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Populations of wild and feral reindeer in Siberia and Far East of Russia

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Abstract: Identification and cataloging of discrete reindeer (*Rangifer tarandus*) populations in Siberia and the Far East of Russia has not been carried out. This prohibits accurate measures of population structure and dynamics that would allow more intensive management of this important renewable resource. To rectify the lack of information, an inventory was made that identifies 84 wild populations and 3 feral populations originating from domestic reindeer. This inventory summarizes the information available on the location, approximate population size, approximate range size, and occurrence by ecoregions and habitat types of each of those 87 reindeer populations. The 87 reindeer populations used a collective landmass of about 3 000 000 km^2. The range size for each population was calculated to be between 446 km^2 and 392 267 km^2, with a mean ± SE of 34 033 ± 5734 km^2. The 86 populations for which population size could be approximated totaled 790 655 reindeer, with an approximate mean ± SE of 9194 ± 2517, a minimum size of 50, and maximum size of 145 000. The location of the calving grounds could be determined for only 26 (30%) of the 87 reindeer populations.

Key words: Far East of Russia, population identification and cataloging, *Rangifer tarandus*, Siberia.

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Introduction

Prior to this inventory, identification and cataloging of discrete reindeer (*Rangifer tarandus*) populations in Siberia and the Far East of Russia had not been carried out and no detailed assessment at the level of the population for the status of reindeer in those vast regions could be made. This lack of information prohibited measures of population structure and dynamics that would allow more intensive management of this important renewable resource. The inventory was made without the aid of data from animal-marking, radio-tracking, or satellite telemetry studies.

Encouragement to complete this effort came from the listing of statistics for many populations of North American caribou and Norwegian reindeer that had been identified, their sizes estimated, and their ranges delineated before radio-collaring and satellite telemetry studies were widespread and had been conducted (e.g., Skoog, 1968; Hemming, 1971; Klein & White, 1978; Williams & Heard, 1986; Skogland, 1989; Ferguson & Gauthier, 1992). For example, as data accumulated, it became apparent that the earlier concept of a "center of habitation" with only one caribou population throughout Alaska (Skoog, 1968), should be replaced with a management scheme based on many discrete populations (e.g., Valkenburg, 1998, 2001). Also, as time passed, a greater number of populations were identified in Canada (e.g., Williams & Heard, 1986; Ferguson & Gauthier, 1992). The following reports the compilation of information that could be obtained for identifying and describing reindeer populations in Siberia and the Far East of Russia (Maps in Figs. 1-26).

Methods

We collected data on reindeer distribution in Siberia and the Far East of Russia and put them into GIS maps. For each population, we then mapped range limits based on known perimeter points collected over the years from various sources and joined them together in GIS to create a range map from which an

approximate range size was calculated (Figs. 2-26). This facilitated the incorporation of observations made over time. As a result, however, the apparent accuracy of each reported numerical value does not necessarily reflect the accuracy of the approximated range size (e.g., the maximum range size of 392 267 km^2 would most likely be just as accurate if reported as 390 000 km^2).

Although the accepted standard for naming *Rangifer* populations (herds) in North America is usually after the location of their calving grounds (e.g., Thomas, 1967; Klein & White, 1978; Valkenburg, 1998; Russell *et al*., 2002), this could not be done for most reindeer populations in this inventory because that information is not often available in Russia. Only a few studies of reindeer distribution during the calving season have been made: primarily in the Taymyr by Kuksov (1981) and subsequently in Yakutia by Safronov *et al*. (1999). We obtained a little information on calving grounds from Shtilmark & Azarov (1975), Malygina (2000), Zhukov (2000), Shirshov (2003), Chernyavsky (1984), and Kupriyanov (2003), and also from V. I. Mosolov (pers. comm.) and V. I. Fil (unpubl. data).

Because of the limited information, there is even uncertainty about populations whose calving grounds are known. For example, in the Western Taymyr, tundra calving grounds are known in the basins of Pura and Agapa Rivers (Fig. 7, Kuksov, 1981; Kolpashchikov, 2000). Tens of thousands of reindeer arrive for calving in this area from different directions – SE from Eastern Evenkiya and Yakutia, SSE from Evenkiya, through Putorany Mountains, and SW from the left bank of Enisey River. It is most likely that these reindeer represent two different populations (No. 13 and 17, in Table 1). However, Syroechkovsky (1986), Pavlov *et al*. (1996), and Kolpashchikov (2000) believe that there is a single numerous Taymyr population, including populations No. 13, 14, 17 and 21 in Table 1.

Another controversial locality is Western Yakutia, where numerous reindeer inhabit the northern parts of the basins of Lena and Olenek rivers (Fig. 2, populations No. 36, 37, 38, 45). One of the calving areas is on the delta of the Lena River (Fig. 15). In 1960s, the population that calved there was very large (tens of thousands) and its range overlapped ranges of neighboring populations (Egorov, 1965). Now, because of human persecution, this population has been diminished to a few hundred (Population No. 45 in Table 1).

We used data on reindeer distributions in all seasons in order to make the information in this inventory more complete. The approximations of the sizes of different populations were obtained from a wide spectrum of sources that yielded data of markedly different quality and thus their relative accuracies varied. Ecoregions are presented according to Bailey (1998) and the main habitat types occupied by each population are noted. One asterisk (*) was used in Table 1 to identify a population that probably includes some individuals from any other population or possibly even more than one other population. Two asterisks (**) were used in Table 1 to identify a population whose information is out-of-date and needs to be updated.

Each of the 36 populations in the inventory with rough approximations of population size was adjusted to a single value. That is, all populations identified as being "A few 100" animals were arbitrarily set at 300 reindeer, any > or < qualification was ignored (eg. > 1000 or < 1000 was treated as 1000), and each population reported as a spread of values (e.g., 1500–2000) was assigned its mid-point value (e.g., 1500–2000 = 1750). This procedure allowed an assessment of 86 (99%) of the populations rather than of just the 50 (58%) possibly with more accurate approximations of population size. All 87 populations were used in calculating the overall statistics for range size.

Wild and Feral Populations

To rectify the lack of information on populations of reindeer in Siberia and the Far East of Russia, an inventory was made that identifies 84 wild populations and 3 feral populations originating from domestic reindeer (Tables 1, 2, 3). This inventory summarizes the information available on the location, approximate population size, approximate size, and occurrence by ecoregions and habitat types of those 87 reindeer populations.

