A bird census in a Finnish park

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The bird density in a 4.8 ha large countryside park in southwestern Finland was 19.4 pairs/ha. This figure is much higher than figures obtained for parks in Helsinki and in Finnish deciduous forests in general. It is equalled or exceeded by bird densitites obtained in Russian deciduous forests at about latitude 50° N, and some parks in Central Europe and in the U.S.A. The factors promoting the bird density in the park studied are discussed. It is likely that both a favourable foodsituation and suitable nest-sites play their parts.

The relations between the four thrush species nesting in the park are discussed. Whereas all species are territorial, they show a high degree of interspecific tolerance.

The lack of any effective interspecific mechanism for dispersing the nests may have been compensated by character displacement among the thrushes with respect to habitats, nest-sites, nests, and eggs.

Description of the area

The park at Lemsjöholm in southwest Finland (60°30′ N, 21°47′ E) was mainly planted by Lars Gabriel von Haartman in the early 1830's. This was established by counting the annual rings of a large lime which recently had to be felled. Topelius's well-known work *Finland framstäldt i teckningar* (Finland shown in pictures, 1845—52) shows the park in its earliest stage with small trees surrounding the main building; a few of the trees are large and had obviously been planted in the 18th century.

During his *grand tour* of Europe (see v. HAARTMAN 1967) in 1827—29, Lars Gabriel von Haartman, who was at that time an outspoken anglophile, had become personally acquainted with the English park, and the park at Lemsjöholm was his modest attempt to copy the British vogue for grass lawns, irregular groups of deciduous trees, artificial ponds, and winding paths. Considering the high latitude, the list of trees planted in the park is imposing. Ash, maple, oak, elm, and lime, in the order mentioned, are the dominant trees, but numerous other deciduous trees occur in smaller numbers. Of the bushes lilac, *Spiraea,* and *Caragana* are the most important. Of the native deciduous trees, there are only a few birches and aspen. They have probably not been planted but have spread into the area from the surroundings. Also, some of the planted trees, especially the ash, have spread greatly, invading those areas where the lawns have not been mowed regularly. For this reason much of the park is nowadays in rather a wild state, with a dense secondary growth of young trees between the older ones.

In the south the park includes the remains of an orchard with large scattered trees, in the north a small area of old unmanaged pine-spruce forest of *Myrtillus* type. Three small ponds are found within the park. It is surrounded by fields or open meadows, except in the southwest and west, where it borders on an open pine forest and a spruce forest. Three alleys lined with broad-leaved trees cross the fields between the park and the main road.

In the park there are a number of empty buildings or remains of buildings. These are used as nesting-places by an astonishing number of birds, especially thrushes (Redwing, Blackbird, and to a lesser extent Song-thrush and Fieldfare). The interference of human beings with the bird fauna of the park is nowadays negligible, at least if my own activities are left out of account.

Numerous nest-boxes (both Starling and

Great Tit size) and niches for Spotted Flycatchers have been put up. Their number has been kept constant for years.

The size of the censused area (as calculated from an aerial photograph) is c. 4.8 ha. The map in Fig. 1 was made by me in 1941 and has minor distortions.

A park is not a natural habitat. Its closest counterpart in Finnish wildlife is the leaf meadow, characteristic of the Åland archipelago, which is not an entirely natural habitat, either. It may be questioned whether it is worth while to census such an unnatural and capriciously varying habitat as a park. I carried out the present census mainly because I knew that the bird density in the park was unusually high, and I wanted to compare this density both with the maximum densities known for Finnish deciduous forests in general and with the bird densities in city parks.

Method

Six methods have been used in bird censusing, i.e. (1) the line transect method, (2) the sample plot method, (3) recording the number of contacts with the different bird species per unit time YAPP (1956), and others), (4) mapping the territories, (5) searching for the nests, and (6) ringing the birds.

An ideal census method should fulfil two requirements: (1) It should make comparisons possible. The student should be able to compare his own results in different years (if possible also in different seasons, but this seems to be very difficult) and in different habitats. Further, comparisons between the results obtained by different persons should be possible. (2) Although the fulfilment of these requirements will give a census of a certain value, this value is much enhanced if absolute numbers of birds (or a certain category of birds, like those nesting or occupying a territory) can be obtained. In the present study I aimed at clarifying the absolute numbers of breeding birds.

