BTO Research Report No. 581

An Evaluation of Bird Populations on Pea Growers Farms Between 2007 and 2010 and Relative to Neighbouring Farmland.

Author

Dr Ian Henderson

Report carried out by the British Trust for Ornithology

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EXECUTIVE SUMMARY

1. In lowland Britain, in the last 30 years there have been widespread changes in the pattern of land-use, that have caused significant losses of heterogeneity (complexity), at landscape, inter-crop and intra-crop scales. Demands for higher standards for biodiversity, and the protection of soils and raw materials have stimulated both Government (Curry, 2002) and corporate-funded research programmes. For Birds Eye, their sustainable agriculture programme demonstrates recognition of environmental responsibilities, designed also to secure and support key business demands for product quality. Birds, being popular and conspicuous species, tend to be valued as a desirable and measurable component of biodiversity. Furthermore, for some species, such as Lapwing and Skylark, their songs and behaviour are evocative of a healthy, open countryside, with widely acknowledged aesthetic value.

2. In 2005 (winter 2006), 2007 and 2008 bird census data were taken from 19 pea-growing farms, targeting crops and surrounding habitats using standardised mapping techniques. These identified some changes in population trends for the period 2005 to 2008 relative to national data, and also examined differences between habitats and crops in their support of birds in summer and in winter. In 2010, the breeding bird survey was repeated on the project farms, to identify changes in the population trends of species since 2005 on growers' farms, and relative to national bird-monitoring data.

3. In 2010 there were both increasing and declining trends amongst the species of interest. There was a general increase in the trend for seed-eating species on grower's farms (bar Yellowhammer) against the national trend, but inline with the national trend, a decline for insectivorous species and in-field species on grower's farms, with the exception of Lapwing. Lapwings increased in number on growers' farms, especially between 2008 and 2010.

4. The contrasting trends between bird limited by winter seed resources ('seed-eating') and species limited buy arthropod availability at some point during the life cycle ('insectivorous' species) implies that on average growers may have been providing more winter seed food for birds than previously.

5. The reason for the increase in Lapwings on growers' farms is not clear but may be due farmers becoming more aware of the birds' presence and needs, so allowing them more time and space to settle and complete broods.

6. Additional recommendations are made that may help growers continue to progress in providing habitats and conditions that are favourable to a broader range of species.

1. INTRODUCTION

In lowland Britain, in the last 30 years there have been widespread changes in the pattern of land-use, that have caused significant losses of heterogeneity (complexity), at landscape, inter-crop and intra-crop scales (Benton *et al*., 2003). Similar processes have occurred throughout industrialized agronomic regions of western Europe and North America (Donald *et al.*, 2002b; Banks, 2004) where technological advances in crop management have led to greater control of competitive plants, invertebrates and disease (e.g. O'Connor & Shrub 1986), contributing therefore, to simplified crop rotations and crop structures (Chamberlain *et al.*, 1999). In the arable sector, the progression towards cereal monocultures and the spatial dominance of winter-sown cereals has contributed to well-documented declines in the abundance and variety of many once common and widespread plants and animals. Examples include reductions in the abundance and diversity of invertebrates, arable weeds (Wilson, 1992; Sotherton and Self, 2000), reduced food availability for seed-eating and insectivorous birds (Siriwardena *et al.*, 1998a, Robinson & Sutherland 1999; Brickle & Harper 2002) and a lack of suitable nest sites for field-nesting species such as Lapwings *Vanellus vanellus* (Sheldon *et al.*, 2002), Yellow Wagtail *Motacilla flava* and Skylarks *Alauda arvensis* (Wilson *et al.* 1997; Donald *et al.*, 2002a). In winter, poor foraging conditions (low weed seed value and grain wastage) on farmland have been associated with reduced over-winter survival in species such as Reed Bunting (Siriwardena *et al.* 1998b).

