BTO COMMON BIRDS CENSUS INSTRUCTIONS

Text: John Marchant

AN INTRODUCTION TO THE CBC

A frequent talking point among bird-watchers, particularly in summer, is the status of the various breeding species. Questions might be raised such as "*How badly were Wrens affected by the latest cold winter?" "Are there fewer Lesser Whitethroats breeding this year?" "Has there been a change in the relative status of Blackcap and Garden Warbler over the last decade?"*

The Common Birds Census provides a solid base for answering such questions using the BTO's network of active members. It was started in 1962, following pilot trials in the previous year, at the instigation of the Nature Conservancy (now Nature Conservancy Council). Its aim was to monitor bird population numbers chiefly on farmland, where the growing use of agricultural chemicals and the accelerating destruction of hedgerows were causing particular concern. Other habitats, notably woodland, were also included in the scheme (especially from 1964). The method is as objective as possible, which is essential for wide acceptance of the results. Fieldwork is carried out according to specified guidelines, minimum levels of effort are set down, and a paired sample technique is used by which results are only compared between seasons where the effort has been consistent (see below).

Birdwatchers everywhere found that Whitethroats had suddenly become scarce in 1969 : the CBC was able to estimate these decreases at 71% on farmland and 65% in woodland habitats. Drought in West Africa was later identified as the cause of the decrease.
Photo: Eric Hosking

In addition to monitoring, the CBC offers other information of particular value to local and national conservation. A by-product of the method we use is a set of maps showing the location of each territorial bird. These species maps can be used to estimate the density of the various species on the plot, for comparison between years or between plots, and provided that the habitat description is sufficiently detailed it is also possible to see how the birds are distributed in relation to different elements of the habitat.

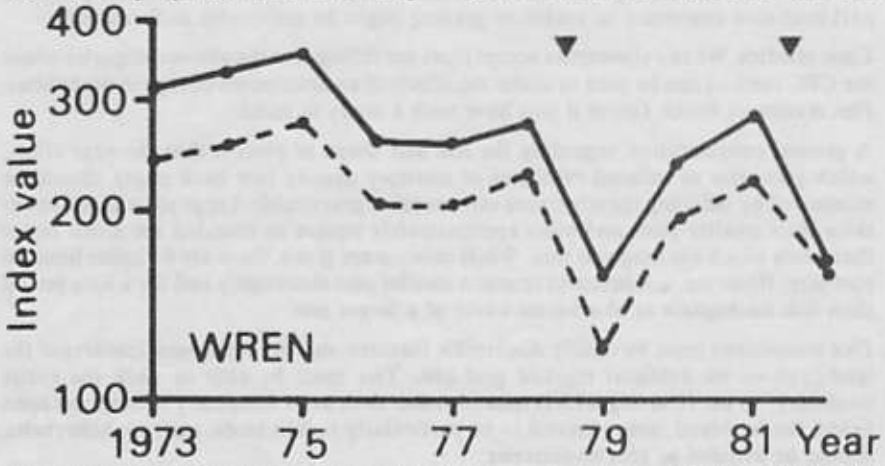
Where the habitat alters during the lifespan of a census, for example by removal of hedgerows on farmland or by a change in management in woodland, the effects of these alterations on bird populations can be measured by comparing the species maps before and after. The CBC can also be used to predict the likely effects of proposed management, by extrapolation from established case studies.

In 1982 the CBC scheme (and five of the original observers!) completed 21 years of continuous monitoring of populations. Current applications of the CBC data include study of the effects of changes in farming practice on birds, the effects of woodland management and the significance of the reductions in resident birds brought about by the recent severe winters. The NCC continues to fund the CBC and is the major user of the results.

INDEXING POPULATION LEVELS

The results of the CBC provide indices of population change for (currently) sixty bird species. Many of the indices have been running since 1962. The scheme is called the **Common** Birds Census simply because only species which are fairly numerous provide samples large enough to build a population index.

The index for any particular species is a measure of its change in abundance relative to an arbitrarily chosen 'datum-year', in which the index value was set at 100. It is not a measure of relative abundance between species. For most species 1966 is usually given as the datum year; thus an index of 620 for Stock Doves in 1982 means that the CBC data estimate it to be 6.2 times as common as a territory-holding bird as it was in 1966, but the fact that this was the highest index value in 1982 does not mean Stock Dove was our commonest bird in that year!



An example of a CBC index graph. The indices for Wren over ten years 1973-82 clearly show the impact of the two hard winters 1978/79 and 1981/82 (marked with triangles). The changes on farmland (solid line) are clearly parallelled in woodland (dotted line). Indices are given relative to 100 in 1966. Data are available from 1962.

Each index is updated annually by applying the total percentage change detected between the year in question and the previous year on the available sample of census plots. Only plots where coverage was adequate and comparable between the two seasons can be included in the sample. The territory totals for each species and plot are compared with those on the same plots in the previous year, to give paired estimates of the change between the two seasons. This pairing procedure ensures a robust method of indexing, but it does mean that **single-season censuses, and those lacking consistent coverage between seasons, cannot be used in the index calculations.**

THE METHODS OF THE COMMON BIRDS CENSUS

The basis of any method of monitoring bird numbers must be some standard way of counting birds which can be repeated exactly between breeding seasons over a long period of time. The CBC method is based on the **mapping method**, in which a series of thorough visits are made to all parts of a defined plot and **contacts** with birds (by sight or sound) are recorded on large-scale maps. The maps on which the contacts are registered in the field are referred to as the **visit maps**. At the end of the season, the registrations are copied across onto a separate map for each species (the **species map**) which summarises all the information obtained for that species during the season, and each species map is then analysed to estimate the number of territories found.

A special advantage of the mapping method is that maps are produced which show the approximate location of every territory detected. These maps can be compared in detail between years to show the preferred sites of each species in relation to the habitat, and any effects of habitat change. Where species maps are not needed to answer the questions posed in a particular study, simpler and less time-consuming methods are available, such as those involving point counts or transects, but only the mapping method as described here can be used in the Common Birds Census.

The visit map is clipped to a board and carried around the plot. Binoculars are essential for finding birds and locating them accurately.

Marking a registration on the visit map. Brightly-coloured ballpoints are best, so that the entries stand out well from the background.

Photos: Jane Marchant

Who can help?

For effective monitoring on farmland and in broad-leaved woodland, a total of about 250 plots is required, half in each habitat category, scattered throughout the UK. New contributions meeting the following criteria are welcome:

1. **Observers must be competent to identify readily both by sight and by sound all species likely to occur, and fit enough physically to cover all parts of the chosen plot without excessive fatigue.**
2. **Unless it is a specially approved case study the chosen plot must be representative of the farmland or woodland in the surrounding region, and must meet all the other requirements specified below under "Selecting a plot".**
3. **The fieldwork procedure must be in full accordance with these Instructions.**
4. **The observer must intend at least two consecutive seasons' work on the same plot, employing the same thorough fieldwork effort, so that the results can be used towards the calculation of population indices. This applies even where an already-established plot is being taken over from another observer.**

Considerable commitment is demanded of the observer both for fieldwork and the subsequent paperwork, but most observers find census work very enjoyable. It is most rewarding to gain both the intimate knowledge of a particular area that a census gives and the satisfaction of contributing to conservation nationally; most observers also find their results are of local value for conservation or simply for the county bird report.

If in doubt about the value of your potential contribution, or if you have any other queries relating to the Common Birds Census, please write to:-

Common Birds Census, Populations Section, British Trust for Ornithology,
The Nunnery
Nunnery Place
Thetford
Norfolk IP24 2PU

Thetford (0842) 750050
Thetford (0842) 750030

HOW TO START

To ensure the best use of resources for map analysis and research at Beech Grove, only those plots which can be classified as either 'farmland' or 'semi-natural woodland' can be accepted as new plots for monitoring purposes.

Farmland can be any type of arable, horticultural or grazing land except unenclosed sheepwalk, provided that it is more or less typical of the local countryside. Where small woods and copses occur among fields, they should be treated as part of a farmland plot, but the proportion of woodland included should be typical of that in the surrounding area and in any case should be less than 10% of the plot. **Please aim for at least 60 hectares (150 acres):** plots smaller than 40 hectares (100 acres) cannot be accepted.

Woodland includes all kinds of semi-natural broad-leaved and mixed woodland but excludes parkland, scrubby heathland and even-aged plantations of conifers. As far as possible, plots should be typical of woods (other than conifer plantations) in the area. **At least 10 hectares (25 acres) are needed.** 'Parkland,' for which no new plots can be accepted, is itself a vague term; it is meant to encompass all sorts of open land with scattered trees which cannot be described as semi-natural because it has a *use* aside from its value as woodland (eg. town parks, cemeteries, golf courses). (Ancient ornamental parkland now converted to arable or grazing might be acceptable as farmland.)

