Mapping breeding range structure of tundra waders in Russia

E.G. Lappo

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A series of maps (scale 1:8,000,000), showing the structure of wader breeding ranges with explanatory texts have been compiled on the basis of literature and unpublished data from different northern regions of Russia and using a recent method of zoological mapping (Brunov 1982). Seven waders (Red-necked Phalarope *Phalaropus lobatus*, Grey Phalarope *P. fulicarius*, Temminck's Stint *Calidris temminckii*, Curlew Sandpiper *C. ferruginea*, Pectoral Sandpiper *C. melanotos*, Knot *C. canutus* and Sanderling *C. alba*) were chosen as more detailed information for them was available. New data on distribution, numbers and some details of the birds ecology are used in mapping, and the landscape extrapolation method was used as a basis for the work. For every species more exact information (compared with the data of Kozlova 1961-1962) on the borders of the breeding ranges and previously unknown breeding places were obtained. Core zones of the breeding ranges were also determined, since such areas are the most important for the productivity of a species. Core zones are where maximum population density, the widest use of available habitats and most regular breeding occur. Although Red-necked Phalarope and Grey Phalarope have partly overlapping breeding ranges their core zones are more or less allopatric. The core zones within wader breeding ranges are especially important in the context of wader conservation strategies, as it is in these areas that species have the highest productivity and where conservation efforts are most effective.

Elena G. Lappo Institute of Geography, Russian Academy of Sciences Staromonetny per., 29 Moscow, 109017, Russia.

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Серия карт (с масштабом 1 : 8,000,000), показывающая структуру гнездовых ареалов куликов с пояснительнымыи текстами, была составлена на основе литературных источников и неопубликованных данных, полученных из разных регионов русского Севера, используя новый метод зоологического картирования (Брунов, 1982). Семь видов куликов (круглоносый плавунчик *Phalaropus lobatus*, плосконосый плавунчик *P. fulicarius*, белохвостый песочник *Calidris temminckii*, краснозобик *C. ferruginea*, дутыш *C. melanotos* исландский песочник *C. canutus* и песчанка *C. alba*) были выбраны в следствии того, что по ним была доступна наиболее подробная информация.

Для картирования используются новые данные по распространению, численности и некоторым подробностям экологии этих птиц, тогда как основой для работы послужил метод экстраполяции по ландшафтам. Для каждого вида была получена более точная информация (по сравнению с данными Козловой, 1961-1962) о границах гнездовых ареалов и о ранее неизвестных местах гнездования. Также, были определены оптимумы гнездовых ареалов, так как такие зоны являются самыми важными для продуктивности отдельного вида. Оптимум ареала - это зона, где зарегистрированы максимальная плотность популяции, самое широкое использование доступных биотопов и самое регулярное гнездование. Несмотря на то, что у круглоносого и плосконосого плавунчиков гнездовые ареалы частично перекрываются, оптимумы их ареалов более или менее аллопатричны. Оптимуиы внутри гнездовых ареалов куликов имеют особо важное значение в контексте стратегий охраны этих птиц, так как именно в этих зонах характерна самая высокая продуктивтость видов, и усилия по охране там наиболее эффективны.

