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Overall and regional trends in warbler populations of British farmland over 25 years

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Seven species of warbler have been monitored in British farmland annually since 1962 by the Common Birds Census. The sedge warbler has shown fluctuations in numbers with a decrease in the early 1970s. It was commonest on the arable farms of eastern England. The blackcap has shown a steady increase through the period. It occurred especially in small woodlands although it also occurred along tall hedges especially those with trees. The garden warbler has shown fluctuations very similar to those of the sedge warbler. It was commoner in the western half of the country, and was largely restricted to scrub and copses. The lesser whitethroat has shown a steady though slight increase. It occurred mainly in the southeast of Britain along larger hedges. The common whitethroat also occurred mainly along hedges. Numbers crashed in 1969 and have remained fairly constant since though with some fluctuations. The willow warbler has become the commonest warbler in farmland having shown a steady increase through the period. It was commonest in patches of woodland particularly on pasture farms. The chiffchaff also occurred predominantly in small patches of woodland. It increased till 1969 since when there has been a significant decline.

The population trends of the warblers do not show any general association with any factors occurring in their breeding grounds. However, the trends are strongly associated with where the species spend the winter and it is suggested that it is the winter which is the major influence on the numbers of these species.

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1. Introduction

The fate of migrants which spend the winter away from Europe has been the cause of some concern in recent years. This is especially the case for those which spend all or part of the winter period in the Sahel region of West Africa. The Sahel was first brought to the attention of the ornithological world when the numbers of several species which spend the winter there, especially sand martins *Riparia riparia* and common whitethroats *Sylvia communis*, which returned to breed in the spring of 1969 appeared to be very many fewer than in previous years. Other species seen to be more or less severely affected included redstart *Phoenicurus phoenicurus* and sedge warbler *Acrocephalus schoenobaenus*. More recently Berthold et al. (1986) showed that the numbers of many passerines, especially the summer migrants, had decreased significantly in numbers over the period 1974–1985 at three migration sites (ringing stations) in central Europe. In most cases the causes of the declines could not be determined.

For farmland in Britain, O'Connor & Shrubb (1986) have shown that many bird species have been affected by changes in farming practices especially changes related to the intensification of farming over the last ten years. More species appear to have declined than benefited, and for many residents it seems to be the winter or at least the non-breeding season which is the critical time. Therefore it is instructive to look at the summer visitors in the farmland bird community to determine if the breeding season affects

them or whether their numbers are more affected by the conditions in their winter quarters and during their long distance migration.

The farmland bird community in Britain contains rather few summer visitors. Of the 42 species which are monitored by the Common Birds Census (see below) in farmland only 11 are such. Seven of these are warblers, all of which use hedges in farmland to a greater or lesser extent as nesting and/or feeding sites, although it must be pointed out that some of them are commoner in other habitats than in farmland.

This paper describes how the populations of the seven warblers have fared over the last 25 years on British farmland as a whole, in different regions and on different farm types.

2. Methods

The data for this paper are taken from the Common Birds Census (CBC), a project organised and run since 1962 by the British Trust for Ornithology under contract to the Nature Conservancy Council. The details of this mapping census are given in Marchant (1983) and are not repeated here. The average size of farmland CBC plots is about 70 ha. Each year an index of the population level of each species is calculated using the difference in number of territories on plots which were censused in both the years. However because of difficulties in using statistics with these figures (because of lack of independence) I have not used the index figures at all in this paper. Instead I have calculated the average density (the mean of the density on each plot censused) in each year. This is very highly correlated with the index for all species but one should be careful in interpreting them as absolute density figures. For example, as most plots are surrounded by a hedge and most bird species in farmland occur in hedges, the calculated figures will overestimate slightly the real density on the ground. However comparing the figures between years and between species, especially between those with similar ecology, is reliable. In this paper all densities are given as territories per square kilometre. Except where otherwise stated the percentage occurrence on plots is the percentage of all site-years on which the species held at least one breeding territory.

