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THE COMPOSITION OF THE BIRD FAUNA IN
TWO CONSECUTIVE BREEDING SEASONS
IN THE FORESTS OF THE AMMARNÄS
AREA, SWEDISH LAPLAND

BY

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Introduction

The field ornithological investigations performed by our group in the Ammarnäs area, Southern Lapland, concern various aspects of the population dynamics and ecology of the passerine bird fauna in the alpine and subalpine belts. One of the main routines in such a project will necessarily be to obtain reliable population measurements during a sequence of years. The investigation of the forest habitats was started in 1963, and the results of this census work have been published in Swedish (ENEMAR 1964). In 1964 the field work was repeated in the same manner and in the same study areas as in the preceding year. These census results will be submitted in this paper and compared with those of 1963. They will be briefly discussed mainly from a methodological point of view. The question which needs to be answered as soon as possible in a project of this type is: are the established study areas large enough to give a coinciding picture of the fluctuations of those species which occur in great numbers? Experience from the first two seasons indicates that this is the case. A few comments on the observed population changes will also be given, although the material does not yet admit a more extensive analysis to be made.

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The Field Work and the Study Areas

The census work consisted of study area investigations and strip surveys. The latter means that the census-taker walks slowly through the terrain noting all birds heard or observed within approximately 75 metres from him. The purpose of these surveys is to obtain rough information about the status of the different species in defined habitats over large areas. The figures gathered can be used for certain comparative calculations, but they are useless as a basis for derivation of density values. In 1964 the strip surveys were exclusively devoted to the meadow birch forests.

The determination of the bird density in absolute figures was made by means of the study area investigations. The method applied involves plotting of observations of singing males or pairs within delimited study areas on maps or

sketches ("mapping method"). Each area was worked through at least ten times during the census period (8 to 28 June). The unit of the established populations, the "stationary" population, according to this method is the "stationary male", i.e. the male bird which has appeared to maintain a territory within the area for most of the census period. Such a male is most often but not necessarily breeding. For a detailed presentation and critical analysis of this method of population determination, cf. ENEMAR (1959, 1963).

The boundaries of the study areas were clearly marked out in the terrain with plastic strips. The routines of our method in establishing and measuring the size of the study areas in wooded terrain have been described previously (ENEMAR 1963, 1964).

The authors are responsible for the census work in all study areas but one (area A 5) which was investigated by INGVAR LENNERSTEDT. We thank him for this valuable help.

The ten study areas in the forests are presented below.

Study area	Habitat
D 1	primeval spruce forest, near the border of the subalpine belt
D 2, D 3	heath birch forest of the subalpine belt
A 1, A 2, A 3	mixed forest in the transitional zone between the subalpine meadow birch forest and the prealpine coniferous forest
A 4, A 5, A 6, A 7	subalpine meadow birch forest

In 1963, study area A 1 was classified as belonging to the spruce forest though it contained a few strips of birches. However, during the intervening winter almost all spruces had been cut and this, of course, has drastically changed the quality of the habitat, which now may be referred to that of the areas A 2 and A 3 nearby. The size of each study area is given in Tables 1, 2, and 3.

The 1964 Results

The detailed results of the census work in 1964 are apparent from Tables 1, 2, and 3 (pp. 5-7). In all, 278 stationary males were established. Out of these, 78 were documented as breeding because their nests were discovered. The size of the investigated study areas taken together was 1.1 square kilometre.

The "boundary cases", the number of which appear within brackets in the tables, refer to stationary males whose territories were apparently traversed by the boundary of the study area. They are not included in the population of

Table 1. The size of the stationary populations in the study areas in spruce forest and in heath birch forest. The figures in brackets denote "boundary cases" of stationary males.

