

# Winter Farmland Bird Survey

## Title

Winter Farmland Bird Survey 1999/2000-2002/03

## Description and Summary of Results

There have been marked declines and range contractions in breeding populations of many farmland birds, and these have prompted intensive studies of many species. Many of these are resident and spend the winter in British farmland but many others come into the country from northern and eastern Europe for the winter. However information on distribution and abundance on a large scale in winter was lacking.

The survey did not concern just the primarily farmland species. A range of other species breeding in woods (eg Chaffinch *Fringilla coelebs*) and uplands (eg Meadow Pipit *Anthus pratensis*) move to lowland farmland in winter, where some form large conspicuous flocks. Additionally, Britain plays host in winter to thousands of immigrant Starlings *Sturnus vulgaris*, thrushes (Fieldfare *Turdus pilaris* and Redwing *T. iliacus*), and plovers (Lapwing *Vanellus vanellus* and Golden Plover *Pluvialis apricaria*), many of which use farmland. For many of these species rather little was known about their numbers, where they occur and how they use the farmland landscape, and most of them were not monitored at all.

The Winter Farmland Bird Survey (WFBS) aimed to provide information on the distribution and abundance of a suite of bird species occurring in farmland in winter in lowland Britain. It also tried to quantify the distribution and abundance of the agricultural habitats available (as these were not known) and to identify the habitat preferences of the birds across a wide geographic area, as well as to look for any regional, seasonal and annual differences in these preferences.

The survey concentrated on 30 species. Many were on the list of Birds of Conservation Concern (eg Grey Partridge *Perdix perdix*, Song Thrush *Turdus philomelos*), some were widespread common species (eg Stock Dove *Columba oenas*, Pied Wagtail *Motacilla alba*), some were immigrants (Fieldfare, Redwing), and three were scarce and localised species (Woodlark *Lullula arborea*, Twite *Carduelis flavirostris* and Snow Bunting *Plectrophenax nivalis*).

Across the three winters of the survey 1090 sample squares were surveyed (about 800 in each winter), providing at least one visit to 18025 habitat patches. These yielded counts of over one million individual birds, and covered a wide geographic area. In each winter over 95% of squares were visited at least twice and in winters 1 and 3 over 85% of squares were visited three times (65% in winter 2). This part of the survey was the most robust in terms of relating birds to habitat patches and the availability of such habitats.

Winter Walks (651 routes (275-450 per winter) averaging 3.7km (mostly 1-3km) and visited regularly with 6-7% over 20 times) and Casual Records (about 300-400 forms received each winter) were popular and each winter yielded several hundred thousand records.

Overall farmland bird species occurred at low densities and were highly aggregated in a small proportion of available pastures, stubble fields and farmyards. For individual species, less than 10% of habitat patches were occupied and densities in occupied patches were low. Chaffinch was the most widespread species at both square and patch scales, being recorded

from 82% of squares and 19% of patches, with Fieldfare, Song Thrush and Starling reported from 53% of squares on average. The scarcest species were Woodlark, Twite and Snow Bunting which were reported from less than 1% of squares. Densities differed significantly between winters for Pied Wagtail, Fieldfare, Starling and Chaffinch; and changed through the winter for five species: Grey Partridge and Sky Lark *Alauda arvensis* dropping in late winter, Fieldfare and Redwing increasing, and Chaffinch peaking in mid-winter. Grass accounted for 43% of the surveyed land, cereal crops for 24%, and 20% was stubble, of which half was cereal stubble. The distribution of grass was mainly in the west, and cereal crops in the east and both remained relatively constant over the winter. In contrast the distribution of cereal stubble was patchy and showed a slight decrease and gradual fragmentation through the winter. Bare tillage showed a clear increase in prevalence. A large proportion of most species was found in grassland and invertebrate feeders showed a preference for improved grassland. Granivores showed a preference for stubbles and farmyards. Some individual species however bucked these general trends.