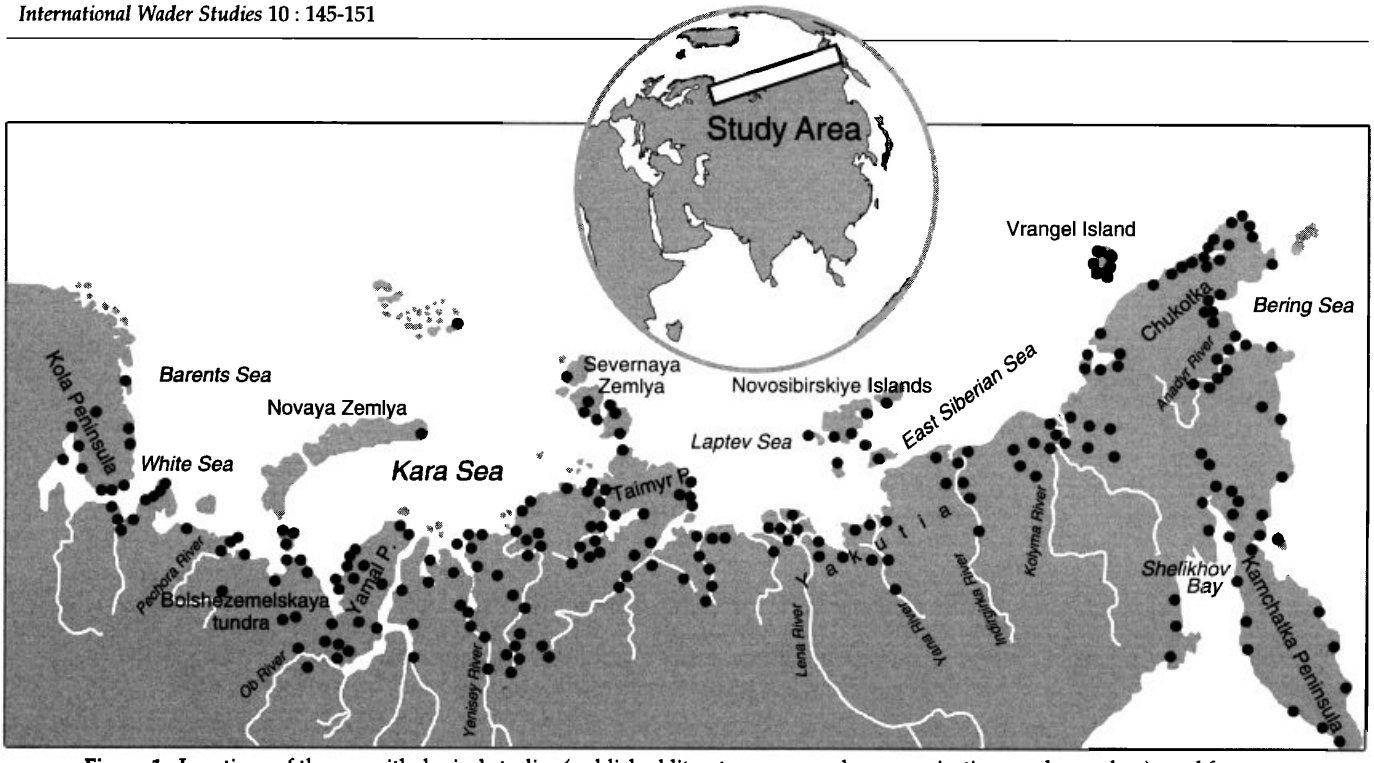

Figure 1. Locations of those ornithological studies (published literature, personal communications and own data) used for the mapping of arctic waders breeding ranges.

Introduction

Maps of bird distribution are published in many Russian ornithological monographs and in papers about individual species. In most, the breeding ranges are outlined extremely schematically and based on the extreme points of their distribution, an approach determined largely by a lack of detailed information (Gladkov 1951; Kozlova 1961, 1962).

In some papers, precise data are shown together with a schematic map. Tomkovich & Fokin (1983) marked localities where nests and broods were found on the map of the breeding range of Temminck's Stint *Calidris temminckii*. For several waders of north-eastern Asia, Kistchinski (1988) distinguished the main breeding grounds and areas where the waders were relatively abundant. Using the basic maps (mostly the maps of vegetation) the boundaries of breeding ranges can be extrapolated. An example is that by Uspensky (1965) for Curlew Sandpiper *Calidris ferruginea*. Determination of the core zones of breeding ranges on the basis of maps based on precise data was done by Brunov (1982) for the birds of the Palearctic taiga zone.

In spite of a number of studies, including those where mapping methods were used, the boundaries of the breeding ranges of many tundra waders have only been outlined roughly. Our study aimed to work out and analyse such maps based on analysis of current knowledge and using the method of extrapolation according to the maps of vegetation structure. Where possible we tried to define exactly both the boundaries and the optimal or core zones of waders breeding ranges.

Methods

In this paper the distribution of seven wader species, breeding at the Taimyr peninsula (where the author conducted studies in 1990-1992) is analysed: Grey Phalarope *Phalaropus fulicarius*, Red-necked Phalarope *P. lobatus*, Temminck's Stint *Calidris temminckii*, Curlew Sandpiper *C. ferruginea*, Pectoral Sandpiper *C. melanotos*, Knot *C. canutus* and Sanderling *C. alba*.

Methods of compiling the maps of breeding ranges were described in detail by Brunov (1982). For this paper more than 150 literature sources concerning arctic studies were analyzed; most of them, where the exact geographical position was mentioned, are shown on the reference map (Figure 1). While compiling this map we mostly used the information from bibliographic reviews by Yemelyanova and Brunov (1987) and by Brunov (1988).

We define the optimal or core zone of a breeding range as that area which is the most important for the reproduction of the species, where 1) the largest population densities are recorded; 2) the widest habitat spectrum is used by the species; 3) the most regular breeding occurs; and 4) population size is rapidly restored after population depression (Brunov 1982). Owing to a lack of data we were not able to apply the last criterion.

The precise boundaries of the breeding range of each species (in comparison with the monograph of Kozlova 1961, 1962) were plotted on maps mostly based on the *"Vegetation map of the USSR"* (1990). As a result, maps with detailed legends and information on distribution, habitat preferences, and location of optimal zones of the breeding ranges were obtained for each species; changes in knowledge of boundaries and structure of breeding ranges are mentioned in the captions.

