



# The relationship between census results and the breeding population of birds on farmland

D. W. Snow

**To cite this article:** D. W. Snow (1965) The relationship between census results and the breeding population of birds on farmland, *Bird Study*, 12:4, 287-304, DOI: [10.1080/00063656509464999](https://doi.org/10.1080/00063656509464999)

**To link to this article:** <https://doi.org/10.1080/00063656509464999>



Published online: 02 Apr 2009.



Submit your article to this journal [↗](#)



Article views: 222



View related articles [↗](#)

# *The relationship between census results and the breeding population of birds on farmland*

by D. W. Snow

British Trust for Ornithology

## INTRODUCTION

TAYLOR (1965) has shown that the Common Birds Census is already giving a very satisfactory index of the breeding population of birds on farmland, and is thus fulfilling its primary function, that of providing a reliable means of assessing annual changes. But even if observers are themselves consistent from year to year, as they have been shown to be, it is necessary to know how much of the variation between counts from different areas may be due to differences in the observers' methods; and it is even more important to know what relation the counts (the number of territories, or breeding pairs, assessed from the census results) bear to the actual breeding population. The greater part of the field work of the Populations Section of the B.T.O. in the breeding season of 1965 was devoted to studying these aspects of the Common Birds Census. The standard census method in use is described by Williamson & Homes (1964).

The field work was in two main parts. (1) On each of four farmland areas near Tring independent censuses were made by two different observers or teams, and (2) on two of these areas (the Trust's special study areas) an attempt was made to find as many nests as possible of all species, this work being entirely independent of the censuses. In addition, more detailed observations were made on the territories of four species (Song Thrush,\* Blackbird, Robin and Dunnock) on these same two areas, and on one of the other areas an attempt was made to find all first-brood nests of Song Thrush and Blackbird.

It was impossible to ensure complete uniformity in the censuses, just as it is in the work of the regular participants in the Common Birds Census. (If there had been complete uniformity in respect of number and length of visits, spacing of visits, and in the observers themselves, we should have been checking only the effects of differently timed visits, and this is only one of the sources of variability of census results.) Certainly there were differences in the skill and experience of observers, though the effects of such differences were not extreme; in fact the least experienced observers produced results which compared very favourably with those of the most experienced.

\*The scientific names of all species mentioned are given on p. 304.

## THE FOUR DUPLICATED CENSUSES

The areas censused were as follows:—

*Pendley Farm, Tring.* 142 acres. Arable, with hedges, hedgerow timber and a thin strip of woodland; bordered on one side by wooded canal bank. Censused by K. Williamson on 7 occasions and by R. D. M. Edgar on 8 occasions. Visits spaced alternately from 17 March to 6 July.

*Grove Farm, Tring.* 214 acres. Mixed arable and pasture, with hedges, a little hedgerow timber and three small spinneys; bordered on one side by wooded canal bank. Censused by R. J. Wilmshurst on 7 occasions and by R. D. M. Edgar on 8 occasions. Visits spaced alternately from 19 March to 7 July.

*Straw's Hadley Farm, Wingrave.* 167 acres. Almost pure pasture with hedges and hedgerow timber. Censused by D. W. Snow on 10 occasions and by B. K. Snow on 8 occasions. Visits spaced nearly alternately from 18 March to 15 July.

*Windmill Hill Farm, Waddesdon.* 170 acres. Mixed arable and pasture, with a considerable amount of timber in hedges and pastures, one small wood and a woodland strip. Censused by Mr. and Mrs. A. B. Bailey on 9 occasions and by D. W. Snow, assisted by R. D. M. Edgar and R. J. Wilmshurst, on 8 occasions, from 29 March to 6 July.

The results of each census were analysed in the standard way, by either K.W. or R.J.W., or in some cases by D.W.S. For many species independent analyses were made by two or three of the above. Where there was a difference of opinion as to the number of territories (or pairs) to be allowed, an agreed figure was arrived at. In fact individual estimates rarely differed by more than 10 per cent.

For each area, after the individual censuses had been analysed, the two independent sets of data were combined and the analysis was repeated. Thus the population could be further assessed from a much more thorough census of 15-18 visits (many more than are usually made by the regular census-workers). The combined data were not analysed until some time after the individual censuses had been analysed, so that the previous estimates should not be too fresh in the mind of the analyser.

The results of these analyses are set out in Table I, which deals with the 11 most important territorial species, and Table II, which summarises more briefly the figures for 11 less abundant or, in the case of the finches, semi-colonial species. Table I shows that for most of the 11 species concerned the individual censuses gave estimates of the population which were on average not far from 70 per cent of the total estimated from the combined census data. Table II shows that similar percentages were obtained for the further 11 species with which this table deals.

