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Renewal of methodology in the second bird atlas of Finland, 1986–89

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The first Finnish bird atlas project, covering an area of 3859 10-km squares, was completed during 1974–79, with over 2000 observers collaborating. The second atlas survey was started in 1986 and had several methodological improvements. For example, the number of categories of evidence of breeding for a species in a square was reduced from 17 to 9. The areal coverage of bird atlas studies in a square is given by the research grade, using a scale of five categories; the index increases yearly. Numbers of breeding pairs of a species in a square can be estimated on three levels of different accuracy. A register of important bird sites is kept for conservation purposes.

Point counts in homogeneous habitats are recommended for the quantification of pair numbers and to study population changes of land birds in atlas years. Further, salaried assistants will census line transects in the whole of Finland during 1987–89. These data are used to estimate pair numbers and regional densities of common land bird species in 50-km squares, to calculate distribution of pairs in various habitats and to detect long-term population changes which occurred during the last 50 years. Counts of breeding waterfowl pairs in lakes are conducted in early summer by two methods, (1) circumventing a lake and censusing adult birds, or (2) censusing from fixed points along the shore. Archipelago birds are censused using standardized methods.

A nest record card has been developed, e.g. to combine data on reproductive success with data on population fluctuations.

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1. Introduction

The first Finnish bird atlas project, covering an area of 3856 10-km squares, was completed during 1974–79, with over 2000 observers collaborating. The results have been published in Finnish (Hyytiä et al. 1983) and a shortened version in English (Koskimies 1989).

The second atlas survey in Finland started in 1986. Experience from the preparation the first atlas led the organising committee to plan several methodological improvements, described in Finnish by Koskimies & Väisänen (1986, 1988) and in Swedish by Väisänen (1986). The purpose is to improve the applicability of the data to scientific studies and to nature conservation.

However, the volunteers were not given demanding duties that would destroy their enthusiasm. Each volunteer was asked primarily to survey breeding species in atlas squares and then do an extra amount of study that s/he wished.

2. Breeding evidence codes, survey activity and frequency indices

The number of categories of evidence of breeding for a species in a square was reduced from 17 to 8(9) (Table 1), for the following reasons:

1) some of the 17 EOAC codes (Sharrock 1977) were superfluous or illogical (certainty of breeding did not increase consistently with code number),
2) the new codes give a sufficiently accurate basis to classify observations into three main categories (possible, probable and confirmed breeding) that are really needed in atlas maps, and
3) costs are reduced and errors avoided in storing codes of one digit, instead of two.

Distribution maps of species become much more informative when the research grade of atlas squares (the areal coverage of bird atlas studies) can be represented in the background. We have started to collect these data on a scale of five categories (Table 2).

Table 1. Categories of breeding evidence for a species in the second Finnish bird atlas project (1986–88a).

A. Unlikely breeding (code 1)

1. *Species has been observed in the breeding season in a 10-km square, but breeding there is not likely.* — *Not* applied, however, for overflying or resting migrants, or for visitors searching for food from neighbouring squares. Note geographical and within-species variation of breeding phenology.

B. Possible breeding (codes 2–3)

2. *Bird observed once* (e.g. singing or displaying male) *in typical nesting habitat and breeding of the species in the square is possible.* The site was visited (only) once or the bird was recorded only during one of several visits. — Note that the proper breeding habitat may vary geographically.
3. *Pair observed once in a suitable nesting habitat and breeding of the species in the square is possible.*

C. Probable breeding (codes 4–6)

4. Singing or displaying *male present after migratory period on more than one day in the same place (persistent territory).*
5. *Female or pair present on more than one day in the same place*; or *bird visiting probable nest-site more than once* (e.g. repeated settling down in a reedbed or on an island).
6. Bird (or pair) observed
   - *building nest* (excavating nest-hole, bringing nest-material, etc.)
   - *uttering anxiety calls*, suggesting probable presence of nest or young nearby
   - *showing distraction-display or injury-feigning* to distract observer from probable nest or young
   - *attacking* or other agitated behaviour (e.g. owls and terns).

   Nest material (e.g. decorated nests of birds of prey) or *food remains from the same year* recorded; no direct proof of eggs or young, however.