For each plot the observer completes a habitat map indicating crops, hedges, ponds, woods, buildings etc. This has enabled the farms to be classified into groups. The divisions used here are:

1) Altitude. Low: 0–50 m above sea level, Mid: 51–100 m and High: more than 100 m.
2) Region. One of the main possible influences on bird populations in farmland is agricultural practice. The regions are therefore defined on the basis of the annual agricultural June Census Statistics for England and Wales compiled by the Ministry of Agriculture, Fisheries and Food. Three regions were defined:
   a) Cereal region (counties with more than 50% of their cultivated area under cereals — approximately East Anglia and north to Humberside);
   b) Grass region (counties with more than 50% of their cultivated area under grass — mainly the western half of England and all of Wales); and
   c) Mixed region (the remaining counties).
   d) Scotland is considered as a region on its own.
3) Agricultural habitat. Each plot was classified into one of three habitat categories: all or predominantly arable, mixed in about equal proportions, all or predominantly pasture. Analyses of agricultural habitat are restricted to plots in the Cereal and Mixed regions. There were almost no arable or predominantly arable farms in the Grass region, but there were some pasture farms in the Cereal and Mixed regions.
4) Other habitats present. The most important 'other habitat' for the warblers is the presence or absence of small woodlands. Others investigated here are the presence or absence of running water.

3. Results

3.1. General patterns

Seven species of warblers occur on at least 10% of all farmland Common Birds Census plots and this paper is restricted to these. They are the sedge warbler *Acrocephalus schoenobaenus*, blackcap *Sylvia atricapilla*, garden warbler *S. borin*, lesser whitethroat *S. curruca*, common whitethroat *S. communis*, willow warbler *Phylloscopus trochilus* and chiffchaff *P. collybita*.

The trends in the mean density of each of these species in farmland over 25 years are shown in Fig. 1. Before the population crash of the common whitethroat between 1968 and 1969 it was the commonest warbler on farmland, but after the crash it remained at around the same density as both the blackcap and chiffchaff. The willow warbler has become by far the commonest warbler on farmland plots. The garden warbler and lesser whitethroat have been consistently the least common, although the sedge warbler was often at the same level. The density of this last has fluctuated rather more than others.

The overall average density of each species in various subgroups of plots is shown in Table 1. This hides the, sometimes considerable, variations over time but gives an indication of the overall differences between the various groupings. It is clear that densities in Scotland are lowest for all species except for the sedge and willow warblers. (The statistics for this and other general statements here will be found in the following sections.) As Scotland appears so unimportant for any of the other species and that the number of plots was rather low it is largely ignored in subsequent discussions. The sedge warbler and the two

Fig. 1. The mean density each year of seven species of warbler on farmland plots. The sedge warbler occurred on 25% of all plot-years, blackcap on 48%, garden warbler on 24%, lesser whitethroat on 28%, whitethroat on 68% (but 90% up to 1968, and 60% from 1969 onwards), willow warbler on 78% and chiffchaff on 40%.

Table 1. The mean densities over all site-years of seven warbler species in different subgroups of farm plots. The various subgroups of plots are defined in the text.

	All plots	Regions				Farm type		Altitude			Woodland	
		Cereal	Mixed	Grass	Scotland	Arable	Pasture	Low	Mid	High	Present	Absent
Sedge warbler	1.58	2.15	1.27	0.70	2.13	2.51	1.49	3.27	0.78	0.46	1.61	1.62
Blackcap	2.57	2.56	2.89	3.19	0.08	2.44	3.04	2.55	2.86	2.27	2.88	1.40
Garden warbler	0.78	0.70	0.67	1.32	0.55	0.65	0.57	0.56	0.81	1.03	0.88	0.39
Lesser whitethroat	0.77	1.23	0.79	0.53	0.02	1.08	1.12	1.04	0.73	0.49	0.82	0.66
Common whitethroat												
1962–68	10.64	11.60	11.99	8.84	4.49	10.93	12.45	10.83	11.26	9.85	11.43	8.28
1969–86	2.94	3.60	3.39	1.99	1.89	3.90	3.33	3.82	3.34	1.73	3.16	2.27
Willow warbler	9.90	4.91	7.59	16.93	16.99	4.77	9.32	7.18	9.82	12.89	11.59	3.73
Chiffchaff	2.41	1.62	2.69	3.42	0.12	1.67	3.60	2.22	2.54	2.39	2.62	1.60

whitethroats are also the only ones commoner in the Cereal and Mixed regions rather than the Grass region. For the two whitethroats the reason for this appears to be geography rather than habitat type as there is little or no difference between farm types. For the sedge warbler though there is a preference for arable farms (see below). The blackcap, garden warbler, willow warbler and chiffchaff are all commonest in the Grass region with the last two also considerably commoner on pasture plots than on arable. It will be seen that all four species are also much commoner in plots with woodland than on those without. There is however no difference in the proportion of plots with woodland either between regions ($\chi^2 = 2.56$, df 2, NS) or between farm types in the Cereal and Mixed regions ($\chi^2 = 2.38$, df 2, NS). Only the willow warbler and garden warbler showed a preference for higher altitude plots. This again could not be explained by more of these having woodland ($\chi^2 = 3.50$, df 2, NS).

