

## SUMMER FLOCKING OF WILLOW PTARMIGAN IN CONDITIONS OF INCREASED PRESSURE FROM PREDATORS

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*By studying individually marked willow ptarmigans in the tundra of Northern Yamal, it was shown that flocks of nonnesting birds at nesting time consisted of bachelor males, and also of birds that had lost their nests and males that had abandoned brooding females. This occurred during a depression of rodents, in conditions of high numbers of predators, which not only destroyed nests, but also attacked adult ptarmigans.*

Flocks of ptarmigans *Lagopus lagopus* found in the tundra in some years are an interesting phenomenon. Initially, their existence was explained by the presence in the population of birds for which there were not enough places (Mikheev, 1948; Hohn, 1967; Moss, 1972; Boronin, 1978). This explanation was quite plausible, since flocks of ptarmigans consist of males that can quite possibly be taken as "superfluous" ones driven off by resident females that have divided up the whole tundra into territories. In 1986, in Central Yamal ("Khanovei" field station, 68°40' north latitude) there were especially many male flocks. Inasmuch as we had carried out individual marking of ptarmigans since the beginning of spring, we were able to ascertain that males which had their own territories in the spring and beginning of summer, but were left as bachelors (due to disruption of the ratio of the sexes), switched from a solitary territorial lifestyle to a flocking one (Ryabitsev, 1988). In 1989, new data were obtained, which shed light on the problem of summer flocking of willow ptarmigans at the "Yaibari" ornithological field station, which is located in the northern part of the Yamal peninsula, 19 km south of Sabetta, at the southern boundary of the arctic-tundra subzone (71°04' north latitude).

The control area of 3 km<sup>2</sup> included diverse flat watershed and floodplain tundra and was broken up into quadrants 100 m on a side, with a grid of auxiliary markers (pegs with numbers) indicated on a schematic map. After the males were distributed on individual territories, they were caught with an automatic bow on a "provocateur" (a stuffed female in mating display) and marked with a set of colored rings and by painting the oar feathers in individual combinations. Females were caught and marked later, on the nests. In all, we marked 15 males and 9 females, which was 71% of the males and 43% of the females living in the control area. In 1989, our colleagues conducted investigations at the "Khanovei" field station. They shared their observations, for which we are sincerely grateful to them.

When we began the work at the field station in the spring of 1989 (May 26), there were small thawed spots in the tundra, and the ptarmigans stayed in flocks of up to 60 individuals. The males, which by that time had not yet finished their pre-mating molt (many had just begun it), often displayed, in flocks, as well as individually. By June 4-5, the distribution of males over the territories had concluded; the last small flock was seen on June 7.

In 1989, a distinctive situation developed in Yamal: at the end of May-beginning of June there were very many Siberian lemmings *Lemmus sibiricus* in the tundra, and also myophage predators, especially arctic foxes *Alopex lagopus*, snowy owls *Nyctea scandiaca*, and pomarine jaegers *Stercorarius pomarinus*. However, already in the beginning of June dead lemmings began to show up; by the middle of June the number of live animals dropped sharply, and they soon practically ceased to be found. By the middle of June, migrations of pomarine jaegers were already underway, and in July they were almost not found. Snowy owls did not nest, but remained in approximately the same number: 20-30 individuals in a recording area of 25 km<sup>2</sup>; only by the end of July did their number decrease to 10-15 on the same area. All summer, unusually many arctic foxes were noted, with the majority of them evidently being nomadic: animals with conspicuous coloring appeared and disappeared. But there were also settled ones, and part of them tried to breed. In one of the fox "towns" known to us we found three pups.

which dispersed over the tundra at the end of July and apparently died of starvation. During the period of the birds' mass incubation, the predators practically completely switched to feeding on eggs and nestlings, and the success rate of the birds' propagation was extremely low.

After the end of formation of pairs of ptarmigans, it was clear that part of the males remained without females. In the control area, out of 21 males 3 were single, but bigamous males were also recorded (3 out of the same 21). Single males behaved the same as in 1986: they were more tolerant than the others of a "provocateur," and often abandoned their territory. Single males were also found fairly often in the surrounding tundra. The first small flock of seven males was found on June 26; on July 3 we saw a flock of 21 males; and on July 11, one of 45 birds, with several females in this flock. Later, in the flocks we saw marked males whose territories were within 0.5-1 km of the place where the flock was found, and their females were sitting on the nests. In the middle of July, the flocks numbered as many as 60-70 birds; they now stayed scattered in willow thickets, and males whose territories were as much as 2 km away were found in them. The birds molted and stayed practically settled. Of the 14 ptarmigan nests known to us, 2 were abandoned by the females; 6 were destroyed; and the female disappeared from one nest. In four nests in the control area, nestlings hatched out, with the females on these nests being marked. Later, we found the remains of two of these females, which, judging from all of the signs, were caught and eaten by owls, and their broods apparently also died. In the last days of July and the beginning of August, on recording itineraries of about 1000 km altogether, we could not discover a single summer brood. The last sighting of a brood of two fledglings with a pair of adult birds was on July 21.