Table I shows that there was considerable variation in these percentages within each species, ranging in most cases from about 40-50 per

BIRD POPULATION OF FARMLAND

TABLE I—CENSUS RESULTS FOR THE ELEVEN COMMONEST TERRITORIAL SPECIES (NUMBER OF TERRITORIES)

		<i>Combined Census</i>	<i>Census 1</i>	<i>Census 2</i>	<i>Results for individual censuses as % of combined result (range and mean)</i>
Skylark	Pendley	19	19	8	42-100, 71 %
	Grove	13	13	7	
	Wingrave	7	7	3	
	Waddesdon	10	6	7	
Great Tit	Pendley	15	8	7	47-89, 71 %
	Grove	9	7	8	
	Wingrave	12	9	10	
	Waddesdon	13	7	11	
Blue Tit	Pendley	14	14	3	14-100, 59 %
	Grove	7	1	2	
	Wingrave	13	8	11	
	Waddesdon	16	16	10	
Wren	Pendley	5	5	2	40-100, 71 %
	Grove	5	5	4	
	Wingrave	2	1	1	
	Waddesdon	13	7	12	
Song Thrush	Pendley	6	4	4	45-183, 89 %
	Grove	7	4	7	
	Wingrave	6	11	8	
	Waddesdon	11	5	7	
Blackbird	Pendley	36	30	25	64-106, 82 %
	Grove	32	34	27	
	Wingrave	28	30	23	
	Waddesdon	39	25	34	
Robin	Pendley	23	23	11	48-100, 77 %
	Grove	18	12	12	
	Wingrave	13	12	12	
	Waddesdon	19	13	15	
White-throat	Pendley	12	7	6	44-73, 56 %
	Grove	5	2	2	
	Wingrave	11	8	6	
	Waddesdon	39	17	28	
Duncock	Pendley	31	28	19	61-100, 75 %
	Grove	25	17	17	
	Wingrave	24	24	17	
	Waddesdon	22	14	17	
Chaffinch	Pendley	11	8	7	48-93, 72 %
	Grove	13	8	9	
	Wingrave	15	14	12	
	Waddesdon	23	11	20	
Yellow-hammer	Pendley	5	3	6	20-120, 75 %
	Grove	5	1	3	
	Wingrave	13	12	12	
	Waddesdon	27	14	27	
All species	Pendley	177	129 (73 %)	98 (55 %)	
	Grove	139	102 (73 %)	98 (70 %)	
	Wingrave	148	136 (92 %)	115 (78 %)	
	Waddesdon	232	135 (58 %)	188 (81 %)	

BIRD STUDY

cent to 90-100 per cent. In three species (Song Thrush, Blackbird and Yellowhammer) some individual censuses gave a higher estimate of the population than the combined data; this is especially liable to happen when registrations are very scattered on the census map, and the groupings into which they are placed are in consequence rather arbitrary.

Part of the differences between the results of individual censuses can clearly be attributed to differences in their circumstances. Thus K.W., who has most experience of this kind of field work and spends much time on his census visits, recorded 100 per cent of the combined total for four species in spite of only 7 visits. Conversely, D.W.S.'s census at Waddesdon, based on one visit fewer than that of the Baileys, was carried out rather rapidly, due to the limited time available and the distance from Tring, so that the Baileys, who live on the edge of the area and made very thorough census visits, achieved a considerably better figure though they were admittedly inexperienced and still learning some of the songs and calls. Further, the four areas were clearly not equally easy for census work. Thus the Wingrave area, consisting almost entirely of pasture and hedges with a few lines of trees, was rather easy and even 8 visits resulted in a high percentage of the total, whereas Pendley Farm is much more complex and the percentages for the individual censuses were lower.

Variation in results will be considered in more detail later, under the headings of individual species. The main conclusion of importance at this stage is that with 8 visits to a farmland area of 150-200 acres (the number of visits recommended at present, and the normal size of area), even an experienced observer gets results which, when analysed in the

TABLE II—CENSUS RESULTS FOR ELEVEN LESS COMMON, OR SEMI-COLONIAL, SPECIES (NUMBER OF TERRITORIES AND NUMBER OF PAIRS RESPECTIVELY). ALL AREAS COMBINED

	Combined Census	Census 1	Census 2	Results for individual censuses as % of combined result
Carrion Crow	7	4	6	(57.86)
Magpie	11	7	8	64.73
Blackcap	6	5	4	(83.67)
Willow Warbler	12	8	7	67.58
Chiffchaff	9	7	5	(78.56)
Greenfinch	17	13	9	76.53
Goldfinch	20	11	14	70.55
Linnet	52	27	42	81.52
Bullfinch	13	8	9	62.69
Corn Bunting	6	5	6	(83.100)
Tree Sparrow	49	33	29	67.59

NOTES TO TABLES I AND II. Census 1: Pendley, K.W.; Grove, R.J.W.; Wingrave, D.W.S.; Waddesdon, D.W.S.

Census 2: Pendley, R.D.M.E.; Grove, R.D.M.E.; Wingrave, B.K.S.; Waddesdon, A.B.B.

standard way at present used, will indicate on average only some 60-70 per cent of the pairs (or territories) that will be recorded if twice as many visits are made.

It may be noted that these results suggest a considerably lower 'effectivity' than that suggested by Enemar (1959) in a theoretical discussion of the mapping method of censusing. In fact the rather abstract concept of effectivity—the percentage of all territorial males present that are recorded on each visit—is hardly measurable from our data. It varies enormously from week to week, depending on weather, stage of the nesting cycle, cover etc.; and other complicating factors at times assume equal or greater practical importance in assessing census results, *e.g.* which of the birds recorded are really territory-holders, which are transients, and which (if they are territory-holders) have temporarily moved away from their territories. For such reasons theoretical discussions of the validity of the method may be misleading as they tend to suggest that it is much easier to approach complete accuracy than it is in fact. It should also be noted that any valid measure of effectivity depends on positive knowledge of the number of birds present, and this should not be taken to be simply the number suggested by the census, unless the census has been quite exceptionally thorough, since the most silent or secretive individuals may have been consistently overlooked.