Recent studies (HAUKIOJA 1968) have cast some doubts upon the value of the line transect method (as carried out by MERIKALLIO) in revealing absolute numbers of birds. The sample plot method has the serious drawback that no convincing way of correcting the results is known. It is obvious that a single census of a plot will give an underestimate. But censusing repeatedly and choosing the observed maximum number of every species will "overshoot" the mark, as visitors from outside will then add to the population (v. HAARTMAN 1945). Likewise, an area will require fewer censuses if its population is small than if it is large (ENEMAR 1959). Mapping the territories is undoubtedly a valuable aid in censusing song-birds. But it has been found that in a dense population the territories may be continuous instead of standing out as discrete geographical entities (PETERS 1963). In this way mapping may indicate a smaller number of birds than nest-counting. On the other hand, some species are polyterritorial, the number of territories appearing larger than the number of individuals holding territories. To these objections I would add that I do not see how territory mapping could be of any use with respect to a colonial bird like the Fieldfare. I am also inclined to believe that it is easier to count the nests of certain species like the Redwing than to map the territories.

Within my study area ringing of nesting adults was restricted to the tits and the Pied Flycatcher. With respect to the other species finding the nests was aimed at. The thrushes, the dominant group in the area, were censused on the basis of nests. But with respect to the Chaffinch, the Garden Warbler, and several less numerous species, I relied more upon mapping the territories. The males of such species were mapped when the weather was favourable and the singing frequency good. These maps were then checked continuously, and any important divergence was noted. Most of the time from 30 April until the end of the summer of 1969 was spent at Lemsjöholm. My time was mainly used for other work, but living within the censused area, I had the opportunity to check my results every day.

The reason why I did not search for the nests of the Garden Warbler (which I knew I could find) was that the latter part of June was too hot for this strenuous work. Chaffinches' nests I find really hard to detect, but even finding some of the nests is an aid to the census work. On the other hand, even in species like the thrushes, some nests may admittedly have escaped my notice. There was a Redwing's nest, for instance, which was found only after the young had left. A Blackbird's nest was found by my dog only a day before the young became fledged.

Repeat nesting and true second broods may also obscure the picture. For some reason, relatively few Redwings produced a second brood in 1969 (effect of the dry hot summer upon the Redwing's food?). Only a negligible proportion of the nests were deserted or plundered because they had been found by me. An exception was the Great Tit, in which two out of three females deserted their clutches after being ringed, and re-nested outside the area.

Results

The number of breeding pairs is shown in Table 1, which also gives the number of nests found.

Some non-breeding males keeping permanent territories may have been included as pairs in the Table. The Wryneck and the Whitethroats belong here.

Besides, a number of males held territories less permanently, and probably did not nest. Only in species which are few in number and therefore conspicuous were these occasional territory-holders likely to be detected. They were:

Dendrocopos minor. Nested close to the study area, but the female probably died, and the male remained throughout June in the park calling and drumming.

Oriolus oriolus. For many years this easterly species has repeatedly visited the park, never staying more than a day or two. A yodeling Golden Oriole was heard on 15 June from 8 a.m. until the evening, but then disappeared.

Hippolais icterina. Up to three males may sing permanently in the park, but in 1969 there were only two transient territory-holders: (1) a male singing feebly on 8 June at 2.15 p.m., disappeared immediately afterwards, (2) a male singing on 13 June in another territory until late in the evening, but then disappeared.

Sylvia atricapilla. In some years the species may nest in the park, but usually it does not. In 1969, an unmated male sang erratically in various parts of the park throughout a prolonged period. Probably the same male had a territory in the spruce forest west of the area but did not obtain a mate.

Luscinia luscinia. Observed twice in 1969: (1) on 18 June from 2.15 a.m. until late after midday, a feebly singing male, (2) on 21 June before noon, a feebly singing male. Both these males were heard in the orchard.