Case studies. We can sometimes accept plots not falling into the above categories where the CBC method can be used to assess the effects of an anticipated change in the habitat. Please contact Beech Grove if you have such a study in mind.

A general consideration regarding the size and shape of plots is that the edge effect, which gives rise to inflated estimates of territory density (see back page), should be minimised by reducing the edge: area ratio as far as practicable. Large plots have a lower ratio than smaller plots and plots approximately square or rounded are much better than plots which are long and thin. While minima are given, there are no upper limits to plot-size. However, it is better to census a smaller plot thoroughly and for a long period than risk inadequate or short-term cover of a larger one.

Plot boundaries must be clearly discernible features, such as permanent features of the landscape or an artificial marked grid-line. You must be able to walk the entire boundary, so use field edges on farmland rather than draw imaginary lines across open fields. On farmland, areas known to be particularly rich in birds, such as shelterbelts, should be avoided as plot boundaries.

In all cases, you must ensure that you have the permission of the landowner(s) or tenant(s) to carry out a census and to visit every part of the proposed area. Special permission must be sought if the plot needs any gridding (see opposite).

Obtaining maps

Once you have chosen provisional boundaries, send to Beech Grove a tracing from the relevant Ordnance Survey map, preferably at the 25 inches to the mile scale (1: 2500). The local library will often have them. If you are unable to obtain the 25 inch maps, send us a tracing from a smaller-scale map and we will order the full-scale maps from the Ordnance Survey. (Plots which you have surveyed and gridded need not be traced from the O.S. map, but please be sure to use 1:2500 scale.)

The final tracing of the plot should show not only the plot boundaries copied from the 1:2500 map but also sufficient internal detail to enable accurate plotting and transcription of registrations. This would include tracks, buildings, hedges, isolated trees (mark with a cross), grid lines if present, and perhaps other features such as telegraph poles (mark with a dot) and tree-stumps where detail is otherwise sparse. Too much detail may however mean that registrations have to be plotted aside from their true positions, thus decreasing the accuracy of the plotting, and may conceal the registrations. Unless you can provide your own outline maps for the census (normally 25–30 maps a year) we will prepare and keep the master-tracing and send you a supply of blank maps at the start of each season. **If you run short of maps during the season, please ask for more rather than economise on visits or overcrowd the species maps.**

The process of obtaining maps may initially take as long as six weeks if we need to order from the Ordnance Survey. It is therefore a good idea to begin as far in advance of the proposed first visit as is possible, and in any case by the end of February so that fieldwork can begin not later than mid-April.

Probationary Period

Censusing is a skill for which some potential observers are better suited than others. Please regard your first two years of census work as a 'probationary period' during which you can improve your census skills. After this time we will be able to continue analysing your maps only if they are comparable with those of other contributors. Most observers will have no difficulty achieving the required standard. From time to time we will be staging weekend courses on census methods both for novices and as 'finishing schools' for observers who already have some censusing experience.

GRIDDING A WOODLAND PLOT

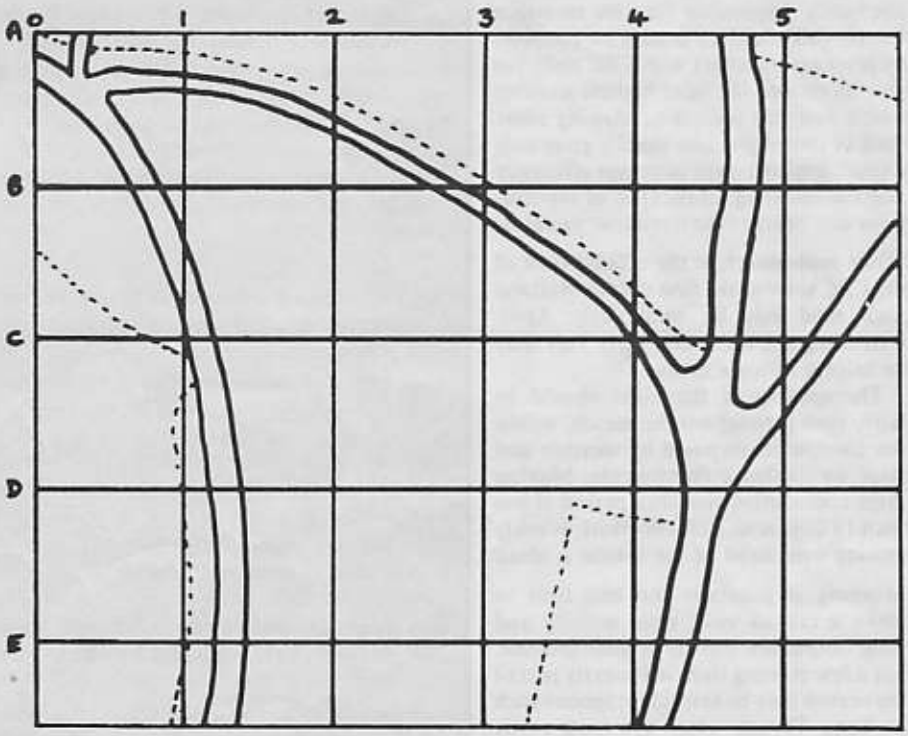
Census work in woodland requires special care. The habitat often appears fairly uniform and visibility, especially in the height of summer, tends to be restricted by the lower canopy or shrub layer; it becomes very difficult for the observer to know his own position, let alone those of the birds! Particularly for species with small territories, inaccurate plotting may lead to over-estimation of territory numbers. The solution to the problem is to locate a number of features, widely scattered, which are easily recognisable as you walk around the plot, and to mark them on the master-tracing. These can be used as reference points when censusing and when compiling species maps. However, if after marking all tracks, paths and other accurately located features some parts of the plot remain empty of reference points, some **gridding** will be necessary.

In its simplest form gridding involves only the addition to the master-tracing (copied from the 25" Ordnance Survey) of a few accurately surveyed points. For example, if there are insufficient natural features along a particular path (already on the master-map) to enable you to judge your position accurately, a simple line of markers at 50 metre intervals may suffice. A 30 or 50 metre tape-measure and a supply of marking tape are all the equipment required for the fieldwork. Each marker must be semi-permanent and easily visible : two-inch wide fluorescent orange tape is ideal. It is necessary to label each one individually (best done using a broad-tipped black waterproof pen) and to enter the location and label of the marker on the master-map.

Compass-line gridding is needed when large areas of the master-map are devoid of features, and (in the extreme case) when no Ordnance Survey map is available. The first step is to choose a base-line, normally along part of the plot boundary but along an internal ride if no other straight lines are available. This is marked at 50 metre intervals, and then grid-lines are set up at right angles until the required area is completely covered by a 50-metre grid. An accurate sighting-compass is required. Grid-lines parallel to the base-line can be labelled alphabetically, and those at right angles with numbers, so that each grid-point has a logical and unique label (**A1, A2, A3; A1, B1, C1**, etc).

This sort of gridding is best accomplished by a team of three people, each of whom carries a lightweight surveying pole (a stick marked with fluorescent tape); the three poles can be used to carry a straight line forward through the woodland quite accurately without constant recourse to compass-bearings. Gridding should ideally be tackled in the winter, when visibility inside the wood is at its greatest.

Further advice can be sought from Beech Grove. In all cases where gridding is needed, it is necessary to seek special permission from the landowner even though access to the plot may already have been obtained.



Part of an outline map for a woodland plot with a full 50 metre grid, reproduced at the standard 1:2500 scale. Grid-points are marked A1, B2, C3, C4, etc. The observer can follow the grid-lines, using a compass if necessary, so that he always knows his position on the map.

IN THE FIELD

The mapping visit

The basis of the CBC fieldwork is the **mapping visit**, involving full coverage to all parts of the plot. Normally each visit should be completed within a period of a few hours; *partial visits are to be avoided if at all possible.*

Carry an outline of the plot (the visit map) attached to a clipboard or suitably-sized piece of hardboard using a bulldog clip or elastic bands. Use a brightly-coloured pen: BTO staff find that fine-pointed red ballpoints are ideal. Do not use ink which runs when wet. Always write as small and as neatly as possible.

You will need your binoculars, but no other equipment. You must not use tape-recorded calls to elicit playback responses from the birds.