Results

Grey Phalarope *Phalaropus fulicarius*

This species breeds in the polar desert zone and in all the tundra subzones from the north-east of European Russia to the Anadyr' river and Bering Strait as well as on Novaya Zemlya, Novosibirskiye and Vrangel Island. Compared with the map of Kozlova (1961), the northern and southern boundaries of breeding ranges on the Taimyr Peninsula, in Yakutia, along the northern coasts of the Chukotka Peninsula and in the Anadyr' river basin were defined more precisely in our version of the map. The limits of the breeding range stretch much further westwards than earlier supposed, including the Yamal and Gydan Peninsulas. Isolated records of Grey Phalaropes breeding outside the compact breeding range were found on Vrangel Island and in eastern Europe (Yugorsky Peninsula and Novaya Zemlya). The core of the breeding range is located in the arctic and typical tundra subzones of Yakutia and Chukotka.

Grey Phalarope breeds in lowland (mostly oligotrophic) sedge - cotton-grass (*Carex* spp., *Eriophorum* spp.) marshes with ponds, in the wet coastal meadows with ponds and lakes, and in marshy sedge - cotton -grass tundras.

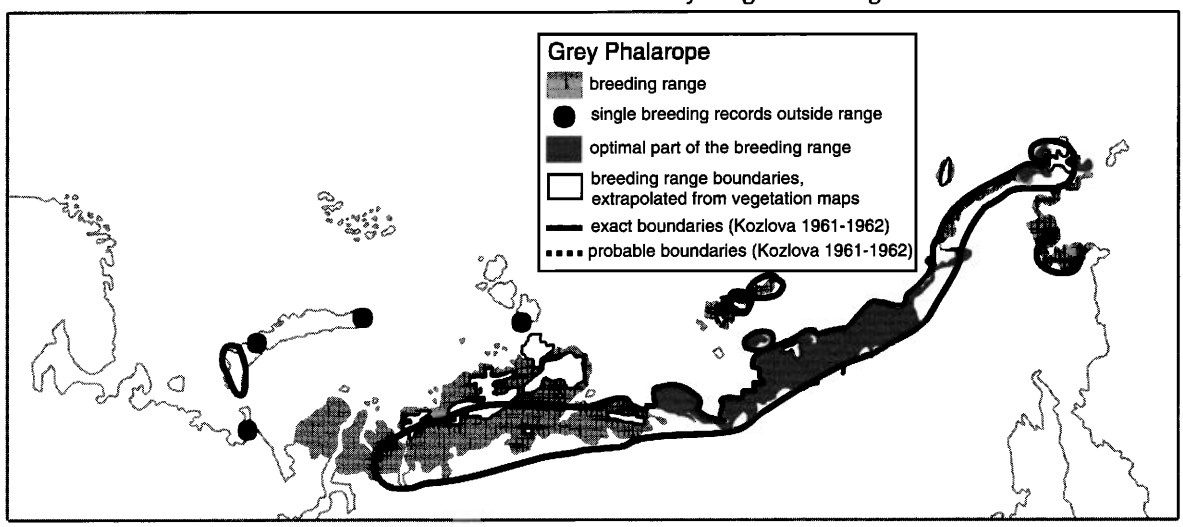

Figure 2. Map of Grey Phalarope *Phalaropus fulicarius* breeding range.

Red-necked Phalarope *Phalaropus lobatus*

Red-necked Phalarope bred in tundras, forest-tundras and northern taiga from the Kola Peninsula to Chukotka and Kamchatka Peninsulas. The northern and southern boundaries of distribution were defined more precisely for this species over the whole breeding range. Vast breeding areas, not previously known, were revealed in the Anadyr river basin, at the coast of Kamchatka Peninsula and Shelikhov Bay. Single breeding localities were also found in the Pyakopur river basin and on Sakhalin Island.

Two core zones exist; in the typical and southern subzones of Bol'shezemel'skaya, Yamal and Gydan tundras, and probably also both in the shrub tundra (=southern) subzone of the Kanin Peninsula and close to the Yenisey river as well as in the shrub tundras of the lowland between the Yana and Indigirka rivers, and Yakutia.

Red-necked Phalarope prefer to nest near eutrophic water bodies with sedge-dominated shallow waters in the lowlands of river mouths, in marshy coastal plains, and in mountain tundras with numerous lakes.