The location of the calving grounds could be determined for only 26 (30%) of the 87 reindeer populations (Table 2). Another 27 (31%) of the populations exist on ranges separated from each other and therefore, because of their isolation, they seemingly can be identified with confidence. These are island populations or populations inhabiting ranges surrounded by vacant areas where reindeer have been exterminated. For example, on the Kamchatka Peninsula, three populations are isolated from each other (Voropanov *et al*., 2003). The remaining 34 (39%) of the 87 populations inhabit taiga and mountain taiga, based on data obtained mostly during winter. However, much of the evidence for these 34 populations comes only from indirect but frequent observations of reindeer tracks. Obviously, it is hard to determine if these animals live separately from all other reindeer in neighboring localities. Future investigations using radio-collaring will help determine how many populations exist in these areas.

These 87 reindeer populations used a collective landmass of about 3 000 000 km^2. The range size for each population was calculated to be between 446

km² and 392 267 km², with a mean ± SE range size of 34 033 ± 5734 km². Only 25 (29%) of the 87 reindeer populations occupied ranges larger than the mean range size but collectively 81% of the approximated number of reindeer occurred on those ranges. The 86 populations for which some measure of population size could be approximated totaled 790 655 reindeer. Those 86 populations occupied 99% of the collective range of the 87 reindeer populations. The 12 largest reindeer populations collectively occupied only 43% of the entire reindeer range of the 86 populations, but contributed 85% of the approximated number of reindeer. No approximation of population size could be made for one of the 87 populations (Table 1, No. 38).

Enough information exists to allow further examination of the basic statistics for 86 of the 87 reindeer populations by comparing the 50 populations with a more accurate approximation of population size to the 36 populations with a less accurate approximation of population size (Table 3). The ranges occupied by those 50 and 36 reindeer populations represented 82% and 17% respectively, of the total range occupied by the 87 populations. As there did not appear to be any consistent relationship between the sizes of the populations and the amounts of range that they occupied, it follows that there is also no relationship between the overall mean density of a population and the size of the range that it used (Tables 1, 3).

Although this inventory is far from complete, it is a necessary first step. This compilation will form the basis for building a more complete inventory of data for reindeer populations in Siberia and the Far East of Russia.

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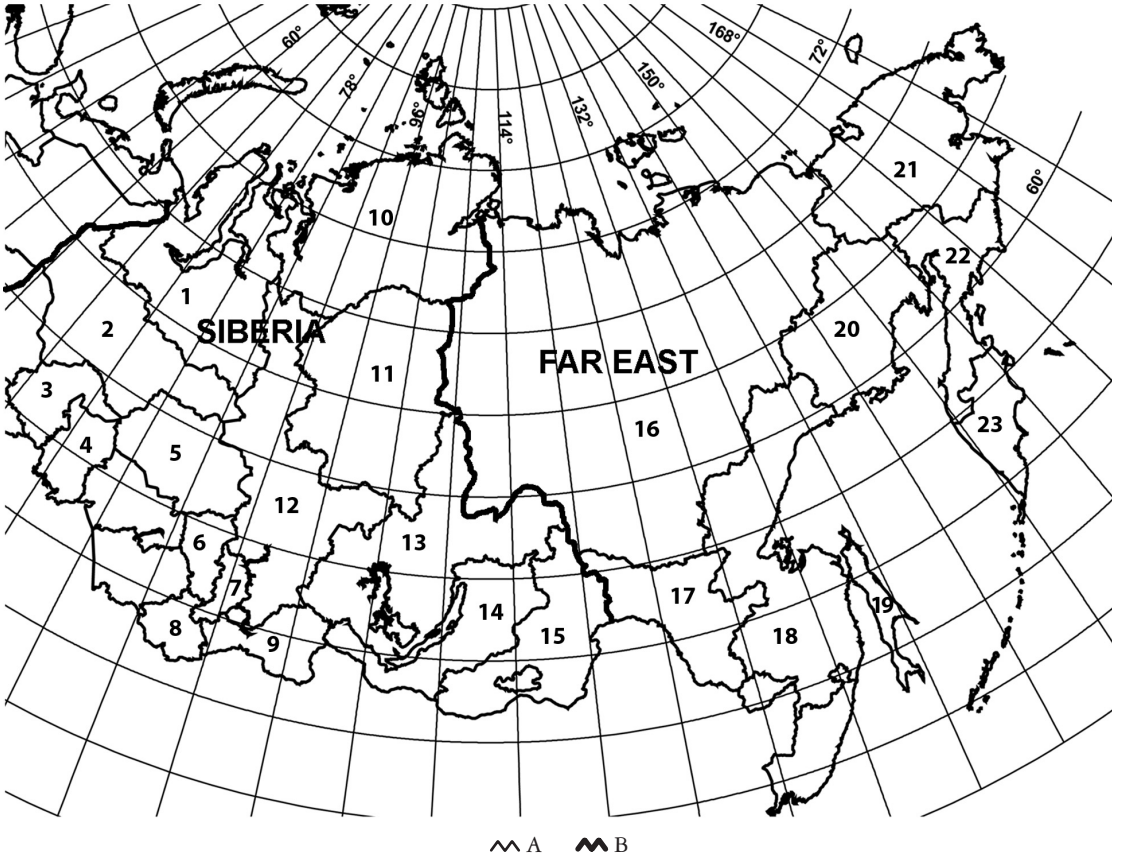

Fig. 1. Map of Russia, showing the geographical locations of Siberia and the Far East of Russia. A: borders of administrative regions; B: Siberian and Far East border. Administrative regions with wild and feral reindeer are 1 Yamalo-Nenetsky AO; 2 Khanty-Mansiysky AO; 3 Tumenskaya oblast; 4 Omskaya oblast; 5 Tomskaya oblast; 6 Kemerovskaya oblast; 7 The Republic of Khakasia; 8 The Republic of Altay; 9 The Republic of Tyva; 10 Taimyrsky AO; 11 Evenksky AO; 12 Krasnoyarsky krai; 13 Irkutskaya oblast; 14 The Republic of Buryatia; 15 Chitinskaya oblast; 16 The Republic of Sakha (Yakutia); 17 Amurskaya oblast; 18 Khabarovsky krai; 19 Sakhalinskaya oblast: 20 Magadanskaya oblast; 21 Chukotsky AO; 22 Koryaksky AO; 23 Kamchatskaya oblast.