When to visit

The number of territories you find will depend to some extent on the number of visits you make. **It is therefore essential that the number of visits is the same – plus or minus one at the most – from year to year, so that any changes detected are not simply due to the change in effort.**

The standard now adopted for the CBC is **10 complete mapping visits** during the census season, mid-March to late June. This is sufficient for detection of a high proportion of the real territories present (the proportion depending on your own characteristics as a birdwatcher). If it is absolutely impossible for you to attain the 10-visit standard it may be possible, by prior arrangement with CBC staff, for you to choose the next highest number which you can maintain. Making more than 10 thorough visits usually gives only a small improvement in census efficiency and the resulting abundance of registrations can obscure the territorial patterns.

While mid-March is the official start of the CBC season, the first visit to Midland sites need not be until early April. Extending the visits into early July may be helpful in some areas.

The spacing of the visits should be fairly even throughout the season, within the constraints imposed by weather and your own other commitments. Making three consecutive visits in a period of less than 10 days is wasteful of effort. Weekly visiting over most of the season is ideal.

Morning is generally the best time to make a census visit, since activity and song output are usually at their greatest, but a few evening visits in the early part of the season may be helpful for species such as Song Thrush which are most easily detected then. A combination of 8 morning visits and 2 evening visits is probably the ideal for most plots; the evening visits should not be consecutive. Do not persist with evening visits if you find them unproductive. Avoid the early afternoon, when bird activity is low, and avoid also the dawn chorus when bird detectability may change rapidly during the course of your visit and lead to uneven cover. In British conditions, bird activity on farmland and in woodland remains at a moderately high level until about noon. For a three-hour census visit (about the average) it is best therefore to start either **before 9 a.m. or after 5 p.m.**

Cold, windy or wet days are to be avoided since the activity and detectability of the birds are much reduced. Showery days make acceptable census weather, since birds are often quite active after each shower; it is important to protect the visit map as much as possible from the rain, and to carry a pencil since ballpoint pens do not work when wet. On particularly fine days an early start is recommended since bird activity may tail off somewhat earlier than expected. **Please do not allow persistently bad weather during a season to prevent you from carrying out your full complement of visits.** It is better to make a relatively inefficient visit, perhaps on a windy or showery day, than to miss a visit entirely. Ending the season short of visits is likely to jeopardise the comparability of your results.

. . . . . *unacceptable census weather!*
Photo: Kenneth Taylor

SPECIAL PROCEDURES

Partial visits

Normally, a full mapping visit covering all parts of the plot should be carried out during a single outing. If this is not possible, it can be composed of two or more **partial visits**. Partial visits should **only** be used in the following circumstances:-

(a) where a full visit was rained off before completion, to complete the coverage of that visit. (Alternatively, it may be better to make a new start.)

(b) to record extra observations, made outside full visits, for species otherwise poorly recorded, for example any Tawny Owls or Woodcock seen or heard on a special short visit at dusk. Casual registrations for common species are not required. Remember that, if you are making special visits for crepuscular species, you must do so every year if your effort is to be comparable.

(c) where a non-standard procedure for regular partial visits, for example in a group census (see below), has been specially approved by CBC staff.

In every case, it is essential that **each partial visit is given a different visit letter** so that the registrations made on each partial visit can be readily distinguished on the species map. Suffixes are the best way of doing this; for example if the third visit was composed of four partial visits they could be labelled C_1, C_2, C_3, and C_4 – they must not be lumped under **C**. It must always be clear which visit map registrations belong to each visit letter. Use different coloured ballpoints for each partial visit, or if necessary different outline maps.

Group censuses

A group census is one where a large plot is divided into sub-plots and covered by a team of observers; each full visit to a sub-plot is effectively a partial visit to the full plot. Partial visit letters must be used.

Regular use of partial visits, as in a group census, has two important drawbacks. Firstly, coverage of the plot is necessarily uneven; the internal boundaries between sub-plots will tend to receive up to twice the cover given to other parts of the plot. Secondly, if the observers stick to the same sub-plots, real differences in bird density between different parts of the plot will be obscured by the differences in censusing efficiency between the observers. These drawbacks do not affect the value of the results for assessing population change between years, but may bias the investigation of territory distribution in relation to habitat.

To minimise these biases:-

(a) please be sure to make 10 full visits, so that all parts of the plot are well-covered, and

(b) please try to set up a rota by which each sub-plot is visited by different observers in turn.

Where full visits to a plot are shared between several observers, the number of visits made by each should be the same (plus or minus one at the most) from year to year. If the team is of 3 or more and some turnover of observers is likely, please ensure that no observer makes more than half the visits.

Fieldwork procedure

The aim of your visit is to mark on the map the location and movements of every bird present or flying over during the visit, but to **record each individual once only**. The symbols section and the example maps show how this can be done. Since birds are small, difficult to see, and fast-moving relative to the observer, some inadvertent double-recording is bound to occur: the procedure for assessing the final total of clusters (usually performed by BTO staff) makes allowance for this. **If however individual birds are persistently plotted more than once the final total of territories will be an over-estimate.**

It is essential when registering birds on the visit map that the standard codes are used for species and activities. This will ensure that the maps can be readily understood at Beech Grove. The full list of codes and symbols is given overleaf. **Please take special note of the section describing dotted and solid lines between registrations**, since proper use of these symbols is essential for easy and accurate analysis of your maps.

As you enter the plot, record the date and your starting time. On completion, note your finishing time – we use your total time spent censusing as a measure of consistency in effort between years. Make a brief note of the weather (e.g. "fine, sunny, NW3", where NW3 indicates the wind direction and force, or "cool, showery, cloud ⅜, SW2") and the extent of your coverage during the visit.

Farmland plots: special hints on coverage

About 3–4 hours are required for thorough coverage of the average farmland plot (70 hectares). Progress can be quite fast, since the number of birds detectable from any one point is usually rather limited, but the route should take the observer at least once along every major internal hedgerow as well as completely around the perimeter of the plot. Accurate placing of the registrations on the map is normally made easy by the network of field boundaries.

Take care not to damage crops and hedgerows. If there is no path next to a hedge that must be walked, the best alternative is the first set of tractor wheel-tracks (tramlines), usually about 5m. from the hedge. Only where the fields are unusually large (greater than 25 hectares) might it be necessary for you to stray further from the field edge, and for this you should seek special permission.

Most farmland plots are an intricate patchwork of fields and hedgerows.
Photo: Kenneth Taylor

Frequent use of binoculars is essential for an efficient census on farmland, since typically most of the birds in view will be some distance away. Sequential movements of individual birds should be recorded carefully: the point beyond which a bird cannot be driven along a hedge is likely to correspond closely to the edge of its territory.

Coverage should be as even as possible, but more time should be allowed for areas where bird density is higher. The direction and, if possible, starting point of the route should be varied between visits.

Woodland plots: special hints

A thorough visit to the average woodland plot (20 hectares) should take about 3–4 hours. A route should be followed which takes you to within 50 metres of every part of the plot at least once during the visit; the direction and, if possible, starting point of the route should be varied between visits to improve the evenness of cover. As on farmland, **even cover of the whole plot is essential**. In particularly dense woodland, a compass may be helpful to enable the observer to follow a marked grid-line or to cross a block of woodland between marked paths. Progress should be quite slow and careful so that there is time to register all the birds seen or heard, and so as to disturb the birds as little as possible. The majority of contacts in woodland will be by sound; practice will help you estimate the positions of birds you can hear but not see. If unsure of how far a singing bird is away from you, try the method of triangulation – walk twenty metres or so and estimate its direction from another point.

In contrast to the situation on farmland, where you are more or less restricted to the field-edges, you can wander anywhere within a woodland plot during the course of a visit. It is well worth using this freedom on occasion to follow distant noises of particular interest to ensure that the birds in question are recorded accurately on the map. Examples might be a tapping noise (a Nuthatch, one of the spotted woodpeckers, or just a Great Tit?), a Chaffinch singing against the one you have just recorded (it will be important to plot this valuable registration accurately) or your first record of a Golden Oriole! Where you have deviated from your planned route, however, it is important to reassess carefully the route for the rest of the visit so that all parts of the plot are covered evenly.

SOME STATISTICS

At the 25" (1:2500) scale: one centimetre represents 25 metres, one inch represents about 70 yards, an acre is represented very accurately by one square inch, and one hectare (a square with sides of 100 metres) is represented by 16 square centimetres (or four 50-metre grid-squares). These Instructions, closed and laid across your census map, would cover about 39 hectares (or 96 acres).

What to record . . . .