The following sections investigate the trends of each species individually in more detail and discuss some of the reasons for the patterns which emerge.

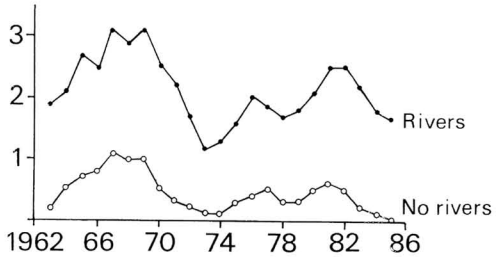

Fig. 2. The density of sedge warblers on plots with running water and on plots without.

3.2. Sedge warbler

Fig. 1 shows that the sedge warbler increased until 1969 then decreased sharply until the mid 1970s. Since then it has partially recovered though the last two or three years have again shown a sharp decline. Overall it has shown no change (Spearman rank correlation coefficient of density on rank of year = –0.09, *df* 23, NS). Its density was highest in the Cereal region and lowest in the Grass region (Table 1, over the years Kruskal-Wallis H=12.9, *df* 2, P<0.02). Within the Cereal and Mixed regions arable farms held a significantly higher density than pasture farms (Table 1, Wilcoxon matched pairs T=62.5, N=25, P<0.02).

The main habitat of the sedge warbler in farmland is the fringes of water both of ponds and of rivers/streams. A comparison of CBC farm plots with and without running water shows that the sedge warbler showed a fourfold difference in average density (2.1 cf. 0.5 territories respectively). Inspection of the trends on these plots (Fig. 2) shows that the species appeared on plots with no running water only in years of higher average density.

Other than the species of open fields such as skylark *Alauda arvensis*, the sedge warbler is one of relatively few species to be recorded on CBC maps as actually in the crops rather than solely at field margins. This may explain the preference for arable farms, compared to pasture farms. Cereal fields are much more similar to their natural habitat than are grass fields particularly those which are grazed.

Another crop which is now becoming more prevalent in many cereal areas is oilseed rape. There are indications from the CBC maps that sedge warblers are recorded in rape fields to a greater extent than in other crops.

3.3. Blackcap

The blackcap has shown a very significant increase in overall numbers (Spearman rank correlation as above = 0.92, *df* 23, P<0.001). The density was lower in the Cereal region than in either the Mixed (Table 1, Wilcoxon T=57, N=22, P<0.05) or the Grass region (T=31.5, N=24, P<0.002). The density in the Mixed and Grass regions was similar (T=116.5, N=25, NS). Within the Cereal and Mixed regions the density was slightly lower on arable than on pasture farms (T=75.5, N=24, P<0.05).

The blackcap is primarily a woodland bird (Simms 1985) and Table 1 shows that on CBC farm plots its average density on farms with some woodland was double that on those without (Wilcoxon T=0, N=25, P<0.001).

3.4. Garden warbler

Garden warbler numbers overall have remained fairly constant (Spearman rank correlation as above = 0.24, *df* 23, NS), although there are slight fluctuations which are very similar to those of the sedge warbler — slightly higher numbers in the late 1960s, lower numbers till the mid 1970s and a subsequent recovery. The density was higher in the Grass region than in either the Mixed region or the Cereal region (T with Mixed = 32, T with Cereal = 40, both with N=25, P<0.002). There was no difference between the Cereal and Mixed regions (T=73.5, N=19, NS). Having said this the species occurred on about the same proportions of plots in all three regions (24–29%).

The garden warbler's preferred habitat is thick undergrowth (Simms 1985). It very rarely occurs along hedges.

3.5. Lesser whitethroat

The lesser whitethroat has shown a slight though significant overall increase in average density (Spearman rank correlation as above = 0.76, *df* 23, P<0.01). The distribution of the species in Britain is mainly restricted to England south of Morecambe Bay and the Humber, and east of Exeter and the Welsh border (Sharrock 1976). This shows up in the CBC data with the highest density in the Cereal region in all years (Wilcoxon T=0 with both Mixed and Grass regions, N=25, P<0.002) and lowest in the Grass region in all but two years Grass: Mixed region T=9, N=24,

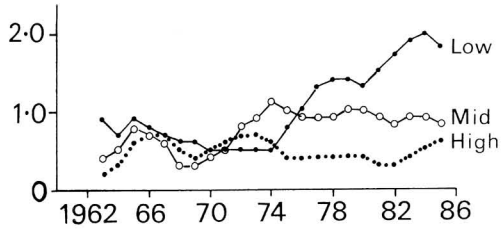

Fig. 3. The density of lesser whitethroats on plots at different altitudes. Low = 0–50 m, Mid = 51–100 m and High = >100 m above sea level.

