in color, with perhaps most of them similar to wild reindeer, one would expect a high proportion of domestic reindeer genes in the population.

4) 2.1.2.3.1 In discussion of Severnaya Zemlya mention is made of the risk of losing genetic uniqueness for adaptation to living in the Arctic deserts. A major point here is how frequently reindeer move across the sea ice to the islands from the Taimyr Peninsula. I recall from other Russian reports that this has happened periodically in the past and is the source of reestablishment of reindeer on these islands following decimation of the few animals that stay there by climatic extremes.

5) 2.1.2.3.2 Wrangell Island. Reference is made to the possibility of reindeer being present there in the remote past. This is an important point from a paleontological and biogeographical perspective and should be supported by the specific reference. And, at the end of this section it is suggested that the reindeer may move to the mainland if

food conditions become worsened. Is there any reference to this ever happening or is it just speculation?

6) Throughout the report the term grasslands is used when what is meant is grazing lands.

I hope these comments are of help.

Regards,

David R. Klein
Professor Emeritus
Institute of Arctic Biology
University of Alaska Fairbanks

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 Nippon 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 improvement 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 stock-holding 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 specializes 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 multi-disciplinary approach, entailing extensive cooperation with other research institutions both at home and abroad. The INSROP Secretariat is located at FNI.