All species seen or heard during visits are relevant to the census and every bird should be recorded on the visit and species maps, with the following specific exceptions:-

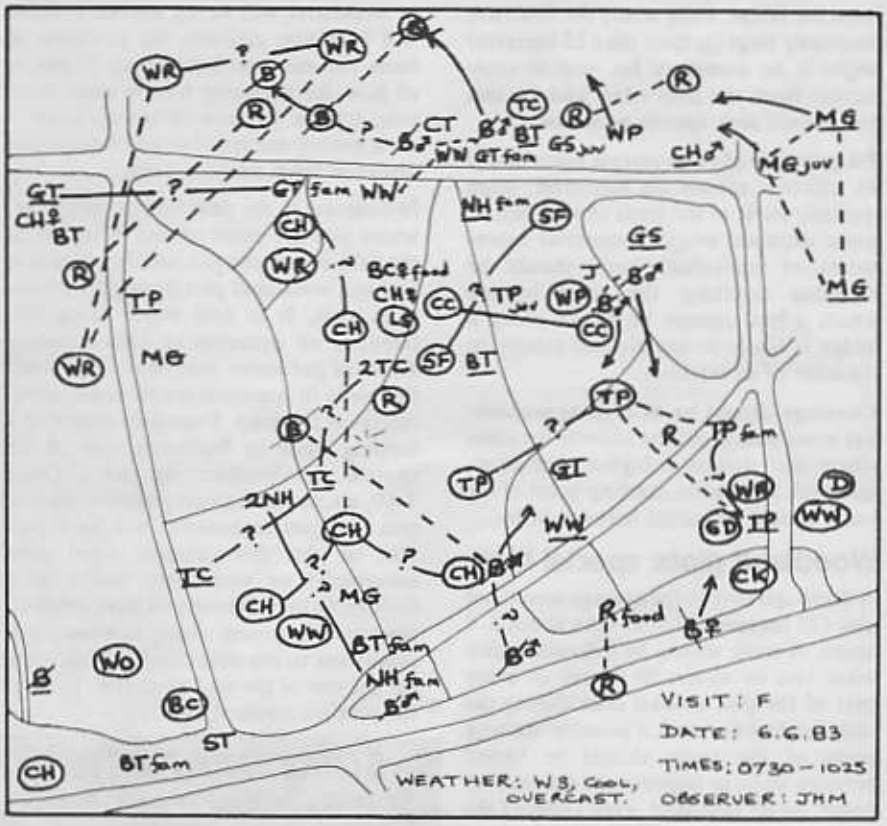
(1) Grey Heron, Rook, Sand Martin, Feral Pigeon and all gulls and terns. If nesting, please give a count or estimate of active nests and record them on the maps. No other registrations are needed. If present but not nesting, just note their presence at the edge of each relevant visit map.

(2) Woodpigeon, Swift, Swallow, House Martin, Magpie, Jackdaw, Carrion Crow, House Sparrow and Starling. These species are best censused by a nest-count on most plots. Please make special efforts to locate as many nests as possible of these birds. If you are confident that you are recording nearly all the active nests, you may omit all other registrations if you wish, as for species listed under (1), but please make it clear that you are doing so. Normally, however, the assessment will be made using a combination of nests and other registrations. Observations of song and display, for example in Woodpigeon and Starling, will be of particular value. For Magpie and Carrion Crow, special attention should be paid to looking for active nests on the early visits, before they become concealed by too much foliage.

(3) Fieldfare, Redwing, Brambling and other common winter visitors seen only on the early visits will usually be ignored by the analyst. However, any of these species, or any unexpected spring migrant, might be recorded on later visits and perhaps qualify as a territory-holder (even though out of normal range and probably unmated); it is best to plot everything and allow us to discard what turns out to be irrelevant at the end of the census.

Birds just outside the plot boundary should be plotted since this extra information is essential for defining the full extent of the territories which straddle the boundary. Remember that such birds may be found within the boundaries on later visits. Simultaneous registrations (dotted lines) are, as always, especially valuable. It is important to be consistent between seasons in the extent to which you record birds outside the boundaries.

Intensive nest-searching is not recommended. It is exceedingly time-consuming to find enough nests to make a significant contribution to the census results. Additionally, it is



Part of a completed visit map for a woodland census, reproduced at the 1 : 2500 scale as used in the field. It was a productive visit and all parts of the map are crowded with registrations. The dotted lines will be particularly helpful in the later analysis of territories. Blackbird registrations have already been copied to the species map and cancelled with a light stroke of the pen.

important (but very difficult in practice) to standardise nest-finding effort between years. However, please record all active nests you find during normal census work, using dotted lines where appropriate to denote nests of different pairs. Do not spend time nest-searching to the detriment of mapping the birds, except for those species (Rook, Sand Martin, Magpie, Carrion Crow, etc.) for which nest counts are particularly important. Remember to distinguish between natural sites and nestboxes. Submit nest record cards separately. As with all nest-finding, it is essential to keep disturbance to a minimum. Finally, do not change your nest-finding effort on the plot between seasons to an extent which may affect the results.

COMPILING THE SPECIES MAPS

This is normally a job for the late summer, in the weeks following the fieldwork, but it can be done concurrently with the fieldwork if you prefer. Compilation of species maps cannot be undertaken by BTO staff.

Check that you have given each visit a **visit letter**. These should start with A and typically run through to K (omitting I) for a ten-visit census. Suffixes should be added to the visit letters to distinguish any partial visits. Select each species in turn, and copy neatly all registrations of the chosen species from the visit maps onto a fresh outline map. As you transfer them **substitute** the visit letter for the species code (so that, for example, **CH** on visit G becomes **G** on the Chaffinch species map) and **cancel** the visit map registration with a light stroke of your pen. **It is essential to cancel the registrations, so that the visit maps can later be checked for any registrations missed. All registrations must be transferred to the species maps: do not let your information be wasted by leaving it on the visit maps.** Copy all conventions (arrows, dotted lines, etc.) exactly as they appear on the visit maps. The single exception here is when a nest is recorded on more than one visit: the asterisk for any one nest should appear only once on the species map, with the appropriate visit letters listed beside it. Some slight displacement of the registrations may occasionally be necessary, for example where a bird repeatedly uses the same songpost, but plot them as close as possible to the original spot.

Brightly-coloured pens are best for species maps, so soluble pens which fade quickly in sunlight and m different colours, several species can be combined o based in different parts of the plot: for example on might make a good combination. Take care not to results of 10 visits appear on roughly 15–18 specie

Once the species maps are complete, please double-c will almost certainly find some! If you wish, you ma species, following the guidelines given below. This w several species on a sheet please use **only a soft lead** to make any necessary amendments. An example s

SPECIES AN

This standard list of conventions is designed fo necessary. Additional activities of territorial signi clear abbreviation.

CH, CH♂, CH♀ 3CH juvs, CH2♂1♀	Chaffinch sight reco one pair of Chaffin
R fam	Juvenile Robins wit
R	A calling Robin
R	A Robin repeatedly territorial significan
(R)	A Robin in song.
R R	An aggressive encou
* R	An **occupied** nest o significance by them
BT	Blue Tits nesting in nest in a nestbox.
* PW on	Pied Wagtail nest w
PW mat	Pied Wagtail carryi
PW food	Pied Wagtail carryi

Movements of birds can be indicated by an arro

GR →	A calling Greenfinc
(D) →	A singing Dunnock
→ B♂	A male Blackbird fl
WR → WR	A Wren moving be

The following conventions indicate which registra **proper use will be essential for the accurate asses**

(WR) - - - (WR)	Two Wrens in song **simultaneous regist** territories.
* - - - - - * LI LI	Two Linnet nests another example of
(CK) — (CK)	The solid line indica
(SD) — ? — (SD)	The question-marke bird. This conventio already covered – it before, **without risk** marked solid line, **o**
(WR) WR mat	No line joining the r depending on the p involved. (You ma registrations were al
C* C*	Where adjacent nest and second broods,

Please use the following abbreviations of species n the list, use a longer (unambiguous) abbreviation. the Waterways Bird Survey and Winter Atlas; yo

that the registrations stand out well from the background. Avoid water-
ıy tend to spread. Fine-pointed ball-pens are recommended. By using
ı a single map. Try to combine species of differing abundance and those
farmland, Skylark (a field species) and Dunnock (chiefly in hedgerows)
overcrowd the maps. Good economy of materials is achieved where the
ı sheets.

heck the visit maps for registrations missed. Experience shows that you
y then make a provisional estimate of the number of territories for each
ill be very useful to us when we finalise the analysis. Even when there are
pencil for your provisional analysis, so that it is easy for the BTO analysts
pecies map is shown overleaf.

