

Group size and sex ratios among Finnish Black Grouse

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The paper analyses field sightings of over 25 000 Black Grouse *Tetrao tetrix*, recorded under the direction of the Game Research Institute of the Finnish Game Foundation in 1945–62. The group size for birds of all ages was: winter 13.73, spring 6.78, summer 4.34, and fall 7.63. During winter, the groups were significantly smaller in the north of Finland than in the south, but the size of the broods did not differ. In a total of over 20 000 sexed birds, the fraction of males was as high as 0.61, ranging from 0.56 to 0.66 in the 7 years of most abundant observations.

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Introduction

This report gives some findings from 20 years of field sightings of over 25 000 Black Grouse *Tetrao tetrix*, an important species esthetically and as game in northern Eurasia. These data are probably the most extensive existing on flock sizes and field-observed sex ratios of this species. This should be of interest, since flock size is poorly documented for most birds, and previous reports on sex ratios of Black Grouse have given varying results. The important papers on habitats and population dynamics of Black Grouse include Koskimies (1957), Siivonen (1957), Seiskari (1962), Helminen (1963), Rajala (1974), and Lindén (1981a).

Methods

Numerous collaborators, working in many parts of Finland and using a standard form and set of directions, recorded various data on the habitat of Black Grouse, while carrying out normal duties, usually as state forestry or wildlife employees. The data collection was under the direction of the Game Research Institute of the Finnish Game Foundation. Seiskari (1962) alone sighted 1184 Black Grouse, and gives more details of the survey methods. For an analysis of group size and sex ratio the data may be slightly biased, as some collaborators may have selected observations that they considered to be important. Thus, the proportion of large groups and broods may be too high. On the other hand, a large part of the observations were made by a few persons who apparently wrote down all the sightings they made.

Most of the observations were connected with the weather and the habitats, and many of these were published by Seiskari (1962), but none of the findings in the present paper have been published before. Because more observers worked in central and southern Finland, and grouse in Finland are more visible in late fall and winter (Seiskari 1962), more sightings were made in

those regions and seasons. About 64 % of the total birds were seen in winter. In some cases records were made throughout the period 1945–64 but most were made in 1945–46 and 1956–62. The seasons were defined as follows: winter, November–March; spring, April–May; summer, June–August; and fall, September–October.

Results and discussion

Group size. The average group size, nationwide, in the different months is shown in Fig. 1, and the group size for the total time is contrasted between northern and southern Finland in Table 1. Every sighting of a single individual or assemblage of individuals is arbitrarily called a "group". Only a small percentage of the sightings was of singles. A total of 2 761 groups, comprising 25 269 individuals, is represented in Table 1.

Most grouse seen during June–August were family units (hen with young) and many single birds may have been omitted from the data. The Finnish route-census of tetraonids has later revealed (Lindén & Rajala 1981) that in August, for example, all males and 40–45 % of the hens are single. In September juveniles cannot be told from adults (Koskimies 1957). In Fig. 1 group size is averaged over all age categories. The size in different seasons was: winter, 13.73; spring, 6.78; summer, 4.34; and fall, 7.63. The differences between the seasons were significant (analysis of variance; $F = 84.33$ with 3 and 2413 df; $P < 0.005$). The average size of the flocks studied by Koskimies (1957) during September–January in 2 years was 14.4, which is similar to the present result for the period November–March, but Koskimies' data for November–January gave a group size of 20.7. Winter weather increases sociability and

hence flocking, but reproductive behavior decreases these tendencies (Koskimies 1957). Apparently these were the main causes of the peak in February and the low in May (Fig. 1). No extensive data for the period February-August are available for comparison.

The separation of northern from southern birds was based on the "Maanselkä line", running southeast between 65°N and 64°N (Koskimies 1957, Seiskari 1962, Lindén & Rajala 1981). This line is an important biogeographical limit; for example, it separates the two subspecies of the Capercaillie *Tetrao urogallus* in Finland (Johansen 1957).

During winter, the flocks were significantly smaller in the north ($t = 3.07$ with 1179 df; $P < 0.005$). During the other seasons, the groups were about the same size in the north and south ($t = 0.19$ with 1347 df). The population density of Black Grouse is lower in northern Finland than in central or southern Finland (Rajala 1974, Lindén & Rajala 1981).