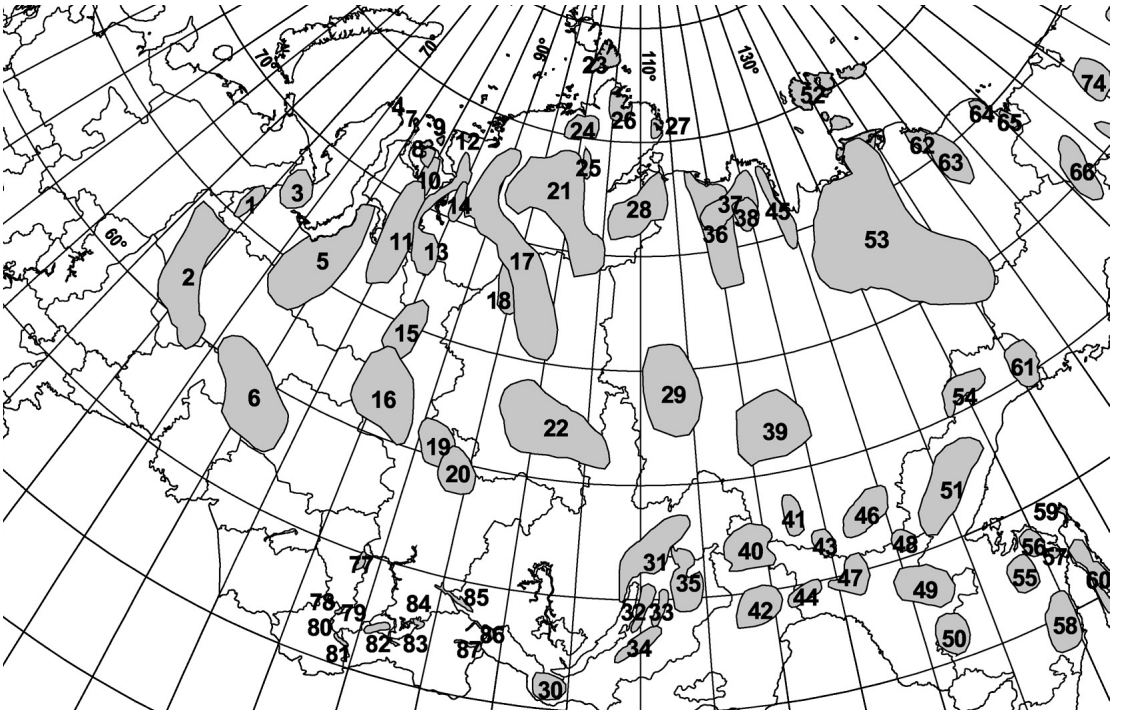

Fig. 2. Reindeer populations (Nos. 1-35 and 77-87) in Siberia (I.D. No. in figure correspond to the I.D. No. for populations listed in Tables 1 and 2).

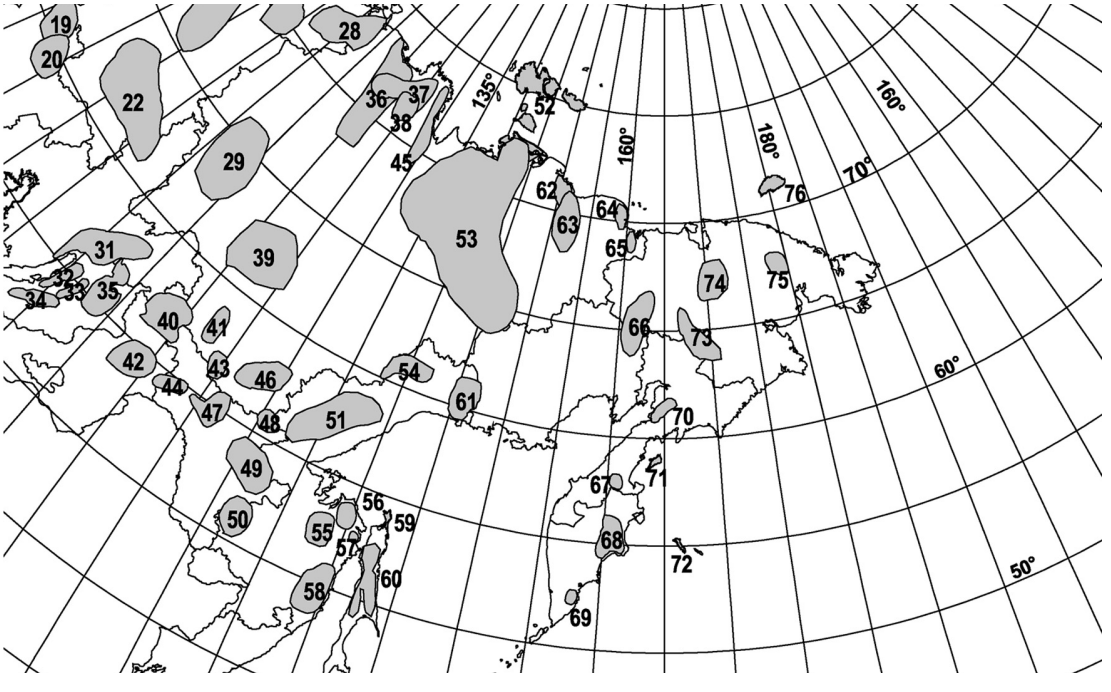

Fig. 3. Reindeer populations (Nos. 36-76) in Far East of Russia (I.D. No. in figure correspond to the I.D. No. for populations listed in Tables 1 and 2).

Table 1. Inventory of 87 wild and feral reindeer populations identified in Siberia and the Far East of Russia, 2006[a].

