Nesting density dynamics and site fidelity of waders on the middle and northern Yamal

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Monitoring of nesting density and colour-ringed birds was carried out on survey plots at two ornithological field stations: Khanovey, in the middle Yamal, north of the shrub tundra 68°40'N (1982-1991), and Yaibari, in the northern Yamal, south of the arctic tundra 71°04'N (1988-1991). Species with a high site fidelity index had a more stable population density.

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Рябицев, В. К., Алексеева, Н. С. 1998. Динамика плотности гнездования и гнездовой консератизм куликов на Среднем и Северном Ямале. *International Wader Studies* 10: 195-200.

Были проведены мониторинг плотности гнездования и цветное кольцевание куликов на пробных площадях в районе двух орнитологических стационаров: "Хановэй", находящийся на Среднем Ямале, на севере кустарниковой тундры, 68°40' с. ш. (1982 - 1991 гг.), и "Яйбари", расположенный на Северном Ямале, на юге арктической тундры, 71° 04' с. ш. (1988 - 1991 гг.). Была отмечена более стабильная плотность популяции для всех видов с высоким показателем гнездового консерватизма.

Introduction

There are only a few places in the tundra zone where continuous bird studies have been carried out during several breeding seasons. We have worked on two such field stations on the Yamal peninsula in north-west Siberia (Figure 1) where we have studied changes in bird communities since 1982. This report contains data on changes in the densities of breeding waders. We put a special emphasis on site fidelity, because we consider this to be very important for understanding the annual changes in breeding densities. Appendix 1 gives more information on wader distribution on Yamal based on our studies on other parts of the peninsula (Danilov *et al.* 1984; Ryabitsev 1986).

Study Area and Methods

Long-term investigations of the population sizes, ecology and behaviour of birds were carried out at two ornithological field stations, Khanovey and Yaibari. Khanovey is located on Middle Yamal (68°40' N, 72°52' E), in the north of the shrub tundra subzone. The studies at Khanovey took place between 1982 and 1991. At Yaibari (71°04' N, 72°20'E), on the southern boundary of the arctic tundra subzone and 275 km north of Khanovey, we studied waders from 1988 to 1991.

The size of the census plots varied between species according to differences in abundance, visibility etc. (Table 1). We used aerial photos and maps at various scales to map breeding birds. A system of additional landmarks in the tundra (numbers on pegs) was devised to aid mapping of breeding birds and nests.

Colour-ringing was used to study of the birds' ecology and behaviour; birds were either caught using different kinds of traps on nests, or on leks (Ruff *Philomachus pugnax*). In this paper we use the results of colour-marking to estimate site fidelity. A quantitative estimation of site fidelity (a return index) was calculated using the formula:

$$T = \frac{Nrx100}{NmxK}$$

where:
T is the return index (in %) to the study area (the site);
Nm is the number of marked birds on a survey plot in the previous year;
Nr is the number of marked birds found the next