The size of the broods did not differ significantly between northern and southern Finland

(Table 1, $t = 1.25$ with 229 df). Here "brood" is a group of interacting juveniles, usually with an attendant hen. In Helminen's (1963) study of Black Grouse bagged by hunters, the number of juveniles per adult female was a little higher in the north zone than in the central one (the most important in production), but he concluded, "The high values may be caused by an error in such a small samples or by differences in flocking habits or mobility between young and old birds." (p. 82). Thirty-four broods were seen per month for the whole country and the average sizes were: May, 7.50; June, 6.01; July, 5.50; and August, 5.20. The observed decline in brood size during May-August was about 31 %, but the real decline was probably more, as observability would rise as the juveniles grew older and some hens would lose entire broods. Lindén (1981b) found a decline of 52 % from hatching to the end of August, and this included some broods lost completely. The average brood size reported by Rajala (1974) for transect routes checked during 5 August — 4 September was 5.07 (calculated from his total raw data), or similar to the value of 5.20 found here for August.

Sex ratios. The sex ratios of adult Black Grouse were studied in different years (Fig. 2), months (Table 2), seasons (Table 3), and two regions (Table 4). A total of 20 061 birds were sexed and another 5208 could not be sexed (though included in the study of group size). The observed fraction of males during the entire study averaged 0.61 (95 % confidence limits, ± 0.01). In the 7 years when the sample size was 1 000 or more, the fraction of males ranged from 0.56 (in 1956) to 0.66 (in 1961) (Fig. 2). In two years when the sample sizes were smaller, 1948 and 1954, the fraction of males was as high as 0.75. H. Lindén (pers. comm.) found that a high fraction of males indi-

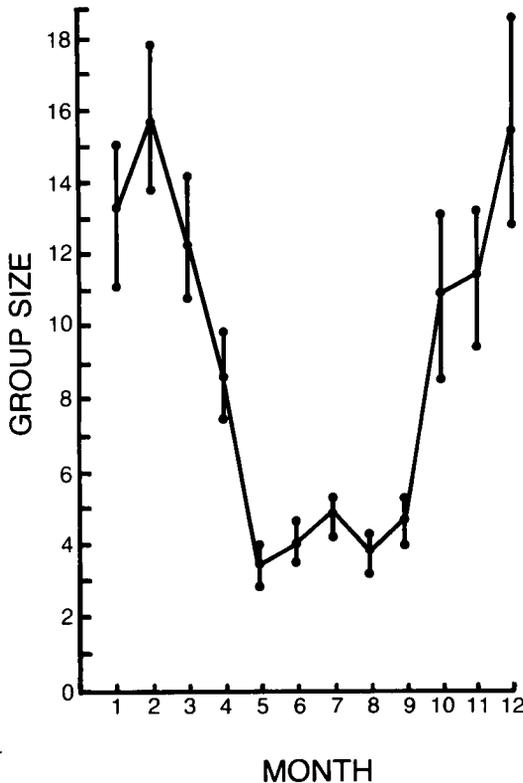


Fig. 1. Average group size of Black Grouse in different months and seasons. Vertical bars show 95 % confidence limits.

Table 1. Group size of Black Grouse in northern and southern Finland.

Groups	North	South
Broods		
N	70	161
\bar{x}	5.27	5.79
S	2.44	3.07
Adults, Winter		
N	220	961
\bar{x}	10.69	14.43
S	11.33	17.27
Adults, Other seasons		
N	373	976
\bar{x}	5.65	5.78
S	8.46	12.37

Table 2. Monthly sex ratios of Black Grouse (\pm 95 % limits in parentheses).

Month	N	% Males
I	2 471	62 (2)
II	2 949	55 (2)
III	2 590	61 (2)
IV	2 611	61 (2)
V	616	67 (5)
IX	1 082	66 (3)
X	2 114	64 (3)
XI	2 410	62 (2)
XII	2 552	60 (2)
Z & x	19 395	61 (1)

Table 4. Sex ratios of Black Grouse in northern and southern Finland (\pm 95 % limits in parentheses).

Season	North	South
Winter		
N	2,010	10,962
% Males	52 (2)	61 (1)
Other seasons		
N	2,079	5,010
% Males	56 (2)	68 (1)

icates a low mortality rate in the preceding year. The year 1953 was an exceptionally good year for tetraonid production in Finland (Helminen 1963).

The sex ratios for the whole country varied considerably between months, the male fractions being highest in May and lowest in February (Table 2). The period June-August, when 382 cocks and 284 hens were seen, is omitted from Table 2. A test of association showed a highly significant difference in the monthly sex ratios ($\chi^2 = 76.52$ with 8 df; $P < 0.001$). The observed male proportions declined from September through December. The open hunting season usually began in early September and continued at least through November. Nevertheless relatively more cocks were observed in fall than any other season (Table 3). The differences between seasonal ratios were highly significant (test of association; $\chi^2 = 32.46$ with 3 df; $P < 0.001$). Black Grouse from northern Finland (north of "Maanselkä line") showed smaller percentage of cocks in both winter and other seasons than birds from southern Finland (Table 4). These differences were also highly significant (test of association; $\chi^2 = 603.88$ with 3 df; $P < 0.001$).