   A trapped female with brood-patch (probably breeding in the square).

D. Confirmed breeding (codes 7–8)

7. *Indirect proof of breeding* recorded:
   - a nest being occupied in the same season (eggs, eggshells, droppings of young, 'feather scales', etc.)
   - adults entering or leaving a nest-site indicating occupied nest (including high nests and nest-holes, the contents of which cannot be seen)
   - recently fledged young (nidicolous species) or downy young (nidifugous species), which probably have been born in the square
   - adult carrying food for young or faecal sac; nest is probably in the square surveyed
   - adult incubating.
8. *Direct proof of breeding*:
   - voices of young heard from the nest (e.g. high nests or nest-holes)
   - nest with eggs or young seen.

(9.) *Nest record card* on an active nest and the card sent to the Zoological Museum.

Finland has been divided into 53 subregions, within which the standard of the data from the squares is yearly estimated in co-operation with field-observers and the regional atlas organiser. The survey activity index accumulates yearly. It is of special interest to examine the occurrence of species in thoroughly surveyed squares. This index also helps to focus special attention on areas where many squares seem to be poorly surveyed.

Numerical EURING codes of the species were replaced by six letter codes derived from their latin names. The codes were developed by Pertti Saurola of the Ringing Office of the Zoological Museum of the University of Helsinki. Most of the codes consist of the three first letters of the scientific names, e.g. *Passer domesticus* is PASDOM. In a few cases the three last letters of the species name have been used to avoid confusion, e.g. *Phylloscopus trochilus* is PHYLUS and *Ph. trochiloides* is PHYDES. The advantage of these codes is that gross errors that are inevitable in the input of Euring codes and that are difficult to detect can now be avoided.

Estimation of abundance is optional but desirable in squares that have been surveyed at least to a satis-

Table 2. Survey activity categories of a 10-km atlas square.

1. Occasional observations
   - only casual visits in the square.

2. Fair survey of the square
   - breeding birds of the most common habitats have been surveyed, but only in a small part of the area
   - if valuable bird sites (e.g. wetlands) are known to exist in the square, some have been checked.

3. Satisfactory survey of the square
   - the most common habitats have been surveyed in several sites
   - good bird sites of the square (wetlands, open islands, rich forests etc.) have been visited at least once during the breeding season
   - several additional species would probably be found by more intensive recording.

4. Well-surveyed square
   - all habitats and good bird sites have been surveyed regularly and the observation area covers at least half of the square
   - there may still be some breeding species which have remained unrecorded
   - additional observing would improve the categories of breeding evidence and abundance indices of species.

5. Thoroughly surveyed square
   - all habitats and good bird sites have been surveyed through the breeding season and the observation area covers (almost) the whole square
   - finding new species breeding regularly in the square is improbable
   - it is difficult to improve the categories of breeding evidence and abundance indices.

factory level (survey category 3 or more). Indices are given to all species except the most abundant passerines. The number of breeding pairs of a species in a 10-km square can be estimated on three levels, differing in accuracy:

1) *Pair number* (code starting with P and followed by up to four numbers) is based on special studies or concerns a fairly abundant species, the breeding population of which may be estimated at an accuracy of ±20% (e.g. colonial species such as *Riparia riparia*).
2) *Accurate index of abundance* (code T followed by number(s) 1–9(–12); Table 3) is based on surveys conducted within the square (survey activity categories 3–5), as well as other information such as actual censuses of breeding populations or data on average distances between territories of the species. In practice the estimation of accurate abundance indices is not feasible if the population in the square is over 1000 pairs (classes T10–T12; Table 3).
3) *Inaccurate index of abundance* (code E followed by number(s) 1–9(–12)) may contain an error of one class downwards or upwards. For example, abundance index T5 means 20–50 pairs, but E5 10–100 pairs (includes classes 4, 5 and 6 of Table 3). More inexact estimates of abundance are not made.

Table 3. The 12 abundance indices with corresponding total number of pairs in the 10-km square; average density (pairs/km^2) and distance between pairs.