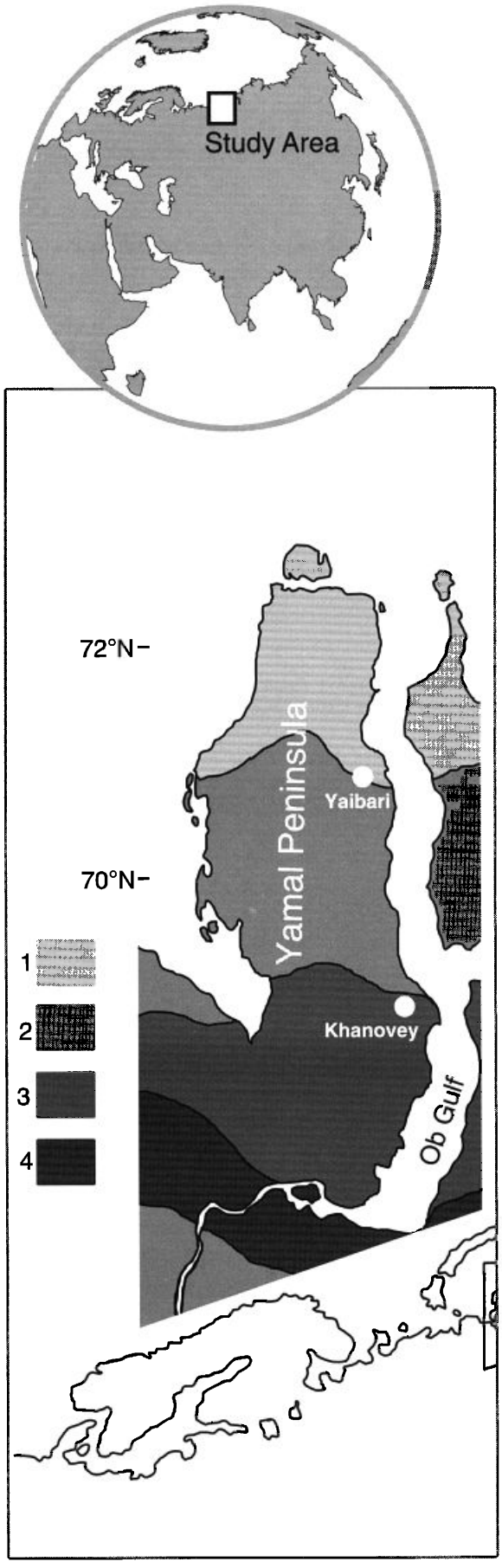

Figure 1. Study area - Yamal peninsula: **1**- arctic tundra; **2** - moss-lichen (typical) tundra; **3** - shrub tundra; **4** - forest-tundra. Ornithological stations: Khanovey (1982-1991); Yaibari (1988-1991).

season;
K is the identification coefficient; the proportion of identified individuals (of which legs with or without rings were seen) of all birds of this species, recorded on the survey plot. If we had seen the legs of all birds, K = 1.

The standard deviation of the return index was calculated according to Bailey (1963):

$$\sqrt{\frac{T(100-T)}{Nm}}$$

For calculating the return index for more than a one-year period, we summed Nm and Nr for all years. In this case, Nm and Nr may be larger than the number of marked birds because of birds nesting and returning in more than one year. The numbers of marked birds nesting on survey plots (totals for all years) are shown in Table 1.

Results

Table 1 shows the data on densities and site fidelity of waders breeding at Khanovey and Yaibari. Population density indices describe the abundance of every species on both field stations fairly well. However, the following additional observations were made.

The wader species studied could be separated into two groups: 'conservative', those having a high site fidelity index, and 'opportunistic', those not returning to their nesting sites. The majority of species belonged to the first group. The opportunistic group included Ruff (males and females) and Little Stint *Calidris minuta*. Figure 2 shows the densities over ten years of these two opportunistic species and two conservative species, Eurasian Golden Plover *Pluvialis apricaria* and Wood Sandpiper *Tringa glareola*. In general, the densities of those species with high return indices were more stable between years.
Both successful and unsuccessful breeders returned to their breeding areas the following year. Some waders returned even after several unsuccessful seasons in which they had been unpaired or their nests had been destroyed. Some differences between successful and unsuccessful seasons are, however, apparent. For example, the return rate of Grey Plover *Pluvialis squatarola* after successful nesting was 67% (SD ± 11, n=20), while the return rate after an unsuccessful nesting was 37% (SD ± 17, n=4). Sex differences in site fidelity were also recorded for Grey Plover (males: 75%, SD ± 12, n=11; females: 43%, SD ± 13, n=13).

Some data in the literature show philopatry in tundra wader chicks. In spite of ringing large numbers of chicks of some species, for example 96 Dunlin *Calidris alpina* and 109 Little Stint, we have not yet recorded any returns.

The breeding density of some wader species, especially that of Little Stint, depends on the spring