#### FINDING THE NESTS

H. Mayer-Gross spent a large part of his working time from late March to early August searching for and checking nests on Pendley and Grove Farms. It was considered that this was the only feasible way of gaining an accurate idea of the true number of pairs of many of the species breeding on the area; and it was possible only through the painstaking work of an extremely expert nest-finder. Clearly it is not a method which can normally be used. There were of course a few species, *e.g.* Robin, Skylark, whose nests are so hard to find that, for them, this work did not provide population figures against which the census results could be checked. Altogether, some 800 nest records were obtained on the two farms.

At the end of the season, the nests of each species were mapped, those that were probably or certainly repeats by the same pair were linked together, and those that must have belonged to different pairs, through being active at the same time, were marked accordingly; so that eventually a firm figure could be obtained for the minimum number of pairs breeding on the area.

Because an overgrown canal bank that borders both areas is very difficult to search thoroughly for nests, and in any case the nests may equally well be on the opposite bank, which is not included in the census areas, this part of the area was not fully covered by H.M.-G. The figures used in the comparisons between the census results and the population

## BIRD STUDY

as shown by nests are therefore a little different from those used for comparing the census results between themselves.

### SPECIFIC SECTION

It is not profitable to take the general analysis of results any further. Different species differ so markedly in the ease and reliability with which they can be censused that the main species that occurred on the census areas will now be considered individually.

*Carrion Crow.* On Grove Farm the combined census data suggested four 'territories', which were in fact no more than rough groupings of the scattered registrations. However, the five nests found by H.M.-G. showed that this assessment was reasonably accurate; 4 were in the presumed territories, and the fifth not indicated by the census data. On Pendley Farm a full comparison is not possible, as K.W. did not census crows, considering that they came mainly from an adjacent wooded area which he also censused. R.D.M.E. recorded three 'territories'. There were no nests, hence the supposed territories were probably parts of the territories of pairs nesting outside the area.

The results show that the method can give good results, and that correct assessment would be made easier if observers paid more attention to nests (which in April are usually easy to see).

*Magpie.* The position was rather similar to that described above. On Grove Farm the combined census data gave 5 territories, and H.M.-G. found six nests, one of which could have been a repeat though he thought that it was unlikely to have been. Omitting this one, the positions of the other five agreed well with the territories assessed from the census (one nest was just outside the area). On Pendley Farm the census gave three territories, all of them marginal; but there were no nests on the area. Exactly the same conclusions may be drawn from these results as for the Carrion Crow.

*Skylark.* Differences between observers were more marked than for most other species, accounting probably for a large part of the variation in percentages (42-100 per cent) given in Table I. Thus, over the same large field, one observer would regularly record twice as many birds as another. Skylarks are not easy to record accurately for an observer who is concentrating mainly on hedgerow birds, and variation such as was found here is not surprising (though observers themselves may be fairly consistent). Since only one nest was found, there is unfortunately no information on the accuracy of these results.

*Great Tit and Blue Tit.* These are difficult species to assess, at least on farmland, the Blue Tit more so than the Great Tit. They tend to give very scattered registrations, presumably because the pairs need to forage along considerable lengths of hedge in order to obtain their food. The way in which the scattered registrations are grouped by the analyst

is highly arbitrary, and many subjective decisions have to be made, mainly as to whether or not to group together registrations made on different visits which, though they *may* refer to the same bird, are rather more widely separated than might be thought usual for a nesting bird. These species were in fact the main exceptions to the generalisation made above, that independent analyses of the same census data gave very similar results: for instance, D.W.S. tended to allow about half as many territories as were allowed by K.W. and R.J.W. This need not affect the consistency of the Common Birds Census results from year to year, as they are analysed by K.W. and R.J.W., who do not vary their methods, but it does raise the question of the accuracy of the results. Unfortunately, H.M.-G. did not find enough tit nests for an independent check, based on nests, to be possible. It should not however be at all difficult to settle the matter by future field work.

*Wren.* Individual censuses showed good agreement as to the areas where Wrens were present; in some cases eight visits or so were sufficient to give an estimate equal or nearly equal to that obtained from twice as many visits. Seven of H.M.-G.'s nest or breeding records were in or close to territories as assessed from the census, but one cock nest was well away from any territory. Nest records were however not complete enough for a proper test of the accuracy of the census results, since most Wrens were along the canal bank where nest-finding was incomplete.

*Blackbird.* The difficulties of censusing Blackbirds came in for much discussion at the Common Birds Census Conference held at Tring in May this year, and they have been brought up at other times by census-workers; in fact it has been widely felt that the standard census method may produce quite unrealistic results for this species. Consequently special attention was paid to Blackbirds in this year's field work. Briefly, the main difficulties are that Blackbirds sing erratically, and very little at the beginning of the breeding season (except at dawn and dusk, when censuses are not usually carried out); that there is great variation in the amount of song from different individuals; that song may be less at low than at high densities; that in open farmland Blackbirds have very large territories and may move even further afield when feeding; that in thickets and overgrown places where the Blackbird population is most dense they are very difficult to record at all accurately; and that all through the breeding season a proportion of the males in the population are unestablished, and these sing more than the established birds.