Habitat Study area	Spruce forest D ₁	Heath birch forest			Nests
		D ₂	D ₃	D ₂ + D ₃	
<i>Parus montanus</i>	—	— (1)	—	— (1)	
<i>Turdus philomelos</i>	1 (1)	1	— (1)	1 (1)	2
<i>Turdus iliacus</i>	1	— (1)	2	2 (1)	3
<i>Phoenicurus phoenicurus</i>	— (1)	2 (1)	2 (2)	4 (3)	3
<i>Luscinia svecica</i>	—	—	3	3	2
<i>Erithacus rubecula</i>	2 (1)	—	—	—	
<i>Phylloscopus trochilus</i>	4 (1)	14 (5)	10 (5)	24 (10)	3
<i>Regulus regulus</i>	2 (1)	—	—	—	
<i>Ficedula hypoleuca</i>	2	—	—	—	
<i>Prunella modularis</i>	1 (1)	1	1	2	1
<i>Anthus pratensis</i>	—	—	3	3	
<i>Anthus trivialis</i>	— (2)	1	— (1)	1 (1)	
<i>Carduelis spinus</i>	2	—	—	—	
<i>Carduelis flammea</i>	— (1)	1	— (1)	1 (1)	
<i>Fringilla coelebs</i>	1 (1)	—	—	—	
<i>Fringilla montifringilla</i>	2 (2)	3	1	4	1
<i>Emberiza schoeniclus</i>	—	1	2	3	1
<i>Lagopus lagopus</i>	—	1	—	1	1
Totals	18 (2)	25 (8)	24 (10)	49 (18)	17
Size of area (km ²)	0,105	0,143	0,145	0,288	
Density (number/km ²)	171	175	166	170	

the study area because they were more often observed and plotted just outside the boundary than inside it (cf. ENEMAR 1963). These cases, however, are always accounted for because they may be of importance when the population fluctuations are to be interpreted. A population decrease of a certain species in a study area is of less significance if the number of boundary cases shows a clear increase.

The results of the strip surveys in the meadow birch forests are given in Table 4 (p. 8). The surveys were carried out mainly on the slopes of the mountain of Kaissats facing the lake of Stora Tjulträsk.

Comparisons and Discussion

When comparing the results from 1963 and 1964 two study areas must be omitted: A 1 because its habitat had been drastically changed (p. 4), and A 7, since this area was not established until 1964.

The total stationary populations of the remaining eight study areas can be compared in Table 5. It is apparent that the figures do not differ to any great

Table 2. The size of the stationary populations in the study areas in mixed woods. The figures in brackets denote "boundary cases" of stationary males.

Habitat Study area	Mixed wood				Nests
	A1	A2	A3	A1-A3	
<i>Parus montanus</i>	—	1	—	1	1
<i>Certhia familiaris</i>	1	—	—	1	1
<i>Turdus pilaris</i>	— (1)	—	—	— (1)	
<i>Turdus philomelos</i>	2 (1)	4	1 (2)	7 (3)	6
<i>Turdus iliacus</i>	— (1)	1	1	2 (1)	2
<i>Phoenicurus phoenicurus</i>	3 (2)	2	1	6 (2)	3
<i>Erithacus rubecula</i>	— (1)	—	—	— (1)	
<i>Phylloscopus trochilus</i>	2 (1)	11	11 (2)	24 (3)	1
<i>Regulus regulus</i>	1	—	—	1	
<i>Ficedula hypoleuca</i>	2	2	—	4	3
<i>Prunella modularis</i>	1	—	2 (1)	3 (1)	
<i>Anthus trivialis</i>	3	1	1	5	
<i>Carduelis spinus</i>	1	—	—	1	
<i>Carduelis flammea</i>	—	2	—	2	
<i>Pyrrhula pyrrhula</i>	—	— (1)	—	— (1)	
<i>Fringilla coelebs</i>	— (1)	1	—	1 (1)	
<i>Fringilla montifringilla</i>	2	2 (2)	4	8 (2)	
<i>Emberiza schoeniclus</i>	— (1)	—	—	— (1)	
<i>Surnia ulula</i>	1	—	—	1	1
<i>Tetrao urogallus</i>	1	—	—	1	1
Totals	20 (9)	27 (3)	21 (5)	68 (17)	19
Size of area (km ²)	0,092	0,085	0,100	0,277	
Density (number/km ²)	217	318	210	245	

degree. A certain trend to population increase in the areas below the heath birch forests (D 1, A 2 to A 6) may be discernible. Considering that the applied mapping method means that the established population numbers are burdened with an uncertainty of approximately ± 5 per cent (cf. ENEMAR 1959), the difference between the two seasons does not prove to be statistically significant.

