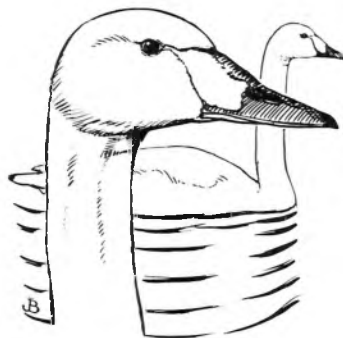


Distribution and numbers of Bewick's Swans *Cygnus bewickii* in the European Northeast of the USSR

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The Bewick's Swan, Cygnus bewickii, has special conservation status in the USSR. As a result of scientific research in northeastern USSR it has been included in the Russian Red Data Book. In this study, the population size and distribution of Bewick's Swans in the European Northeast of the USSR was recorded for the first time. Main breeding grounds and moulting sites were identified and some features of Bewick's Swan ecology were studied.

Study Area

The study area (66-70°N and 44-66°E) comprises an extensive low lying plain, bordered by the Timan, Ural and Pai-Khoya mountain ranges (Fig 1). The region suffers an extremely severe climate of prolonged cold winters from late October to late May. The summer lasts only two months, July and August, and autumn commences in late August. The arctic day lasts from mid May to mid July. During summer the air temperature is low and the weather is very changeable.

The low lying plain is covered by numerous lakes scattered among the morainal ridges and mounds and in the maritime tundras. The main vegetative cover in the region is moss and lichen. In the southern sub-zone there is a shrubby layer over the moss cover, and in this *Betula nana* predominates. Side by side with this, but in smaller quantities, are to be found *Salix*, *Ledum palustre*, *Vaccinium uliginosum*, *Rubus chamaemorus*, *Empetrum nigrum*, *Arctous alpina* etc. In the lower lying areas marshes and peat bogs have developed which are covered with *Carex* and *Eriophorum*. To the south of the

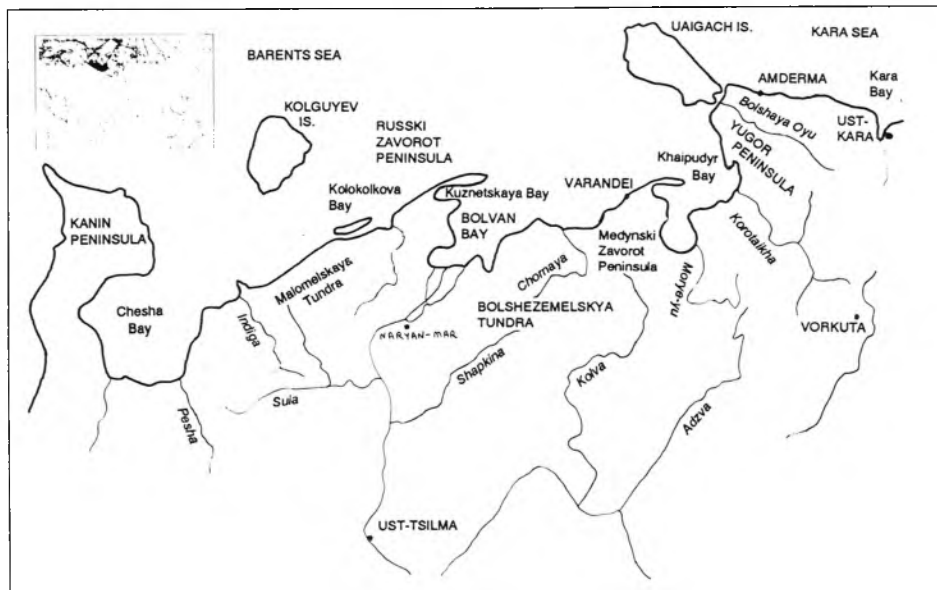


Fig. 1. Region of study in the European northeast of the USSR

shrubby sub-zone of the tundra begins the forest tundra with large shrubs and curtain woody vegetation.

Methods

Long (up to 3 months) and short (up to 1 month) observations of the swans from the first ten days of May to the middle of October were carried out in the Bolshezemelskaya Tundra (1973-1979), Malozemelskaya Tundra (1977-1979, 1982, 1986 and 1988) and on the Yugor Peninsula (1981-1984 and 1987).