A male of this easterly species was heard in the park on a single night in 1943 (V. HAARTMAN in BERGMAN *et. al.*). No further observation was made until 1967, when a pair nested at Jänissaari in Velkua and a male sang in Askainen, according to local people. In 1968, two singing males were heard at Jänissaari, and one male sang permanently at Lemsjöholm. In 1969, there was an invasion of Thrush Nightingales, probably connected with the very warm weather. In addition to the observations made in the censused area 7 singing males were heard on the relatively small island of Haukluoto in Velkua on 15 June (L. v. Haartman and R. Lumio). One male sang at Jänissaari on 14 June, and one, according to R. Lumio, in a garden at Toivainen, Livonsaari, Askainen, on 17 June.

Carpodacus erythrinus. The first individual of this easterly species was heard at Lemsjöholm on 23 May 1959. Since then, the species has appeared frequently, and in 1967 the first nest was found (the male was one-year-old). In 1969, probably 5 different singing males were recorded: (1) 30—31 June, (2) (juvenile) male 14—18 June, (3) (juvenile) male 22 June, (4) 25 June, (5) 1 July.

TABLE 1. The number of breeding pairs and nests on the study area. Nests probably belonging to second or repeat broods are given separately, e.g. 12+4. When half pairs are given, the true number was the nearest figure either above or below.

Species	Pairs	Nests	Pairs/ha
Apus apus	1	1	0.2
Jynx torquilla	1	—	0.2
Garrulus glandarius	1	1	0.2
Parus major	3	3	0.6
„ *caeruleus*	1	1	0.2
Certhia familiaris	1	1	0.2
Turdus pilaris	28	28	5.9
„ *philomelos*	3	3	0.6
„ *iliacus*	12	12+4	2.5
„ *merula*	1½	1+2	0.4
Sylvia borin	4½	1	0.9
„ *communis*	2	—	0.4
Phylloscopus trochilus	2	—	0.4
Muscicapa striata	3	2	0.6
Ficedula hypoleuca	5	5	1.1
Anthus trivialis	1	—	0.2
Motacilla alba	2	1	0.4
Lanius collurio	1	1	0.2
Sturnus vulgaris	8	8	1.7
Fringilla coelebs	8½	4+1	1.8
Emberiza citrinella	2½	1	5.2
Total	92½	75	19.4

Comparisons with other censuses

The high density of birds in the park at Lemsjöholm (19.4. pairs/ha) is partly due to a large colony of Fieldfares, the central part of which nested in the park. The Fieldfares search for food on cultivated fields far from the colony.

The number of Fieldfares was larger in 1968, but a cold spell caused a total loss of eggs and young during this spring, and in 1969 the colony had become somewhat reduced, especially at the margins.

The edge effect of the fields surrounding the park area as well as its very variable habitats are obviously factors with a positive influence on bird density.

Among Finnish habitats the leaf-meadows share many characteristics with the park. But their bird density is not high, the average being only 3.0 pairs/ha (PALMGREN 1930). In none of the different types of deciduous forest which have been studied in Finland has the average bird density ever reached the level of 6.0 pairs/ha. But an old birch wood with secondary growth of spruce at Lemsjöholm undoubtedly has as dense a bird population as the park, at least if the Fieldfare is disregarded.

Temperate North American deciduous forests show a bird density of (1.7) 7.2 (19.1) pairs/ha, the corresponding figures for tropical Mexico being (5.9) 11.7 (17.8) pairs/ha (UDVARDY 1957, quoted from graphs). In Europe, mainly eastern Europe, on the other hand, NOVIKOV (1962) found a high bird density in deciduous forests at latitude 49°—50° N (c. 18.5 pairs/ha) and in deciduous tree plantations at latitude 50° N (c. 19.3 pairs/ha), the density being lower both north and south of these latitudes. In both planted and natural deciduous forests maximum densities reached 30—42 pairs/ha. Compared with these areas, the Lemsjöholm park cannot be said to have a high bird density, but it must be borne in mind that the former areas are c. 10° south of the latter.

In parks in Helsinki KAJOSTE (1961) found an average bird density of 2.1 pairs/ha, which is little more than a tenth of the park population at Lemsjöholm. The dominating species in the Helsinki parks reveal some of the causes of this difference. The Chaffinch is the most numerous species (c. 0.45 pairs/ha), then follow the Great Tit (0.40), the Spotted Flycatcher (0.29), the Willow Warbler (0.14), the Pied Flycatcher (0.12), the Blue Tit (0.11), and the Greenfinch (0.10). The thrushes, the dominating genus at Lemsjöholm, were few in numbers. Their urbanisation, which in Western and Central Europe has lead to spectacular results, is still in its beginnings in Finland.