The inadequacy of song records alone was realised last year. It was hoped that the new recording methods adopted this year, using sight records as well as song, would be especially helpful for the Blackbird, and enable a more realistic estimate of the population to be achieved. As will be seen, this hope has certainly been justified.



Table I shows that 8 census visits tended to give estimates which were close to those derived from twice as many visits (in some cases, slightly higher). In fact, for practical purposes it may be said that increasing the number of visits above 8 increases the complexity and confusion of the map which has to be analysed without substantially altering the number of territories resulting from the analysis.

In comparing the census results with the data derived from nest-finding and special observation of territories, the three areas concerned must be treated separately, as each revealed different points of interest. Observations by D.W.S. on Pendley Farm in April and May, including visits in late afternoon when there was much song, indicated 19 territories in the area worked (some outlying parts were excluded). On the same area the nests found by H.M.-G. indicated 18 breeding pairs, whose positions in the main agreed well with the 19 territories recorded by D.W.S. The combined census data, however, gave a total of 25 territories for this area. The discrepancy is mainly due to the fact that the census analysis gave several territories along stretches of hedge where no nests were found and where it is practically certain that few if any could have been missed. These supposed territories were based almost entirely on birds seen, some of which flew considerable distances while being watched. It seems likely that some 'double registrations' were also involved, due to birds moving when not under observation and so being recorded twice.

On Grove Farm, over most of which Blackbirds are more thinly distributed, results were rather different. The nests, which nearly all fall neatly into mutually exclusive groups, indicated 33 breeding pairs. On the same area the combined census results gave only 28 territories (R.J.W.'s census alone gave 33 territories, but 6 of these did not correspond with any nests). Examination of the maps shows that in three parts of the area where Blackbird density was highest (two spinneys and a woodland strip) the census indicated considerably fewer pairs than were in fact present (7 as against 13), while over the rest of the area the agreement between the numbers estimated from the two sets of data was good.

On the Wingrave area a combination of nest-finding in April and observations on territories in May and June indicated 28 breeding pairs. The combined census data, analysed in the standard way, gave 32 territories.

Observations on the Wingrave area also gave the following results of relevance to the censusing of Blackbirds. With all the census visits combined (totalling 18), plus the extra visits, 5 territories were without any song records, and two more had only one song record each, so that on the basis of song alone 25 per cent of the territories would have been missed. It is also noteworthy that of the five conflicts between males that were seen, three involved a territory-owner driving out an intruder (in all cases a first-year bird), one was probably due to a pair changing

their territory when the female was prospecting for a new nest-site, and the circumstances of one were unknown, but it took place well within the territory of an established bird. Thus none of these conflicts indicated territory boundaries. (Territorial 'patrolling' does indicate boundaries, but it was never observed, and probably it is not as common on farmland as in densely populated garden habitats.)

To sum up, there is some tendency for the methods used at present to give an overestimate of the Blackbird population in farmland with hedges (in two cases, by 39 per cent and 14 per cent), but in pockets of high density the number is underestimated. No significant advantage is gained by making more than 8 visits, as long as these visits are thorough. The accuracy of the estimate can be increased by altering the method of analysis slightly, so as to exclude some of the more doubtfully indicated territories and allow for the possibility of more double registrations, though precise rules for analysis would be very hard to define.

*Song Thrush.* On farmland the census method does not give a very accurate estimate of the Song Thrush population. The same difficulties apply as in the Blackbird, but they are aggravated by the fact that Song Thrush territories on farmland are even larger, so that the individuals range over wider areas, and Song Thrushes, when not singing (which they do only sporadically on farmland), are much less conspicuous than Blackbirds.

The individual censuses, when compared with the results of the combined censuses, varied very much in their effectiveness, from 45 per cent to 183 per cent (Table I). A good deal depends on whether a census visit happens to coincide with a period of song, while the number of registrations based on sight records depends much on the chance flushing of birds feeding in hedge bottoms and other places where they are easily missed. Analysis of the results of such observations is also no easy matter.

On Pendley and Grove Farms, H.M.-G.'s work showed that 23 pairs bred in the area which he worked. This is a highly reliable figure, as there is little doubt as to the interpretation of his nest records, which nearly all fall neatly into mutually exclusive groups. Over the same area, only 11 pairs were assessed from the combined census results (and only 10 and 6 from individual censuses). The accuracy of the census, however, differed markedly over different parts of the area. Thus six pairs of Song Thrushes nested along a lane with hedges which divides the two farms, the density being far higher than over the rest of the area, and five of these pairs were recorded by the census. This was directly attributable to the much greater output of song from these comparatively close neighbours than from the sparser population of the rest of the area. Over the most open parts of the farms 11 pairs nested, but only four were assessed from the combined census results. The positions of these

## BIRD STUDY

four did not correspond with any four actual territories, but were based on scattered registrations from eight or nine of them.