In Britain, demands for higher standards for biodiversity, and the protection of soils and raw materials have stimulated both Government (Curry, 2002) and corporate-funded research programmes. So-called "agri-environment" schemes are playing an increasing role in restoration of habitats for wildlife in arable landscapes, by adopting field-margin and whole-field options. However, it is widely recognised that the huge expanses of commercial crops can and should make basic and fundamental contributions to increased biodiversity if population recoveries of many animals are to be registered on a national scale (Vickery *et al.*, 2004). Indeed, for some species of bird, such as Lapwing and Skylark, that nest within fields and avoid margins, within-crop initiatives are the only options available for their widespread conservation and as such, whole-field management options may have to be considered under conservation initiatives. Overall, then it is helpful, that for agronomic as well as environmental reasons, a determination to find more "sustainable" alternatives to current farming methods has fostered a process of increasing convergence between farming and wildlife interests.

In the UK, pea crops, despite covering a relatively small total crop area, have a high potential to contribute to significant densities of several bird species of high conservation concern on farmland, both within the crop itself and by increasing the complexity of a rotation or landscape. Pea crops may potentially contribute directly or indirectly to bird conservation on farmland, given sympathetic crop management, improved awareness among farm operators and advisors, and improved knowledge of the crops' value relative to surrounding crops, habitats, refuges and foraging sites. But farmers who accept Birds Eye sustainable agriculture guidelines on sustainable management are likely to farm the complete rotation in the same diligent manner. It is hoped that their efforts are reflected in the numbers of birds occurring on the farmland and boundaries. For this reason the study in 2010 was completed as part of the standard monitoring of the sustainable agriculture programme and potential effects on biodiversity. In 2010 farm visits were arranged in order to identify whether there were detectable differences between bird populations on growers farms relative to the surrounding farmed countryside and to assess their overall performance against a national benchmark.

The monitoring of bird populations on project farms is intended to contribute important feedback on the performance of the Birds Eye sustainable agriculture standards, as regards avian biodiversity to help tailor and manage the sustainability protocol in a meaningful and progressive manner.

2. METHODS

2.1 Field visits

In 2005, 2007 and 2008 bird surveys were conducted on a sample of 20 sites managed by growers, using a method that was directly compatibility with the UK national Breeding Bird Monitoring scheme (BTO/JNCC/RSPB Breeding Bird Survey – known as the 'BBS'). In 2010, the survey work was repeated on 15 sites to look for changes in bird populations that may have occurred on grower's farms during the interim period. The national and regional BBS dataset provided a benchmark against which to compare population change on grower's farms. The BBS squares were selected on the basis of their being predominantly arable farmland in character, and therefore representative of the surrounding arable landscape in which the growers farms were situated. Changes in bird populations on grower's farms were compared to: a) the BBS dataset for the England and b) the regional BBS dataset for the Yorkshire & Humberside region (Fig. 1). The English data base is based on a larger sample size of survey squares, so that the bird trends are more robust (precise), while the Humberside data set obviously offers local relevance but, being based on fewer survey squares, may be less precise. Both data sets will offer a relative guide to background levels of change in the wider countryside.

On grower's farms, an area (a 'site) of approximately 40 ha was visited twice between May and July. On some growers farms two or even three sites were covered on the same estate. During each visit, surveyors walked two roughly parallel 1-km transects across each site, allocating all birds seen or heard to distance bands lying perpendicular to the observer and transect line (0-50 m, 50-100 m and >100m). No counts were conducted in persistent heavy rain or wind speeds in access of Beaufort force 4 as these conditions reduce the effectiveness of the survey. Bird registrations were recorded at the first position where they were detected and care was taken not to double count birds when moving around the site. Birds in overhead flight were recorded only if they were considered to be in local territorial or foraging flight (displaying Skylark or Lapwing; foraging Kestrel or Swallow, for example, but not overhead gulls).