### **Methods of Data Capture**

Three main methods were used during the survey. There was also a targeted block of fieldwork directed specifically at flocks of Lapwing and Golden Plover. The different components required differing birdwatching skills and time commitment, which meant that there was something to suit everyone. As a result, the survey was very successful in bringing together a wealth of information from over 2000 volunteers.

1) *Square Surveys* -- visits to randomly selected 1-km squares three times each winter to count birds and record which habitat types were used and which were avoided. Within the selected square bird and habitat recording were undertaken on a patch-by-patch basis. A patch was defined as an area of a single habitat occupying more than 0.3ha. Non-farmland habitats were excluded so in the majority of cases a patch equated to a field, a game cover strip, an orchard or a farmyard. A hybrid of methods involving counts of the whole patch conducted from the patch edge and transects across the patches was used. The latter plus pilot work showed that edge counts were an appropriate means of surveying most of the target species, underestimating the abundance of only four.

Observers made three visits to their square between the beginning of November and the end of February and on each visit surveyed as many patches as possible within a four-hour time limit, ideally surveying the same patches on each visit and in each year. Visits were made on calm, dry days with good visibility, and avoided the first and last hours of daylight. Observers walked around the edge of each habitat patch and recorded birds in three zones: Boundary -- hedges and other boundary structures including any 'verge' vegetation adjacent to the crop/margin; Margin -- outer 20m of the crop or uncropped margin; Interior -- the field beyond the margin zone. Birds were assigned to the zone in which they were first detected, except where, for instance, a flock was continuously moving between the margin and the boundary, in which case they were assigned to the margin as the most likely foraging habitat. In 1999/2000 this edge count was followed by a single, straight, transect across the field, ideally diagonally through the field centre. These transects were only 20m wide (10m either side) to ensure that all birds in the strip would be detected (ie flushed) irrespective of vegetation height. Flying birds were ignored unless clearly associated with a patch (eg just flushed or about to land).

Each patch was assigned a habitat code based on the BTO standard Crick system modified as necessary to accommodate winter habitats relevant to birds. Habitats were coded on each visit to account for the high rate of change due to agricultural operations in winter. Illustrated notes were provided to all observers to aid the identification of crops and stubbles. Set-aside was recorded as a stubble or grassland depending upon what it most resembled.

2) Winter Walks -- observers were asked simply to choose a route at least 1km long and visit it regularly between November and February. On each visit they were asked to note date and the number, activity and habitats used by the 30 target species.

3) Casual Records -- observers were asked to note records of "significant flocks" of the target species from anywhere in the country. Guidance was given as to what constituted a "significant flock".

4) Golden Plover and Lapwing Survey -- a small added on survey targeted specifically at obtaining information on plover abundance and habitat use on individual flock ranges. All survey workers were provided with both audio tapes as an aid to identifying by call those bird species likely to be encountered, and with some guidance to identifying crop types in winter.

### **Purpose of Data Capture**

There were three main aims: 1) to provide information on the distribution and abundance of a suite of bird species occurring in farmland in winter in lowland Britain; 2) to quantify the distribution and abundance of the agricultural habitats available to birds in winter; and 3) to identify the habitat preferences of farmland birds in winter across a wide geographic area and to look for any regional, seasonal or annual differences in these preferences.

### **Geographic Coverage**

The lowland agricultural land of Great Britain.

### **Temporal Coverage**

The winters of 1999/2000-2002/03. The original intention was to finish after the 2001/02 winter but access to farmland in that winter was very restricted due to the outbreak of Foot and Mouth Disease in 2000/2001, so the fieldwork extended to 2002/03.

### **Other Interested parties**

The survey was conducted by the BTO. Funding came out of the partnership between BTO and the Joint Nature Conservation Committee (on behalf of English Nature (now Natural England), Scottish Natural Heritage, the Countryside Council for Wales (now Natural Resources Wales) and the Environment and Heritage Service in Northern Ireland). The plover survey associated with the project was funded by a Natural Environment Research Council CASE studentship. The production of the bird identification audiotapes was supported by Birds Eye Wall's, Zeneca Agrochemicals and British Sugar plc. A small scale project, used as part of the pilot survey, was funded by Defra.