On the Wingrave area six territories were assessed from the combined census, but nest-finding showed that at least ten pairs bred in April. Again, there was very little agreement between the positions of the territories indicated by the two sets of data. Thus three nests, which certainly belonged to three different pairs as they were synchronous, were outside any of the territories recorded by the census; and along one long hedge, where the combined census gave only one rather dubious territory (with one song record), three other nests were occupied at the same time in mid-April.

*Robin.* The individual censuses gave a fairly high percentage of the total number of territories suggested by the combined censuses (omitting the very low percentage of 48, the seven others averaged 81 per cent). K.W. recorded 100 per cent on 7 visits, and the two Wingrave censuses recorded 92 per cent, from 10 and 8 visits. Lack (1954) used essentially the same methods for Robins in woodland and found it very satisfactory; he was able to record the full population of singing males (present at that time) in two visits in late March and April, but his censuses were carried out more slowly, without the distracting influence of a lot of other species to be recorded.

More detailed field work on Grove Farm, where there were some colour-ringed birds, showed that not only the number, but also the spatial relationships of the territories assessed by the census were substantially correct. A few cases of changes of territory were not recorded, but these were of minor importance.

H.M.-G. obtained breeding records which fitted 12 of the territories recorded by the census, two of which were based on few registrations and might otherwise have been considered doubtful. In addition, one of the nests found in the part of the area where Robin density was highest showed that one breeding territory had been missed by the census.

In conclusion, it is clear that for this highly territorial species the censusing method is effective, and eight visits are amply adequate if they are thoroughly carried out.

*Whitethroat.* The individual censuses gave on average a rather low percentage of the total number of territories as assessed by the combined censuses. Whitethroats arrived late this year, and eight visits spaced at approximately fortnightly intervals, three of which were made before they arrived, were clearly insufficient. Thus there were a considerable number of isolated song records in May, with no further registrations to show whether they were passing males or birds which quickly obtained mates and bred. On the other hand, the results indicated that one song record, if supported by only one subsequent record

(sight or song), generally corresponded to a territory as indicated by the data from the combined censuses.

On Pendley and Grove Farms, H.M.-G. achieved the remarkable feat of finding 33 Whitethroat nests, which can be allocated to a minimum of 17 pairs and two unmated males. For a number of pairs it is possible to work out what must be complete breeding records from a series of successive nests within a small area. Hence nest-finding was so effective that it seems unlikely that many breeding territories can have been missed completely.

As it happened, the combined censuses on the areas covered by H.M.-G. also gave an estimate of 17 territories, but they did not correspond completely with the territories as shown by nests. The position may be summarised as follows. Of the 17 territories recorded by the combined censuses :

- 10 (8 certainly, 2 probably) contained active nests;
- 3 almost certainly belonged to unmated males, as only cock nests (7 altogether) were found in them and the number of song registrations from them was higher than for any other territories;
- 2 were doubtful (a nest was built in one but was not known to have been used, and a nest was built near the other, but not used);
- 2 were probably not independent territories, but were based on (justifiably) mistaken interpretation of inadequate records.

In addition, nest-finding showed that there were five other breeding territories. Of these, two had single song records in or near them, which in the absence of supporting data were not considered significant; the other three were not detected at all.

To sum up, 7-10 visits gave estimates of the population which averaged only 56 per cent of those obtained from twice as many visits. The latter gave a figure which, on the two areas checked, agreed with the breeding population as shown by nest-finding, but there was only partial correspondence between the two sets of territories, about 30 per cent of the breeding territories being missed and a few of those recorded being certainly or probably false.

*Lesser Whitethroat.* Very few territories could be allowed on any of the four farms censused. For Pendley and Grove Farms no territories were allowed, there being only six scattered song records altogether. However, H.M.-G. found eight nests, which showed that at least seven pairs bred, four of them successfully. Lesser Whitethroats which obtain mates apparently sing for a very short time and thereafter are very secretive, and fortnightly visits are not nearly frequent enough to give much chance of recording the breeding population.

*Blackcap and Garden Warbler.* As with other warblers, a rather large proportion of isolated song registrations made assessment of the Blackcap population difficult. On Grove Farm, where the only comparison

with nests could be made, two territories were assessed from the census data. The canal bank, where these two territories were, was not thoroughly searched by H.M.-G., but two nests were found, neither of them within a recorded territory (though one was not very far from a territory recorded on Pendley Farm).

No Garden Warbler territories were recorded, only one or two isolated registrations being made for all areas together. On Grove Farm there were no registrations, but H.M.-G. found a nest which was successful.

To sum up, even with 15 or more visits the census was not very successful in recording breeding Blackcaps and Garden Warblers, but no useful quantitative assessment of accuracy can be given.

*Sedge Warbler.* Sedge Warblers, which were present on two of the areas, are probably easier to census accurately than *Sylvia* warblers, perhaps because they sing more persistently and are more conspicuous when they have young. Quantitative treatment is not possible because of the small number of pairs, but with one exception the individual censuses gave the same number of territories as the combined censuses, and both of the territories recorded on Grove Farm were confirmed by nests found by H.M.-G., who did not find any others elsewhere.

*Willow Warbler and Chiffchaff.* Nest-finding, which was certainly very incomplete (most pairs were along the canal bank, which was not worked very thoroughly), confirmed three of the 17 territories assessed from the census, and no nests were found elsewhere. Hence the territories recorded by the combined censuses were probably real; but as Table II shows, the percentages recorded by the individual censuses were rather low.

