

6 Mapping Census of Breeding Land Birds

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Mapping census / Zoological Museum
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1. BACKGROUND AND AIMS. The mapping method is based on the territorial behaviour of birds. By marking the locations of observed birds on a detailed map during several visits within a breeding season, it is possible to count the number of territories in an area. Simultaneous observations of individuals of the same species are especially important when interpreting the boundaries of territories. The mapping method is most efficient for birds which have territories smaller than 10 ha with relatively clear boundaries (e.g. most passerines). The method was developed especially during the 1960s, and it has been used for monitoring population fluctuations in Great Britain, for example, since 1962, and in Sweden since 1969. The international standard was published in 1969, but the method has been modified further since then.

In Finland mapping is not used as a general method for broad-scale monitoring of breeding land birds, because it requires more time and field work than single-visit point counts and line transects. However, the method should be applied when fairly precise pair numbers and densities as well as the distribution of territories in small study areas or patchy habitats are to be studied. Point count and line transect data are still sparse from most uncommon habitats. Mapping gives more reliable results for less numerous and poorly detectable species than one-visit censuses. The mapping method also gives the actual abundances of species. A much smaller census area is covered, however, per unit of time.

The mapping method has been used in a minor scale for several special purposes in the Finnish bird monitoring programme since 1987: (1) monitoring of bird communities in various habitats and the effect of habitat changes on them, (2) monitoring birds breeding in wetlands, (3) counting breeding birds at

valuable bird sites (Bird Site Register) and in well preserved, protected areas (nature reserves and areas of integrated environmental monitoring used as reference for human-altered environments), and (4) censusing less numerous bird species in large study areas. Mapping may also be used for studying various ecological and biogeographical problems.

Although the following instructions are best suited to Finnish conditions they are comparable with the mapping method routines described in other countries. There are various definitions for the different census purposes in Sections 12–15. The aim of the standardized instructions is to get reliable data on annual population fluctuations. – If one wishes to know the “absolute” number of pairs in a certain area, the instructions should be applied according to the species and the study area: e.g. the number and timing of census visits is adjusted to the breeding birds and weather conditions of the particular year. Nest searching and bird ringing is often a must in order to get the “true” number of birds in the area.

2. EQUIPMENT AND TIME NEEDED. One needs 30–40 copies of a very detailed map (1:2000, in open areas 1:3000 may be acceptable), a compass, a plastic band for marking the area, and binoculars. A writing-pad and plastic cover to protect the map are advisable.

The time needed depends on the size and terrain of the census area as well as on bird density. Usually about 30 hectares in a wooded area or 50–80 ha in an open area may be counted in one morning. Thus, in forest it takes 10 mornings to census 30 ha by the ordinary 10-visit version of the mapping method (about 50–60 hours of field work). In addition, it takes about 40 h (4 h per census morning) to prepare the species maps, and about 5–10 hours to analyse them. In total one spends about 100 hours for censusing 30 ha of forest during one breed-

ing season. Marking the 50 × 50 m grid in the field takes about 25 hours before the first census season.

One should be able to identify all species breeding in the study area, especially by their calls and songs. Mapping should be practised before participating in the monitoring.

3. CHOOSING A CENSUS AREA, DRAWING A MAP AND MARKING THE AREA.

The mapping method is suitable for all terrestrial habitats. Depending on the problem being studied, the study area may be homogeneous or include several types of habitat. The area may have natural borders or be a part of a larger habitat.

Present-day habitats are usually patchy and edge-effects are pronounced. This does no harm if population fluctuations are being monitored or large areas censused in the same region. However, if one intends to compare communities living in the same kind of habitat in different regions, the study areas should be homogeneous.

The census area should cover at least 10 ha in forest and 50 ha in open habitats. The minimum size depends on the bird density: the sample should consist of at least 50 but preferably over 100 bird pairs, in order to get sufficient data for statistics. On the other hand, however, there is time to count only about 30 ha of forest during one morning (see Sect. 2). The study area, if divided into subareas of 30–50 hectares depending on bird density, can only be some square kilometres at the most. If only some of the species are censused (Sect. 15), or if the number of visits is less than ten (Sect. 4), the area may be larger. At least 30 ha should be censused in lush deciduous and mixed forests, 30–50 ha in more barren deciduous and coniferous forests and 50–80 ha in pine forests and open areas.