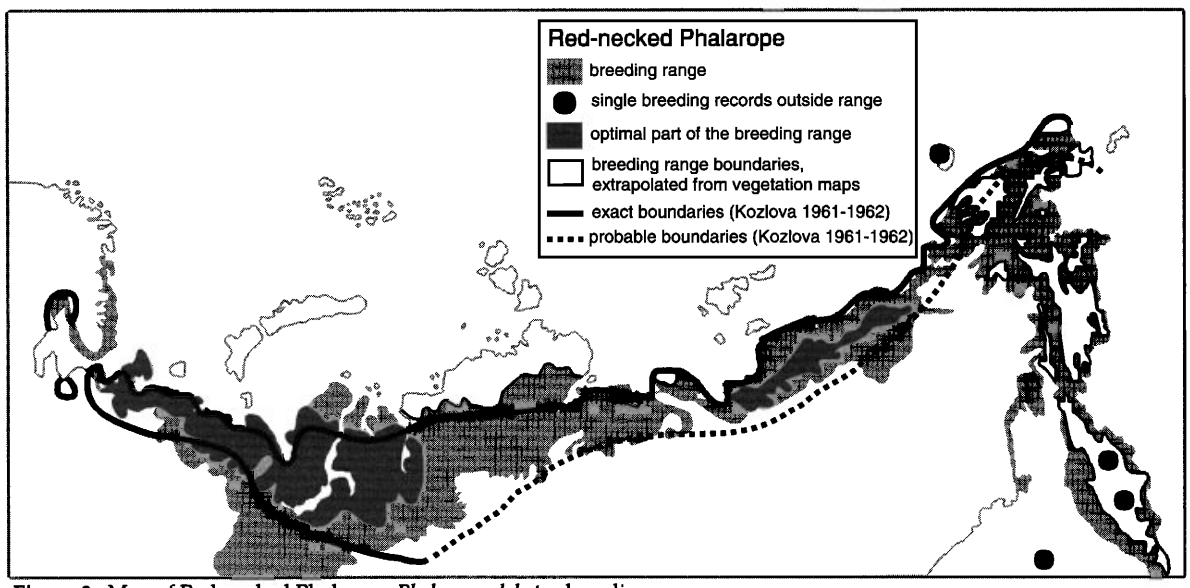

Figure 3. Map of Red-necked Phalarope *Phalaropus lobatus* breeding range.

Temminck's Stint *Calidris temminckii*

This wader breeds from the Kola to Chukotka Peninsulas in all tundra subzones, forest-tundras, and locally in northern taiga.

We clarified the northern and southern boundaries of the breeding range in the European part of Russia, on the Taimyr Peninsula, in Yakutia and in the Anadyr' river basin. The arctic and typical tundras of the Yamal and Gydan Peninsulas were also included in the breeding range as well as the coastal tundras of the western coasts of the Bering Sea, Penzhina and Shelikhov Bays.

The core of the breeding range is in the typical and northern part of shrub subzones of the Yamal, southern Yenisey, and Yakutia tundras and probably also of the Taimyr Peninsula.

Through the whole breeding range this species occurs in the intrazonal habitats, prefering waterside areas with disturbed tundras and areas with sparse vegetation (Tomkovich & Fokin 1983).

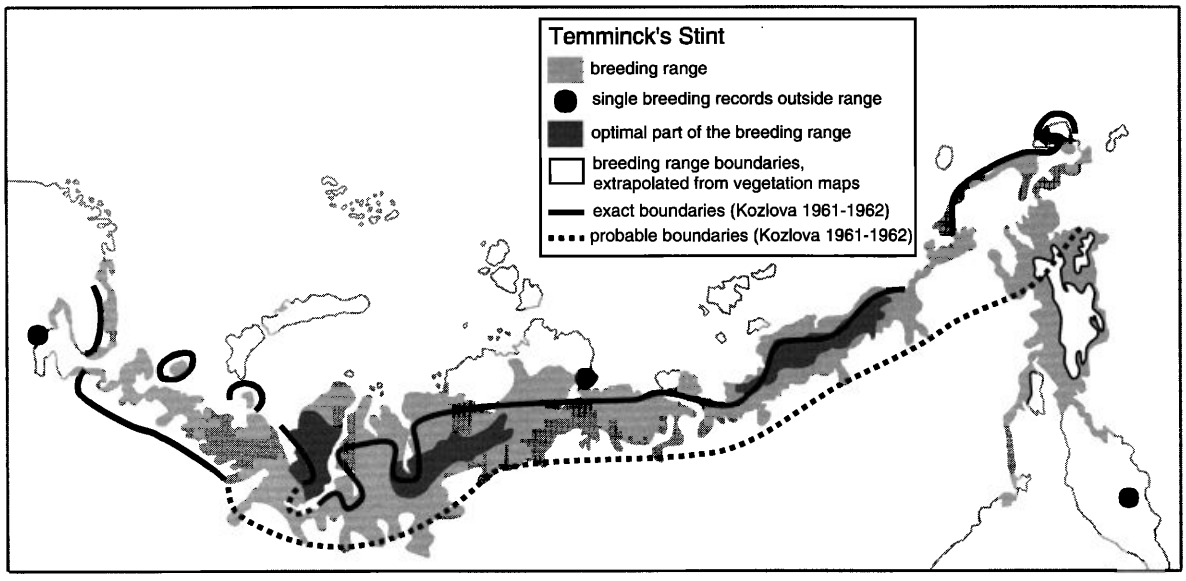

Figure 4. Map of Temminck's Stint *Calidris temminckii* breeding range.