Field studies were carried out at fixed observation points in the basins of the Bolshaya Rogovaya, Morye-Yu and Chornaya Rivers and on the coast of Khaipudyr Bay in the Barents Sea (Bolshezemelskaya Tundra), on the Russki Zavorot Peninsula, in the northern forest-tundra and on the coast of the Barents Sea (Malozemelskaya Tundra), in the basin of the River Bolshaya Oyu (Velikaya) and in the maritime tundra of the coasts of the Kara and Barents Seas (Yugor Peninsula).

Annual counts were made at each field study site and the distribution of swans in relation to habitat type was established during breeding, moulting and migration. At key areas, nest density and the number and distribution of broods over the study areas was recorded. The seasonal migration during spring, summer and autumn was studied in detail. Aerial surveys were used to calculate numbers and identify major sites during moult and the autumn migration. Observations were made in August-September 1973-1979, 1983 and 1985 along permanent transects from the River Mezen (Kanin Peninsula) to the Ural (River Kara) and in 1983 and 1985 - as far as Yamal. The length of the count transects was about 260 count hours, of which about 100 hours were in the autumn period. An MI-4 helicopter was used in 1973 for the counts while in the other years an AN-2 plane was used. The height of the flight trajectory did not exceed 100m and all the observations were tape-recorded.

Results

Population distribution

The distribution of Bewick's Swans throughout

the European Northeast of the USSR varies widely between tundras in different regions, despite the similar habitats. Numbers in each

Table 1. Population distribution of Bewick's Swans during the summer throughout the European north-east of the USSR

Region	Average density (number per 10 square km.)
1. <u>Timan Ridge tundras</u> (between rivers Indig & Velt)	0.9 - 2.0
2. <u>Malozemelskaya Tundra</u> (east of River Indiga to River Pechora)	26 - 85
River Senyakha & Kolokolkova Bay	13 - 31
3. <u>Bolshezemelskaya Tundra</u> Bolvenski Nos Peninsula to River Khilchuyu & coastal shallows of Bolvan Bay	7 - 28
River Chornaya to Varandei Bay & Medynski Zavorot Peninsula	5 - 49
Central Bolshezemelskaya to upper reaches of Adzava and Bolshaya Rogovaya rivers	0.4
4. <u>Yugor Peninsula</u> Kara coast (sedge and sedge moss-osier tundras)	20 - 51
Barents Sea coastal region	3.5 - 11

localised region fluctuate widely between years.

The average densities (number per 10 square km) for the main regions are given in Table 1. A small number of swans are recorded in the lake-filled lowland of the Kanin peninsula and the maritime tundra to the south of Chesha Bay, as far as River Pesha, and in the Timan tundras between the rivers Indiga and Velt. The swans occupy these regions mainly during migration and the moulting period.

Numbers increase to the northeast (Fig.2). The maximum density of breeding and moulting swans is recorded in the Malozemelskaya Tundra in the basin of the River Senyakha and on the Russian Zavorot Peninsula (68°33'N to 68°50'N, between 52-54°E). In autumn there are large gatherings of swans in the north of the Russian Zavorot Peninsula and in the shallows of the southeastern part of Korovina Bay and the south coast of Kolokolkova Bay. In these regions up to 6,000-10,000 Bewick's Swans gather in groups of 100-300 birds.