I.D. No.	Location[b]	Approximate population size	Approx. Range size (km^2)	Eco-regions[c]	Habitat types[d]	Authority
1	Shuryshkarskoe L. (Fig. 2)	200	10 644	TRM	MTu	Shirshov, 2003
2	Konda and Sosva R. (Fig. 2, 4)	5500	114 992	TD	B, PTa	Novikov *et al*., 2003
3	Shchuchinskoe L. (Fig. 2)	> 100	22 774	TRM	MTu, LS	Shirshov, 2003
4	Belyi Is. (Fig. 2)	2000**	1858	TD	PTu, SS	Kupriyanov *et al*., 1985
5	Nadym and Pur R. (Fig. 2, 5)	30 000	117 677	TD, SD	HTu, B, PTa	Kupriyanov, 2003
6	Yugan R. (Fig. 2)	600	124 276	SD	B, PTa	Azarov & Afanasev, 2003
7	Yavay P. and Shokalskogo Is. (Fig. 2)	A few 100**	1751	TD	PTu, SS	Shirshov, 2003
8	Mamonta P. (Fig. 2)	A few 100**	5454	TD	PTu, SS	Shirshov, 2003
9	Sibiryakova Is. (Fig. 2)	300	838	TD	PTu, SS	Kupriyanov *et al*., 1985; Novikov, 1983
10	Gydan P. (Fig. 2)	1500	12 920	TD	PTu	Shirshov, 2003
11	Pur and Taz R. (Fig. 2, 6)	1500–2000	72 811	TD, SD	HTu, B, PTa	Kupriyanov, 2003
12	Chichagov Shore (Fig. 2)	A few 100**	1572	TD	PTu, SS	Uchitkin, 1990
13	Western Taymyr (Fig. 2, 7)	70 000**	42 850	TD, SD	HTu, PTu, B	Kolpashchikov, 2000
14	Agapa R (Fig. 2, 7)	A few 100**	9874	TD	HTu	Kolpashchikov, 2000
15	Turukhan R. (Fig. 2, 8)	800–2000	38 178	TD, SD	HTu, PTa, B	Zhukov, 2000
16	Upper Taz R. (Fig. 2, 9)	1000	98 169	TD, SD	HTu, PTa, B	Zhukov, 2000
17	Pura R. (Fig. 2, 7)	145 000	168 141	TD, SD	HTu, MTa	Tikhonov *et al*., 2003
18	Putorany Mt. (Fig. 2)	A few 100**	22 836	SRM	MTu	Michurin & Mironenko, 1966.
19	Enisey R. (Fig. 2, 10)	11 800	31 796	SRM	MTa	Lutsky & Zyryanov, 2003
20	Angara R. (Fig. 2)	5000	31 695	SRM	MTa	Lutsky & Zyryanov, 2003
21	Dudypta R. (Fig. 2, 11)	110 000	139 795	TD, SD	PTu, HTu, MTa	Tikhonov *et al*., 2003
22	Middle Siberian* (Fig. 2)	55 000	135 079	SD	PTa	Paponov, 2000; Lutsky & Zyryanov, 2003
23	Severnaya Zemlya Archipelago (Fig. 2)	A few 100**	11 260	TD	HTu	Kupriyanov *et al*., 1985; Novikov, 1983
24	Nizhnya Taymyra R. (Fig. 2)	A few 100**	15 826	TD	HTu, MTu	Uchitkin, 1990
25	Taymyr L. (Fig. 2, 12)	5000	4675	TD	Tu, LS	Malygina, 2000
26	Faddey B. (Fig. 2)	A few 100**	11 544	TD	HTu, SS	Uchitkin, 1990
27	Mariya Pronchishcheva B. (Fig. 2, 13)	A few 100**	3896	TD	HTu, SS	Uchitkin, 1990
28	Popigay R. (Fig. 2, 14)	31 000	53 793	TD, SD	PTu, HTu, MTa	Popov, 2003

29	Western Yakutia (Fig. 2)	3300	101 601	SRM	MTa	Revin, 1989
30	Khamar-Daban Range (Fig. 2)	200	17 260	SRM	MTu	Noskov & Shchepin, 2003
31	Northern Baikal * (Fig. 2)	4000	57 639	SRM	MTu	Noskov & Shchepin, 2003
32	Barguzinsky Range (Fig. 2)	500	11 878	SRM	MTu	Noskov & Shchepin, 2003
33	Ikatsky Range (Fig. 2)	650	7253	SRM	MTu	Noskov & Shchepin, 2003
34	Ulan-Burgassy Range (Fig. 2)	150	15 931	SRM	MTu	Noskov & Shchepin, 2003
35	Muysky Range (Fig. 2)	2100	34 769	SRM	MTu	Noskov & Shchepin, 2003
36	Lena and Olenek R. (Fig. 3, 15)	33 000	80 488	TD, SD, SRM	HTu, MTu, MTa	Popov, 2003
37	Bulun R. (Fig. 3)	57 000	39 607	TD, SD, SRM	HTu, MTu, MTa, SS	Safronov, 2002; Popov, 2003
38	Kystyk Uplands (Fig. 3, 16)	?	14 653	SRM	MTu	Safronov *et al*., 1999
39	Lena and Viluy R. (Fig. 3)	2000	94 547	SRM	MTa	Noskov & Shchepin, 2003
40	Chara R. (Fig. 3)	A few 100**	43 184	SRM	MTu, MTa	Revin, 1989; Bolotov, 2003
41	Amga R. (Fig. 3)	A few 100**	15 123	SRM	MTu, MTa	Revin, 1989
42	Tungir and Olekma R. (Fig. 3)	700	34 747	SRM	MTu, MTa	Bolotov, 2003
43	Timpton R. (Fig. 3)	A few 100**	10 880	SRM	MTu, MTa	Revin, 1989
44	Oldoy R. (Fig. 3)	> 1000	12 055	SRM	MTu, MTa	Telkov, 2003
45	Lena Delta R. (Fig. 3, 15)	A few 100**	22 438	TD	PTu	Safronov *et al*., 1989
46	Gonam R. (Fig. 3)	A few 100**	33 971	SRM	MTu, MTa	Popov, 2003
47	Giluy R. (Fig. 3)	> 1000	23 821	SRM	MTu, MTa	Telkov, 2003
48	Bolshoe Tokko L. (Fig. 3)	A few 100**	9563	SRM	MTu, MTa	Revin, 1989
49	Selemzha R. (Fig. 3)	2000	46 162	SRM	MTu, MTa	Telkov, 2003
50	Bureya R. (Fig. 3)	2000	26 389	SRM	MTu, MTa	Telkov, 2003
51	Maya R. (Fig. 3)	2000	77 854	SRM	MTu, MTa	Telkov, 2003
52	Novosibirskie Is. (Fig. 3, 17)	17 000	52 884	TD	PT, SS	Labutin & Kurilyuk, 1981
53	Yana and Indigirka R. (Fig. 3, 18)	40 000	392 267	TD, SRM	HTu, MTu, MTa	Safronov, 2002; Popov, 2003
54	Yudoma R. (Fig. 3)	> 2000	23 240	SRM	MTu, MTa	Dunishenko *et al*., 2003
55	Amgun R. (Fig. 3)	1000	20 583	SRM	MTu, MTa	Dunishenko *et al*., 2003
56	Dzhap R. (Fig. 3)	A few 100**	11 443	SD	PTa, B	Dunishenko *et al*., 2003
57	Tym R. (Fig. 3)	A few 100**	2128	SD	PTa, B	Dunishenko *et al*., 2003
58	Tumnin R. (Fig. 3)	150	37 687	SD	PTa, B	Dunishenko *et al*., 2003
59	Shmidt P. (Fig. 3)	A few 100**	1806	SRM	MTa, PTu, SS	Eremin, 2003
60	Nogliki R. (Fig. 3, 19)	3500	29 521	SRM	PTu, MTa, SS	Eremin, 2003