Curlew Sandpiper *Calidris ferruginea*

According to Kozlova (1962) the breeding range of Curlew Sandpiper occupies only the tundra belt from Taimyr to the Lena delta, and a few places on the Novosibirskiye Islands and in the Kolyma delta. The map published by Uspensky (1965) showed the breeding range outlined only within the arctic tundra subzone. We consider that, as well as the arctic tundras, the northern parts of typical tundra subzone from the Yamal Peninsula to the Kolyuchinskaya Gulf and the Novosibirskiye Islands are also within the breeding range of Curlew Sandpiper. Moreover, single localities where breeding has been recorded, are found in the shrub tundra subzone of the Yamal and eastern Taimyr, and on the arctic tundras of Vrangel Island.

The core of the breeding range is found in two areas: (1) the arctic and northern typical tundras of the Taimyr Peninsula, and (2) probably the most northern part of the mainland arctic tundras between the Yana and the Indigirka rivers.

Curlew Sandpipers nest usually in dry places, mostly in upland polygonal, polygonal-tussocky or hummocky tundras on plains and gentle slopes of hills.

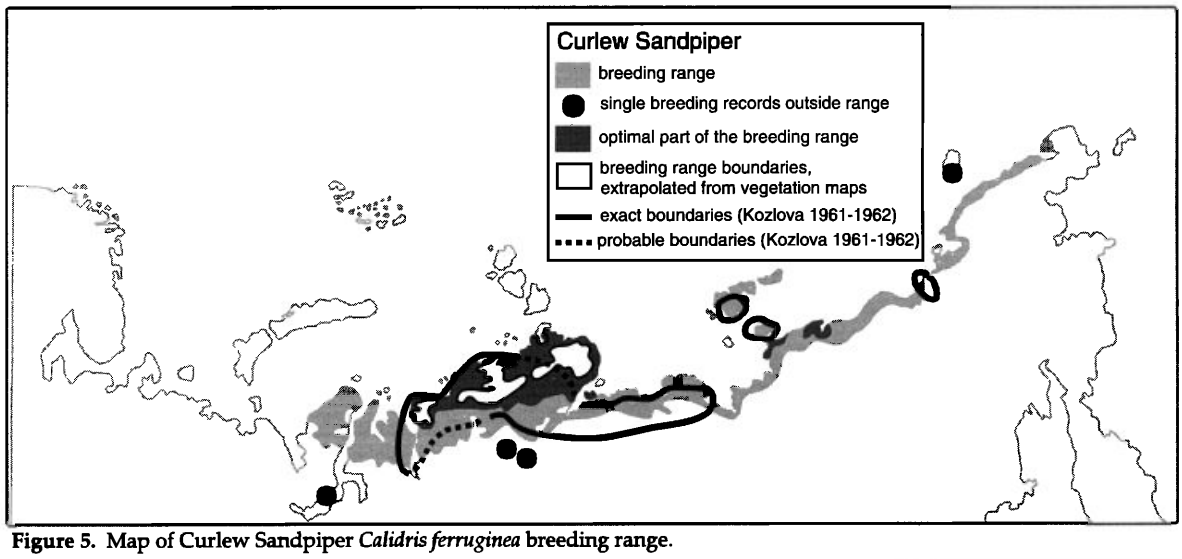

Figure 5. Map of Curlew Sandpiper *Calidris ferruginea* breeding range.

Pectoral Sandpiper *Calidris melanotos*

Pectoral Sandpipers breed in the arctic, typical and southern tundras from the Yamal to Chukotka Peninsula and to the Anadyr river basin. The western and south-eastern limits of the breeding range were defined more precisely: typical and southern tundras of Gydan, western and central Taimyr, and also the Bolshoy Lyakhovsky and Vrangel Islands were included in the breeding range.

The core of the breeding range is probably situated, in the southern and typical tundras of Yakutia (in the Lena delta, and the tundras between the Khroma and Indigirka rivers and close to the Kolyma river valley), and probably in the eastern part of the Taimyr typical tundras.

This species prefers to breed on tundra-bog complexes, mostly on hillocky and polygonal bogs.