*Dunnock.* The individual censuses varied in their effectiveness less than for most other species, averaging 75 per cent of the figure derived from the combined censuses (Table I). The two highest (100 per cent and 90 per cent) show that for this species eight visits can be sufficient providing they are thorough.

On the part of Pendley Farm which he worked, H.M.-G.'s nests indicated 23 breeding territories, and field work by D.W.S. in April and May suggested 21 territories. It does not seem likely that H.M.-G. missed many territories completely, as his nests were nearly all in groups of 2-4, with dates indicating successive nesting attempts by the same female. On this same area 31 territories were assessed from the combined census data (an excess of 35 per cent).

On Grove Farm nest-finding showed 18-19 breeding territories, and the combined censuses 23. The discrepancy (an excess of 21 or 28 per cent) is less serious than these figures suggest, as three of the extra territories indicated by the census were along the canal bank, where nest-finding was admittedly incomplete. Excluding this area, the agreement was good (nests, 15-16 pairs; census, 17 pairs).

Unpublished work by I. J. Ferguson-Lees (*in litt.*) has shown that Dunnocks have unusual social and territorial habits, which must undoubtedly complicate the interpretation of census results. Observations on the farms, where a few birds were colour-ringed, showed that birds singing in the same place on different days were not necessarily the same individuals, and in some places three birds were regularly seen consorting together, two of which were sometimes males (as judged by song). Possibly there was an excess of males in these areas. In any case, in view of these complicating factors the census results seem as satisfactory as could be expected.

*Greenfinch.* Assessment of the census data for this species is especially difficult, as Greenfinches are non-territorial and semi-colonial when nesting. In analysing the records, the aim has been to indicate the approximate number of pairs in each breeding group, without very exact localisation.

H.M.-G. recorded 28 nests, which must have belonged to a minimum of 16 pairs. A high percentage of these nests were occupied in July or August, after the census work had finished. From the combined censuses, nine pairs were assessed (from the individual censuses, 5 and 6 pairs). It must be concluded that the censusing methods cannot be expected to give accurate results for this species.

*Goldfinch.* Goldfinch registrations in farmland tend to be very scattered and correspondingly difficult to evaluate. A very tentative interpretation of the combined census data gave a total of five pairs on Pendley and Grove Farms. H.M.-G.'s nest records showed a minimum of four pairs, but since the census data are clearly fragmentary, and the nest records are also probably incomplete, the agreement may be largely due to chance.

*Linnet.* Linnets nest semi-colonially, and the general remarks made for the Greenfinch apply to this species too. The nest records show, however, that the combined census data gave a reasonably accurate figure for the breeding population, and the positions of the concentrations of nests and of census registrations were also in the main the same. The larger population perhaps made censusing easier, and the Linnet's more mobile habits, and tendency to frequent low rather than high hedges, probably make it generally more conspicuous than the Greenfinch.

On Pendley Farm, the combined data gave 12 pairs, and the 35 nests found indicated a minimum of 15 breeding pairs. On Grove Farm the combined census data gave 15 pairs, and the 38 nests found indicated a minimum of 16 breeding pairs. The individual censuses, however, showed rather wide divergences between themselves which seem to have been due at least in large part to differences in the observers, some of whom seem to have been better at noticing Linnets than others. But some individual censuses gave high percentages of the combined total, so

that it seems that a standard census of eight visits can give good results for this species.

*Bullfinch.* Bullfinches are not easy to census on farmland, as a large proportion of the registrations tend to be scattered. Observations by I. Newton (*pers. comm.*) show why this is so. In April, when they are feeding on buds, they are conspicuous along hedgerows, but from May onwards, though they may be present in considerable numbers, they are not so easily seen. Moreover they forage over wide areas in summer, and when feeding young they may be present in the vicinity of the nest for only a few minutes each day. The poor results of the census are therefore understandable.

On Grove and Pendley Farms six pairs were assessed from the combined censuses (and four from each of the individual censuses). H.M.-G. found 15 nests, which indicated that at least 10 pairs bred. Only one of these 15 nests was within a 'territory' as assessed from the census, though two others were very close.

*Chaffinch.* Percentages of 93, 87 and 80 obtained by individual censuses show that 8 visits may give an estimate of the population that is not far short of the estimate obtained from twice as many visits.

From H.M.-G.'s work, breeding was confirmed in 8 of the 11 Pendley Farm territories and in 4 of the 14 Grove Farm territories, and only one nest was found outside the territories assessed from the censuses. It seemed very probable however that the Grove Farm population had been somewhat overestimated by the census. No nests were found in the central part of the farm, where the hedges are rather thin, although this part was searched as thoroughly as the rest; but two territories were recorded. Observation shows that in rather open farmland Chaffinch territories may be very large and males may use different song-posts 200 yards or more apart; hence there is always a danger that outlying parts of a large territory may be assessed as separate territories. This source of error should however be largely avoided if, during the field work, time is taken to follow, and plot, the movements of individual males, and those that are known to be different are always so indicated. In this way the standard method of censusing should be able to indicate the breeding population quite accurately (*i.e.* to within 80-90 per cent of the true figure).