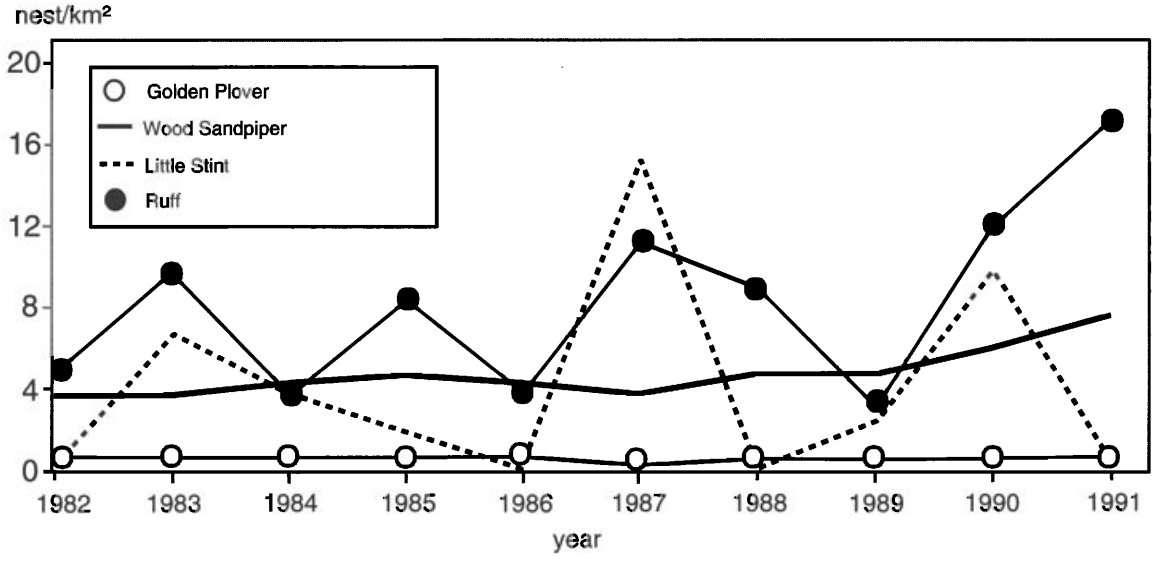

Figure 2. Examples of the density dynamics at Khanovey, 1982-1991: conservative species (Eurasian Golden Plover *Pluvialis apricaria*, Wood Sandpiper *Tringa glareola*); opportunistic species (Little Stint *Calidris minuta*, Ruff *Philomachus pugnax*).

Table 1. Nesting density and site fidelity of adult waders on the Middle and Northern Yamal.

Species	MIDDLE YAMAL				NORTHERN YAMAL			
	survey plot size km²	density limits nests.km⁻²	no. of marked adults	site fidelity %±s.d.	survey plot size km²	density limits nests.km⁻²	no. of marked adults	site fidelity %±.d.
Pluvialis squatarola	22.4	0-0.04	-	-	10	2.2-3.6	26	58±10
Pluvialis fulva	22.4	0-0.04	-	-	10	0.1-0.2	3	-
Pluvialis apricaria	22.4	0.3-0.8	7	42±18	25	0	-	-
Charadrius hiaticula	22.4	0.09-0.2	13	53±14	25	0-0.08	-	-
Tringa glareola	1.6	3.7-8.1	32	62±9	25	0	-	-
Phalaropus lobatus	0.8	15-32.5	13	+*	1	3-6	-	-
Arenaria interpres	22.4	0	-	-	25	0-0.1	-	-
Philomachus pugnax	1.6	3.1-18.1	32m,16f	0	1	0-5	-	-
Calidris minuta	1.6	0-16.2	33	0	1	37-95	91	0
Calidris temminckii	1.6	1.9-5.6	26	58±10	1	7-9	10	10±9
Calidris ferruginea	4.5	once	1	-	3	0.2-1.3	-	-
Calidris alpina	4.5	0.7-2	15	37±12	1	24-33	111	68±4

*+ = the species returned often but we cannot give a numerical estimate for methodical reasons

weather. For example, at Khanovey, the later the spring occurred, the higher the density of Little Stints that was recorded. In the warmest and earliest springs, Little Stints migrated further to the north and they were either not recorded on the survey plot (1982, 1986, 1988, 1991), or only a few of them were observed (1985, 1989) (Figure 2). The exception was 1990, when the spring was early but high densities of Little Stints were found. Maximum densities were observed in 1987 after the latest spring.

Discussion

The densities of species with high return indices were more stable (Table 1) because birds returning to their old breeding areas form the main group of birds present.

Conservative and opportunistic species occur in other taxonomic groups of northern birds (Ryabitsev in press), as also birds of other geographical zones. Evidently it is a general principle that there are two different strategies of annual distribution of birds within their range. Each of these strategies has its advantages. Conservative (returning) ones have a base for constant population structure and their knowledge of the area from previous seasons favours successful reproduction. Opportunistic (non-returning) birds are able to adapt to variable conditions and to change breeding area according to the conditions in any particular season.
The level of stability and site fidelity is not uniform in some species. A decline in site fidelity from south to north is well documented in passerines (Ryabitsev in press). Such a decline may now have been demonstrated in waders, *e.g.* Temminck's Stint *Calidris temminckii* (Table 1). At Khanovey, the return index is higher than at Yaibari. At more southerly latitudes, in Finland, this index is even higher (Hilden 1979). Ruff (males and females) in middle Europe often return (Scheufler & Stiefel 1985) but on Yamal they do not return at all. The geographical differences in site fidelity of Dunlin are more complex. The return index in Poland is 21% (Krol 1985), in Finland it is about 75% (Soikkeli 1970) and on the Chukotsky peninsula it is 73% (Tomkovich 1982) compared with 37% and 68% for middle and northern Yamal, respectively. This apparent deviation from the pattern emerging for other species may be related to differences in methods of calculation or by peculiarities of site fidelity in different populations or subspecies. The return index in Dunlin on the Yamal peninsula is higher at latitudes where densities are also higher. Therefore we propose that site fidelity is higher in the core parts of a species' breeding range.

It is notable that related species, for example Temminck's and Little Stint, may have quite different distribution patterns within their range. There are many similar examples in other bird groups such as the skuas *Stercorarius* spp., and the passerine genera *Anthus* and *Fringilla* (Paskhalny 1985). This suggests site fidelity is of great adaptive importance.