61	Kava R. (Fig. 3)	1000	26 858	SRM	PTu, MTa, SS	Bobykin, 2003
62	Indigirka R. (Fig. 3)	A few 100**	11 096	TD	PTu	Popov, 2003
63	Sudrunskaya (Fig. 3, 20)	30 000	31 868	TD, SDM	PTu, MTu, MTa	Popov, 2003
64	Galgavam R. (Fig. 3)	2000	5988	TD	PTu, SS	Safronov, 2002
65	Kolyma R. (Fig. 3)	A few 100**	4117	TD	PTu, SS	Popov, 2003
66	Omolon R. (Fig. 3)	20 000–30 000	34 447	SRM	MTu, MTa	Zhelesnov & Panovik, 2003
67	Elovka-Uka R. (Fig. 3, 21)	300–500	4225	SRM	MTu	Polkanov, 2003; V. I. Fil (unpubl. data)
68	Kronotsko-Zhupanovskaya (Fig. 3, 22)	2700	22 451	SRM	MTu, SS	Voropanov *et al*., 2003
69	Southern Kamchatka (Fig. 3, 23)	50	3612	SRM	MTu	Voropanov *et al*., 2003; V. I. Fil (unpubl. data)
70	Parapolsky Lowlands (Fig. 3)	300–400	8189	TD	PTu	Polkanov, 2003
71	Karaginsky Is. (Fig. 3)	300	1968	SRM	MTu	L. M. Baskin (unpubl. data)
72	Bering Is. (Fig. 3)	900	1189	TD	PTu	Voropanov *et al*. 2003
73	Mine R. (Fig. 3, 24)	50 000	27 383	SRM	MTu	Polkanov, 2003
74	Elgygytkyn L. (Fig. 3, 25)	8500	26 154	SRM	MTu	Zheleznov-Chukotsky & Panovik, 2003
75	Amguema R. (Fig. 3)	A few 1000**	10 631	TD, SRM	HTu, MTu	Zheleznov-Chukotsky & Panovik, 2003
76	Vrangel Is. (Fig. 3, 26)	3000	7711	TD, TRM	PTu, MTu	Baskin & Skogland, 1997
77	Kuznetsky Alatau Range (Fig. 2)	180	2865	SRM	MTu	Vasilchenko, 2003
78	Biyskaya Griva Range (Fig. 2)	200**	694	SRM	MTu	Sobansky, 1992
79	Abakan Range (Fig. 2)	100**	599	SRM	MTu	Sobansky, 1992
80	Korbu Range (Fig. 2)	< 100**	446	SRM	MTu	Sobansky, 1992
81	Shapshal R. (Fig. 2)	< 100**	1608	SRM	MTu	Sobansky, 1992
82	Kantegir* (Fig. 2)	200-250**	4308	SRM	MTu	Sokolov, 1983
83	Kazyr-Suk R.* (Fig. 2)	600–650**	1220	SRM	MTu	Sokolov, 1983
84	Us R. (Fig. 2)	200–250**	1994	SRM	MTu	Sokolov, 1983
85	Sayany Mnt.* (Fig. 2)	A few 100**	4040	SRM	MTu	Sokolov, 1983
86	Khamsyra R.* (Fig. 2)	2000	2358	SRM	MTu	Batkar, 2003
87	Azas R.* (Fig. 2)	1000	2531	SRM	MTu	Batkar, 2003

[a] Ninety-seven per cent (n = 84; I.D. No.: 1–70, 73–75, 77–87) of the 87 reindeer populations have wild origins and the remaining 3 (3%: I.D. No.: 71, 72, 76) are feral, having originated from domestic animals.

[b] One asterisk (*) identifies a population that probably includes some individuals from any other populations; and two asterisks (**) identifies a population whose information is out-of-date and needs to be updated.

[c] Ecoregions types equal (TD) Tundra Division), (TRM) Tundra Regime Mts., (SD) Subarctic Division, (SRM) Subarctic Regime Mnt. (Bailey 1998).

[d] Habitat types equal (PTu) Plain Tundra, (HTu) Hilly Tundra, (MTu) Mountain Tundra, (B) Bogs, (PTa) Plain Taiga, (HTa) Hilly Taiga, (MTa) Mountain Taiga, (SS) Sea Shore, (LS) Lake Shore.

Table 2. Known location of calving grounds for 26 reindeer populations in Siberia and the Far East of Russia.

I.D. No.[a]	Location of calving grounds
2	Srednesosvinskie and Verkhnevolinskie Uvaly Upland (Fig. 4)
5	Tazovsky Peninsula (Fig. 5)
11	Gydanskaya Gryada Upland (Fig. 6)
13	Basins of Agapa and Mokhovaya Rivers (Fig. 7)
14	Hills along Upper Agapa River (Fig. 7)
15	Hills of Nizhneeniseyskaya Upland (Fig. 8)
16	Verkhnetazovskaya Upland (Fig. 9)
17	Between Pura and Agapa Rivers (Fig. 7)
19	Western Slope of Enisey Kryazh Range (Fig. 10)
21	Kamen-Kherbey Uplands (Fig. 11)
25	Kalamisamo Peninsula (Taymyr Lake) (Fig. 12)
27	SE Spurs of Byrranga Range at Mariya Pronchishcheva Bay (Fig. 13)
28	Suryakh-Dzhangy Kryazh Mountains (Fig. 14)
36	Pronchishcheva Kryazh Mountains (Fig. 15)
38	Kystyk Plateau (Fig. 16)
45	Lena Delta (Fig. 15)
52	Novosibirskie Archipelago (Fig. 17)
53	Churpuniya, Zimovie, Muksunikha-Tas, Khaar-Stan and Uryung-Khastakh Hills (Fig. 18)
60	Basin of Nogliki River (Fig. 19)
63	Southern Slope of Ulakhan-Tas Range (Fig. 20)
67	Upper Elovka River (Fig. 21)
68	Sea Shore Tundra near Kronotskaya River (Fig. 22)
69	Sea Shore Tundra between Khodutka and Asacha Rivers (Fig. 23)
73	Right Side of Anadyr River Basin (Yablon, Peledon and Mechkereva Rivers) (Fig. 24)
74	Elgygytkyn Lake Area, Upper Yurumkuuveem and Enmyvaam Rivers (Fig. 25)
76	Basins of Mamontovaya and Tundrovaya Rivers (Fig. 26)

[a] I.D. No. corresponds to the population location on Figs. 2 and 3.

Table 3. Various statistics for 86 reindeer populations in Siberia and the Far East of Russia.

Statistic	Approximation of population size	Approximation of range size (km^2)	Approximation of mean density (reindeer • 100 km^{-2})
50 populations with a single approximation for each population size			
Summation	747 080	2 439 363	–
Median	2000	28 452	13.6
Mean	14 942	48 787	34.7
±SE	4129	9308	6.3
Min-Max	50–145 000	599–392 267	0.4–182.6
36 populations with only a rough approximation[a] for each population size			
Summation	43 575	506 880	–
Median	300	10 253	5.4
Mean	1210	14 080	10.1
±SE	687	2540	2.4
Min-Max	100–25 000	466–72 811	0.4–72.6
All 86 populations combined from above			
Summation	790 655	2 946 243	–
Median	800	15 879	7.6
Mean	9194	34 259	24.4
±SE	2517	5796	4.0
Min-Max	50–145 000	466–392 267	0.4–182.6

[a] Populations identified as being "A few 100" animals were arbitrarily set at 300 reindeer, any > or < qualification was ignored (e.g., > 1000 or < 1000 was treated as 1000), and each population with its size reported as a spread of values (e.g., 1500–2000) was assigned its mid-point value (e.g., 1500–2000 = 1750).