*Yellowhammer.* On Grove and Pendley Farms, where Yellowhammers are comparatively sparsely distributed, the individual censuses gave variable percentages of the total assessed from the combined censuses (Table I), but on the other two farms, with higher densities, a higher and more consistent result was achieved by the individual censuses, each territory being based, on average, on a greater number of song records. The results in any case show that eight visits may be sufficient.

On Pendley and Grove Farms, H.M.-G. found 21 nests, which must have belonged to a minimum of 10 pairs. Analysis of the combined census data also gave 10 pairs. The agreement between the two sets of data was not quite as good as this suggests, but was nevertheless encouraging. Seven of the territories coincided more or less well. On one part of the area, where four pairs nested rather close together, only two territories were assessed from the census data, and in another place three were assessed instead of four. This deficit was offset by two territories which were certainly real ones though no nests were found in them (one was on the canal bank), and one supposed territory which was almost certainly not a real one (based on some scattered sight records only). The best estimate possible of the true breeding population is thus 12 pairs.

Taking into account the rather poor output of song on these two farms (which may have been due in part to bad weather as well as to a low density of birds), the result of the censuses, giving over 80 per cent of the probable true population, may be considered very satisfactory.

*Corn Bunting.* Though the numbers were small, the results from the three areas where Corn Buntings occurred showed that in all cases except one the same assessment was made from the individual censuses as from the combined censuses. Thus eight visits are sufficient for this species, at least under the conditions of these censuses. Nest-finding was too incomplete to provide a check on the accuracy of the figures (which in this polygamous species are of course a measure of singing males, not of pairs).

*Tree Sparrow.* Results of individual censuses differed rather widely between themselves, but some gave an estimate of the population as high, or very nearly as high, as the combined censuses. A good deal seemed to depend on the observers, some of whom apparently noticed Tree Sparrows more than others. It was also found on the Wingrave area that on one visit in April, when all the Tree Sparrows seemed to be displaying, more were recorded than on any other of the 18 visits; hence a good deal may also depend on the timing of visits.

H.M.-G. found 20 nests on Grove and Pendley Farms, which must have belonged to a minimum of 12 pairs, and probably 15. The combined censuses gave 20 pairs for the two farms. The agreement between the two sets of data was numerically best on Grove Farm (both giving 6 pairs), but this was partly due to chance, as three nests found by H.M.-G., all in hedges, had no census registrations near them. On Pendley Farm the numerical agreement was less good but the results were in fact better, as census registrations fitted the known nest sites well (some high tree nests were probably missed by H.M.-G.); but again some nests in hedges were missed by the census. The results indicate that Tree Sparrows can be censused quite accurately by the method in use, except that hedge-nesting birds tend to be missed. Considerable variation between observers may however be expected.



## BIRD STUDY

### DISCUSSION

The most important findings may now be summarised under the two main heads (1) whether or not, for each species, eight census visits are sufficient to give an estimate of the population which approaches that which results from twice as many visits, and (2) to what extent the figure thus estimated agrees with the true breeding population.

(1) This point has already been partly dealt with in presenting Tables I and II, where it was shown that the individual censuses, of about 8 visits, gave percentages which varied rather widely in most species but usually averaged around 60-70 per cent of the figure derived from the combined censuses. The more detailed discussion of the different species showed, however, that for some species considerably better percentages than the average could be achieved. The position may be summed up as follows: 8 visits normally sufficient:—*Blackbird, Robin, Sedge Warbler, Dunnock, Chaffinch, Corn Bunting*. 8 visits potentially sufficient, if visits are thorough and field technique good:—*Carrion Crow, Magpie, Song Thrush, Wren, Skylark, Great Tit, Blue Tit, Linnet, Yellowhammer, Tree Sparrow*. 8 visits not sufficient:—*Whitethroat, Lesser Whitethroat, Garden Warbler, Willow Warbler, Greenfinch, Goldfinch*. Data inconclusive:—*Blackcap, Chiffchaff, Bullfinch*.

(2) The accuracy of the combined census results, based on 15-18 visits, can be assessed for 16 species, and roughly judged for 3 more, but is unknown for 5 species, as follows: Accuracy high to adequate:—*Carrion Crow, Magpie, Blackbird, Robin, Whitethroat, Sedge Warbler, Dunnock, Linnet, Chaffinch, Yellowhammer*. Accuracy probably adequate:—*Wren, Willow Warbler, Chiffchaff, Tree Sparrow*. Accuracy poor to very poor:—*Song Thrush, Lesser Whitethroat, Garden Warbler, Blackcap, Greenfinch, Bullfinch*. Accuracy unknown:—*Skylark, Great Tit, Blue Tit, Goldfinch, Corn Bunting*.

Clearly the species most satisfactorily censused are those for which 8 visits are sufficient and accuracy is high. The following were found to meet these requirements:—

*Carrion Crow*  
*Magpie*  
*Wren (probably)*  
*Blackbird*  
*Robin*  
*Dunnock*  
*Sedge Warbler*  
*Chaffinch*  
*Linnet*  
*Yellowhammer*  
*Tree Sparrow (probably)*

## BIRD POPULATION OF FARMLAND

The following other species may be as good, though it seems unlikely, but their accuracy is not yet known: *Skylark*, *Great Tit*, *Blue Tit*, *Corn Bunting*. At the other extreme are species for which 8 visits are not enough and/or whose accuracy is low. There are intermediate species, for which good accuracy can be achieved but more than 8 visits are necessary; of these the *Whitethroat* is one of the most important.