ID ACTIVITY CODES

r clear and unambiguous recording. Symbols can be combined where
icance, such as display or mating, should be noted using an appropriate

ds, with age, sex or number of birds if appropriate. Use CH♀ to indicate
hes, so that 2CH♀ means two pairs together.

h parent(s) in attendance.

giving alarm calls or other vocalisations (not song) thought to have strong
e.

nter between two Robins.

f Robins. Do not mark unoccupied nests, which are not of territorial
selves.

ı specially provided site. Please remember to use this special symbol for a

ith an adult sitting.

ıg nest material.

ıg food.

v using the following conventions:

ı flying over (seen only in flight)

perched then flying away (not seen to land).

ying in and landing (first seen in flight).

veen two perches. The solid line indicates it was **definitely the same bird**.

itions relate to different, and which to the same individual birds. **Their**
sment of clusters at Beech Grove.

at the same time, i.e. **definitely different** birds. The dotted line indicates a
ation (or contemporary contact) and is of very great value in separating

ccupied simultaneously, and thus belonging to different pairs. This is
ıe value of dotted lines. Only adjacent nests need to be marked in this way.

tes that the registrations definitely refer to the same bird.

d solid line indicates that the registrations relate to **probably the same**
ı is of particular use when your census route brings you back past an area
is possible to mark new positions of (probably the same) birds recorded
of double-recording. If you record birds without using the question-
ver-estimation of territories will result.

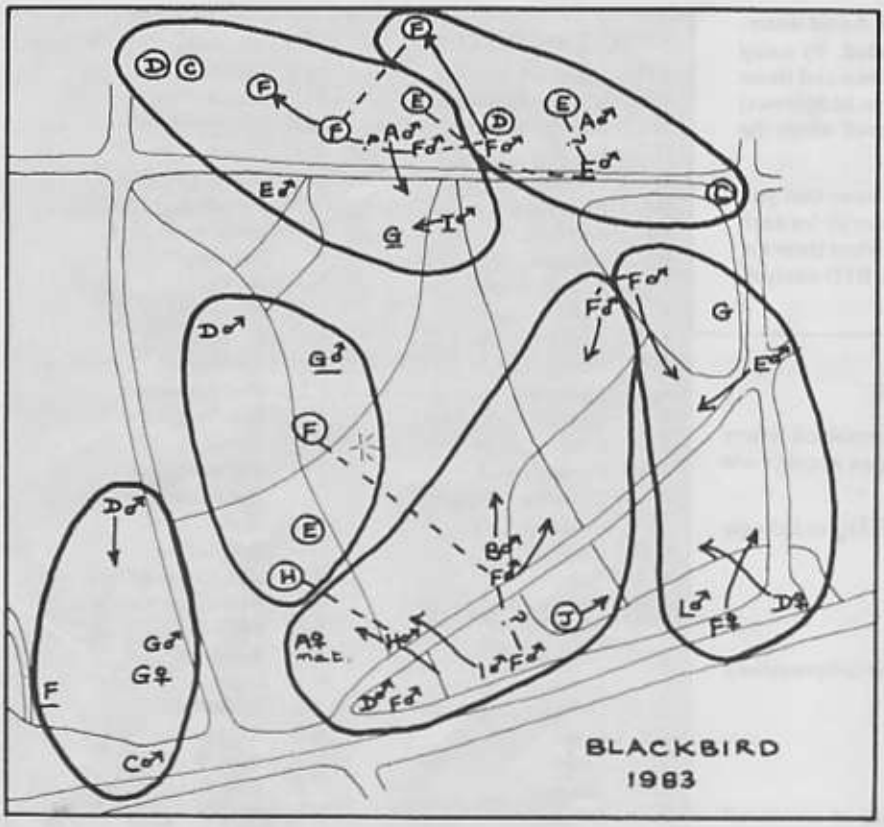
egistrations – it will be assumed that the birds are **probably** different, but
ittern of other registrations they may be treated as if only one bird was
if you wish use a question-marked dotted line, indicating that the
most certainly of different birds.)

s are marked without a line, it will often be assumed that they were first
or a replacement nest following an earlier failure."

imes. If uncertain of the correct code, or if you encounter a species not on
These codes are the same as those used for other BTO schemes including
u may also find them helpful in other birdwatching studies.

SPECIES CODES:

BO	Barn Owl	MN	Mandarin
BH	Black-headed Gull	MT	Marsh Tit
B	Blackbird	MW	Marsh Warbler
BC	Blackcap	MP	Meadow Pipit
BT	Blue Tit	ML	Merlin
BL	Brambling	M	Mistle Thrush
BF	Bullfinch	MH	Moorhen
BZ	Buzzard	MS	Mute Swan
CG	Canada Goose	N	Nightingale
C	Carrion Crow	NJ	Nightjar
CW	Cetti's Warbler	NH	Nuthatch
CH	Chaffinch	OC	Oystercatcher
CC	Chiffchaff	PH	Pheasant
CT	Coal Tit	PF	Pied Flycatcher
CD	Collared Dove	PW	Pied Wagtail
CM	Common Gull	PT	Pintail
CS	Common Sandpiper	PO	Pochard
CN	Common Tern	Q	Quail
CO	Coot	RN	Raven
CA	Cormorant	RG	Red Grouse
CB	Corn Bunting	RM	Red-breasted Merganser
CR	Crossbill	RL	Red-legged Partridge
CK	Cuckoo	LR	Redpoll
CU	Curlew	RK	Redshank
DW	Dartford Warbler	RT	Redstart
DI	Dipper	RE	Redwing
DN	Dunlin	RB	Reed Bunting
D	Dunnock	RW	Reed Warbler
E	Eider	RZ	Ring Ousel
FP	Feral Pigeon	RI	Ring-necked Parakeet
FF	Fieldfare	RP	Ringed Plover
FC	Firecrest	R	Robin
GW	Garden Warbler	RC	Rock Pipit
GC	Goldcrest	RO	Rook
GF	Golden Pheasant	RY	Ruddy Duck
GP	Golden Plover	SM	Sand Martin
GN	Goldeneye	SW	Sedge Warbler
GO	Goldfinch	SU	Shelduck
GD	Goosander	SE	Short-eared Owl
GH	Grasshopper Warbler	SV	Shoveler
GB	Great Black-backed Gull	SK	Siskin
GG	Great Crested Grebe	S	Skylark
GS	Great Spotted Woodpecker	SN	Snipe
GT	Great Tit	ST	Song Thrush
GE	Green Sandpiper	SH	Sparrowhawk
G	Green Woodpecker	SF	Spotted Flycatcher
GR	Greenfinch	SG	Starling
GK	Greenshank	SD	Stock Dove
H	Grey Heron	SC	Stonechat
P	Grey Partridge	SL	Swallow
GL	Grey Wagtail	SI	Swift
HF	Hawfinch	TO	Tawny Owl
HH	Hen Harrier	T	Teal
HG	Herring Gull	TP	Tree Pipit
HM	House Martin	TS	Tree Sparrow
HS	House Sparrow	TC	Treecreeper
JD	Jackdaw	TU	Tufted Duck
J	Jay	TD	Turtle Dove
K	Kestrel	TW	Twite
KF	Kingfisher	WA	Water Rail
L	Lapwing	W	Wheatear
LB	Lesser Black-backed Gull	WC	Whinchat
LS	Lesser Spotted Woodpecker	WH	Whitethroat
LW	Lesser Whitethroat	WN	Wigeon
LI	Linnet	WT	Willow Tit
LG	Little Grebe	WW	Willow Warbler
LO	Little Owl	WO	Wood Warbler
LP	Little Ringed Plover	WK	Woodcock
LE	Long-eared Owl	WL	Woodlark
LT	Long-tailed Tit	WP	Woodpigeon
MG	Magpie	WR	Wren
MA	Mallard	YW	Yellow Wagtail
		Y	Yellowhammer



This is the Blackbird species map from the same census as the example visit map on page 6. On transfer to the species map the B for Blackbird has been replaced in every case by the visit letter F, but the symbols indicating sex, song and movements have not been changed. The map has already been analysed, and six territories found on this portion of the plot, although two of these lie mostly beyond the northern boundary.

HABITAT DESCRIPTION

Information on the nature of the habitat is an essential complement to the data you supply on the numbers and distribution of the territorial birds on your plot. It enables us to assess how representative is our index (by comparing the habitat of our plots with that of farmland or woodland as a whole), to compare the birds on plots of differing habitat and, most importantly perhaps, to measure the effects on birds of specified changes in the environment.