Even though the size of the total population in the study areas has remained practically constant this has certainly not been the case for all separate species populations, as will be shown below.

The material of the Brambling (*Fringilla montifringilla*) is presented in Table 6. It is clear that the population has decreased markedly in 1964 and this applies to all study areas. The results of the strip surveys support this observation. The number of Bramblings counted, expressed as percental share of the total number of birds registered, was 20 per cent in the 1963 surveys and only 10 per cent in 1964. There seems to be no doubt that in 1964 the population was reduced to about half that of 1963.

Table 3. The size of the stationary populations of the different species in the four study areas in the meadow birch forest. The figures in brackets denote "boundary cases" of the stationary males.

Habitat Study area	Meadow birch forest					Nests
	A4	A5	A6	A7	A4-A7	
<i>Parus montanus</i>	1	1	—	—	2	2
<i>Parus major</i>	— (1)	— (1)	—	—	— (2)	
<i>Turdus philomelos</i>	2 (1)	1	2	1 (1)	6 (2)	6
<i>Turdus pilaris</i>	1 (1)	—	—	1	2 (1)	2
<i>Turdus iliacus</i>	1 (1)	—	1	1 (1)	3 (2)	2
<i>Saxicola rubetra</i>	1	—	—	—	1	1
<i>Phoenicurus phoenicurus</i>	1 (2)	—	4	— (1)	5 (3)	3
<i>Luscinia svecica</i>	1	2	—	—	3	1
<i>Erithacus rubecula</i>	—	—	—	— (1)	— (1)	
<i>Sylvia borin</i>	—	3	1	—	4	
<i>Phylloscopus trochilus</i>	17 (6)	18 (4)	18 (1)	11 (3)	64 (14)	4
<i>Phylloscopus sibilatrix</i>	—	—	—	1	1	1
<i>Ficedula hypoleuca</i>	3	—	1	1 (1)	5 (1)	2
<i>Prunella modularis</i>	3	3	3	1 (1)	10 (1)	4
<i>Anthus trivialis</i>	2 (2)	—	2	2	6 (2)	
<i>Anthus pratensis</i>	—	2	—	—	2	
<i>Carduelis flammea</i>	2	—	—	— (1)	2 (1)	1
<i>Fringilla coelebs</i>	1	—	—	— (1)	1 (1)	
<i>Fringilla montifringilla</i>	4 (1)	2	4	2	12 (1)	2
<i>Emberiza schoeniclus</i>	4	5	2 (1)	1	12 (1)	9
<i>Lagopus lagopus</i>	1	—	—	—	1	1
<i>Tetrao urogallus</i>	—	—	1	—	1	1
Totals	45 (15)	37 (5)	39 (2)	22 (11)	143 (33)	42
Size of area (km ²)	0,129	0,111	0,122	0,080	0,442	
Density (number/km ²)	349	333	320	275	324	

The Willow Warbler (*Phylloscopus trochilus*) has shown tendency to increase (Table 7) which applies to all study areas but one. The strip surveys also follow this trend: 40 per cent of the total number of birds registered in 1963, 45 per cent in 1964. The population rise can be estimated to be of the order of magnitude of 20 per cent.

The Willow Warbler and the Brambling are the most numerous species in the investigated habitats, together constituting half of the number of birds in the subalpine forests (ENEMAR 1964). Obviously the available areas are large enough to reflect a population change in these species occurring in the district. The following facts justify this conclusion: first, the observed changes were established in all study areas but one, and secondly, the same trend were indicated by the figure material obtained during the strip surveys. The fact that four different census-takers were engaged in the work and were responsible for

Table 4. The number of males or pairs of birds observed during the strip surveys (920 minutes) in the meadow birch forests on the slopes of the mountain of Kaissats.