$P<0.002$). The reason seems to be a geographical rather than an agricultural one as there is no difference between arable and pasture plots within the Cereal and Mixed regions ($T=131$, $N=23$, NS).

Fig. 3 shows that the increase in density which has occurred in recent years has mainly been on the lowest altitude plots (Kruskal-Wallis $H=20.3$, df 2, $P<0.001$). As the lesser whitethroat is on the edge of its range in Britain this is logical.

In farmland the lesser whitethroat occurs most commonly in hedges and it is especially in those with trees. However as is clear from Fig. 1 and Table 1 the lesser whitethroat never occurred at a high density.

3.6. Common whitethroat

The large decrease between 1968 and 1969 occurred in all regions and over all habitats. It was subsequently thought to be due to the drought in the Sahel zone of West Africa where the species spends the winter (Winstanley et al. 1974). Overall the decrease was significant (Spearman rank correlation = –0.58, df 23, $P<0.02$). Two other features can be seen in Fig. 1. Firstly, by 1968 the population had been increasing steadily to a peak, and, secondly, that although there have been some fluctuations the population has subsequently remained at more or less the same new level, about a third of that prior to the crash (Spearman rank correlation = 0.02, df 16, NS).

Both before and after the crash the density in the Grass region was lower than in the Cereal or Mixed regions (all years, therefore $T=0$) and there was no significant difference between these latter two (up to 1968, $T=10$, $N=7$, NS; 1969 onwards, $T=51$, $N=16$, NS). The reason here is likely to be geographical as within the Cereal and Mixed regions there was a higher density on pasture farms than arable ones up to 1968 ($T=1$, $N=17$, $P<0.05$) although no significant difference after this ($T=36$, $N=17$, $P<0.10$ in favour of arable farms). Furthermore in the Grass region after 1968 the common whitethroat occurred on only about half the sites that it had occupied previously whereas it remained on about three quarters of the sites in the Cereal and Mixed regions. A very similar pattern emerged with a lower density and a lower proportion of sites remaining occupied in the High altitude plots compared to those lower down. Therefore although there was a major decline in all areas the distribution has become more concentrated into what are presumably preferred areas.

The density on plots with woodland was higher than on those without (Table 1, up to 1968, $T=0$, $N=7$, $P<0.02$; 1969 onwards, $T=1$, $N=18$, $P<0.002$), but the proportional decrease in sites occupied was about the same in each (about 90% to about 60%). The common whitethroat is, however, very much a hedgerow bird (Simms 1985), and Williamson (1971) showed that it occurred quite commonly along low-trimmed hedgerows and not on well-timbered hedgerows.

3.7. Willow warbler

The willow warbler has shown a significant overall increase over 25 years (Spearman rank coefficient = 0.75, df 23, $P<0.01$), and it is now the most common and widespread warbler on British farmland. The increase has not been as steady as in the blackcap (Fig. 1). There was a sharp decrease in the early 1970s, then a levelling off, and numbers only started increasing again in the 1980s.

Dividing the plots into groups shows that the willow warbler is especially common in the Grass region ($T=0$, $N=25$, $P<0.02$ with both other regions), commoner in the Mixed region than the Cereal ($T=1$, $N=25$, $P<0.002$), and commoner on plots with some woodland ($T=0$, $N=25$, $P<0.002$) and at higher altitudes (High to both Mid and Low, $T=0$, $N=25$, $P<0.002$, Mid to Low $T=8$, $N=25$, $P<0.002$). Grassland areas are evidently preferred as, within the Cereal and Mixed regions, it is commoner on pasture plots than on arable ones ($T=4$, $N=24$, $P<0.002$).

In farmland the willow warbler occurs mainly in scrub and woodland (Simms 1985), and rather rarely in hedges and then only in large well-timbered ones.

3.8. Chiffchaff

The chiffchaff is widespread in farmland although the density is always rather low. The long term trend shows that there has been no overall change in population level since 1962 (Spearman rank correlation = 0.20, *df* 23, NS). Since 1969 when the population level reached a peak, there has been a significant overall decrease (Spearman rank correlation = –0.50, *df* 16, $P<0.05$), but Fig. 1 shows that there was a partial recovery in the latter 1970s. The Chiffchaff was much commoner on plots with some woodland ($T=0$, $N=25$, $P<0.002$), but there were no significant differences with altitude nor with region.