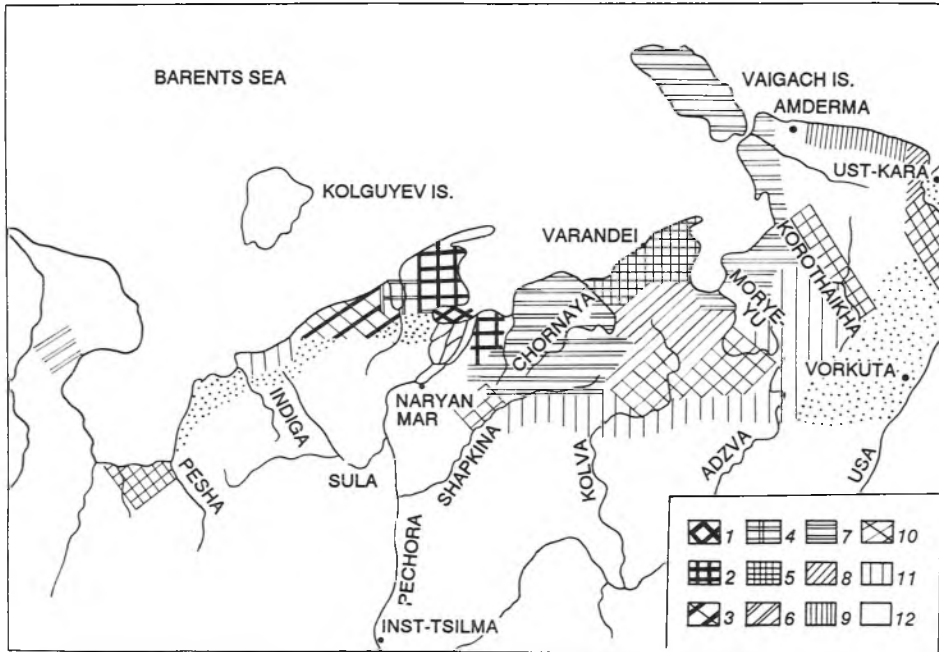


Fig. 2 Average long-term (1973-1985) population density of Bewick's Swans in the European northeast of the USSR (birds per 100 sq km). 1 - about 700, 2 - about 400, 3 - about 300, 4 - about 200, 5 - 80-100, 6 - 60-80, 7 - 50-70, 8 - 35-45, 9 - 20 -30, 10 - 10-15, 11 - 5, 12 - 2.
Swan population density on Vaigach Island from data by Karpovich & Kokhanov (1963)

In the similar habitats in the Bolshezemelskaya Tundra there is a lower population density of Bewick's Swans, but they are more evenly distributed throughout the area. The largest numbers in this area are recorded in the maritime tundra of the Bolvan Bay coast, in the central and eastern part of the Medynski Zavorot peninsula and in the maritime belt of Khaipudyr Bay in the Barents Sea (68°33'N - 68°54'N, 58 - 60 E). At the end of August-September mass gatherings of birds occur in the maritime tundra and on some large lakes. At the beginning of autumn migration the population density varies between 0.6 to 23.0 swans per 10 square km. in different regions of the Bolshezemelskaya Tundra.

On the Yugor peninsula, to the northeast of the River Korotayka, Bewick's Swans breed and moult every year, along almost the entire low lying coast of the Barents and Kara seas. There are considerable changes in the swans' distribution during the autumn, according to the type of habitat. The numbers decrease 2-4 fold compared with the summer period, down to 0.7 to 1.9 swans per 10 square km. There are no mass gatherings of swans in the Yugor penin-

sula during summer-autumn.

Further east, from the River Kara (foothills of the arctic Urals) to Baidaratskaya Bay (Yamal) there are few Bewick's Swans either breeding or moulting. Groups of between 7-18 birds are recorded on some islands in Baidaratskaya Bay and there are occasionally pairs with broods in some coastal sites.

Distribution of breeding Bewick's Swans

During the breeding period Bewick's Swans are found in the moss-lichen, moss-sedge and sedge tundras. They are rarely found in the shrubby tundra and only during migration are they recorded in the forest-tundra and taiga zone (Fig.3).

Bewick's Swans arrive in their breeding sites as the snow begins to melt. The first birds appear at the end of April-early May. In the Malozemelskaya Tundra mass migration (40-75% of the swans) occurs in the last 3 weeks of May, in the Bolshezemelskaya Tundra from the middle to the end of May and on the Yugor Peninsula from the end of May to the first ten days of June.