The connection between site fidelity and weather conditions during the pre-nesting period or in the previous season, and food conditions and population density during the present or previous season, has been found in birds of various taxonomic groups in the tundra and lower latitudes (Ryabitsev in press). In relation to northern waders, however, these issues, with some exceptions, are still unclear.

Having data on density dynamics for several years, it should be possible to explain these dynamics according to the effects of factors such as variation in nest survival. We tried to find correlations between the density of different bird species (not only waders) and their breeding success in the previous season. No such relationship was discovered in waders, although a positive correlation was found in Willow Ptarmigan *Lagopus lagopus*. It is clear that, in opportunistic species, annual redistribution of birds within their ranges may mask the effect of any local factor, whilst in conservative species, this may be caused by the presence of young birds.

The environment of the Yamal tundra is still quite favourable for waders. Habitat damage arising from human activity occurs only locally and there is very little hunting pressure. There are no other significant factors, except natural ones, which appear to influence wader populations.

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Appendix 1. Remarks on the distribution of waders on Yamal

On Southern and Central Yamal, almost as far north as 69°N, Grey Plovers are rather rare. At Khanovey, breeding pairs were not recorded every season. Further north, Grey Plovers are fairly common.

Pacific Golden Plovers *Pluvialis fulva* occur on Yamal at the western limit of their breeding range. They are rather rare and nest only in the central part of the peninsula, where both our stations are located. Eurasian Golden Plovers are relatively common on the southern half of Yamal, with a fairly stable density at Khanovey. Near Yaibari, they are very uncommon and none were recorded on the study plots.

Ringed Plovers *Charadrius hiaticula* breed throughout Yamal. They are most common along the coast but are also present at lower densities in most tundra habitats.

Wood Sandpipers are very common on Southern and Central Yamal, with relatively stable densities. They do not occur on Northern Yamal.

Red-necked Phalaropes *Phalaropus lobatus* are widely distributed on the peninsula. They are most numerous on Central Yamal.

Turnstones *Arenaria interpres* were the only breeding species found north of 70°N. The species is rare but breeding is not confined to the coast.

Ruff are very common in Southern and Central Yamal but their nesting density and the number of males on leks vary from year to year. In the southern arctic tundra, Ruff did not nest every season. A very unbalanced sex ratio in different seasons is notable for this species.

Little Stints are the most numerous of the genus *Calidris* on Yamal. This species occurs mainly in moss-lichen ('typical') and arctic tundra subzones although the density is very variable. Near the southern limit of its breeding range at the Khanovey station, Little Stint was quite common in several seasons but was completely absent in others. At Yaibari, its density was higher and in several seasons reached up to 100 nests per km² on the survey plot as a whole, and 3-5 nests per ha locally.

Temminck's Stint was present at lower and less variable densities. It is distributed over the whole peninsula except the most northerly part of the arctic tundra (Danilov *et al.* 1984; Paskhalny 1985).

Curlew Sandpiper *Calidris ferruginea* is an arctic species and the main part of its breeding range is in areas further east. At Yaibari, its density was relatively low and it was found breeding at Khanovey only once. Dunlin is a species typical of

the moss-lichen and southern part of the arctic tundra subzones. At Yaibari its density was high and fairly stable, while at Khanovey it was also stable but much lower.

The list of breeding waders presented in Table 1 is not complete. Four snipe species are known for Central Yamal. Common Snipe *Gallinago gallinago* and the Pintail Snipe *G. stenura* are fairly common, whereas Jack Snipe *Limnocryptes minima* are much rarer. Displaying male Great Snipe *Gallingo media* were sporadically seen at Khanovey and nests were found in the very south of Yamal. A Pectoral Sandpiper *Calidris melanotos* nest was found on Khanovey in 1974 (Danilov *et al.* 1984), the westernmost breeding record for this species.

Everywhere on Yamal, the Dotterel *Charadrius morinellus* is a rare breeding species. Snipe and Dotterel are difficult to census and therefore we are not able to give a quantitative estimate of their density. Only a few individuals of these species were ringed and we did not have any retraps or resightings.

In the vicinity of Yaibari, the Grey Phalarope *Phalaropus fulicarius* was found as a rare breeding species; it is more common further east.

Two migrating wader species are worth mentioning. Single birds and small flocks of Sanderling *Calidris alba* migrate through Yamal, mainly along the coasts. Knot *Calidris canutus* were observed sporadically on migration: a single bird was recorded at Khanovey on 13 June 1984 and flocks of up to 50 Knots were observed on Yaibari during spring migration from 3 to 10 June 1990.