The census area should be as round or square as possible in order to minimize border length (border territories are difficult to analyse, see Sect. 8). In special cases the area is determined according to other criteria (e.g. a valuable bird site, see Sections 12–15).

After the area has been chosen, a detailed map (known as a visit map) is drawn of it before the first census. The recommended scale for the map is 1:2000. A survey map (1:20 000) and field experience should be used in drawing. Boundaries of the area and landmarks such as

edges between habitats, streams, roads, paths, buildings, big rocks and trees, nestboxes etc. are marked on the map. There are enough landmarks when the observer is able to locate his position accurately on the map anywhere in the area. One copy of the map is needed for each visit and enough copies should be reserved for making the species maps (see Sect. 8).

If the area is homogenous and there are only a few natural landmarks, artificial marks should be added. The best way is to mark a 50-m grid in the field using a compass and counting one's paces or with a 50 m-long rope or measuring tape. The corners of the squares are marked with coloured plastic bands, and coordinates of the point are written on them. The grid and the coordinates are drawn on the map. The bands may be tied to trees, bushes, stones etc. It is important that the bands are well attached and that the coordinates may be read with binoculars from a distance.

In mapping areas which will be censused over several years, it is advisable to make a permanent grid. It ensures standardized location of birds and uniform habitat description (see Sect. 11). The boundaries of the census area should always be marked, if they do not run along natural boundaries. Permission from the landowner for marking the area is necessary.

4. CENSUS PERIOD AND NUMBER OF VISITS.

The census should coincide with the peak of most active singing and territorial behaviour of the particular species breeding in the area. Because of differences in phenology of arrival and nesting, the visits should cover a period long enough to ensure that each species is easily observable on at least three visits. Records from other visits supplement the results of these "core" visits during which the probability of obtaining simultaneous records is highest.

The most effective census period depends on the phenology of the spring and the nesting of the birds. In forests of southern Finland the most suitable period is from about 25 April to 20 June, in central Finland from 5 May to 30 June and in northern Finland from 20 May to 5 July. The beginning of the census period may vary by about one week from year to year. In open habitats censuses are started a little later according to the arrival and nesting of the particular species of the area.

There should be ten visits in a standard mapping of forest birds. If the bird density is very high and the nesting period of the community is long, or if there are many night-active species, 12 visits are recommended (see Sect. 5). The visits ought to be evenly distributed over the census period; for example, in southern Finland the area should be counted just over once a week. The exact timing of the visits depends on the breeding bird fauna in each area – the basic recommendation is: 1–2 visits in April, 4–5 in May and 4–5 in June. If bird density is low or the nesting period is short, eight visits are enough, but this means one has to “hunt” intensively for simultaneous observations of individuals in neighbouring territories (see below).

In open habitats, where bird densities are usually lower than in forests, or if a few species markedly dominate the community (reed-beds etc.), eight visits are enough. If bird density is very low and the nesting period does not vary much between species (peatlands, alpine heaths), five visits may suffice.

5. TIME OF DAY. The main census time is 4–10 a.m. when the birds sing most actively. After a very cold night counting can be delayed (especially on peatlands) and during very warm weather it should be prolonged due to lower activity of birds. Two visits should be made in the evening, the first in the beginning of the census period (especially for counting thrushes and Robins), the second in the beginning of June (especially for counting night-active singers). If there are several night- or dusk-active species breeding in the area, these two censuses should be added to the ordinary programme of ten morning visits. Owls, woodpeckers and cross-bills should be censused by extra visits in March and April.

6. WEATHER. Counts are made in calm and rainless, not in windy, rainy or cold weather. Especially on peatlands very hot weather is unsuitable for censusing. It does not bias the census, however, if the weather is not good during one or two visits, as long as the other visits take place in good weather conditions.