Index	Pairs	Density	Distance
1	1–2	0.01–0.02	7–10 km
2	3–5	0.03–0.05	4.5–6 km
3	6–10	0.06–0.1	3–4 km
4	10–20	0.1–0.2	2–3 km
5	20–50	0.2–0.5	1.4–2 km
6	50–100	0.5–1	1–1.4 km
7	100–200	1–2	700–1000 m
8	200–500	2–5	450–700 m
9	500–1000	5–10	300–450 m
10	1000–2000	10–20	220–450 m
11	2000–5000	20–50	140–220 m
12	>5000	>50	<140 m

By using symbol P0 (P and zero) one may code the absence of a species in a well-studied square. The code should not, however, be used to accumulate self-evident information into the data. The occurrence of the species within the square should be possible from an ecological and zoogeographical standpoint: the distribution limit is near enough, proper breeding habitat is available and surveys cover patches of suitable habitat well. Symbol E1, which means 0–5 pairs, is practical for expressing the possibility that a species is lacking from a square. This code can be used, although breeding of a species is only possible or probable.

3. Important bird sites

In addition to atlas data, a register of important bird sites for nature protection is being made, using standardized recording forms. The site types particularly searched for are

1) lakes or sea bays with a rich avifauna,
2) wetlands (wet shore meadows and/or reedbeds),
3) mires or peatlands with abundant pools and rich bird life,
4) open islands with a notable gull or tern colony,
5) shore meadows with rich bird life,
6) productive forests,
7) old forests (long period since last logging, many trees with holes),
8) important bird colonies (e.g. *Alca torda*, *Corvus frugilegus* or *Emberiza aureola*).

Other sites can also be included. Data on the location, area, need of protection, and the most important breeding birds with estimates of their breeding population, are recorded. This register will be forwarded to the Ministry of the Environment (which mainly funds the bird atlas project) for purposes of nature protection and environmental planning. It will also be of importance in the planning of fieldwork for forthcoming bird projects.

4. Numerical censuses

Point censuses were started in Finland in 1984 for the monitoring of yearly population changes of land birds (about 2000 points were censused for five minutes, Hildén & Väisänen 1986, Väisänen et al. 1989). Volunteers are recommended to use point counts in homogeneous habitats for the quantification of pair numbers and to study population changes of land birds in atlas years. It is hoped that the coverage of point plots will be representative in about 15 main habitats in different parts of the country.

Salaried assistants census line transects all over Finland. These data are used to estimate pair numbers and regional densities of common land bird species in 50-km squares, in order to calculate distribution of land bird pairs in different habitats and to detect long-term population changes during the last 50 years. In Finland we have line transect data for about 4600 kilometres, from the 1940s, 1950s and the 1970s (Merikallio 1958, Järvinen & Väisänen 1980), which gives a unique basis for the quantitative study of population changes (e.g. Järvinen & Väisänen 1978, 1981). A new version of the Finnish line transect method was developed for the atlas project, including detailed coding of habitat structure on the main belt (Koskimies & Väisänen 1988).

Counts of breeding waterfowl pairs in lakes are conducted in early summer by two methods,

1) moving around the lake on foot or by boat and censusing all adult birds, or
2) censusing from fixed points along the shore.

Our censuses cover only a small sample of Finnish lakes with an area over 1 ha (total number about 120 000). During 1987–89 salaried ornithologists will repeat censuses in about 300 lakes all over the country by using mainly method (1). Volunteers collect data mainly by using the easier point count method. Because breeding birds of the large Finnish archipelagoes are censused by using special methods, it is possible to calculate population sizes of waterbird species and to monitor their yearly variation during the preparation of the bird atlas.

5. Links with the nest card program

A nest record card (Tiainen & Väisänen 1986) was developed by adapting some of the most promising ideas of the American and British nest cards. Information from a maximum of 15 nest visits is recorded to make the use of Mayfield's method (see e.g. Bart & Robson 1982) possible. One of the aims of the nest card program is to combine data on reproductive success with population changes of species, which links the nest card program with the bird atlas work. To promote the accumulation of nest cards in the atlas, the highest code of evidence of breeding (Table 1) is reserved for certain breeding documented with a nest record card. Nest record cards are requested for all observations (also other than nests) made during the breeding period of threatened birds in the Finnish Red Data Book, because the location, date and habitat of the observation are then obtained in computerizable form. In the first study years, 1986–88, about 5500 cards were collected annually. (Using the previous version designed by Lars von Haartman, about 115 000 nest record cards were collected in 1954–85.)