Species	Number	Species	Number
<i>Corvus corone cornix</i>	3	<i>Anthus trivialis</i>	61
<i>Parus major</i>	1	<i>Carduelis spinus</i>	2
<i>Parus montanus</i>	7	<i>Carduelis flammea</i>	28
<i>Certhia familiaris</i>	1	<i>Fringilla coelebs</i>	8
<i>Turdus pilaris</i>	25	<i>Fringilla montifringilla</i>	108
<i>Turdus philomelos</i>	36	<i>Emberiza hortulana</i>	1
<i>Turdus merula</i>	2	<i>Emberiza schoeniclus</i>	64
<i>Turdus iliacus</i>	45	<i>Pyrrhula pyrrhula</i>	1
<i>Saxicola rubetra</i>	6	<i>Surnia ulula</i>	3
<i>Phoenicurus phoenicurus</i>	37	<i>Cuculus canorus</i>	2
<i>Luscinia svecica</i>	9	<i>Picoides tridactylus</i>	1
<i>Erithacus rubecula</i>	6	<i>Lagopus lagopus</i>	8
<i>Sylvia borin</i>	18	<i>Lyrurus tetrix</i>	2
<i>Sylvia curruca</i>	1	<i>Tetrao urogallus</i>	2
<i>Phylloscopus trochilus</i>	488	<i>Buteo lagopus</i>	3
<i>Phylloscopus sibilatrix</i>	3	<i>Falco columbarius</i>	2
<i>Muscicapa striata</i>	2	<i>Scolopax rusticola</i>	1
<i>Ficedula hypoleuca</i>	34	Total	1077
<i>Prunella modularis</i>	43	Number of species	37
<i>Anthus pratensis</i>	13		

the population determination in one to three study areas each has apparently not been any obstacle to a consistent census result. This speaks in favour of the view that the method applied works satisfactorily.

The Song Thrush (*Turdus philomelos*) shows the most conspicuous increase among the species which are represented with fairly low numbers compared with the Brambling and the Willow Warbler (Table 8). The determination of the population numbers is of very high reliability for the thrushes since the figures are most often based on nests discovered. But the population rise cannot be blamed on a more effective search for nests in 1964 than in 1963 because the total number of nests discovered (all species) was approximately the same for both years. Moreover, the Redwing (*Turdus iliacus*), which is very similar to the Song Thrush from the point of view of the census work, showed a population decrease from 11 to 7 stationary males.

In the strip survey material the Song Thrush shows a slight increase from 3.0 to 3.3 per cent and the Redwing a decrease from 4.9 to 4.2 per cent. The Hedge Sparrow (*Prunella modularis*) increased in five areas, totally from 9 to 14 stationary males which is in accordance with a rise from 2.7 to 4.0 per cent in the strip surveys. The populations of the Redstart (*Phoenicurus phoenicurus*) and the Pied Flycatcher (*Ficedula hypoleuca*) were reduced in the study areas

Table 5. The stationary populations of eight study areas in 1963 and 1964.

Study area	D ₁	D ₂	D ₃	A ₂	A ₃	A ₄	A ₅	A ₆	Total
1963	15 (8)	28 (8)	26 (6)	20 (9)	22 (9)	43 (16)	29 (6)	34 (6)	217 (68)
1964	18 (2)	25 (8)	24 (10)	27 (3)	21 (5)	45 (15)	37 (5)	39 (2)	236 (50)

Table 6. The stationary population of the Brambling (*Fringilla montifringilla*) in the eight study areas in 1963 and 1964.

Study area	D ₁	D ₂	D ₃	A ₂	A ₃	A ₄	A ₅	A ₆	Total
1963	6 (2)	6 (1)	4	6 (3)	6 (2)	7 (2)	4 (1)	7 (1)	46 (12)
1964	2 (2)	3	1	2 (2)	4	4 (1)	2	4	22 (5)

Table 7. The stationary population of the Willow Warbler (*Phylloscopus trochilus*) in the eight study areas in 1963 and 1964.