But even without the thrushes, the bird density is much higher in the Lemsjöholm park than in Helsinki. Of the 7 species most abundant in Helsinki, 6 were more abundant at Lemsjöholm; the seventh species, the Greenfinch, does not nest in the Lemsjöholm park, although it feeds there, sometimes in considerable flocks. A factor obviously restricting bird numbers in the city parks is the poor nesting facilities. A typical Helsinki park has no understorey, apart from some shabby *Rhododendron*. Small spruce and junipers, which form the most important nest-site for a great many Finnish passerine birds, are with few exceptions also lacking from the park at Lemsjöholm, but here all kinds of deciduous bushes form an excellent substitute, as do also the numerous empty buildings. The latter, in fact, offer the birds super-normal stimuli as compared to junipers and small spruces, giving perfect support from below, shade, and cover. So it comes about that many species which mainly use small spruces for nesting, also nest in buildings.

The availability of optimal nest-sites is undoubtedly an important factor in influencing numbers of song-birds. This is especially evident with hole-nesting

birds. Many more nest-boxes should be put up in the parks of Helsinki. Whether bushes should also be planted is a more difficult question, as these might well function as traps, attracting birds whose nests would then be plundered by dogs or human beings. The relatively high density of the ground-nesting Willow Warbler in the Helsinki parks indicates that this view may be too pessimistic. A more liberal policy with respect to bushes should, perhaps, be followed in the parks of Helsinki for the sake of nature conservancy.

A park in Leningrad showed a much higher bird density than the Helsinki parks, although a much lower one than the Lemsjöholm park. The park in question, the S. M. Kirov park, is remarkable in having been censused as long ago as 1886, 1891, and 1896 by KAIGORODOV, and again in 1947 and 1958 by MALTSHEVSKI (summary by NOVIKOV 1962). During this long period the bird density remained very stable, (4.7) 6.6 (7.7) pairs/ha.

It would be going too far to attempt a detailed comparison between bird densities in my study area and in parks in Europe and North America. A few more examples will suffice.

In two meticuously studied parks in Central Europe, PETERS (1963) found a bird density which approaches that at Lemsjöholm (Breslau 11.0, Frankfort-on-Main 11.4 pairs/ha). In the Frankfort park the Blackbird reached nearly the same numbers (5 pairs/ha) as the Fieldfare at Lemsjöholm. Further censuses in Central Europe gave the following bird densities: Dortmund 10.6 pairs/ha (ERZ 1956), Franfort Zoo 14.6 pairs/ha (STEINBACHER 1942), cemetery, Berlin, 16.3 pairs/ha (SCHIERMANN, quoted from ERZ 1956), and Prague Zoo 10.4 pairs/ha in an Acacia wood, and 13.8 pairs/ha in an orchard (WAHL, quoted from ERZ 1956). These figures approach the bird density in the Lemsjöholm park, especially if its Fieldfare colony is disregarded. In parks on the outskirts of Göttingen even higher densities were obtained (up to 43 pairs/ha); in the largest area studied the density was 17.8 pairs/ha (HEITKAMP & HINSCH 1969).

Summarizing some American bird censuses, LACK (1937) gives the density of birds in "typical" parks in the U.S.A. as 7.4—17.3 pairs/ha. A park in San Fransisco showed a density as high as 25.0 pairs/ha.

Interspecific relations within the genus *Turdus*

The four thrush species nesting in the park at Lemsjöholm allow a few conclusions about interspecific relations between members of the same genus.