In years of deep snow cover the swans remain

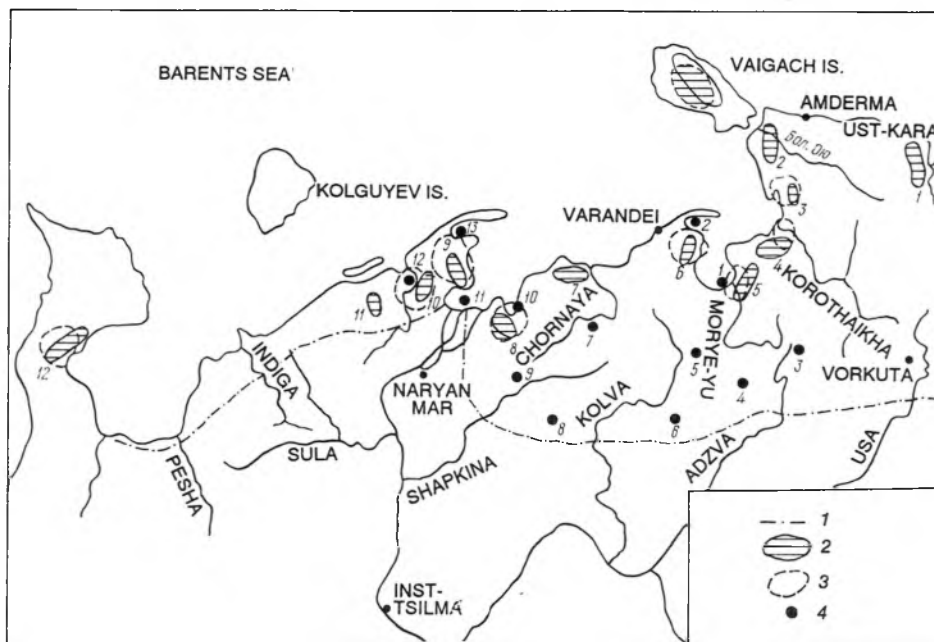


Fig.3 Bewick's Swan distribution in the European northeast of the USSR.

Key 1 - southern limit of summer distribution

2 - Regions of mass breeding: 1-maritime tundra in Kara Bay, 2-area between Rivers Bolshaya Oyu (Velikaya) - Lymbadayakha - Sedyakha, 3-Lower Belkovskaya, 4-coast of Khaipudyr Bay, 5-Lower Morye-Yu, 6-Medynski Zavorot Peninsula (Varandeiskaya lapa), 7-coast of the Barents Sea between the Rivers Chornaya and Dresvyanka, 8-maritime tundra in Bolvan Bay (Popovski Island), 9-Ruski Zavorot Peninsula 10-tundra in Kolokolokova Bay, 11-Senyakha basin, 12-area between the Rivers Chesha and Shoina

3 - Regions of mass moulting of Bewick's Swans (Vaigach Island; according to Karpovich & Kokhanov 1963)

4 - sites of autumn gatherings: 1-coast of Khaipudyr Bay, 2-Perevoznaya Bay, 3-Vashutkiny Lakes, 4-Lake Vatyarto, 5-region of Porchto and Sryerto Lakes, 6-Lake Kolvato, 7-region of River Chornaya, 8-Lake Beluga-ty, 9-Lake Oshkoto, 10-Bolvan Bay, 11-Korovina Bay, 12-Kolokolokova Bay, 13-Kuznetskaya Bay

in groups of up to 100 birds on the polynyas of the rivers and channels (about 24%) and on small lakes (over 36% of those recorded). About 40% of the swans are found in small groups and pairs on the low lying maritime areas where the first thaw occurs. When the snow cover is moderate, the bogs and maritime tundras are the first to thaw in the early spring and the swans remain in these regions. Once the thaw becomes widespread the swans disperse into the sedge and sedge-moss boggy depressions flooded by melt-water, the floodlands of the lower reaches of rivers and the damp moss and sparse shrub covered tundra plains.

Courtship displays commence shortly after arrival and the swans disperse over the breeding territory. The breeding biotopes are quite varied: sedge-grass, sedge-moss, moss-lichen-sparse osier, sedge and moss sections of the tundras, low lying and flat raised maritime bogs and also valleys of the lower reaches of the tundra rivers. On the Kanin Peninsula a small number of Bewick's Swans breed in the eastern

part between the Chesha and Shoina Rivers. In the Malozemelskaya Tundra a large number of birds breed in the eastern part of the Ruski Zavorot Peninsula and in the Senyakha basin. In the Bolshezemelskaya Tundra the main breeding regions are in the maritime lowlands of Bolvan Bay, the Medynski Zavorot Peninsula and the southern coast of Khaipudyr Bay in the Barents Sea. On the Yugor Peninsula they breed at high density in the maritime lowlands of the Kara Sea and in a narrow belt (10-15 km) of the Barents Sea coast (Fig 3).

In the optimum habitats in the Malozemelskaya Tundra the breeding density of the swans varies from 2.7 to 14 pairs, in the Bolshezemelskaya Tundra from 0.2 to 1.8 pairs and on the Yugor Peninsula from 0.8 to 6.6 pairs per 10 sq. km. On Vaigach Island the swans' breeding density averages 1 pair per 10 sq. km (Kalyakin 1987). From 12 to 32% of the Bewick's Swan population take part in breeding and this is numerically similar to the breeding structure of Tundra Swans, *Cygnus c.*

columbianus (15.1 - 47.8%) breeding in Alaska (Lensink 1973).