The only other extensive data on sex ratios of Finnish Black Grouse are those of Helminen (1963) and Rajala (1974). Helminen reported sex ratios based on wing samples from 8 207 Black Grouse shot by hunters during the open season in 1953-61. He attempted to obtain wing specimens from all parts of the country, but the greatest number came from central Finland. Rajala (1974) and his collaborators attempted to make

Table 3. Seasonal sex ratios of Black Grouse (\pm 95 % limits in parentheses).

Season	N	% Males
Summer	666	57 (5)
Fall	3,196	65 (2)
Winter	12,972	60 (1)
Spring	3,227	62 (2)

complete counts on numerous transect strips in many parts of the country from 5 August to 4 September in 1963-66 and noted the sex of 16 097 Black Grouse. Those two projects covered mainly August-November and there are no extensive comparative data for December-July.

Of the shot Black Grouse approximately 60 % were males (Helminen 1963); the corresponding value for live birds reported here for a similar period was 62-66 % (Table 2). Of the Black Grouse seen on transect strips, however, only about 47 % were males (Rajala 1974). In all three cases, the portions of males were lower in the north than the south. Ordinary field surveys are said to be biased because cocks are less secretive than hens (Voipio 1950) and are physically more conspicuous (Helminen 1963). Both Helminen and Voipio claimed that Finnish hunters consciously tended to select cocks in preference to hens. Hel-

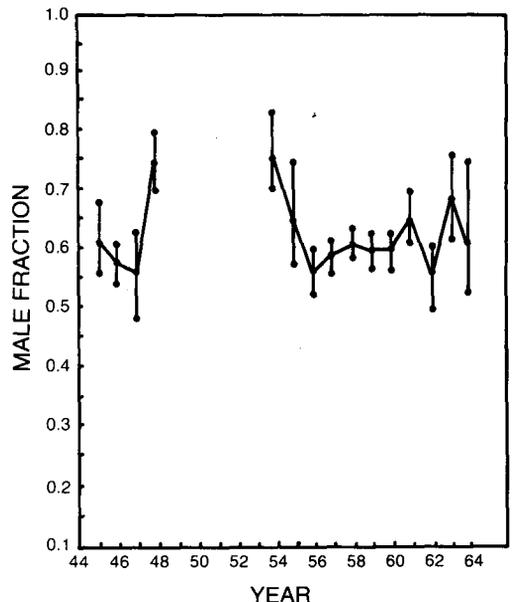


Fig. 2. Annual sex ratios of Black Grouse in Finland. Vertical bars show 95 % confidence limits.

minen concluded that the natural sex ratios were nearly even or that females were perhaps slightly more numerous, but Rajala (1974) believed that females definitely predominated and that this might partly be caused by differential shooting. According to Lindén (1981b), the male fraction of adult Black Grouse in Finland was c. 45 %. He thinks that the low male fraction resulted from sex-related differences in juvenile mortality rates brought about by differential growth rates as a result of sexual size dimorphism and different energy requirements.

Why did the research workers and collaborators in the present field surveys see relatively so many more cocks than were seen in the careful surveys of Rajala and his collaborators? More research is required on the causes of bias in field surveys of Black Grouse. Though hunters may practice some deliberate selection of cocks, we conclude from the data reported here that they tend to see considerably more cocks than hens and this is largely responsible for the preponderance of cocks in the bag.

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Selostus: Parvikoko ja sukupuolten osuus Suomen teerikannassa 1945—62

Riistantutkimuslaitoksen esiintymisympäristölomakkeista analysoitiin tiedot yli 25000 teerestä. Aineisto ei ehkä ole sattumanvarainen otos, sillä havainnontekijä voi ilmoittaa enemmän niitä havaintoja kuten parvia ja poikueita, joita hän itse pitää tärkeinä. Parvikoot olivat keskimäärin talvella 13.73, keväällä 6.78, kesällä 4.34 ja syksy-

syllä 7.63 yksilöä. Aineistossa on yksinäisiä lintuja ilmeisesti liian vähän varsinkin loppukesällä. Talviparvet olivat pohjoisessa pienempiä kuin etelässä, mutta poikuekoko ei eronnut. Kaikista teeristä oli koiraita 61 % mutta poikkeuksellisesti (1948, 1954) jopa n. 75 %. Siinäytetutkimuksissa on aikaisemmin päädytty yhtä suureen (60 %) koirasosuuteen, mutta loppukesän reittilaskennat antavat koirasosuudeksi vain n. 47 %. Vuodenajoittain koiraiden osuus vaihteli merkittävästi teeren elintapojen vuosikierron mukaisesti, mikä osoittaa teeren havaittavuuden merkityksen aineiston koostumuksessa

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