7. FIELD WORK. A clean map is reserved for each visit. In the margin of the map write the name of the area, the date, the number of the visit, starting time (when the visit is over, also

the finishing time), observer, weather (cloudiness, wind, temperature, rain), possible changes in the weather during the visit, and other things which may possibly influence the census results.

The census area is worked systematically, e.g. from one coordinate point to another. Each visit should cover the area as evenly as possible and no place should remain further than 25 m (dense vegetation or high density of birds), 50 m (sparse vegetation, few birds) or 100 m (open habitats) off the route. Successive visits should be started at different points. This is especially recommended if the observer feels that a part of the area is getting attention at the expense of the rest. In successive visits one should start censusing from different points in order to disperse census activity over different times of the morning equally all over the area. Simultaneous observations must always be recorded carefully so that birds can still be separated from their neighbours after they have moved, which frequently happens during a census visit.

Mapping should be extended about 50–100 m (depending especially on territory size of species) outside the census area to locate most border territories (for their analysis, see Sect. 8).

Busy censusing impairs observing. On the other hand, one should not walk very slowly, because then, for example, a bird uttering alarm calls may attract other birds to congregate near by. Thus, walk with moderate speed and record the birds all the time. Stop frequently to “hunt” for simultaneous observations of different individuals of the same species, to listen, and to mark the birds on the map. If one is not sure whether there is only one bird or two, one can return to the area censused already to make sure which is the case. In open areas it is often useful to search for the birds with binoculars.

The ordinary speed of censusing is 10–12 min/ha, or 5–6 ha/hour when the bird density is about 300–500 pairs/km². If the density is very high, the censusing speed slows down to 3–4 ha/hour (15–20 min/ha). If the density is very low or only some of the species are being censused early in the spring, one may walk a little more rapidly; however, at least eight minutes should be allowed for each hectare.

There are many advantages to slow and thorough censusing: (1) one can gather simultaneous observations effectively by following the

movements of individual birds in different parts of their territories; (2) one can pay special attention to species difficult to detect; and (3) one can search for nests and check those found earlier. During a very slow census, however, there is a risk that birds may be recorded more often far away from their territories (e.g. foraging).

Species singing most actively early in the morning (e.g. nocturnal singers, doves, thrushes and Robin) may remain unnoticed in the last hours of the census. This disadvantage may, however, be diminished by paying special attention to such birds in the whole area in the beginning of the census (the approximate locations are marked down first and the exact place later when the bird is closer, or, alternatively, the whole area is quickly walked through in the beginning of the census and only certain species are marked).

All observations are marked on a map using standard codes which are given at the end of these instructions. Place the codes at the exact locations of the birds. If you use any other marks, explain their meaning in the margin of the map. Write the notes either with a soft pencil (no mess allowed – take a knife or pencil sharpener with you!) or with a pen, never with water soluble ink. One may need a compass to measure directions to observations further away.

Mark the movements of birds carefully on the map. Special care should be paid to all activities that confirm breeding (nest, feeding parent, parent uttering alarm calls). One should not, however, waste much time in searching for nests but instead concentrate on recording the network of simultaneous observations: when a species is seen or heard, as many neighbouring birds as possible, belonging to the same species, should be identified and located at the same time. Individuals of many species may be marked on the map even when they are still far away; the exact location is checked when the bird is approached (if it is found). Simultaneous observations of neighbouring males and pairs are of vital importance to the analysis of the results, so they should be gathered actively!

The mapping of several species is more effective when a tape recorder or other lure is used. Location of a bird already silent may be affirmed with a playback of its song. If this procedure is used, it has to be used in the same manner every year (make note!). Because the

routine is difficult to standardize, such equipment should be used only in special studies.

The standard mapping method is less suitable for species which live in colonies or loose groups (e.g. Swift, swallows, some Fieldfares, sparrows, Siskin), and for Capercaillie and Black Grouse (no actual territories), raptors, rails, Crane, most waders, Cuckoo, woodpeckers or crows (both sexes call, part of the species breed early, large territories). The observations of species like these do not form as firm clusters as the observations of really territorial species. In order to detect the number of breeding pairs of these species one has to census large areas (see Sect. 15), make additional visits, record very carefully (e.g. follow feeding or calling individuals) as well as search for nests (where nests are later destroyed, any replacement nests should not be included). Mark separately nests situated in nest-boxes and in natural holes.