If the habitat of your plot is subjected to major change, subsequent census results may form the basis of a detailed case study. **We are likely to welcome the continuation of a census following such a change, even where the changed area is substantially less attractive for birds**, but please check with us first to ensure that the results will be worthwhile.

The following items are needed annually to accompany each completed census sent to Beech Grove:-

(a) **a habitat map.** A full habitat map is essential in the first year but in subsequent years it is necessary only to show changes from the previous year's map, and any special information which is relevant to that year (including field-use on farmland plots). Details on compiling habitat maps are given below.

(b) **a completed habitat questionnaire.** Each observer will be sent a questionnaire before the start of the season, to be completed as fully as possible and returned with the maps. The content of the questionnaire may vary from year to year but for farmland will include field-use (cropping, management, farm chemicals used, etc), hedgerow management and other detailed aspects of habitat change. If there has been no change on the plot, whether farmland or woodland, this will be your opportunity to say so.

In addition, photographs of the plot are very helpful to the analyst, since they give an accurate impression of the habitat; they must be regarded as a complement to the habitat maps and questionnaires, **not a substitute**. Colour slides are particularly welcome. Please enclose with them a map showing the points from which the photographs were taken, and a note of the date.

Farmland habitat maps

In your first season, and in any subsequent season if you wish, please complete a **full habitat map**. This should be on one of the outline maps sent to you for the census and should describe the permanent skeleton of the plot – including any hedges, fences, ditches, tracks and lanes, farmsteads, gardens, scrub, copses, permanent pasture, streams and standing water – together with a note of the field use in that season. Conventions are to mark hedgerows and wooded areas in green, and any streams or standing water in blue. Mapping should extend for 50–100 metres beyond the plot boundaries. The following details should be given:-

(a) **the plot boundaries, clearly marked.**
(b) **contours, copied from the 6" or 2½" O.S. maps.**
(c) **a six-figure grid reference for a point near the centre of the plot.**
(d) **a description of each copse or block of woodland (see woodland section opposite).**
(e) **the structure of each hedge in terms of height, width, shape, main species of hedgerow shrubs and species and height of standard trees. The positions of standard trees should be marked with a cross.**
(f) **position of any nestboxes.**
(g) **any other details you think may affect the distribution of birds on your plot.**

Estimate hedge width at the height at which the width is greatest; for hedges not recently trimmed it may be necessary to give ranges for height and width rather than single values.

A full habitat map will be welcome in any subsequent year of the census, and would be particularly useful following a period of habitat change, but the only requirement following the initial year is for a **'crops and changes'** map. This should show:-

(a) **any changes in the habitat since the map for the preceding year**, e.g. hedgerow losses, streams which have been dredged,
(b) **the cropping or field-use,**
(c) **the hedgerows present in that year, marked with a green line**, and
(d) **the period of the season for which any standing water was present.**

The 'crops and changes' map can be used to illustrate points you mention in your answers on the annual questionnaire. Please remember that unless you inform us of changes we might assume that the information on your previous habitat map is correct, so it is very important to **keep up to date with recording habitat change**.

Habitat information is best collected during the course of normal visits, but make a special visit if you wish. Notes made on the visit maps should be cancelled as they are copied to the habitat map.

Woodland habitat maps

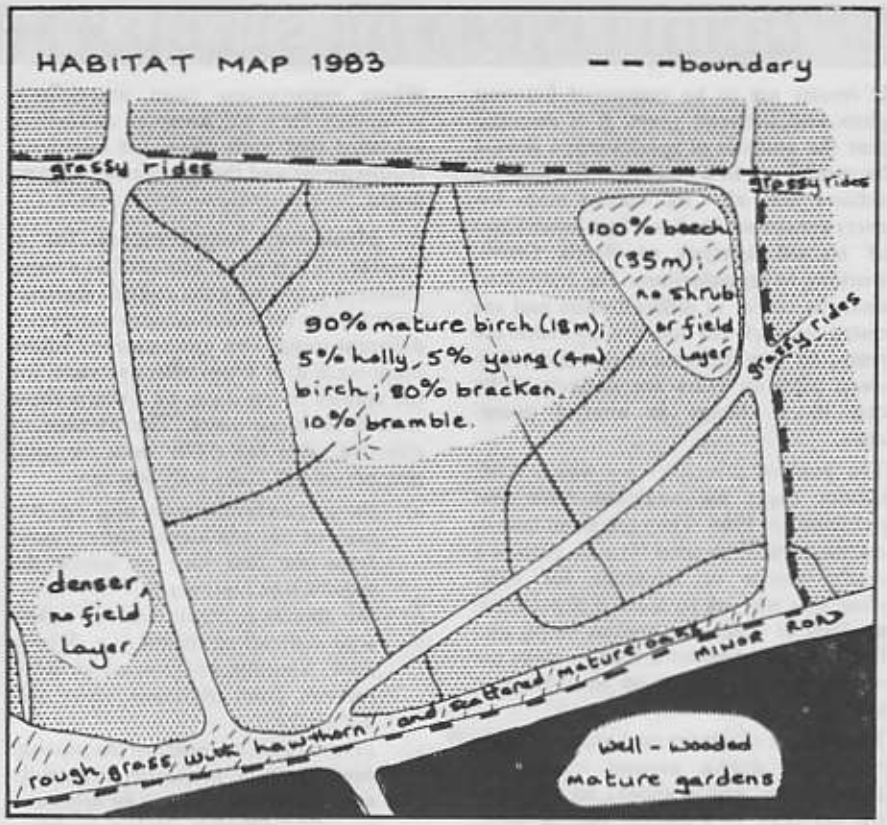
As for farmland, a full habitat map is requested to accompany your first census. Please read the section on farmland habitat maps and mark all the features listed there, where relevant to the habitats present on your plot and in the surrounding 50–100 metre zone. In addition, the following specifically woodland features should be recorded:-

(a) rides, clearings and glades
(b) boundaries between the major stand types, together with a brief description of each type.

Stand types can be recognised as blocks of woodland within which the tree and shrub species and the woodland structure are broadly uniform. Please provide the following details for each stand:-

1. **Management type:** stands may vary in management (e.g. high forest, wood pasture, active coppice, derelict coppice). In coppiced woods, the boundaries of different ages of coppice should be marked and the approximate date of cutting provided. Please inform us of any management activity on the annual questionnaire.
2. **Canopy or tree layer:** list the dominant species of trees and estimate by eye the approximate % cover for each tree species contributing more than 10% of the total ground cover. Also estimate the typical height of the dominant tree species: BTO staff can advise on methods if necessary.
3. **Shrub layer** (1 to 5m above ground): list the main species, their typical height and approximate % cover.
4. **Field layer and ground composition:** record the approximate percentage cover of grass, heather, herbs, bracken, bramble, rocks etc.

A varied piece of woodland on an Oxfordshire census plot, holding a good variety of bird species. Both Blackcap and Chiffchaff regularly hold territory around this point in the wood. *Photo: John Marchant*



The habitat map for the same section of CBC woodland plot as in the other examples. This is a simplified version of the original, which shows more details and uses colours to distinguish stand types. On the original map, the management type is given as "abandoned wood pasture now moving towards high forest structure, grazed by deer."

Many plots contain only 3–4 different stand types which can be readily identified, and it will be rare to need more than 7 or 8. A friendly botanist may be able to assist. If in difficulty consult Beech Grove.

A simplified example of a woodland habitat map is shown above, to give an indication of what is required.

Please remember to keep us informed of any changes in habitat in subsequent years. Maps showing **changes only** would be welcome in addition to the completed questionnaire.

SUBMISSION OF RETURNS

When completed, the visit, species and habitat maps should be sent to **The Nunnery.** It would be helpful to the analyst if you could also include a separate list of the visit letters, dates and times. Please try to send us your completed maps **before the New Year.**

If the maps are relatively small they are best folded and sent in an envelope, but larger maps should be rolled tightly and (ideally) packed in a cardboard tube. In either case, please ensure that a return address is included in the parcel. For added security, you can send the visit and species maps separately so that it is unlikely both will be lost.

The final assessment of territories is made by **The Nunnery** staff, so that we can be certain that maps from different sites, observers and years are always analysed in the same way. Once the analysis is complete we will send you our version of the results together with a first assessment of the overall changes in population. It is a good idea for you to send a copy of the results to the county bird recorder, so that they can be summarised in the annual bird report.