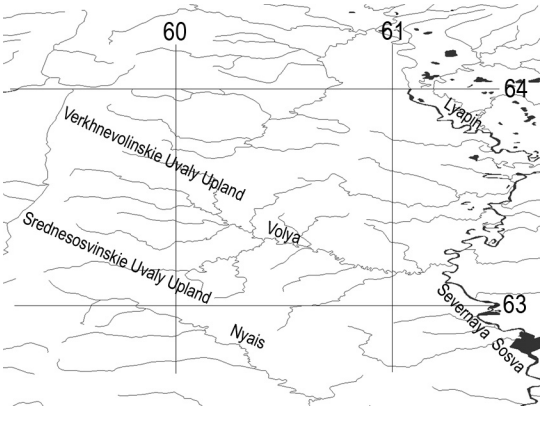

Fig. 4. Map of Srednesosvinskie and Verkhnevolinskie Uvaly Upland calving grounds.

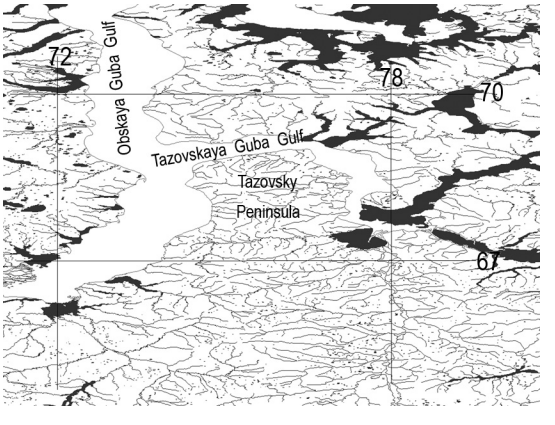

Fig. 5. Map of Tazovsky Peninsula calving grounds.

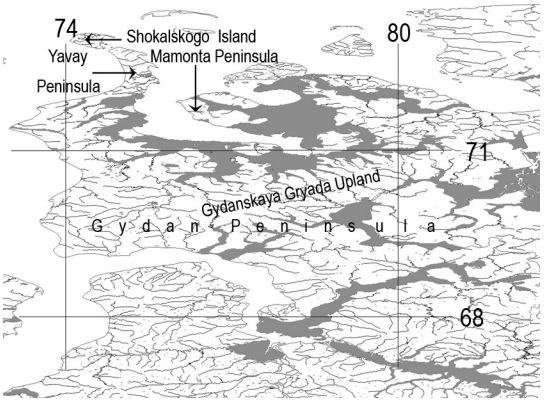

Fig. 6. Map of Gydanskaya Gryada Upland calving grounds.

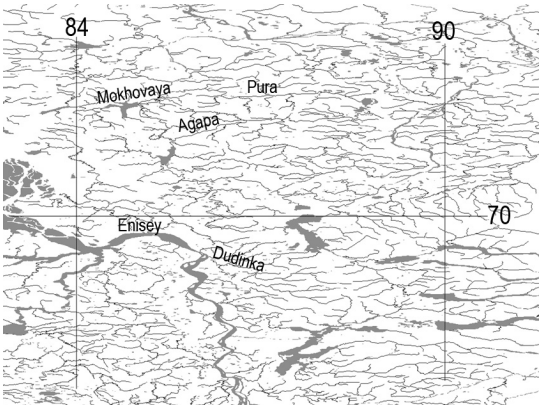

Fig. 7. Map of Basins of Agapa and Mokhovaya Rivers, Hills along Upper Agapa River, and Between Pura and Agapa Rivers calving grounds.

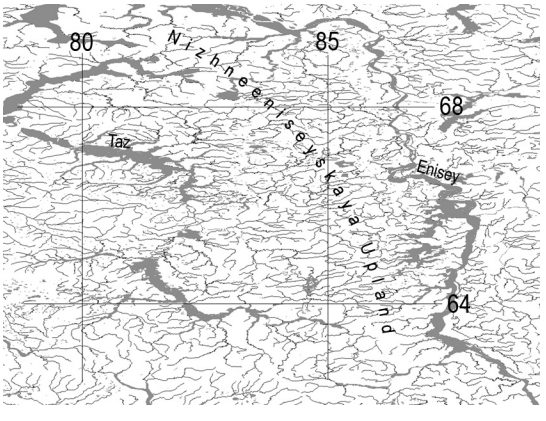

Fig. 8. Map of Hills of Nizhneeniseyskaya Upland calving grounds.

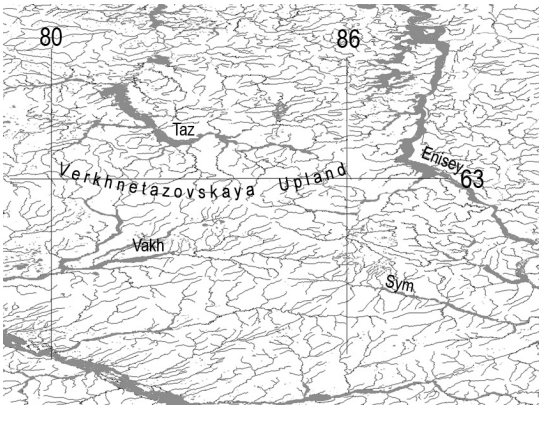

Fig. 9. Map of Verkhnetazovskaya Upland calving grounds.

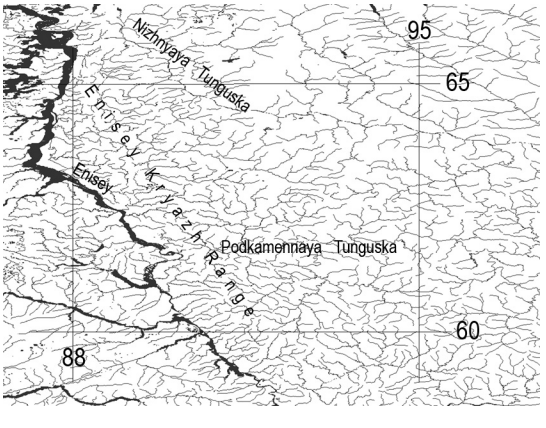

Fig. 10. Map of Western Slope of Enisey Kryazh Range calving grounds.