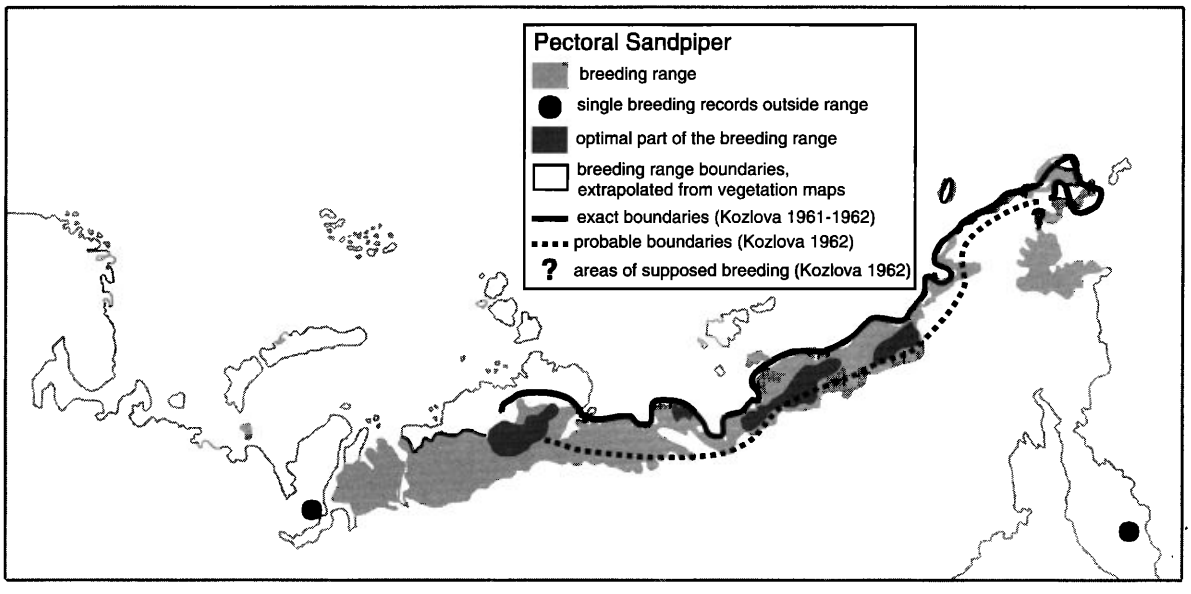

Figure 6. Map of Pectoral Sandpiper *Calidris melanotos* breeding range.

Knot *Calidris canutus*

1. *Calidris canutus canutus*

Knots of the nominate subspecies breed in the arctic tundras of the Taimyr and Novosibirskiye Islands. During the study we defined more exactly the western and eastern limits of the breeding area occupied by the subspecies on the Taimyr Peninsula. The probable breeding record of this subspecies from the area at the southern shore of the Taimyr lake, mentioned by Kozlova (1962) is hardly probable in the light of current data. The breeding core zone of the subspecies is restricted to the northern belt of the Taimyr arctic tundras (in the coastal areas of the central and eastern parts of the Peninsula) where the low-mountain or polygonal tundras with debris are developed on fjell-field areas on the tops or slopes of hills; these habitats are prefered for breeding.

2. *Calidris canutus rogersi*

On the basis of recent data the supposed breeding range of the subspecies is the mountain tundra of the Chukotka Penunsula and the Anadyr mountain range. It probably also breeds at the Koryakskoye