Study area	D ₁	D ₂	D ₃	A ₂	A ₃	A ₄	A ₅	A ₆	Total
1963	2	12 (4)	11 (3)	6 (3)	8 (3)	15 (4)	11 (2)	14 (2)	79 (21)
1964	4 (1)	14 (5)	10 (5)	11	11 (2)	17 (6)	18 (4)	18 (1)	103 (24)

Table 8. The stationary population of the Song Thrush (*Turdus philomelos*) in the eight study areas in 1963 and 1964.

Study area	D ₁	D ₂	D ₃	A ₂	A ₃	A ₄	A ₅	A ₆	Total
1963	1 (2)	—	1	1 (2)	— (1)	1 (1)	—	—	4 (6)
1964	1 (1)	1	1 (1)	4	1 (2)	2 (1)	1	2	12 (5)

from 18 to 12 and from 10 to 8 stationary males respectively, a trend which was reflected also in the strip survey material (change from 7.2 to 3.4 per cent for the Redstart and from 5.7 to 3.2 per cent for the Pied Flycatcher). In fact, the results of the two census methods agreed also for the Reed Bunting (*Emberiza schoeniclus*) and the Tree Pipit (*Anthus trivialis*) (population increase) as well as for the very sparsely occurring Willow Tit (*Parus montanus*) (decrease). Thus, a more or less pronounced coincidence seems to occur between the absolute population figures obtained in the study areas and the relative values gathered during the strip surveys as regards the direction of the change in population size, even in those species which are represented by fairly low numbers.

The strip surveys cover large areas but the population figures obtained, which are of value only for comparative purposes, are burdened with a considerable and unmeasurable uncertainty, because they are seriously affected by changes in the general weather conditions and by the varying "conspicuousness" of the

different species. These sources of error are eliminated in the study areas, but the latter have the disadvantage of being relatively small and they must necessarily be so because the absolute population determination is very time-consuming work. Therefore, one of the most important methodological aims of the future field work will be to investigate to what extent a coincident change in the material from the strip surveys and the study areas, as regards the status of a sparsely occurring species, justifies the conclusion that a corresponding change has in fact taken place in the population of the district.

Strong fluctuations in the density of the Brambling have previously been observed in its breeding areas. They have been demonstrated by means of population measurements of varying reliability above all in northern Finland (cf. SIIVONEN 1952, MERIKALLIO 1958). In that country the fluctuations have mainly been correlated with changes in the extension of the breeding range. The forests of the Ammarnäs area have hitherto been investigated for two seasons only, and therefore it is impossible to say what is the normal density of the Brambling population in this district. Since the density of the species as obtained in the subalpine birch forests of the Abisko area in 1961 (ENEMAR 1963) agrees well with the figures gathered in Ammarnäs in 1963, it seems likely that the population size in 1964 was far below normal.

More or less drastic changes in the population density of the Willow Warbler have repeatedly been reported (cf. SIIVONEN 1949, 1950; NORDSTRÖM 1953; PRICE 1961) although it has mostly been impossible to arrive at a satisfactory explanation. The established rise in the population of the species at Ammarnäs may well fall within the amplitude of the normal "restricted fluctuations" (cf. LACK 1954) of the species in this northern range. Further investigations extended over a series of years, however, are required in order to answer this question.

Summary

The size and composition of the breeding bird fauna has been determined in absolute numbers in ten study areas which have been established in the subalpine forests of the Ammarnäs area, Swedish Lapland. The size of the areas taken together is 1.1 square kilometre. The census work started in 1963. In the present paper the results of the field work of 1964 are submitted and compared with those of 1963. The total bird density has remained the same although the abundance of certain species showed considerable alterations. Thus the Brambling population showed a 50 per cent decrease in 1964 whereas that of the Willow Warbler underwent a 20 per cent increase. The established fluctuations of these dominant species as well as the observed changes of less abundant species are in accordance with the figure material obtained during extensive strip surveys (line transects) in the district.

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