8. INTERPRETING OBSERVATIONS. All observations are transferred from the field maps to exactly the same locations on the species-specific maps. There should be a separate map for each species although sparse species can be marked together on a common map with different colours. The same activity codes are used in the species maps as in the field maps, but the running number of the visit (from 1 to the number of the final visit) is written instead of the species code. In the margin of the map write the species, census area, observer, dates of the visits and a note on which visit the majority of the species had arrived in the study area (more detailed notes on observability etc. should be given on the visit map).

The species maps may be drawn after the census period. However, if observations are transferred to the species maps after each visit, one can check the stability of territories more effectively during the next visits by searching for certain individuals and simultaneous observations.

Interpreting the codes of species maps as numbers of pairs (territories) is based on clusters of observations, which usually refer to a certain individual repeatedly observed in its territory during different visits. Clusters may be tight, but in some species and habitats are often scattered. As a result of a male having several singing sites a territory may also contain more than a single cluster. Movements of the birds or

a single male with more than one singing site cause special problems of interpretation. The territories can reliably be separated from each other only if there are simultaneous observations from every territory in various directions during several visits.

To minimize individual differences the analysis of all species maps is checked at the Museum. Basic rules for analysis are described here (more detailed information is available from the Museum).

The observations that are interpreted as referring to the same territory are circled. The first rule is that there have to be at least 2–3 observations for a cluster to be regarded as representing a territory (the minimum depends on the number of visits):

Number of visits when species was observable	10	9	8	7	6	5
Minimum number of observations	3	3	3	2	2	2

At least two observations should indicate nesting (singing, alarm calls, territory defence etc.; only one such case is needed if the minimum number is two). The time scale between the first and last observation in a cluster should be at least 10 days (certain species-specific exceptions from this rule may exist). On the other hand, a cluster with time-separated observations possibly refers to a territory held by two successive males for a brief period. Such clusters are disqualified. In a few cases one observation of a species difficult to observe is enough (an ideal case would be a nest with eggs or chicks; not, however, fledglings able to fly).

The following main rules deal with distinguishing a pair of neighbouring clusters from each other (is there one territory or two?). The clusters are interpreted as separate territories, if

(1) there is at least one simultaneous observation between the clusters and the number of observations reaches the minimum in both clusters (see above), or if

(2) there are no simultaneous observations between the clusters but in both clusters there is at least the minimum number of observations, of which at least two are made during the same census visit (there was a bird in both territories in the same two visits). Also, the distance between the territories has to be long enough for

them to probably represent separate territories considering the territory size of the species in question.

The territories around the border of the census area may cause problems (this is why censusing should be extended a little outside the study area; see Sect. 7). If the territory of the species is relatively small and more than half of the observations fall inside the study area, the territory is interpreted as a whole unit. If about half of them are inside the area, it is interpreted as a half (marked "0.5"). If the territory is very large compared with the size of the study area and the study area covers only a part of it, or only a small part of a border territory is within the area, use the sign "+".

Skill of interpreting the species maps develops with experience - standard rules cannot cover every case. Also the biology of the species, habitat and the geographical location of the area have an influence on interpretations.

9. FILLING IN THE FORMS. Mapping Form 6A–B is filled in with clear handwriting, in pencil, using BLOCK LETTERS. All numbers are written so that they end at the right margin (e.g. observer number, area). All data with letters are started from the left margin (e.g. municipality, name of the area).