After the lemmings' mass death, adult ptarmigans evidently became the main food of snowy owls. Often, the owls pursued ptarmigans, and such pursuits were successful. One marked male was caught in front of our eyes. Apparently, the constant owl attacks provoked almost all of the males to join together into flocks. In the middle of July, we found six broods (not yet fledged), and there were males with only two of them. At that time, most of the females had already lost their nests and broods and were also in the flocks. It is known that birds are better protected in flocks than alone. This was shown most clearly on wintering shorebirds (Page and Whitacre, 1975; Stinson, 1980). Therefore, the increased urge of ptarmigans to flock in the summer of 1989 is fully understandable.

As was previously ascertained in Northern Yamal (Ryabintsev, 1987, 1988) in conditions when the threat of predators was not so great, males left without females, like pairs left without nests, usually stay in the area where they lived formerly or not far from it. Summer flocking is a rare phenomenon: in 20 years of work in Yamal, we have noted it only twice. In 1986, in Central Yamal this occurred with spring density of 14.2 males per 1 km<sup>2</sup>, which must be considered relatively low density for willow ptarmigan (Nazarov, 1983; Potapov, 1985). Then, "vacuum experiments" proved the absence of a "population reserve," i.e., superfluous birds. In 1989, in Northern Yamal flocks formed with low spring density (7 males per 1 km<sup>2</sup> in the control area), i.e., there was no basis for suspecting overpopulation. Nonetheless, two experimental removals were carried out, after which the freed territory remained unoccupied.

In 1989, in Central Yamal ("Khanovei" field station), ptarmigans were counted by N. S. Alekseeva, A. G. Lyakhov, and Yu. A. Tyul'kin in the former control area. During the 11 years of the field station's existence, the maximum density was precisely in 1989: 29.3 males per 1 km<sup>2</sup>. According to the testimony of these ornithologists and a Norwegian colleague who worked with them that season, J. Birkjedahl, flocks of willow ptarmigans were one of the most outstanding features of the summer of 1989, along with lemmings and predators, including numerous snowy owls, similarly to the "Yaibari" field station. The ptarmigan flocks reached numbers of 300-400 individuals, with females, as well as males in them. J. Birkjedahl reported several relatively small flocks (up to 30 birds), in which there were primarily or only males; these flocks appeared at the end of June. Evidently, females joined the flocks after their nests were destroyed by predators.

In regard to male flocks, we can suppose that in 1989 in Central Yamal they may have consisted, at least partially, of a true "population reserve." Such an assumption could be based on the very high density of territorial males for this location (but not, it is true, for the species as a whole) before the beginning of nesting. Moreover, flocks of males were found throughout the season without interruption; the spring migration flocking gradually turned into summer flocking. In 1986, in Central Yamal, like in 1989 in Northern Yamal, at the beginning of June the birds were distributed over their territories, and by the end of June no flocks were seen.

In 1990, at the "Yaibari" field station the spring density was 5.0 males per 1 km<sup>2</sup>; flocks were not found in the summer; and there were no bachelor males in the control area. Of the males marked in 1989, five returned and proceeded to nest in their last-year's territory or not far from it. One of these males had remained single in 1989, while in 1990 he had a female. Thus, lack of success in breeding in the previous season was not reflected in the males' ability to form a pair and

breed successfully. In Central Yamal, according to our colleagues' testimony, in 1990, with a density of 13.3 males per 1 km<sup>2</sup>, flocks were also not seen in the summer, as in other years, with the exception of the two described seasons.

So, formation of flocks during nesting time can be caused by different factors. It has been confirmed (Ryabintsev, 1988) that the flocks are based on single males. The role of predators evidently consists not in the fact that they destroy nests, but in the constant pursuits to which the adult birds themselves are subjected. There is hardly any other predator besides snowy owl that can be such a provocateur of flocking. Flocks may also be a consequence of surplus population. Apparently, in such a situation it does not matter at all what the ratio of the sexes is. However, by themselves, flocks during nesting time are still not indisputable evidence of overpopulation of willow ptarmigan. Undoubtedly, with further study of this species we can discover new interesting facts for understanding summer flocking.

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