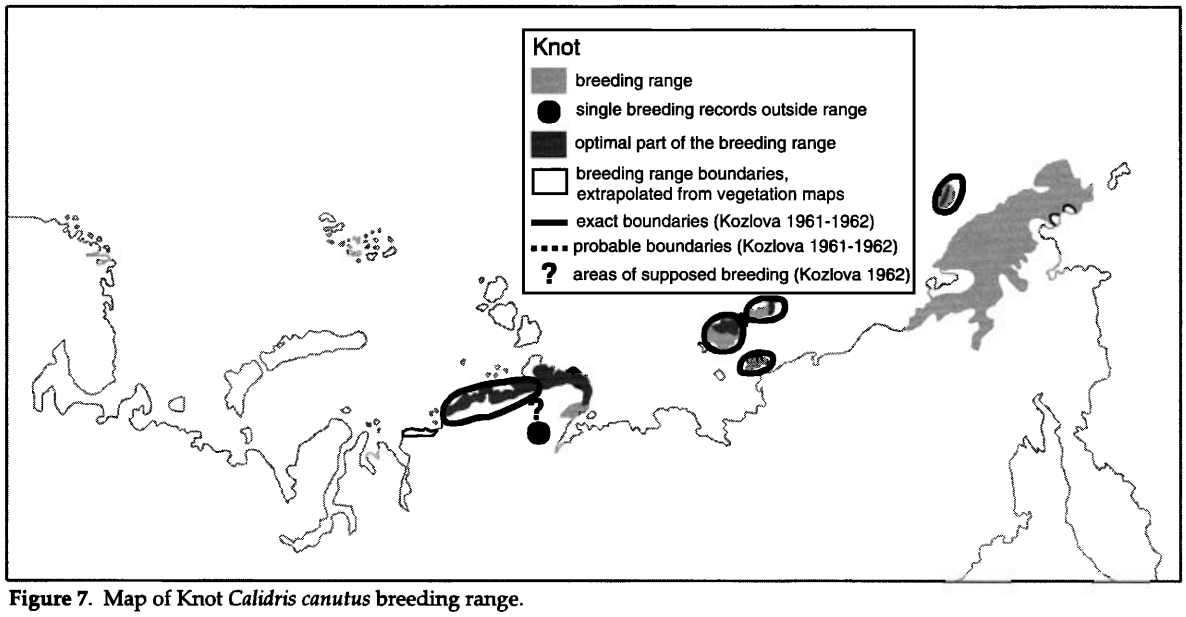

Figure 7. Map of Knot *Calidris canutus* breeding range.

highland further south. Being restricted to the polygonal tundras and fjell-fields it penetrates to the typical tundra subzone down to the sea level.

The core of the breeding range was not distinguished as the subspecies has been insufficiently studied.

3. *Calidris canutus roselaari*
Within Russia this subspecies breeds only on Wrangel Island, where it is found on polygonal and fjell-field/forb tundras from the tops of low mountains down to the coast. The core of the breeding range is located in the arctic tundras, mostly in areas of mountainous relief.

Sanderling *Calidris alba*

Sanderling have high-arctic and disjunct breeding range. In Russia it breeds in polar deserts, arctic tundras and the alpine tundras bordering arctic tundras, on the Taimyr, Severnaya Zemlya and Novosibirskiye Islands. Limits of the breeding range were determined for the Taimyr, nesting was confirmed on the Severnaya Zemlya Islands. Breeding of Sanderling on the Lena Delta, mentioned by Kozlova (1962) has not yet been confirmed by recent studies.

As the species is rather poorly studied, it is still difficult to determine the core of its breeding range. We suppose that it is restricted to the marine coasts of the Northern Taimyr arctic tundra subzone. Sanderlings breed in different types of tundras, usually on elevated areas with patches of bare ground.

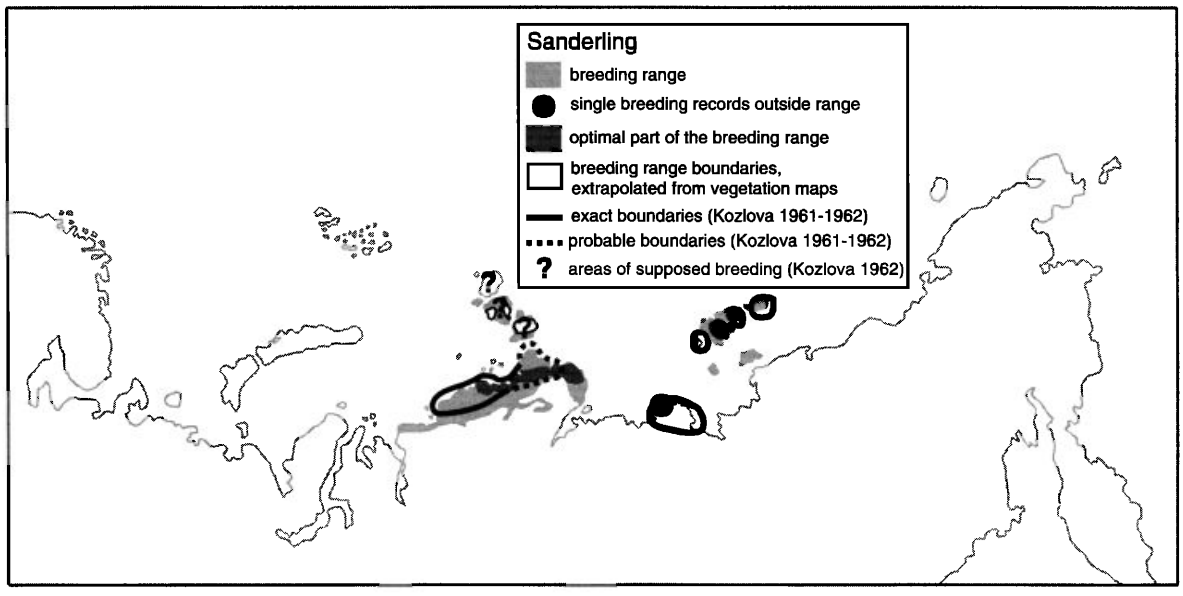

Figure 8. Map of Sanderling *Calidris alba* breeding range.