2.2 Analysis

For the analysis, bird 'territories' were estimated from counts, averaged over the two visits, using registrations extending up to the 100m distance band only. This created a standardised 2-km by 200-m recording area of approximately 40 ha. Territory estimates provided a consistent measure of change over time between the years, 2005, 2007, 2008 and 2010, this being the focus of the survey, but they did not provided an 'absolute' value for bird densities as based on 'distance' sampling. Bird territory estimates were plotted as an index which represents the percentage change in abundance since the baseline year set in 2005. Tests of the statistical significance of such changes (2005 to 2010) were carried out using General Linear Models (GLM) Poisson regression with log-link error terms.

3. RESULTS

3.1 National trends

Figure 2a and b show the combined Breeding Bird Survey (BBS) trend (averaged trend across all species) for the farmland bird indicator species in England since 1970. The trend has been in steady decline since the mid 1970s, though less so during the late 1990s, probably as a results of set-aside being at its peak in terms of area coverage. Since 2003 or 2004 the index has fallen further into decline. This sets the background against which the present monitoring on the growers' farms was conducted, between 2005 and 2010. Unfortunately the national BBS figures for 2010 were not available at the time of writing so we make the conservative assumption that there was no change between 2009 and 2010.

Nationally, between 2005 and 2009 there was a 9% decline in the index, mainly attributable to declining Kestrel, Turtle Dove, Skylark, Lapwing, Grey Partridge, Linnet, Tree Sparrow, Yellowhammer and Corn Bunting, and despite increases in other species (eg., Goldfinch, Jackdaws, Woodpigeon and Stock Dove). Turtle Dove is now so rare that is was not recorded on any of the project farms in Humberside, so this species was not included in any analysis of local trends referred to in this report.

3.2 Trends on growers' farms

In Figure 3, the graphs show the trends for species that are part of the farmland bird index (FBI) and also consistently recorded on grower's farms in Humberside. The data points are based on the total count of each species across all farm sites visited in each year.

In Figure 3a, the figure illustrates a general **decline** for in-field species on grower's farms, with the exception of Lapwing. Of these trends, however, non were statistically significant except for Kestrel (strong, significant decline Likelihood ratio (LR) Chi-square = 8.1, $p < 0.005$). For Lapwing, the increasing trend was encouraging and approaching significance (LR Chi-square = 3.1, $p = 0.07$). Both of these species are in national decline, Lapwing less so. Farms growing peas have an advantage in this being one species that can breed successfully in pea crops, given reasonably considerate management that is in alignment with the Birds Eye standards biodiversity guidelines.

In Figure 3b, the figure illustrates a general **increase** in the trend for seed-eating species on grower's farms, (bar Yellowhammer, a non-significant decline), though only the trend for Tree Sparrow and Linnet were statistically significant (LR, Chi-square = 3.83, $p = 0.05$; 4.17, $p < 0.05$ respectively). Overall, this is a very promising result as these species are 'struggling' to maintain populations on modern farmland in England.

In Figure 3c (in contrast to the seed-eaters in 'b'), species with a strong invertebrate requirement have tended to **decline**, though only the trend for Starling was statistically significant (LR, Chi-square = 3.83, $p < 0.05$). The trends for these species are consistent with national patterns of decline, including Starling. Starlings probe for soil invertebrates, such as leatherjackets and beetle larvae (such as chafers) that become scarce in dry arable conditions. Starlings require more organically rich pastoral or fallow substrates in which to probe.

In Figure 3d, the graph shows the farmland bird indicator species, a) as a group and b) as a sub-group that are in current national decline. Both of these two groups have **increased on growers' farms** since 2005 relative to the national and regional trend. This pattern of increase on growers' farms is most closely related to the pattern of increase among the **seed-eating species** in Fig.3b above. It implies that the farmers are probably providing more winter seed food for birds than in the past as this is the element that these five nationally declining seed-eating species have most in common.