Bewick's Swan breeding potential depends on ecological conditions, especially weather conditions, during breeding and on the population structure. During the study period the population was dominated by pairs (over 40%) and small groups of 3-10 birds (over 29%). There were large annual fluctuations in the number of pairs which varied between 23.7 to 71.2% of the total number of swans. A significant number of pairs are territorial non-breeders.

In June-early July several pairs performed courtship displays which often resulted in nest-building but no egg-laying. Some pairs imitated the process of incubation on the empty nests. It is likely that these are new inexperienced pairs. Possibly the imitation of incubation is linked with territorial marking for subsequent years. In the wintering grounds at Slimbridge, England, a high proportion of pairs without young has been observed (Evans 1979a). During the study, on average 24.6% (11-65%) of pairs laid eggs, which is similar to the 28.3% (12.8-47.3%) of pairs with broods observed wintering at Slimbridge (Evans 1979b). Similarly the proportion of Tundra Swan pairs with broods in Alaska was 31.4% (Lensink 1973).

Breeding success

Average clutch size and brood size after hatching for three regions of the European northeast of the USSR are given in Table 2. Average clutch size increases from west to east. The overall average for the European northeast of the USSR is 3.1 eggs per clutch (range 1-6). Embryonic mortality and other causes result in lower brood sizes after hatching. The average brood size in the first days after hatching is just over 85% of the clutch. The average brood size for the European northeast is 2.66 (n=485, range 1-5). On Vaigach Island the average brood size is 2.6-3.5 cygnets (Karpovich & Kokhanov 1967, Kalyakin 1987). At the end of the breeding

season it is estimated that there are approximately 4,000-5,000 young in the population but under favourable conditions up to 12,000 young have been recorded. It is unknown how many young return to their natal area. There is high juvenile mortality during the autumn migration. The average brood size at the wintering sites in Britain is 2.1 young (Evans 1979b).

Moulting

The distribution of Bewick's Swans changes during the moulting period. Pairs with broods, territorial pairs and occasionally single birds remain in the breeding grounds. Small flocks of non-breeders congregate in the shallow sea bays and coastal regions. Very few swans remain on the lakes to moult.

The moulting grounds are localised and the swans use the same sites each year (Mineyev 1986). After moulting is complete the swans congregate in larger pre-migration groups mainly on the coast and sea shallows (Fig 3). At the beginning of autumn migration the non-breeding territorial pairs and birds with broods remain in the breeding habitat. The migrating swans concentrate in the Malozemelskaya and Bolshezemelskaya Tundras on the maritime sedge-grass water meadows (about 50%), low lying sea coasts - marshes (28%) and sea shallows (about 20% of sightings). During the intensive migration period the migrants stop-over on large lakes, especially on the Yugor Peninsula where in 53% of sightings the swans were on the maritime lakes and in 35% were near river estuaries. Autumn gatherings of swans are not recorded west of Kolokolkova Bay as far as the Kanin Peninsula. Most of the broods remain in the breeding grounds until mid-end of September, before joining the migration.

Discussion

In recent years there has been an increase in the

Table 2. Breeding success of Bewick's Swans in the European northeast of the USSR.

Region	mean	Clutch Size range	no. of nests	Brood Size after hatch mean
Malozemelskaya Tundra	2.8	1-4	35	2.45
Bolshezemelskaya Tundra	3.5	2-6	14	2.75
Yugor Peninsula	3.5	2-6	24	2.80

number of Bewick's Swans in the tundras of the European northeast of the USSR. At present 30,000-36,000 Bewick's Swans inhabit the region, including 7,500 swans on Vaigach Island (Kalyakin 1987), which suggests that this region is of major importance.

Numbers have fluctuated between the different tundras with no apparent synchronisation. It

is believed that these fluctuations are caused by different ecological conditions in the Bewick's Swans' breeding and moulting grounds, resulting in movements between geographical regions. Such movements are commonly recorded particularly from Vaigach Island, Yamal Peninsula and probably from the Taimyr and Novaya Zemlya Island.

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