Discussion

If the maps of breeding ranges published by Kozlova (1961, 1962) are compared with those compiled during our study, it is clear that the breeding range of every species is much larger than formerly known; this is a consequence of the discovery of new breeding localities. The habitat-based extrapolation used in our study has also highlighted more detailed breeding range boundaries. Earlier ranges were shown as solid belts; currently they have the appearence of lace.

Using these maps of the breeding range structure demonstrates regularities in distribution and environmental conditions for every species. For example Temminck's Stint prefer to breed in disturbed habitats (Tomkovich & Fokin 1983) in the river valleys, the ravine slopes, in anthropogenic landscapes *etc.*, and occupies a wide spectrum of natural habitats in typical and shrub tundras, while in arctic tundras, forest-tundras and northern taiga it breeds almost exclusively in river valleys and in the vicinity of human settlements that leads to a kind of "range-disruption" in these subzones.

Another approach to analyse these maps is to compare the breeding range structure of different species. This approach was used in the study of spatial relations in two allied wader species: Grey and Red-necked Phalaropes (Lappo & Brunov 1989). Their breeding ranges overlap broadly from the Yamal to Chukotka Peninsulas. Red-necked Phalarope, however, is more widely spread westwards (up to the Kola Peninsula), southwards (up to the sparse northern taiga) and to the south-east (up to Kamchatka), while Grey Phalarope penetrates further to the north - up to the marine coasts of northern Taimyr, Novosibirskiye and Vrangel Islands.

The area of sympatry includes the Yamal and Gydan Peninsulas, the northern coast of the Chukotka Peninsula and the Anadyr river basin, where their ranges overlap completely. In Yakutia their ranges overlap on *c.* 75% of the area, on the Taimyr by only

c. 33%. At the same time, the core of breeding ranges in these two waders do not overlap at all: in Red-necked Phalarope it is located generally in more southern areas. For example in Yakutia the core breeding range of Grey Pharapore is found in arctic and typical tundras, whilst in Red-necked Phalarope it occurs in the southern subarctic tundra subzone.

Thus, these ecologically and taxonomically related species with partly overlapping ranges, have different core breeding ranges. This is either the consequence of interspecific spatial competition, or the result of differences in the historical formation of their breeding ranges.

The core of breeding ranges are the most valuable for the conservation of bird species, as they are the most important for reproduction and support the highest breeding densities. The maps compiled in our study may also be useful for planning of areas under protection in the Russian Arctic.

Acknowledgements

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References

Brunov, V.V. 1982. Methods of quick compilation of maps of the birds ranges. *Bull. of Moscow Soc. of Naturalists Biology Branch* 87(6): 66 -73. In Russian.

Brunov, V.V. 1988. *Bibliography and reference cadastre of publications on the bird population of the USSR.* Nauka, Moscow. In Russian.

Gladkov, N.A. 1952. Order *Limicolae. Birds of the Soviet Union* 3: 3- 372. Nauka, Moscow. In Russian.

Yemelyanova, L.E. & Brunov, V.V. 1987. *Cadastre maps on population of mammals and birds.* Moscow Univ. Press, Moscow. In Russian.

Belov, A.V., Gribova, S.A. & Kotova, T.V. (eds.). 1990. *Vegetation map of the USSR* (Scale 1:4,000,000). GUGK, Minsk.

Kistchinsky, A.A. 1988. Ornithofauna of the North-East of Asia. Nauka, Moscow. In Russian.

Kozlova, E.V. 1961. Order *Charadriiformes. Fauna of the USSR: Birds*, Vol. 2. No 1. Part 2. USSR Acad. Sci., Moscow-Leningrad. In Russian.

Kozlova, E.V. 1962. Order *Charadriiformes. Fauna of the USSR: Birds*, Vol. 2. No 1. Part 3. USSR Acad. Sci., Moscow-Leningrad. In Russian.

Lappo, E.G. & Brunov, V.V. 1989. Cartographic analysis of spatial interrelations in some wader species and tundra waterfowl. *In*: Yu.I. Chernov (ed.), *Interactions of organisms in tundra ecosystems. Abstracts of the All-Union Meeting*, pp. 117-119. Syktyvkar. In Russian.

Tomkovich, P.S. & Fokin, S.Yu. 1983. On the ecology of Temminck's Stint at the north-east of Siberia. *Ornithologia* 18: 40- 57. In Russian.

Uspensky, S.M. 1965. Materials on bird fauna of northern Anabarskiye tundras. *In*: N.A. Gladkov (ed.), *Research on the fauna of Soviet Union. Birds. Archives of Zoological Museum of Moscow State Univ.* 9: 63- 97. Moscow. In Russian.