In Figure 3e, the trends for Goldfinch (LR, Chi-square = 3.99, $p < 0.05$) and Greenfinch (LR, Chi-square = 4.1, $p < 0.05$) on growers' farms were consistent with national trends. Goldfinch is undergoing an increase in population size at present due to a higher proportion of birds utilising garden food sources. Nationally, the Greenfinch has suffered large declines in abundance due to mortality from the disease *Trichomoniasis*. Because of their strong association with gardens the trends for Goldfinch and Greenfinch may not be directly relevant to farmland. Bullfinch meanwhile has suffered national declines on farmland. The data suggest no change on pea grower's farms, although the sample size for this species was small.

In Figure 3f, apart from Carrion Crow (almost significant increase; LR, Chi-square = 3.80, $p < 0.06$) the trends for all the farmland corvids and Sparrowhawk showed no significant change in abundance. Numbers of Jackdaws always fluctuates widely between years depending on where flocks are when the sites are visited, meaning that reliable trends can be difficult to ascertain. Overall there was no change on the growers' farms between 2005 and 2010. Sparrowhawk showed a slight decline on growers' farms, and this is consistent with the national pattern of change. This species is no longer increasing in England but has levelled off and is now in shallow decline. Note that none of the species' trends for corvids or Sparrowhawk, either singly or combined, explain the difference in trends between the farmland bird species above that contribute to the farmland bird indicator.

4. DISCUSSION

4.1 Re-cap 2005-2008

As regards trends in bird abundance, between 2005 and 2007/2008, on project farms, the abundance of BAP species (species of conservation concern) increased by 11% by 2007, and by 8% by 2008. The regional trend for surrounding farmland showed no net gain in abundance for the same combined group of species. The species that had undergone the biggest increase in abundance were boundary-based species, such as, Dunnock, Song Thrush, Reed Bunting and Yellowhammer. These species are associated with the presence of well-developed hedgerows, hedgerow boundary strips. The species that had responded least were the open field species, such as Lapwing and Skylark that nest in crops and fallows.

4.2 2005-2010

Between 2005 and 2010 the indications are, that in the latter phase, since 2008, positive effects on birds have been more food related than habitat related, since there are apparent contrasts between functional groups (i.e., seed-eaters versus the insectivorous species). The results in 2010 suggest that actions on growers' farms have favoured the seed-eating species in particular. This is a welcome and promising result as these species have been in very significant decline in England in recent times and are strongly influential on the overall farmland bird index. The fact that these increasing seed-eating species use very different kinds of boundary nesting habitats (Tree Sparrows prefer mature hedges while Corn Buntings prefer open landscapes and lower hedges) suggest that boundary management was not the principal driving factor behind the positive trends registered in 2010. Neither do the predatory species provide an explanation, since generally their numbers have remained stable (bar Carrion Crow) and, more importantly, the trends among farmland bird species that might potentially be viewed as prey show no consistent pattern of direction.

So, the most interesting observation in 2010 was the contrast between the increasing seed-eating species and the generally declining insectivorous species. Their differing trends imply that the provision of winter food for the seed-eaters may have been important in recent years on growers' farms. Virtually all species of both groups forage for invertebrates in summer, so the diet at this time of year is less of a distinguishing factor between the two groups. Survival studies of species such as finches and buntings suggest poor availability of seed-food resources in late winter is a limiting factor in population growth, therefore their pattern of increase on growers' farms implies that this food limitation had been to some degree alleviated. Grey Partridge might also have been expected to respond positively over the same period of time since this species will also exploit a provision of seed resources in winter. However, in this species, the presently recognised limitation on population growth is a lack of invertebrate food for chicks in mid summer. So Grey Partridge and the true insectivorous species such as Dunnock and Starling are principally affected by a different foraging resource to the seed-eaters. The foraging resource for seed-eaters is conceptually easier for farmers to provide, in the form of winter bird-seed crops (e.g., game crops), whereas invertebrate food requires farmers to pay closer attention to the actually quality of the habitats in which these invertebrates thrive, in order to maximise the benefits.

Both the Government, through the ELS, and the Campaign for the Farmed Environment (CFE) have implored farmers to provide more winter food resources for sparrows, finches and buntings. Alignment with CFE guidelines is also a strong requirement of the Birds Eye sustainable agriculture standards (standards for biodiversity: 5.5) and the indications are that seed-eating birds in particular may have benefited from a laudably positive response by project farmers to these 'demands'.