The original species maps will normally be retained on file at **The Nunnery.** They are our ultimate authority for the statements we make based on the CBC results, and are needed to back up our conservation claims if challenged. It is not possible for us routinely to copy the species maps for observers who wish to retain their original maps, but we can supply suitable tracing paper or, if necessary, extra outline maps for observers who wish to make their own copies. Please confer with CBC staff if you wish to retain copies of the species maps. Visit maps will normally be returned on request.

GUIDELINES FOR SPECIES MAP ANALYSIS

If results are to be compared between plots and between years, it is essential that the analysis of species maps should be carried out in a consistent fashion. To achieve this, all CBC species maps for every census are analysed by a small team of trained analysts at The Nunnery, working to set guidelines. The individual analysts confer in difficult cases and are tested regularly for consistency within the team, so any differences in results between plots or years are unlikely to be due to a change in analyst procedure.

The guiding principles by which CBC species maps are analysed were first published in 1968. They are given here in clarified and expanded form so as to be a ready source of reference for CBC observers wishing to make a provisional analysis of their own species maps, and for BTO members who wish to make use of the mapping method in their own studies.

The essence of species map analysis is that rings are drawn around clusters of registrations which appear to represent the activities of a distinct pair of birds. The ring itself merely encloses those registrations treated as forming part of the cluster, and does not necessarily indicate the territory boundaries. By convention, the rings drawn are non-overlapping, although in reality adjacent territories may overlap. The clustering procedure is merely an expedient for assessing the number, distribution and relationship to habitat of territory-holding birds on the data available.

Bird behaviour varies between individuals and between habitats, and may be detected and interpreted differently by different observers. It is therefore inappropriate for the analysis guidelines to be a set of fixed and rigid rules. An element of subjectivity remains even when the guidelines are followed: sometimes there may be more than one allowable way to analyse a species map. Decisions made by the CBC analysts, however, are not arbitrary since they draw on their accumulated experience of censuses in a wide variety of habitats and on their field knowledge of bird behaviour. Examples of cluster analysis are shown opposite to illustrate various of the points made below.

1. Ideal clusters. The typical species map shows discrete grouping of letters indicating the positions held by territorial males on different visits. Each grouping or cluster may show a sequence of observations on different visits of probably the same pair of birds, but in practice will probably show some duplication whereby males or females are registered more than once on a single visit. Areas from which dotted lines radiate may be identified readily as potential clusters.

Where registrations form well-defined groupings, these are accepted as clusters provided that each meets the minimum requirements and the other criteria given below.

2. Minimum requirements for a cluster. If it is to be accepted as a valid cluster, a grouping must contain registrations from a certain minimum number of different visits. This minimum is 2 where there were 8 or fewer **effective visits** for the species in question, or 3 where there were 9 or more visits. The number of effective visits can differ from the total number of full visits only where:-

a) the species is a migrant and was not present on the early visits (count from the first visit on which the species was registered),

b) the species is crepuscular or otherwise difficult to record (e.g. Woodcock, Nightjar, owls), in which case 2 records from different visits will suffice, or

c) in rare cases, coverage of the plot has been uneven: in particularly awkward cases it may even be necessary to apply different minima in different parts of the plot.

A further requirement is that there must be **ten full days** separation between the first and last registrations in the group. This rule (only) is waived in 'expedition methodology' where the visits are compressed into a short period of the season for the purposes of a special study. To determine whether clusters span ten days, it is helpful to keep a list of the visit letters and dates to hand during the analysis.

A single record of a **nest containing eggs or young** can be accepted as the basis of a cluster, even in the rare case of being unsupported by any other registrations. This does not apply to fledged juveniles, or to chicks of nidifugous species (such as Mallard, Pheasant or Lapwing) since they may have moved a considerable distance from the nest.

3. Dotted and solid lines. Two registrations joined by a dotted (or dashed) line should not be included in the same cluster, unless it is probable that the registrations relate to male and female of the same pair, or to juveniles. Such lines are of the greatest value in delimiting clusters. Singing birds can normally be identified safely as males, but for some species females might also be recorded as being in song (e.g. Tawny Owl, Green Woodpecker).

Two records joined by a solid line are effectively the same registration and must not be treated as part of two separate territories.

Records joined by a question-marked solid line may be treated alternatively as if they were separate birds, or the same bird, according to the pattern of other registrations. If included in a single territory, the registration does not count as a "double" (see 5 below).

4. Multiple sightings. A number of birds seen together in a flock may be registered as, for example, **4BT** for four Blue Tits or **2B♂** for two male Blackbirds together. Another common example is a registration of territorial conflict between two or more birds.

Where it is undesirable that such a registration should be treated as part of a single cluster, the analyst can divide the registration between two or more clusters. This is usually the appropriate course for dealing with registrations of conflict which often indicate the boundary between adjacent territories.

5. Double registrations. Double or repeat registrations frequently occur within apparently good groupings. Such registrations might belong to the same individual unwittingly registered more than once, or to different birds (perhaps the territory-holder and a migrant or a wandering male). Where there are more than two double registrations, or where the distribution of the double registrations is associated with a spatial division in the grouping, the analyst should consider whether to draw two clusters. The following points should be taken into account:-

a) whether splitting the group would yield two acceptable clusters, in terms of the minimum requirements, which accord with the territory size and distribution to be expected at that point on the plot,

b) the likelihood of the species performing rapid undetected movements across its territory (several species are especially likely to produce double registrations in this way. Examples include Whitethroat and other Sylvia *warblers, Willow Tit, Chiffchaff and Wren.)*

c) the likelihood of migrants singing while on passage (particularly high for Willow Warbler during their peak of spring arrival),

d) the likelihood of wandering males (high for species which frequently feed outside the defended area of the territory, e.g. Yellowhammer and especially Blackbird which also has a sizeable floating population of non-breeding birds in some years),

e) the number of double registrations is likely to increase with the number of visits made to the plot,

f) double registrations of females are to be expected in polygynous species (such as Pheasant) and should not be counted.

6. Excess registrations. Some registrations will be difficult to assign to particular clusters. In general they should be included in the nearest cluster, except where:-

a) *the registrations are close to the plot boundary and probably belong to territories outside the plot, or*

b) *the resulting cluster would then have too many double registrations, or be too large for the species and habitat concerned, or*

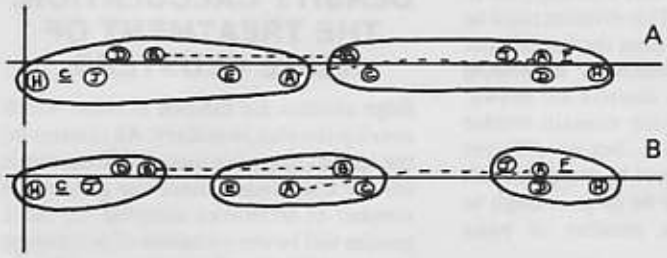
c) *the registrations are likely to be of wandering individuals or late migrants (particularly early in the season) or of fledged juveniles (late season).*

Excess registrations are those which do not fit into any cluster when the above guidelines are applied. It is best to draw a little arc around them to indicate their likely origin (off the plot, probably belonging to adjacent cluster, etc) and to show that their presence has been taken into account during the analysis.

7. Diffuse registrations. Common species in uniform habitats may show a diffuse rather than a grouped distribution of registrations. Dotted lines are particularly valuable in these circumstances. A start may be made by looking for the best nucleus of territorial activity (e.g. observations on successive visits, perhaps in an area from which dotted lines are emanating), drawing a cluster and then working outwards towards areas where the pattern of groupings is less clear. It is not a good idea to start arbitrarily at the edge of the map.

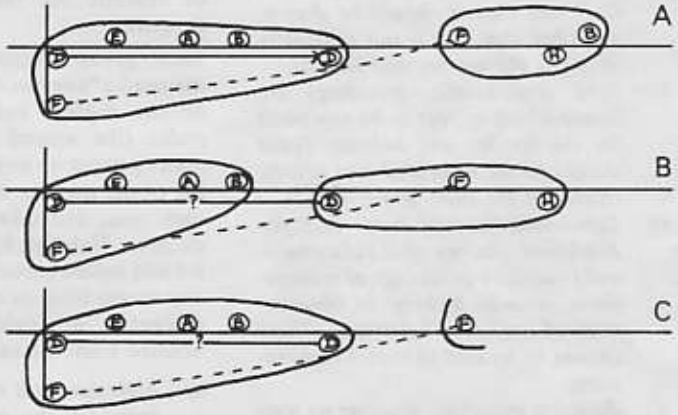
8. Large territories. Species with large territories (e.g. Kestrel, Green Woodpecker, Grey Partridge) present a special problem since the registrations rarely form obvious spatial groupings. Where the registrations fall close to two edges of the plot with a substantial gap between, it is often better to assign them to different groupings (either or both of which may qualify as an accepted cluster) than to draw a single cluster covering most of the plot. The size of the cluster drawn should always be appropriate to the territory-size of the species in the habitat concerned.