As shown by Fig. 1, the nests of a single species are spread out in a non-random fashion. In the Fieldfare the

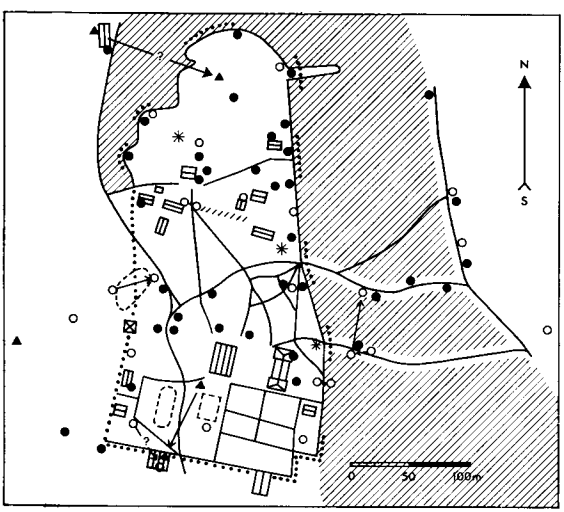

FIG. 1. The nests of the thrushes in the study area and its surroundings. Shaded areas = cultivated fields. . . . . = borders of the study area, - - - - = ponds. ——— = roads, paths, and borders between park and fields, rectangles = buildings. ● = Fieldfare, ○ = Redwing, ▲ = Blackbird, ✻ = Song-thrush.

minimum distance between two nests was 10 m, which was approached at several sites, in the Redwing c. 35 m (outside the area down to 25 m, exceptionally), in the Song-thrush c. 80 m, and in the Blackbird probably 150 m.

Much shorter distances were measured between the nests of different thrush species. Outside the censused area a Redwing and a Song-thrush were once found breeding symmetrically on the two ends of the gable of an old barn only 3 m apart. At the border of the censused area a Redwing and a Blackbird nested on rafters in a barn c. 5 m apart. Redwing and Fieldfare nested c. 10 m[1], Song-thrush and Fieldfare c. 15 m, and Blackbird and Fieldfare c. 20 m apart. Nests of Blackbird and Song-thrush were not found closer than 60 m apart, but the species are not very common and the chance that two nests will occur close to each other is therefore small.

From these data it is obvious that interspecific territorialism is either strongly reduced or does not occur among most of these thrushes.

Too close clustering of nests is obviously unfavourable. Even in such strongly social species as the Fieldfare the nests are spread out. According to TINBERGEN et al. (1967), a predator which has found a nest starts actively searching in its vicinity; when doing so it probaly has a "searching image" of what to look for. LACK (1968) assumes that spacing-out of nests is a major function of territory. But territorialism, how effective it may be, is an "expensive" method of achieving spacing-out, being time-consuming and even outright dangerous to the territory-holder. An unlimited interspecific territorial aggressivity would probably cost more than it would gain.

There are, however, other methods that would reduce the dangers inherent in clustering of nests of different species. Related species could have (1) different breeding times, (2) different habitats, (3) different nest-sites, (4) nests looking different, and (5) eggs looking different. The breeding seasons (point 1 above) are probably determined by other factors and do not come into question. Differences in habitat selection (point 2) are often thought to have developed as a consequence of competition for food, but they evidently cause dispersion of the nests of related species. Different nest-sites (point 3) will probably play a role in dispersing the nests of different species, and both the nest-site and the appearance of the nest and eggs (points 4—5) may influence the "searching image"; the predator which has found a nest will search for another of the same kind, but overlook one that is dissimilar.

The result will be a displacement or divergence of specific characters of the nests and eggs of related species. This divergence is well known to every student of birds, although its theoretical explanation has attracted much less interest than character displacement with respect to feeding habits. But it should be pointed out that other factors besides those discussed here may contribute to character displacement of nesting habits.

Nest-sites overlap to a certain extent among thrushes. This is shown unambiguously by the fact that for many years quite a few sites at Lemsjöholm have been occupied by more than one species. In an old smithy outside the censused area all four species have been found nesting on the same rafter under the projecting roof, and in the censused area too, a few sites have lodged two and even three thrush species, not simultaneously but in successive years.

Interesting as they are, these cases are rather exceptional. Usually, the experienced ornithologist knows precisely

[1] In 1971 only 4 m.

what nest to expect at what site and in what habitat. Table 2 and Fig. 2 show the nest-site and the height of the nest above the ground in the four thrush species. For further details the reader is referred to WILLGOHS (1951) and v. HAARTMAN (1969); there are, of course, important characters of the nest-site which are not visible from the table or the graph.