Lapwings
At the same time, the upturn in Lapwing numbers on the project farms was a further welcome surprise. Between 2005 and 2008, all the in-field species including Skylark and Lapwing had declined. It is generally recognised that farmers attend to in-field species less well than they do to boundary-based

species as they dislike 'tinkering' with the crops themselves as habitats (understandably so since the crops are their income). However, since Lapwings will nest in spring crops such as peas, it was disappointing to report in 2008 a decline in this species on pea-growers' farms. Lapwings do not use *all* pea crops as nesting habitat but they do use pea crops in preference to other crops, such as cereals. Probably the decline was not helped by the widespread loss of set-aside from 2007, which added another valuable layer of complexity to rotations, and provided directly important habitat for Lapwings. It is hoped that the increase in Lapwing numbers on project farms in 2010 is a genuine response by growers to manage their crops in a manner consistent with the aspirations of the sustainable agriculture standards (eg., biodiversity standards section 5.1 vii), by adopting reasonable consideration for in-field species that use the crop rotation.

4.3 Current limitations on species populations and consideration for future management

The general conclusion is that some results from 2010 suggest promising and laudable increases in the populations of species on project farms that appears indicative of growers responding positively to the biodiversity standards. As not all species were affected in the same way, however, it may be worth re-emphasising one or two points that could guide growers wishing to maintain progress. The following is a resumé of important known effects for a number of relevant species or species groups and management that can help (also Table 1):

Food in winter
For many **seed-eating passerines**, the main limitations on populations are currently identified as poor foraging resources in winter that leads to reduced over-winter survival (Siriwardena et al. 1998) and recruitment in the following year. Here, the provision of seed, especially late in winter or early spring when resources are very low, is exceptionally valuable to species such as sparrows, finches and buntings. The better winter bird crops include balance of large and small seeds, from crops that are more persistent in late winter, especially cereals (eg triticale or simply seeding wheat for buntings) and small oilseeds from rape or other brassicas – for finches such as Linnet and Tree Sparrow.

Food in summer
For other species, such as **Grey Partridge** a key limiting factor has been identified as poor chick survival during summer, mainly caused by insufficient insect resources on which the chicks feed. It is important to provide *plenty* in the way of marginal and so called 'interstitial' patches and habitats, such as tracks, headlands, field corners, stack yards and so on. These areas provide vital and rich sources of seed and insects if left unfettered and un-managed in terms of inputs of herbicides and especially insecticides.

Breeding success
For **Skylark and Lapwing** that nest in crops, these species face two other problems, i) crop structure and ii) crop management and harvest. Fast growing winter crops grow too tall and dense in spring and summer to allow the birds to gain access to the ground for breeding or foraging purposes. For Lapwings winter crops can remove all opportunities to breed. For Skylarks winter crops prevent birds from raising second broods (half their annual output). For this reason mixed crops and spring crops offer many more opportunities for these species to succeed since the crops, especially peas, are sown late, are low growing and often have a relatively open crop structure that allows birds to breed successfully from April to June. There are threats to nests and broods located within crops from management activities such as drilling and rolling. Mixed crops and fallows however, can provide nearby refuges for precocial chicks (walking and independent), providing an escape from crop operations in the natal field, such as when harvesting. Also crop management activities are better concentrated in time (such as drilling and rolling in pea crops) so that nesting birds cannot settle in between events but instead are given a long window of opportunity to breed after these events, without risk of damage to the nests. This recommendation is part of Bird Eye standards protocol for biodiversity in vining peas.