**Organiser(s)**

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**Publications**

The main reports of the survey are:

The 1-km square surveys: Gillings, S., Wilson, A.M., Conway, G.J., Vickery, J.A. & Fuller, R.J. 2008. Distribution and abundance of birds and their habitats within lowland farmland of Britain in winter. *Bird Study* 55: 8-22.

The Winter Walks and Casual Records: Gillings, S. & Beaven, P. 2004. Wintering farmland birds: results from mass-participation surveys. *British Birds* 97: 118-129.

A detailed assessment of the Pilot Survey: Atkinson, P.W., Fuller, R.J., Gillings, S. & Vickery, J.A. 2006. Counting birds on farmland in winter. *Bird Study* 53: 303-309.

Specific results of the plovers: Gillings, S., Austin, G.E., Fuller, R.J. & Sutherland, W.J. 2006. Distribution shifts in wintering Golden Plover *Pluvialis apricaria* and Lapwing *Vanellus vanellus* in Britain. *Bird Study* 53: 274-284.

The survey was noticed in *BTO News* numbers 205, 222, 224, 228, 230, 241, 247 and 253.

**Available from NBN?**

No.

**Computer data -- location**

BTO Windows network central area.

**Computer data -- outline contents**

The main square data are in a MS-Access database, although the Excel version extracted from that will be sufficient for most purposes. Other datafiles (mostly Excel files) and GIS analyses are available for each of squares, winter walks and casual records, together with electronic copies of forms etc.

**Computer data -- description of contents**

The data files are divided into a directory for each of Square surveys, Winter walks and Casual Records and the main files are in a directory "data processed" within each.

**Square Survey**

The main data are stored in an MS Access database. However, these require a lot of manipulation to get in a usable format. The best file to use is BEST2USE.CSV which is a large file that includes only the priority species,

only visits in the period, and only those visits with complete bird, habitat and area data (but possibly with a few parameters still missing).

This is formatted as: GRIDREF (1-km square reference); winter (1,2,3); visit (1,2,3); PATCH (coded number); speccode (2-letter code); numbers of birds in MARGIN, INTERIOR, U, F, TH, LH, TL, B, D, V, X (U to X are different types of boundary); hab (field habitat); bdy (boundary habitat); AREA; PERIM; period.

For each there are 30 rows, one for each species, with counts in the margin, interior and different types of boundary. Field habitat, boundary habitat and areas are merged to each (therefore duplicated across species).

A file containing some detailed notes of what is in the database and some explanations is included. Tables are: 1-km square list; 10-km and BTO region; Area surveyed list form; Bird data 1999-2000 (and 2<sup>nd</sup> and 3<sup>rd</sup> winters); Habitat, coverage and areas W1 (and W2 and W3); Optional species coverage; Patches wholly in square; Periods; Square coverage; Square to county; Total area and LCM2000 coverage; Uniform within year coverage; Visit coverage; Visit details W1 (and W2 and W3); Weightings.

### Winter Walks

A spreadsheet for each of 3 winters with columns:

Number of route (as eg WW2001-001); Route code (as eg WW234); Route & Location (name of site); BTOREG (4-letter BTO region); Start Grid Ref (6 figures); Route Length (km); Date (as eg 21Nov2001); Start time (as 10.30); Finish time (ditto); Species code (2-letter -- some are such as FF+RE or "mixed finches"); Number seen; No. specs (no. of species in the line); Sp1 (first species); Sp2 (second species); Sp3 (third); Sp4 (fourth); Sp5 (fifth); Spec total (total number seen divided between number of species); Habitat (Crops: CB--Bean; CBR--Brassica; CC-Cereal; CCW-Wheat; CL-Linseed; CM-Maize; CO-Other (specified); CP-Pea; CQ-Potato; CR-Rape; CS-Sugar Beet; CSS-Sugar Beet grazed by sheep; CT-Turnip; CX-Unknown; OO-Orchard; WA-Arable wet; Cultivations: EB-Bare ground; EH-Harrowed land; EP-Ploughed land; ER-Rolled land; ES-Newly-drilled land; ESA-Newly-drilled arable; Grasslands: GG-Grass field; GGC-Cows/cattle grazed; GGH-Horse grazed (paddock); GGP-Pasture/meadow; GGS-Sheep grazed; GL-Grass ley; HAY-Hayfield; WG-Wet grass; Livestock: FL-Livestock present (specified); OC-Poultry feeder/animal feeder/yard; OG-Game strip; OP-Pheasant feeding station; Manmade: MB-Manmade, buildings, farmyard, farm; OF-Fence; OL-Straw bales/livestock feed; OM-Manure heap; OR-Road/track/bridleway/path; OW-Wire/telegraph wires; Stubbles: SB-Bean; SBR-Brassica; SC-Cereal; SCW-Wheat; SL-Linseed; SM-Maize; SO-Other (specified); SP-Pea; SQ-Potato; SR-Rape; SS-Sugarbeet; ST-Turnip; SX-Unknown; Water: FW-Freshwater - wetland, river, stream, marsh, pond, reservoir; OB-Reeds; OS-Puddle etc; Other: MK-Market garden; MW-Margin weeds; NH-Natural dry habitat, heath; OD-Ditch; OH-Hedge/bush; OT-Trees; OX-Rough area, field margin, thistle patch, weed patch; SAS-Set-aside; SIL-Silage field; TF-Woodland; TS-Shelterbelt; UA-Unknown arable; UF-Unknown farmland ("Field"); UM-Moorland; XO-Other habitat (specified); XX-Unknown); Activity (R-ROOSTING - standing, sitting; L-LOAFING - resting, preening, dust bathing; F-FEEDING; W-FLYING - do not record habitat (insert XX); B-DRINK/BATHE; S-SINGING; P-PRESENT - in, flushed, perched, calling); Notes

### Casual Records

Spreadsheet containing:

Number; Code on Form; DATE (as DD/MM/YYYY); DAY (as number); MONTH (3 letter); WINTER (eg 2001/2002); WEEK (not certain); 2WEEK (normally half previous field); TIME (may be eg 08:30, AM or blank); LOCATION (name of site); COUNTY (as GBxx or blank); GRIDREF (6-figure, or blank); graf4map (10-km square); FLOCK\_SP (species as 2-letter codes); FLOCKTOT (total number of birds); NO\_SPEC (no. of species involved); SPEC1, SPEC2, SPEC3, SPEC4, SPEC5 (the constituent species); SPECTOT (the number of each ie Total/no. of species); HABITAT (as above); ACTIVITY (as above); NOTES

Other sheets contain some notes and the codes for habitat and activity as listed.

### Information held in BTO Archives

1 Archive Box containing data from Winter Walks and Casual Records; 4 Transfer Cases containing data from Square Surveys.

### Notes on Access and Use

## Other information needed

### Notes on Survey Design

a) The species targeted: The survey initially targeted 30 species of farmland bird. These included: (i) species for which winter ecology had been identified as a key research need (eg Tree Sparrow *Passer montanus*), (ii) species whose main wintering habitat is farmland, and (iii) species that use farmland in large numbers in winter but for which it is not necessarily their main habitat (eg Chaffinch). In subsequent winters additional species were also recorded. The species differed widely in ecology and distribution, so methods were integrated to provide adequate coverage and detection of all 30 species.

b) Selection of survey squares: Fieldwork to survey farmland species in winter is very time-consuming, so in lowland farmland areas a two-stage procedure was used to select 1-km sample squares: a coarse 10-km resolution filter followed by a finer 1-km resolution filter. Data on the extent of cropped land (the 'crops and fallow' category) and agricultural grassland ('pasture' category) within 10-km squares in 1988 (data adapted from Parish Summaries of the MAFF Agricultural June Census, provided by University of Edinburgh Data Library) were combined and expressed as the percentage of the land area in each 10-km square. An analysis of the relative abundance bird data from the 1981/82-1983/84 Winter Atlas showed that setting this figure at a threshold of 30% or more encompassed more than 70% of both range and numbers for most of the 30 target bird species for this survey. The resulting selected set of 10-km squares with more than 30% land which was cropped or was agricultural grassland was largely in the lowlands and outside urban areas.