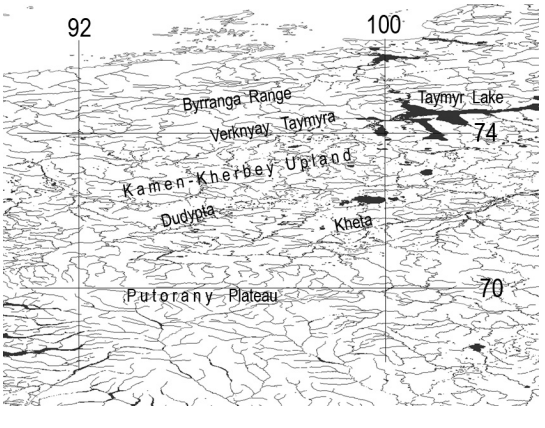

Fig. 11. Map of Kamen-Kherbey Uplands calving grounds.

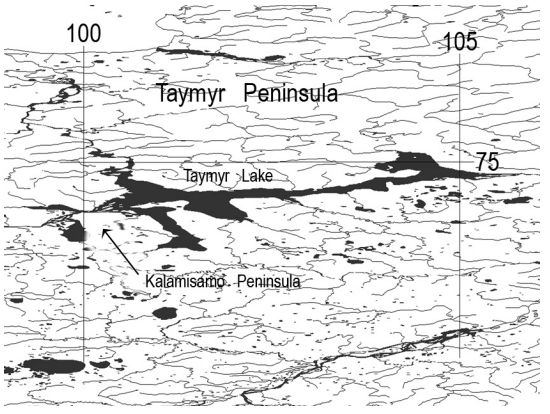

Fig. 12. Map of Kalamisamo Peninsula (Taymyr Lake) calving grounds.

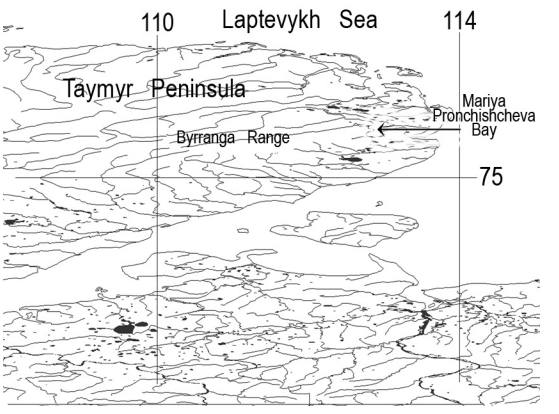

Fig. 13. Map of SE Spurs of Byrranga Range at Mariya Pronchishcheva Bay calving grounds.

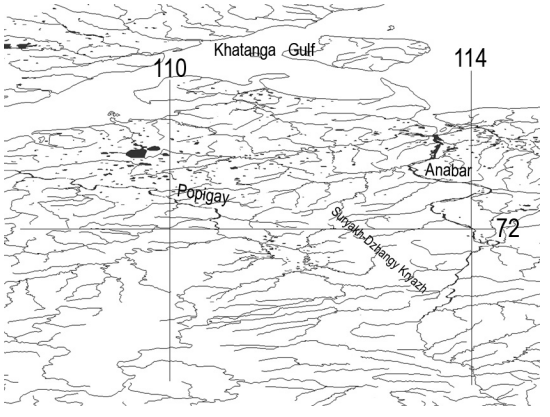

Fig. 14. Map of Suryakh-Dzhangy Kryazh Mountains calving grounds.

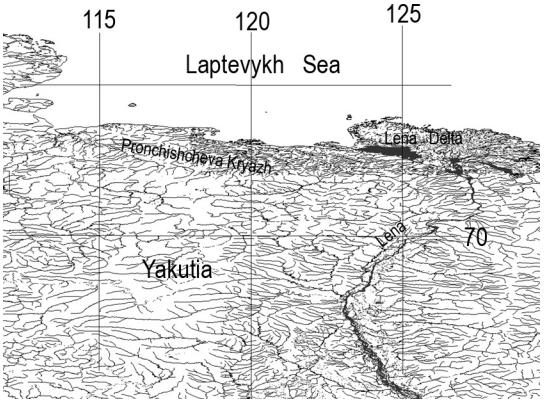

Fig. 15. Map of Pronchishcheva Kryazh Mountains and Lena Delta calving grounds.

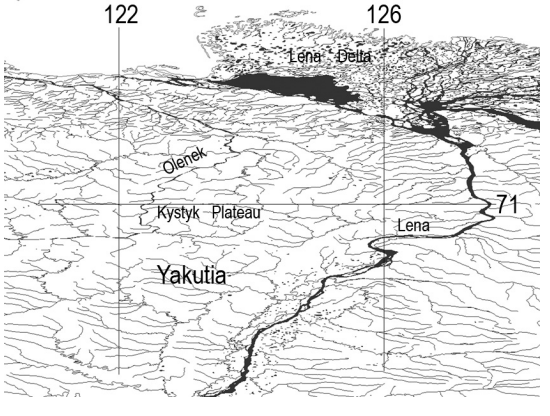

Fig. 16. Map of Kystyk Plateau calving grounds.

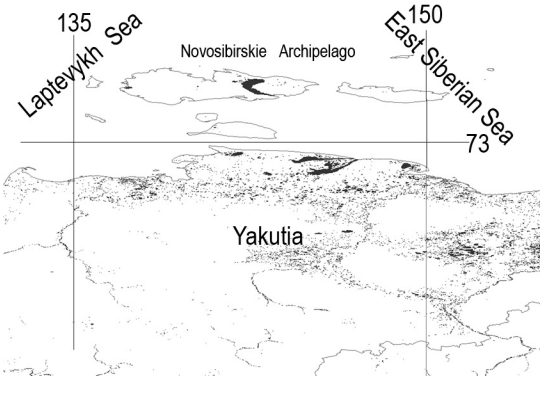

Fig. 17. Map of Novosibirskie Archipelago calving grounds.

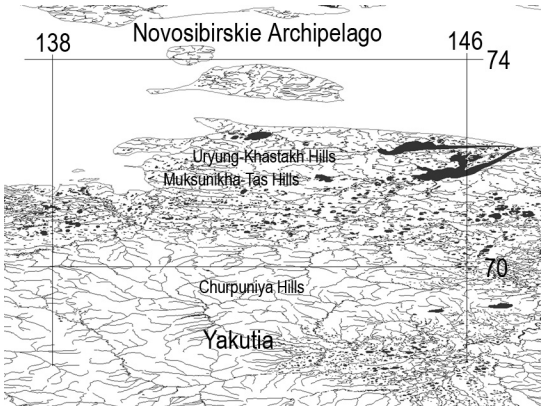

Fig. 18. Map of Churpuniya, Zimovie, Muksunikha-Tas, Khaar-Stan and Uryung-Khastakh Hills calving grounds.