The following diagrams show examples of correct (and in some cases incorrect) assessment of territory numbers using the standard CBC guidelines. Assume there are ten visits throughout, the plot is farmland, and that the species is a strongly territorial resident in all but the last example. The maps are not intended to be the standard 1 : 2500 scale.



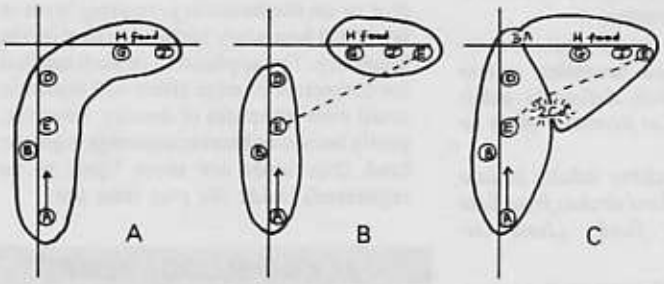
GOOD CLUSTERS

A and B show two different analyses of the same set of registrations. A is unsatisfactory because the apparent nucleus *ABC* is split between two clusters. B, giving three smaller clusters, is a better analysis because it uses *ABC* as the basis of a separate cluster. The treatment of dotted lines is correct in both examples.



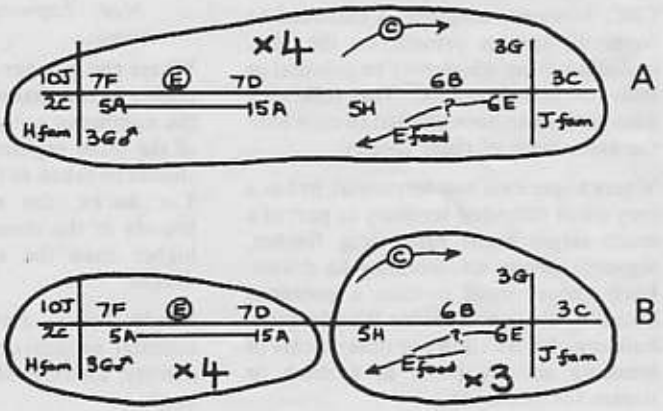
DOTTED, SOLID AND QUESTION-MARKED SOLID LINES

This example shows the correct treatment of lines between registrations. The dotted line *FF* means that the two *F* registrations cannot be placed in the same cluster (A,B and C). In C, the second *F* is treated as an excess registration. The solid line *DD* (example A) means that both *D* records were of the same bird and should be placed in the same cluster. The question-marked solid line *DD* (B and C) can be treated in either of the two ways, depending on the pattern of other registrations. In B, there are sufficient registrations to support a second cluster *DFH* and the *D* records are treated as being of separate birds. In C, there is no support for a second cluster and both *D* records are treated as if one bird was involved. These examples are correct as they stand, but on a real map might be influenced by the pattern of adjoining registrations.



TERRITORY SHIFTS, MULTIPLE SIGHTINGS

Three correct examples of analysis. In A, the two groupings *ABDE* and *GHJ* are merged into a single cluster on the assumption that there has been a shift of territory. It would be wrong to draw two clusters where such groupings are so close together. In B, the addition of a second *E* and a dotted line makes it clear that there are two clusters. In C, the example is extended to show the correct treatment of multiple registrations. Neither cluster has any double registrations.



SEMI-COLONIAL SPECIES

For a semi-colonial species such as Linnet it is often necessary to draw clusters representing groups of territories. Examples A and B show correct and incorrect treatments of the same set of registrations. A is correct, based on totals of 7 birds on visits *D*, *E* and *F*. The high count on visit *A* is discarded as probably a remnant of winter flocks, while that on visit *J* probably includes juveniles. B is incorrect, since the peak counts in these two adjacent putative clusters occurred on different visits, and combining them as in A considerably reduces the assessment.

". . . . does not apply to fledged juveniles . . . . . since they may have moved a considerable distance from the nest." *Drawing: P. Barwick*

9. Spurious groupings. Groupings of registrations sometimes occur which, although fulfilling the minimum requirements, should not be treated as separate clusters.

a) Two distinct adjacent groupings which treated as a single unit have no more than two double registrations, may (particularly in an open or patchy environment) represent two separate songposts of a single bird. Only one cluster should be drawn, provided that this is not unusually large for the species and habitat.

b) Very occasionally, groupings are found which appear to be too small for the species and habitat. These should be incorporated into nearby clusters if the rules allow.

c) Communal feeding areas (e.g. for Blackbird, finches and Yellowhammer) may give groupings of registrations, usually lacking in observations of territorial behaviour. These should be treated as excess registrations.

d) Adjacent groupings showing no temporal overlap (e.g. visits **ABD** *and* **EGJ***) should be treated as an example of* **territory-shift** *and merged into a single cluster, unless this seems unlikely in view of the species, habitat and distribution of registrations.*

10. Clusters representing semi-colonial groups of birds. The mapping method works best for territorial and non-colonial birds (chiefly passerines). In the CBC, however, mapping is extended to cover all species present on the plot, including those which may be colonial or semi-colonial breeders. The following guidelines have been devised to cope with the assessment of these species.

Where a species is non-territorial, or has a very small defended territory as part of a much larger home range (e.g. finches, pigeons), group clusters may be drawn. Each cluster must contain a potential breeding site (e.g. trees for Woodpigeon, buildings for Swallow) or other centre of breeding activity (such as a ditch or stream for Mallard).

The registrations should be divided into groups according to their spacing (ignoring any on the early visits which appear to be of winter flocks). This division must be performed carefully, since the final cluster total may vary considerably depending on how many group clusters are drawn. Putative clusters which contain similar peak numbers of birds, but on different visits, should in general be merged. Each group cluster should be large enough to be realistic for the number of pairs assigned.

Each group cluster should then be assigned a "number of pairs". This should be the highest confirmed number of males (the second highest number of males present on any single visit): make a list of the number of males recorded on each visit, and take the second highest number. Unsexed birds should be totalled and halved between the sexes, treating any excess birds as males. The following categories of registrations should be omitted from the calculations:-

a) high numbers on early visits which may be the remnants of winter flocks.

b) exceptionally high numbers on a single visit which might represent a feeding concentration,

c) high counts after the first observations of fledged juveniles, unless recorded as birds definitely adult (birds recorded as juveniles **must** *be omitted),*

d) influxes of moulting adults in late season e.g. Mallard drakes from late May, Lapwing flocks (June onwards).

Where the number of nests in the group cluster **in simultaneous use** is higher than the number of pairs assigned on the basis of the other registrations, the nest count should be taken as the "number of pairs". For ducks, the number of different broods in the cluster should be used if higher than the assessment based on drakes.

Single clusters may also be drawn for colonial or semi-colonial species at low density; the rules for single clusters then apply.

HOW TO RECORD THE ASSESSMENT

The total number of clusters assessed should be entered on the species map and the summary sheet using the following conventions:-

✓ no clusters assessed, species probably not holding territory. Ticks for species which are common winter visitors should be omitted.

n.c. no count: species probably holding territory, but no assessment made because either it was not mapped by the observer or no proper assessment was possible from the map.

N. adjacent to the assessed number, indicates the figure was based entirely on a count of active nests.

DENSITY CALCULATION: THE TREATMENT OF EDGE CLUSTERS

Edge clusters are defined as those which overlap the plot boundary. All clusters on the species maps are included in the totals for the CBC index, since the greater the number of territories sampled the more precise will be our estimates of percentage change. Dividing the simple total by the area of the plot is likely to give an inflated estimate of the density of territories, because some of the clusters counted will probably lie outside the plot boundaries.

In studies of density and community structure, the totals should be reduced to those strictly relevant to the area within the boundaries. Any clusters lying entirely outside the boundaries should be excluded, together with a proportion of the edge clusters (those which have some registrations inside and some outside).

The method currently recommended by the International Bird Census Committee is to exclude edge clusters unless more than half of the registrations lie within the plot or on the boundary, treating birds in farmland boundary hedges as lying on the boundary. The application of such methods for correction of edge effect still results in small over-estimates of density, however, partly because observer coverage is greater (and thus birds are more likely to be registered) inside the plot than out.

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