It must be stressed that the degrees of accuracy shown in these results must not be taken as applying to species other than those dealt with here, nor to other habitats. For instance, where the density of Blackcaps, Garden Warblers and Lesser Whitethroats is higher, they can almost certainly be censused more accurately than they can on farmland with small spinneys and narrow wooded strips, as territories will more often be contiguous and the output of song probably higher. This could be checked by carrying out a programme of field work similar to that reported here. Nevertheless it is believed that the results given here indicate the kind of accuracy to be expected in censuses on typical farmland.

The accuracy of the census could be increased in several ways, mostly involving changes in field techniques; it would seem that only minor improvements can be achieved by improving the technique of analysis. There are however two reasons, practical and theoretical, why the field methods should not be altered. In the first place, any change designed to increase accuracy would involve longer hours in the field, and the minimum of eight census visits, required at present, is as much as can reasonably be expected of an amateur observer working in his spare time (some, who are in a position to do so, make many more than the minimum number of visits, and their censuses will be correspondingly more complete). Secondly, any change in field technique tends to make annual comparisons difficult if not impossible, and Taylor's analysis has shown that, in spite of inevitable inaccuracies, the census data are already perfectly adequate to show annual changes in population level. Thus the Greenfinch, from the results reported here, is shown to be a very difficult species to census *accurately*, but statistical analysis shows that observers have in fact been censusing it with a high degree of *consistency* from year to year.

### SUMMARY

The results are given of field work designed to test the accuracy of the methods used in the Common Birds Census. Two independent censuses were made on each of four farmland areas, and on two of the areas a high proportion of all the nests were found.

The results showed that for most species a census of 8 visits gave an estimate of the population which averaged 60-70 per cent of the estimate derived from the combined census of twice as many visits. For some species, however, considerably better than the average percentages could be achieved (see under (1), page 302).

The accuracy of the census results could be assessed for 16 species, on the basis of nest records. Accuracy ranged from high to poor or very poor (see under (2), page 302). The species most satisfactorily censused by the standard method are those for which 8 visits (the minimum number required by the Common Birds

## BIRD STUDY

Census) are potentially enough and accuracy is high. The following were found to meet these requirements: Carrion Crow, Magpie, Wren (probably), Blackbird, Robin, Dunnock, Sedge Warbler, Chaffinch, Linnet, Yellowhammer, Tree Sparrow (probably).

Although the accuracy of the Common Birds Census results could be improved by altering the field methods in present use, there are strong practical and theoretical arguments against doing so, of which the chief one is that the Census is already producing valid results for annual comparisons and any change would tend to invalidate such comparisons.

### ACKNOWLEDGEMENTS

Thanks are due to the Nature Conservancy for the very substantial financial support which has made the Common Birds Census possible; to Mr. and Mrs. A. B. Bailey, who welcomed an independent team making a duplicate census of their area in the first year that they took part in the scheme; to my wife, for carrying out one of the censuses at Wingrave; and to Mr. I. J. Ferguson-Lees and Dr. I. Newton for unpublished information.

### REFERENCES

- ENEMAR, A. 1959. On the determination of the size and composition of a passerine bird population during the breeding season. *Vår Fågelvärld*, 18:supp. 2.  
LACK, D. 1954. Two Robin populations. *Bird Study*, 1:14-17.  
TAYLOR, S. M. 1961. The Common Birds Census—some statistical aspects. *Bird Study*, 12:268-286.  
WILLIAMSON, K. & HOMES, R. C. 1964. Methods and preliminary results of the Common Birds Census, 1962-63. *Bird Study*, 11:240-256.

### APPENDIX

The scientific names of the species mentioned are given below:

Skylark	<i>Alauda arvensis</i>
Carrion Crow	<i>Corvus corone</i>
Magpie	<i>Pica pica</i>
Great Tit	<i>Parus major</i>
Blue Tit	<i>Parus caeruleus</i>
Wren	<i>Troglodytes troglodytes</i>
Song Thrush	<i>Turdus philomelos</i>
Blackbird	<i>Turdus merula</i>
Robin	<i>Erithacus rubecula</i>
Sedge Warbler	<i>Acrocephalus schoenobaenus</i>
Blackcap	<i>Sylvia atricapilla</i>
Garden Warbler	<i>Sylvia borin</i>
Whitethroat	<i>Sylvia communis</i>
Lesser Whitethroat	<i>Sylvia curruca</i>
Willow Warbler	<i>Phylloscopus trochilus</i>
Chiffchaff	<i>Phylloscopus collybita</i>
Dunnock	<i>Prunella modularis</i>
Greenfinch	<i>Chloris chloris</i>
Goldfinch	<i>Carduelis carduelis</i>
Linnet	<i>Carduelis cannabina</i>
Bullfinch	<i>Pyrrhula pyrrhula</i>
Chaffinch	<i>Fringilla coelebs</i>
Yellowhammer	<i>Emberiza citrinella</i>
Corn Bunting	<i>Emberiza calandra</i>
Tree Sparrow	<i>Passer montanus</i>