Action	Key species
i) Winter food.	Finches, sparrows and buntings.
ii) Varied rotation including stubbles/fallows and spring crops.	Kestrel (fallows), Lapwing, Skylark, Yellow Wagtail.
iii) Organic input to aid the invertebrate populations on which Starlings and Rooks feed.	Lapwing, Starling and Rook,
iv) Follow the guidelines for pea-crop management in concentrating crop management activities.	Lapwing.
v) Provide as many 'interstitial' habitats margins corners, stack yard as possible and allow these patches to flourish free from herbicides and especially insecticides as valuable seed and insect-rich reservoirs of for many birds species throughout the year.	Many species including Kestrel, Barn Owl, Turtle Dove, Grey Partridge and Linnet.
vi) Boundaries should not be too manicure or cut too frequently, rotationally cut and maintained for variety in structure is best, especially in retaining older trees as nest sites for birds.	Breeding Turtle Dove and Tree Sparrow

Table 1. Summary table of valuable actions for birds, generally of low impact on crops or crop management.

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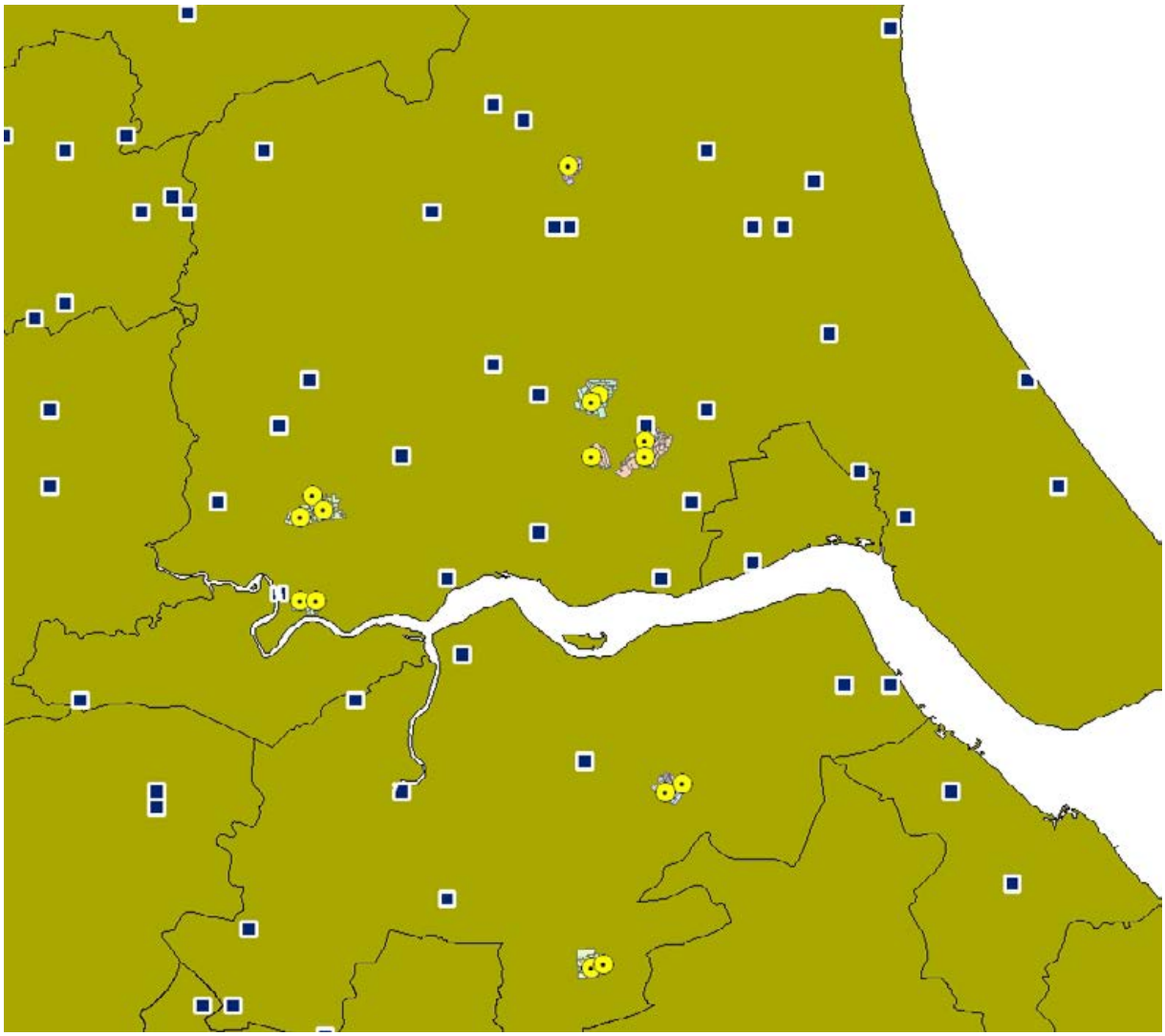
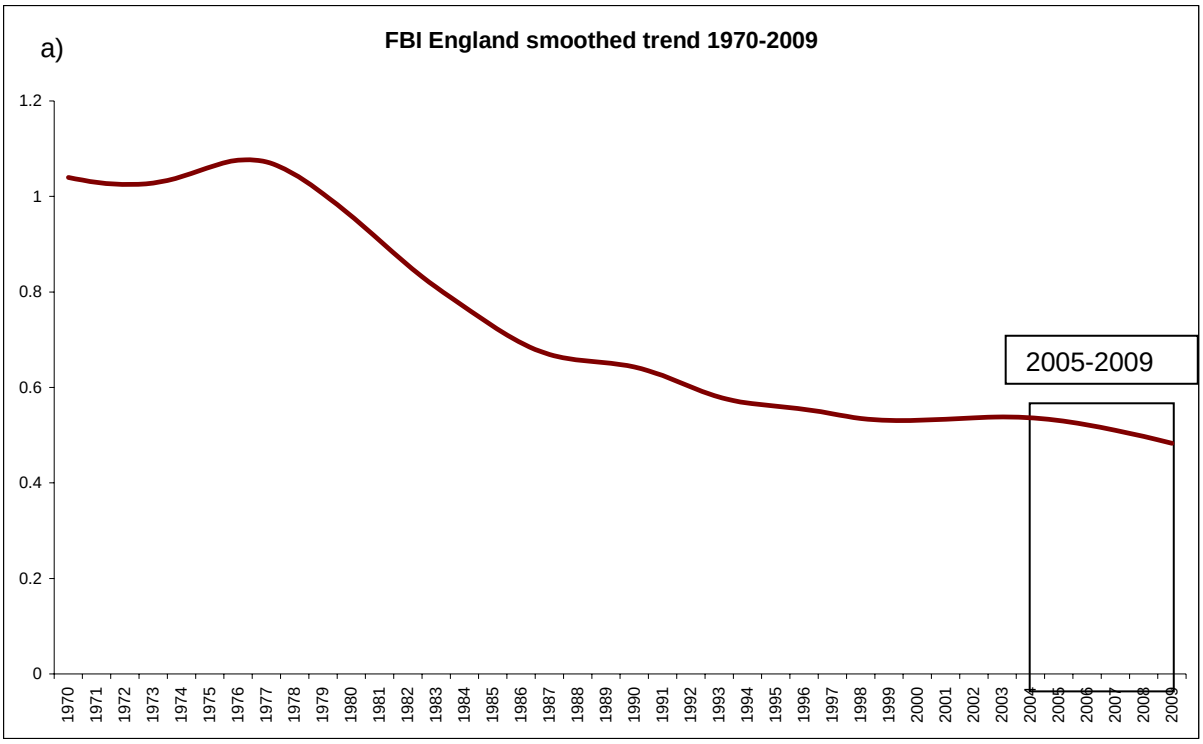


Figure 1. The circles mark the position and distribution of the 15 project farm sites in 'Humberside'. The squares are farmland Breeding Bird Survey (BBS) Squares used by the national monitoring scheme to monitor changes in bird populations. Those BBS squares situated in East Yorkshire and North Lincolnshire were considered representatives of 'average' farmland for Humberside, against which to compare the bird trends from project farms.