Information on the study area and the census is presented on Form 6A. The AREA NUMBER is given after the first census year by the Museum. If the census is changed from the previous year, give the reason (e.g. the number of visits decreased, observer changed). The main OBJECTIVE OF THE CENSUS is given. The NATIONAL GRID coordinate is given according to a centrally placed 1 | 1 km square. If the area is situated in more than one MUNICIPALITY, write down the one where the main part of the area lies. The AREA SIZE is reported with an accuracy of one hectare. The FIRST CENSUS YEAR means the first year when the results were sent to the Museum (if you have older data, write a note in 'remarks' on Form 6B). The NAME OF THE AREA should be found from a survey map. Although the HABITAT distribution is given on a map after the first year (see Sect. 11), list the main habitats on Form 6A also, using the categories presented in the point count instructions of breeding land birds (see Form 2B). A habitat code is filled in the box with black corner at the Museum.

On the lower part of the form, write for each

visit the date, starting time, duration, weather (cloudiness, wind, average temperature and rain) and remarks about factors that might have affected the census results. If there were more than 12 visits, the rest are marked as remarks on the lower margin of Form 6A. If not all species were censused, a list of those included is given (in ordinary mapping all the species are censused).

The INTERPRETED NUMBERS OF TERRITORIES of each species are listed on Form 6B. The names of the species are marked with the 3+3-letter codes (see Appendix 1 of the Manual) in systematic order, followed by the number of territories. One can also give a reference to any more detailed remarks on the lower part of the form.

The observer should send the following material to the Museum every year: species maps, visit maps and form 6A–B. In addition, after the first census year and after habitat changes, a habitat map (see Sect. 11) and a copy of a survey map (e.g. 1:20 000) where the census area has been delimited, are enclosed.

The visit maps will be returned to the observer after checking of the analysis. The species maps, however, are returned only if specially asked for. If the mapping method has been applied to a bird site, one should supplement Mapping Form 6A–B with Bird Site Forms 11A and 11C–D.

10. REPEATING THE CENSUS. For monitoring purposes the mapping censuses should be repeated in the same area during as many successive years as possible (at least two). In order to make the data comparable, censuses have to be made in exactly the same way:

- the same study area
- the same observer
- good weather
- the same census period in relation to the phenology of spring and breeding (usually the start of the period varies within a week from year to year)
- the same census routine: timing of visits, walking routes, speed, time spent in searching for nests and collecting simultaneous observations etc.

11. ENVIRONMENTAL DATA. Using the mapping method it is possible to monitor the effect of local habitat changes on the breeding bird species, provided the habitats of the study

area have been described. Pairs may be allocated to certain subareas to study habitat selection. Continue censusing even if the habitats have changed considerably and the number of birds has perhaps dropped from earlier years!

The Museum collects as detailed habitat data of the study areas as possible. It is recommended that after the first census year the observer sends a habitat map drawn on a clean visit map. At least the following information should be included in the sketch:

- boundaries of the census area
- boundaries of different habitats
- nest-boxes and trees with natural holes
- type of forest (spruce, mixed etc., see Form 2B), forestry use (e.g. clear-cut areas), dominant tree species and their approximate coverages (total coverage being 100%), dominant species of the bush layer and their coverages, main species in the field layer (grasses, mosses etc.; mark open rocks separately)
- in arable areas species under cultivation, lawns and pastures, main ditches, barns, bushes, stone fences and piles of stones etc.
- other environmental factors that may affect the breeding bird populations in the area.

If the habitat structure of the study area changes, a new habitat map should be sent to the Museum. Photographs of the main habitats can be of great help in analysing the results of the census area!

12. MONITORING BIRD COMMUNITIES IN RELATION TO HABITAT STRUCTURE. In Sections 12–15 some special applications of the mapping method used in Finland are presented. The instructions given in previous sections are still valid unless otherwise stated.

When bird communities of geographical regions are to be compared, each mapping area should represent a homogeneous habitat type (e.g. spruce forest, open mire or field). The same habitat should also extend at least 100 m outside the study area in order to minimize the edge effect. However, in practice it is often difficult to find areas uniform enough, especially in southern Finland, and edge effects cannot be avoided. Heterogeneity within the census area does not limit the usefulness of the data for studying effects of habitat changes or annual population fluctuations. If the census area is a large habitat island with clear boundaries, its bird populations are somewhat more restricted

and small-scale dispersal does probably not have so much effect as in uniform habitats. It is also possible to divide a large mapping area into homogeneous subareas from the census maps to be used later in habitat analyses.