Next, individual 1-km squares classified as Marginal Upland or Upland by the Institute of Terrestrial Ecology (ITE) Land Classification System were excluded, and the ITE Landcover Map of Great Britain was used to exclude any squares with 25% or more woodland cover (landcover types 15 and 16) or urban/industrial cover (landcover type 21).

Finally, squares were stratified by region and by Arable or Pastoral ITE landscape types to ensure good geographic coverage. In England, the three regions used were based on amalgamated government administrative regions, and Wales and Scotland were each treated as regions in their entirety. The aim was to assess farmland bird ecology on a regional basis and in order to do so it was necessary to ensure that sufficient numbers of sample squares were surveyed in all regions and landscape types. In some regions certain strata were rare (for example only 7% of 1-km squares fell in Wales, of which only 8% were Arable) so the stratification was adjusted to achieve reasonable sample sizes in each region and landscape type.

### Specific Issues for Analysis

a) Bird data: Visit number (1, 2 or 3) was not biologically meaningful, so they were assigned to one of: early -- November-December, mid -- January, late -- February. Visits falling outside of these periods were excluded from analysis and if more than one visit fell in a period, one was selected at random.

On average, observers surveyed  $57.0 \pm 0.3$ ha of farmland per 1-km square, equivalent to  $72.1 \pm 0.3\%$  of the farmland actually present in each square. Therefore, for mapping, bird

counts had to be standardized by scaling up for each square based on the area of farmland surveyed and the area of farmland actually present in that square.

At least one survey for birds and habitats was undertaken on 18025 patches and most received multiple visits across seasons and winters. The frequency distributions of bird counts were extremely skewed: for many species 90% or more patches were apparently unoccupied leading to zero-inflated distributions which could not be transformed. This presented problems for summary statistics and significance testing so a three-level approach was used: the occupancy of sample squares, the occupancy of patches within occupied squares, and the density of individuals within occupied patches. The percentage of squares occupied by a species was calculated separately for each winter × period and then averaged across the nine winter × periods. For species present in 1% of squares or less, patch occupancy or density figures were not calculated.

Maps summarizing the distribution and abundance of the target species were smoothed contour maps of relative abundance because these could effectively provide summary information when reproduced at a small scale, whilst not placing too much emphasis on the actual densities, which for some species are likely to be underestimates. Maps were produced by inverse distance weighting over the 10-15 nearest neighbours in ArcMap (version 9.0), this used because it makes no assumptions about the underlying data. For each species the bird data used were the total number of individuals recorded on a visit to a square (ie summed across all patches) and standardized for total area surveyed and averaged across all visits. Contour levels were selected to reflect ten quantiles thus producing relative abundance maps comparable across species.

b) habitat availability: Habitat availability was mapped, using inverse distance weighting, in early, mid and late winter using the percentage of farmland in the square that was under each cover type (and taking a mean across winters).

c) Evaluating habitat use and use relative to availability: For a general description of habitat use simple occupancy rates were used based on the proportion of individuals and the proportion of records (approximating to flocks) of each species in each of ten broad habitat types: unimproved grass, improved grass, other grass, cereal crop, other crop, cereal stubble, other stubble, farmyard, bare soil, other agricultural habitats. For subsequent analyses the 'other' categories were broken down into constituent parts.

There was large variation in availability between habitats. Due to the highly skewed survey data, habitat use was measured in relation to availability at two hierarchical scales. Firstly, what were the characteristics of occupied 1-km squares; and secondly, which habitat types were used at the patch level within occupied squares.