Figure 2. Temporal trends in the Farmland Bird Index (FBI) for a) England, long-term, between 1970 and 2009 and b) England between 2000 and 2009 – showing the period of recent decline. At the time of writing there were no data available for 2010. The insets highlight the period of interest during which comparable counts were made on pea grower's farms. The index itself illustrates proportional change relative to an index reference point of '1' set at 1970. So for example 0.8 on the y-axis is 20% below the 1970 reference point. (NB. In 'a' the trend line is drawn slight too high, i.e. 1970 should = index value 1.)



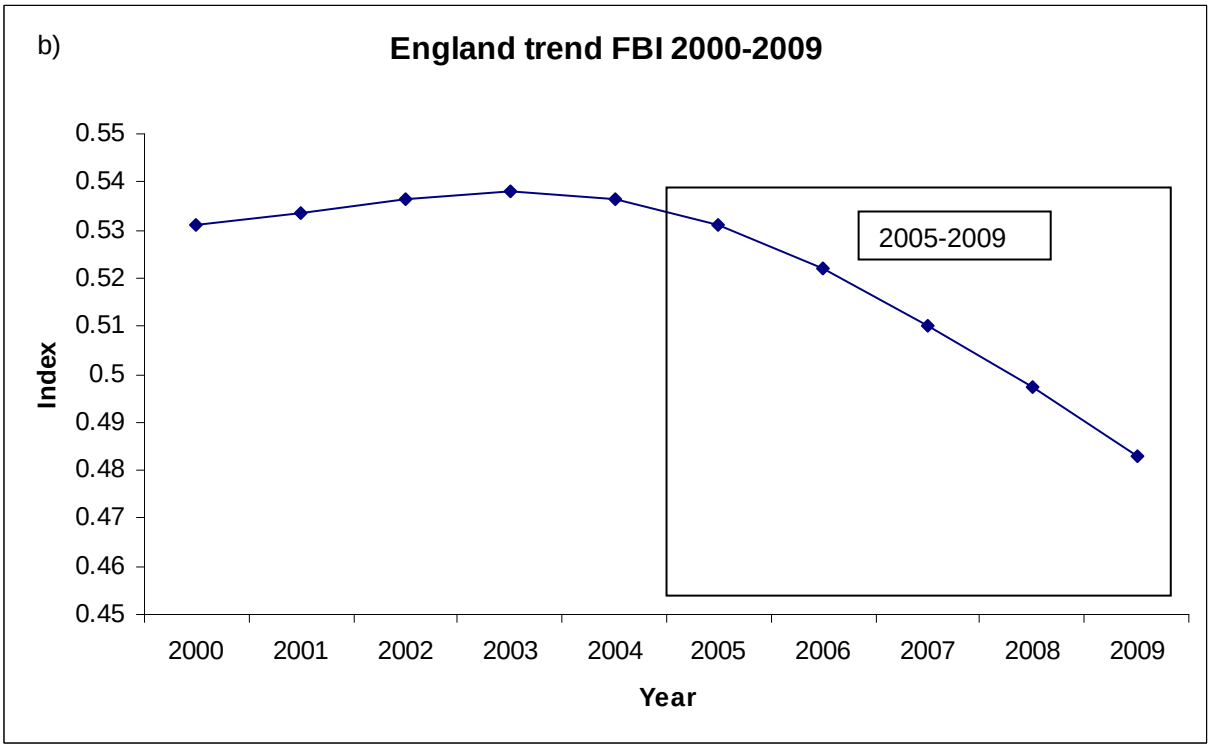


Figure 3. Trends in species populations and trends in the Farmland Bird Index (FBI) during 2005, 2007/8 and 2010. Except for (d) all trends are for birds recorded on the sample of grower' project farms, visited during these four separate years. In (d) comparative trends are displayed for England as well as the Yorkshire/Humberside region. In (d) *only* the national data for 2010 were not available as the time of writing and so were estimated at the 2009 level.