6. Outlines of information content of the second atlas

Maps in the second atlas may contain the following information about the most abundant land bird species (only the first and the third points are applicable to rare species and most waterbird species):

1) symbols of breeding evidence in 10-km squares, with symbols of research grade as a background
2) isodensity lines according to line transect data
3) tabulation of population size in different parts of Finland
4) tabulation of distribution of pairs into the most important habitats (regional density in each habitat, proportion of pairs regionally breeding in each habitat)
5) long-term indices of population change from the 1940s to 1950s, 1970s and 1980s in southern and northern Finland, and
6) short-term (yearly) population indices for the 1980s.

A sketch map of the Siberian Jay *Perisoreus infaustus* can be used as an example, whose data were combined from the first bird atlas of Finland in the 1970s and contemporary line transect censuses, to illustrate the relative importance of breeding evidence and density data in the second atlas project (Fig. 1). Isodensity lines will be more informative than codes of breeding evidence in areas where the species is at least moderately frequent, namely in northern Finland. Frequency of unsatisfactorily studied squares was highest there in the first atlas, and probably most of the white spaces in the north are due to low survey intensity. The symbols of research grade will mainly eliminate that source of uncertainty in the second atlas.

Symbols of breeding evidence of this sedentary species are valuable in depicting the distribution of the sparse population of southern Finland. Here, however, we may expect some bias in the map, because the favourite habitats (old, stunted spruce forests) are situated in remote areas, where the atlassing efficiency was lowest. The location of these threatened populations should appear more precisely in the maps of the second atlas, because the research grades of the squares will also be presented.

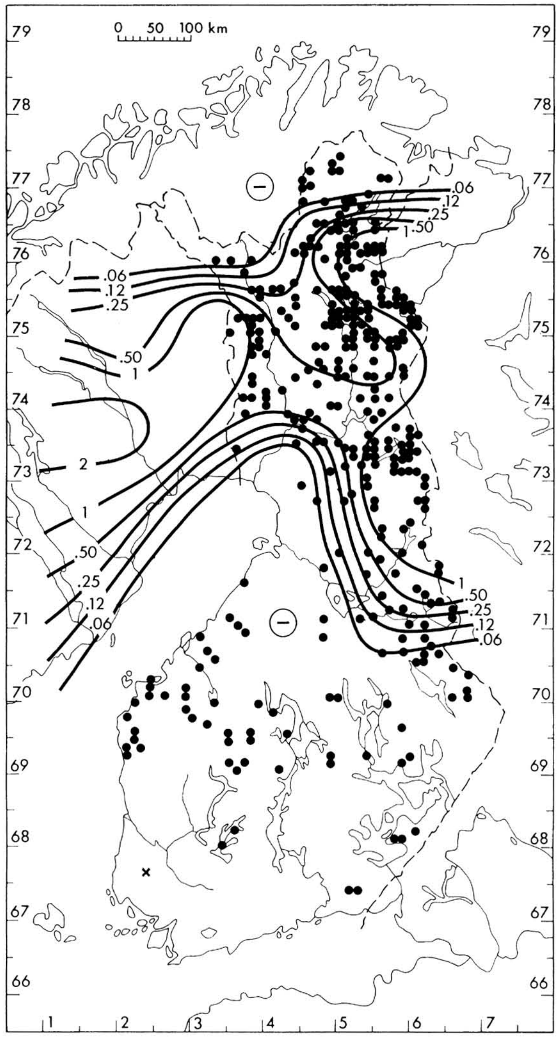

Fig. 1. Distribution and density of *Perisoreus infaustus* in the 1970s. Dots indicate symbols of occurrence in 10-km squares of Finland (data modified from Hyytiä et al. (1983) by combining 333 symbols of probable or confirmed breeding; 415 symbols of possible breeding have been excluded; note that no data from the bird atlases of Norway or Sweden are presented here). The isodensity lines (pairs/km^2) are the result of line transect censuses, which also covered parts of northern Norway and Sweden (Järvinen & Väisänen, unpubl.). Areas with no line transect records (because of the rarity of the species; cross means an occasional observation) are shown by encircled minus signs.

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