Character displacement with respect to the nest is bound to be rather restricted. For instance, the size of the nest is determined by the size of the bird. The nest-material used by the Song-thrush is species-specific, whereas the other three species mainly use clay, the material showing only minor dissimilarities in the different species (use of some moss externally by the Blackbird, and of *Equisetum* stalks by the Redwing). Again, the eggs of the Song-thrush diverge from those of the other three species. This difference is not likely to be connected with camouflage; the Song-thrush nests in darker sites than the Fieldfare and Redwing, but usually in lighter sites than the Blackbird. Much of the seemingly irrational diversity of colour and pattern found in birds' eggs may be the result of selection preventing the development of effective "searching images" among predators. But here, again, other selective factors like brood-parasitism may work in the same direction, not to speak of the cases in which the egg is actually camouflaged.

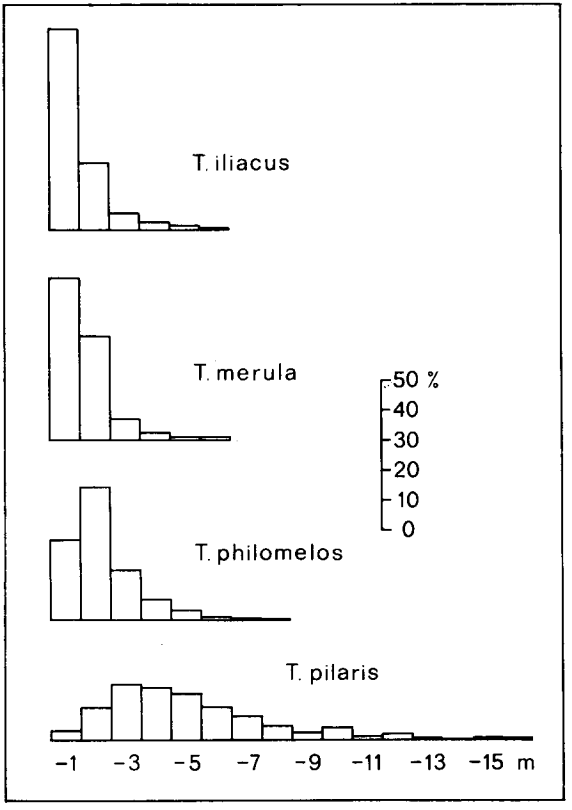

FIG. 2. Height above the ground of the nests of four thrush species, according to data in v. HAARTMAN (1969).

TABLE 2. Nest-sites in four Finnish thrushes. Data (form v. HAARTMAN 1969) expressed in per cent. The category "ground" includes rockfaces, stones etc.

	Spruce	Pine	Birch	Juniper	Ground	Other
Turdus pilaris	49.6	12.6	22.6	1.3	0.4	13.5
T. philomelos	82.9	0.4	0.7	5.0	0.3	10.7
T. iliacus	43.9	1.1	1.7	8.0	18.3	27.0
T. merula	33.4	0.7	1.7	1.7	21.3	40.9

Yhteenveto: **Lintulaskenta suomalaisessa puistossa.**

Lintutiheys lounaissuomalaisessa puistossa (pinta-ala 4.8 ha) oli 19.4 paria/ha.

Lintutiheys on paljon suurempi kuin Helsingin puistoissa ja suomalaisissa sekametsissä lasketut tiheydet. Se on samaa luokkaa kuin Neuvostoliitossa n. 50° N leveysasteella ja eräissä Keski-Euroopan ja Yhdysvaltain puistoissa.

Kirjoituksessa tarkastellaan niitä tekijöitä, jotka ovat vaikuttaneet tutkitun puiston lintutiheyttä lisäävästi. On todennäköistä, että sekä suotuisalla ravintotilanteella että sopivien pesäpaikkojen runsaudella on merkitystä. Jälkimmäisiin kuuluvat puiston tyhjät rakennukset, jotka tarjoavat normaalisti pienissä kuusissa pesiville lajeille ylinormaalin korvikkeen.

Neljän puistossa pesivän rastaslajin keskinäisiä suhteita tarkastellaan. Samalla kun kaikki lajit ovat territoriaalisia, ne sietävät suuressa määrin toisiaan.

Tehokkaan lajienvälisen pesien hajasijoitusta edistävän mekanismin puuttumista mahdollisesti kompensoivat erot lajien välillä biotoopin valinnassa, pesän sijainnissa ja rakenteessa sekä munien värissä.

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