The Chiffchaff's main habitat is copses and other small patches of woodland, and it is more restricted to areas near woodland when the population is low (Osborne 1982).

4. Discussion

The figures presented above show that over 25 years three species have shown a statistically significant overall increase (blackcap, lesser whitethroat and willow warbler), one a significant decrease (common whitethroat) and three no overall change (sedge warbler, garden warbler and chiffchaff). This hides the fact though that only the blackcap and lesser whitethroat did not show a decline between 1969 and about 1974, which in most cases was followed by a subsequent partial or complete recovery.

All the species have slightly different habitat preferences and patterns of occurrence and hence will be subject to rather different factors. These are discussed above under the individual species. There is certainly no very obvious general explanation for the trends from the breeding grounds. There have been some major changes in farmland in this period, but they have mainly occurred in the fields and it is clear that the warblers very rarely use the fields themselves. Berthold et al. (1986) found very similar patterns to Britain over the more recent years of the CBC period except for the willow warbler. In central Europe this declined between 1974 and 1985 (cf. an increase for this period in the farmland CBC; Spearman rank correlation = 0.78, *df* 11, $P<0.02$). Berthold et al. looked at a wide variety of passerine species, including the warblers, and found that 70% of them had declined over this period, but offered no general explanation for the patterns they found.

The wintering areas of these birds do however correlate with the changes in numbers observed in the breeding season. The most important area in respect of the species considered here is the Sahel region of West Africa. Lamb (1982) produced a rainfall index for the period 1941–1981. He showed that 1968 was the first drought year since the CBC started in 1962, and that the rainfall continued to be lower than the longterm average until at least 1981, although with some fluctuations. The area nearest to the Sahara Desert i.e. the furthest north was the part most severely affected, and the changes in bird numbers were shown to correlate with this cline over latitude by Mead & Hudson (1985). They showed that the change in British ringing totals between 1983 and 1984 of a range of migrant species was correlated with the mid latitude of the species's wintering area in West Africa, with those wintering furthest north in West Africa decreasing the most and those furthest south increasing in numbers slightly.

The warbler trends shown here add further support. The whitethroat showed the largest decline and winters nearest the Sahara Desert. The sedge warbler, also severely affected, winters somewhat farther south but spends the winter in reedbeds and other wetland areas (Curry-Lindahl 1981) and therefore may be especially subject to drought conditions. Subsequent to 1969 the population levels of these two species were very closely correlated with each other and with the fluctuations shown by Lamb (1982) in the rainfall index. The garden warbler winters farther south than either of these two and was less affected. The chiffchaff was severely affected though the population peaked in 1970 rather than 1969. It winters in both West Africa and around the Mediterranean (see below). The willow warbler winters mainly well to the south in Africa but passes through West Africa in both spring and autumn. It was the least affected of these five.

The blackcap was almost unaffected despite some birds wintering in West Africa. The majority, however, probably winter around the Mediterranean (see below). Finally the lesser whitethroat, also unaffected, is exceptional in migrating southeast across Europe in the autumn to spend the winter in Ethiopia and the Sudan and thus avoiding West Africa altogether.

The blackcap and chiffchaff apparently winter in similar areas, both around the Mediterranean and in West Africa, but have fared very differently. The respective trends can be explained though by the differ-

ence in the proportion of birds wintering in each area. The British ringing recoveries suggest that the proportion of blackcaps wintering around the Mediterranean is higher than for chiffchaffs. Summing all recoveries to 1981 there were 173 blackcap recoveries in countries around the Mediterranean and 3 south of the Sahara, and 74 chiffchaff recoveries around the Mediterranean and 8 south of the Sahara (Spencer & Hudson 1982). (France is excluded from the Mediterranean countries as much of it cannot be considered as the Mediterranean area.) This difference in ratio is statistically significant (Fisher exact text P=0.005). A similar examination of the recoveries reported in full in British ringing reports for the years 1955–1985 shows that there were 32 blackcap recoveries between November and February (i.e. winter) around the Mediterranean with 2 south of the Sahara, and 18 chiffchaffs around the Mediterranean with 9 south of the Sahara (Fisher exact test P=0.008).

In conclusion therefore it is clear that there are differences between areas of Britain in the warbler populations in farmland, and that each species has preferences for particular regions or farm types, but it seems that it is the winter quarters which hold the key to the population levels rather than the breeding season.

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