13. MONITORING OF FIELD AND WETLAND BIRDS. If a field or a wetland is smaller than one square kilometre, it is preferable to map all of it. In larger habitat islands the census area should cover at least 50 ha in fields and 100 ha in species-poor open mires, in order to get enough pairs for analysis. Forest birds of area borders and small wooded islands in fields and wetlands should also be included in censuses.

The census period is defined according to the breeding bird fauna. In southern Finland it is from about 5 May to 20 June and in northern Finland from 20 May to 30 June. Fewer mapping visits are needed than in forests: the minimum is 5–8 visits depending on the breeding species and habitat (see Sect. 4; fewer visits in fields and barren peat bogs than in eutrophic wetlands). The visits should be evenly distributed over the census period. Observing of birds should be started before entering the study area. Waders and other birds, especially those which gather from outside the study area to warn of the observer, should be recorded from further away.

14. MONITORING VALUABLE BIRD SITES AND VIRGIN REFERENCE AREAS. The mapping method is more suitable for monitoring valuable bird sites than the point count or line transect methods because of the small size of the study areas. Exact numbers of different bird species breeding at such sites are of great value for conservation (see the instructions for bird site register in Ch. 11 of this Manual). The census area should cover the whole bird site, at least if it is smaller than 30 ha (even areas as small as one hectare may be worth censusing). The census period and number of visits depend on the habitat and breeding species (see Sect. 4). Things that may have significance in protecting birds (trees with nesting holes, old deciduous trees, nests of raptors etc.) should be carefully marked on the habitat map. A mapping census, even if done only in one year, may help in preserving valuable bird sites. Of course, if the census is repeated annually, its value increases.

Various nature reserves and other areas in a natural or almost natural state are also valuable bird sites. Data from such areas can be used, for example, to study the influence of habitat preservation on bird populations, and be compared with results from human-altered habitats. Virgin areas are especially important as reference areas in integrated environmental monitoring organized by the environmental authorities in several European countries. In Finland the mapping censuses of breeding birds in 60 ha study plots serve as a part of extensive biological monitoring.

15. MAPPING THE TERRITORIES OF UNCOMMON SPECIES IN LARGE AREAS. Ordinary mapping areas are usually too small to include more than 1–2 pairs of a rare species per area. On the other hand, without several observers working as a group, the census area cannot be extended very much without jeopardizing the accuracy of the results. To obtain a larger data base for uncommon species one may, however, map large areas by concentrating only on these birds and excluding all other species from the census. Among uncommon species raptors, nocturnal singers and gallinaceous birds already have a special monitoring project of their own in Finland. These and other scarce species can be mapped by applying the following instructions:

The aim of mapping the less common species is to collect reliable data on their densities and to map the pairs and sites worth preserving.

The scale of the map for use should be between 1:5000 and 1:20 000. The observer should know the census area well enough to locate the potential breeding habitats of the species. The size of the area, density and detectability of the species and the desired accuracy of the census affect the time needed for field work. Mapping becomes much more effective if several observers participate.

The size and location of the census area should be defined so that there is enough space for several pairs of each species under study. In practice, the size of the area varies from a few to tens of square kilometres. The sample size (the number of pairs) increases if there is plenty of suitable habitat for the species. The generalizing of the census results becomes more difficult, however, if the habitat composition is not representative of the region. The census area should have clear boundaries; this way species

with high site fidelity are less likely to move outside the study area during successive breeding seasons. The total area should be divided into subareas small enough to be mapped in one morning.

Species censused may be chosen according to the interest and resources of the observer(s). Suitable groups are, for example, gallinaceous birds, Crane, rails, waders, doves, Cuckoo, woodpeckers and uncommon passerines (species with low densities or large territories: crows, nocturnal singers, Long-tailed Tit etc.).

The census period and efficiency depend on the species censused and the study area. The censuses should concentrate on the part of the breeding period when birds are easiest to observe, e.g. when they call in order to warn their young. However, the area should also be visited during the singing period in order to detect pairs unsuccessful in nesting. All potential nesting sites should be checked 5–10 times during the breeding season at a suitable time of day and during good weather. Playback of song or other lures increase the efficiency of the census.