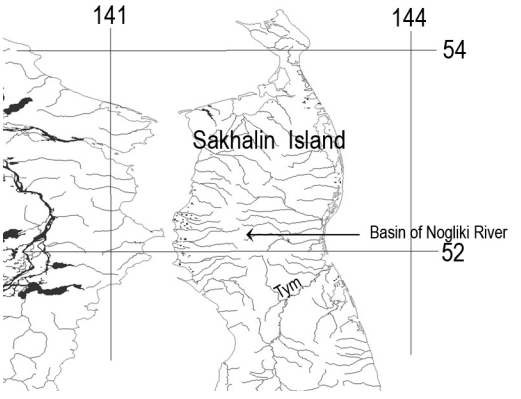

Fig. 19. Map of Basin of Nogliki River calving grounds.

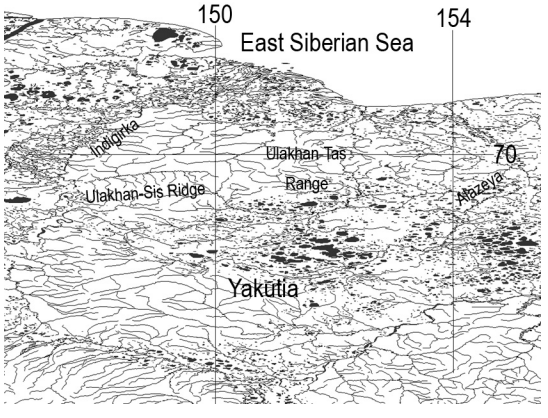

Fig. 20. Map of Southern Slope of Ulakhan-Tas Range calving grounds.

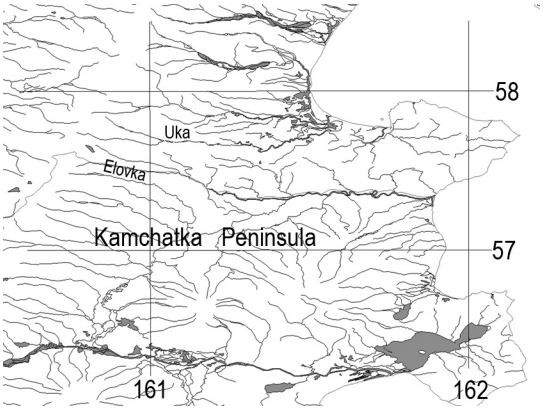

Fig. 21. Map of Upper Elovka River calving grounds.

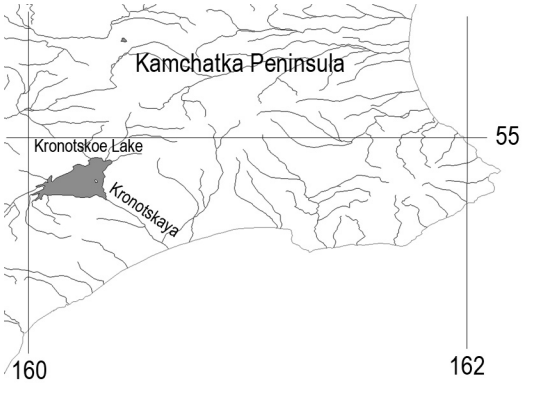

Fig. 22. Map of Sea Shore Tundra near Kronotskaya River calving grounds.

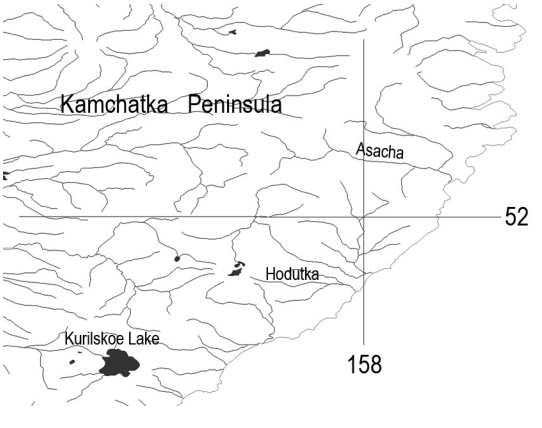

Fig. 23. Map of Sea Shore Tundra between Khodutka and Asacha Rivers calving grounds.

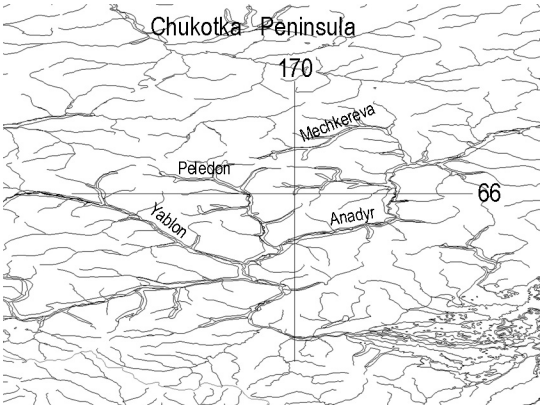

Fig. 24. Map of Right side of Anadyr River Basin (Yablon, Peledon and Mechkereva Rivers) calving grounds.

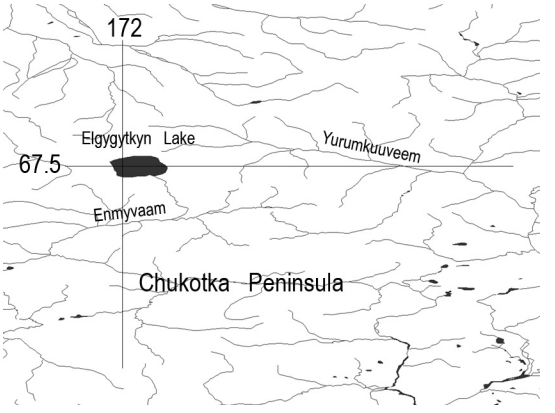

Fig. 25. Map of Elgygytkyn Lake Area, Upper Yurumkuuveem and Enmyvaam Rivers calving grounds.

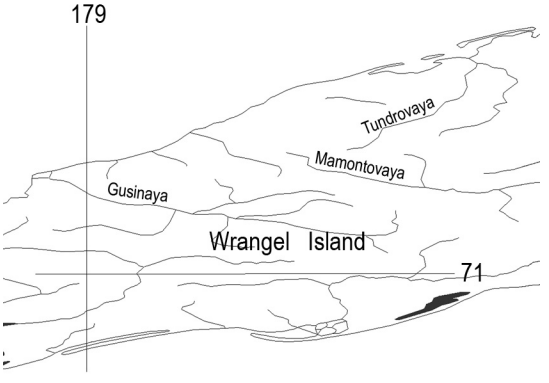

Fig. 26. Map of Basins of Mamontovaya and Tundrovaya Rivers calving grounds.