The interpretation of observations as territories depends on the species: the number, type, time and minimum distance of the observations vary markedly. More detailed information is available from the Museum.

Mapping of uncommon species in large areas is a badly neglected field of research in Finland today. We hope that interest in this field will increase rapidly. In long-term population monitoring comparability of the results is the most important goal - not the "absolute" pair numbers which in practice can seldom be determined.

Return the Mapping Census Form, visit maps and species maps to the Museum before the end of August!

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ACTIVITY CODES OF MAPPING CENSUSES

$\textcircled{\text{Fcoe}}$ A Chaffinch in song

$\textcircled{\text{Fcoe}}$ A Chaffinch in song (exact location shown by the point)

$\textcircled{\text{Fcoe}}$ * A Chaffinch in song (location is not exact; the point where the observation was made shown by the cross)

Fcoe ♂ A male Chaffinch repeatedly giving alarm calls or other vocalisations (not song) thought to have strong territorial significance

Fcoe ♂ A male Chaffinch calling

Fcoe ♂, Fcoe ♀, Fcoe , Fcoe 2♂1♀, 3 Fcoe juv.

Chaffinch sight records, with age, sex or number of birds if appropriate. Use Fcoe ♂♀ to indicate one pair of Chaffinches, i.e. 2 Fcoe ♂♀ means two pairs together.

Fcoe ♂^f A male Chaffinch carrying food (or faeces)

Fcoe ♀^m A female Chaffinch carrying nest material

Fcoe *^{2E3N} An occupied nest of Chaffinch, with 2 eggs (E) and 3 nestlings (N), * shows the location. Do not mark unoccupied nests, which are not of territorial significance by themselves.

ρ maj \square ^{10E} Great Tit nesting in a specially provided site. Please remember to use this special symbol for a nest in a nest-box.

Fcoe *^p Chaffinch nest with a parent bird incubating or warming young.

Fcoe juv A Chaffinch fledgling

Fcoe fam Juvenile Chaffinches with parent(s) in attendance

Movements of birds can be indicated by an arrow using the following conventions:

Fcoe ♂[↑] A calling male Chaffinch flying over (seen only in flight)

Fcoe ♀
 Fcoe ♀[↓] A female Chaffinch moving between perches. The solid line indicates it was definitely the same bird.

Fcoe ♂[↑] A singing Chaffinch perched, then flying away (not seen to land)

Fcoe ♂[↑] A male Chaffinch flying in and landing (first seen in flight)

The following conventions indicate which registrations relate to different, and which to the same individual birds. Their proper use will be essential for the accurate assessment of clusters.



Two Chaffinches in song at the same time, i.e. definitely different birds. The hatched line indicates a simultaneous sighting/hearing of song and is of great value in separating territories.



The solid line indicates that the registrations definitely refer to the same bird.



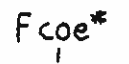
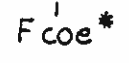


The question-marked solid line indicates that the sightings/songs probably relate to the same bird. This convention is of particular use when your census route brings you back past an area already covered – it is possible to mark new positions of (probably the same) birds recorded before, without risk of double-recording. If you record birds without using the question-marked solid line, over-estimation of territories will result.

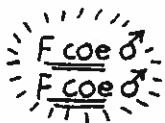




No line joining the registrations – there is no assumption as to whether the records concern different birds, but depending on the pattern of other registrations they may be treated as if only one bird was involved (a question-marked dotted line indicates that the sightings/songs were almost certainly of different birds).

Two Chaffinch nests occupied simultaneously, and thus belonging to different pairs. Only adjacent nests need to be marked in this way. Where they are marked without a line, it will be assumed that they were first and second broods, or a replacement nest following an earlier failure.



An aggressive encounter between two Chaffinches; may be accompanied by notes on vocalizations.

Unambiguous 2- or even 1-letter codes may be used for the most common species (e.g. Fc, Pt, Er, Ti, At etc.; write the meanings of the codes in the margins of each visit map).