Natural England Commissioned Report NECR040

Assessment of the impacts of the Countryside and Rights of Way (CROW) Act 2000 (Part 1) on bird populations

Results from the baseline year of the pilot study, 2006

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Foreword

Natural England commission a range of reports from external contractors to provide evidence and advice to assist us in delivering our duties. The views in this report are those of the authors and do not necessarily represent those of Natural England.

Background

The Countryside and Rights of Way (CROW) Act 2000 (Part 1) came into effect across England in 2005. The Act provides a new right of open access allowing people to walk freely over areas of mapped open country (mountain, moor, heath, down) and registered common land.

The National Open Access Monitoring Programme was set up to evaluate the long-term impact of implementing the new access rights by identifying the level of awareness, uptake, use, economic and biodiversity impacts from the introduction of the Open Access rights across England.

Visitors using this new right of open access could potentially increase disturbance to breeding bird populations, adversely impacting on biodiversity at the landscape scale.

In 2005 the British Trust for Ornithology (BTO) was commissioned to carry out a pilot to explore how the existing breeding bird survey (BBS) developed by BTO/RSPB/JNCC could be used to inform the approach for a full scale monitoring project. The aim was to be able to detect significant changes in bird trends at the population level across newly mapped Open Access Land. In preparation for the full scale monitoring contract BTO carried out this pilot study to develop a method to monitor the impact of any change in access use on breeding bird populations prior to and after the implementation of the new access rights over the long-term.

The Breeding Bird Survey (BBS) was identified as the ideal tool for this purpose, being an extensive annual survey organised by the BTO since 1994. The data collected enables the BTO to generate annual UK (and England) population trends for more than 100 species. Power analysis of existing BBS coverage across newly mapped open access land was undertaken to understand the level of increase in monitoring squares required to detect significant changes in long-term bird trends.

The Upland Breeding Bird Survey (UBBS) was originally set up as an annual integrated monitoring project to monitor long-term bird trends at the upland landscape scale across England to inform the impact of Natura 2000 designated sites (both SPAs and SACs) in protecting cited species and to understand the impact of Open Access on upland bird populations. Elements of this programme are being integrated into Natural England's Integrated Monitoring Programme and Species Surveillance Strategy.

In 2009 UBBS data has already been successfully combined with BBS data for the first time, filling a monitoring gap in the uplands, improving the accuracy and power of the overall BBS and trends it produces. Prior to this the uplands were under represented due to their remoteness, effecting volunteer effort. This was reported in the **BTO Breeding Bird Survey Report 2009**.

This report is being published as part of a package of reports relating to monitoring the impacts of (CROW) Act 2000 (Part 1). These include:

- Executive Summary, Communications and Access Management Commissioned Reports of the National Open Access Visitor Survey (NOAVS) 2006 to 2008, published in three parts NECR036a, NECR036b and NECR036c; and
- Upland Breeding Bird Survey (UBBS) (2007) NECR041.

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Further information
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Executive Summary

1. The Countryside and Rights of Way (CRoW) Act (Part 1) came into effect across England and Wales between 2004 and 2005. This allows the public a new right of open access to areas of mountain, moor, heath, down and registered common land. The Countryside Agency (now Natural England) contracted the BTO to carry out a pilot study to monitor the effect of the CRoW Act on upland breeding bird populations.

2. The BTO/RSPB/JNCC Breeding Bird Survey (BBS), an annual bird survey of random 1-km squares across Britain, provides the basis for the Open Access project, through the comparison of population trends before and after implementation of CRoW and comparisons of trends in areas experiencing different visitor use since the Act. Currently there are approximately 70 BBS squares surveyed annually which contain a significant proportion of upland Open Access land. A power analysis of BBS data, carried out earlier in Phase 1 of this project found that augmenting the BBS sample in English upland open access areas to quadruple its current size would be necessary in order to detect significant population declines in key upland species, such as Golden Plover and Curlew.

3. In the baseline year 2006, 106 additional 1-km squares (53 randomly-selected pairs of adjacent 1-km squares) on upland Open Access land, were surveyed by professional fieldworkers. When the volunteer BBS squares are included, the sample in upland open access will be more than doubled (by approximately 130%). Some additional information on numbers of people and dogs seen on the survey squares was also collected.

4. With only data from a single year to analyse, preliminary spatial comparisons were made between squares on Section 15 land (land which has had historical access rights) and squares covering newly mapped access land. Six species (including five ground-nesters - Curlew, Golden Plover, Lapwing, Snipe and Red Grouse) occurred more frequently on new access land than on Section 15 land. Meadow Pipits were detected in significantly greater numbers on new access land than on Section 15 land. Raven was the only species to show a significantly higher rate of occurrence on Section 15 land. Some of these differences are probably attributable to differences in habitat on new and old access land (Section 15 land includes more pasture and semi-natural grassland, but less bog and heath). More data and work is required to distinguish the effects of habitat and visitor use.

5. We recommend that monitoring for the impact of the CRoW Act on upland birds is integrated with more comprehensive monitoring of birds in all upland habitats of England, including marginal uplands with enclosed pasture and wooded areas as well as the open moors and heaths designated for open access. However, it is also recommended that an additional sampling stratification including all Open Access land as well as designated sites should be targeted for more intensive surveying. This will most effectively focus effort on requirements to assess the impact of CRoW as well as fulfil statutory needs for monitoring of designated sites and species of conservation concern. Monitoring should be long-term, with the aim of increasing the core BBS sample in this upland stratum by about four-fold, in order to be able to effectively assess changes in bird populations within three or four years. The increases in coverage and in the period of time of monitoring will increase the power to detect declines in key upland bird species and will result in a larger number of species for which robust population trends can be generated.

6. Natural England should continue its on-site monitoring on access land across England in order to gain a national picture of visitor use to use in the analyses of the bird data. This could be accomplished through an extensive survey, as planned through the On-Site Visitor Monitoring Surveys, or by undertaking visitor use assessments for existing bird survey sites.

1. INTRODUCTION

1.1 Background and Rationale

The Countryside and Rights of Way (CRoW) Act (Part 1), which came into effect across England and Wales between 2004 and 2005 provides the public with a new right of open access to areas of mountain, moor, heath, down and registered common land that previously did not have a right of open access. From the new rights there is a potential for increased disturbance to breeding bird populations that inhabit newly mapped access land from visitors which could potentially have a negative impact on wildlife, depending on the extent and patterns of visitor use on sites.

There is a growing body of research into the effects of human disturbance on bird populations. Access disturbance is known to negatively affect the foraging behaviour of birds (e.g. Fernandez-Juric and Tellaria 2000; Ronconi and St Clair 2002) and their time activity budgets (e.g. Riddington et al. 1996). The effects of such disturbance can be manifested as reduced breeding success, such as for Ringed Plover and Nightjar (Liley 1999, Murison 2002; Woodfield and Langston 2004), or changes in distribution or abundance of breeding (e.g. Common Sandpiper: Yalden 1992; Woodlark: Liley and Clarke 2002; Golden Plover: Finney et al. 2005) and non-breeding birds (e.g. Pink-footed Goose: Gill et al. 1996; Burton et al. 1996). The extent to which the effects of disturbance are observed may be dependent on a number of factors, such as weather (e.g. West et al. 2002), the presence of predators (e.g. Mikola 1994) and the time of year (see Woodfield and Langston 2004 for review). The type and extent of disturbance is also relevant. For example, Finney et.al. (2005) showed that Golden Plovers avoided areas within approximately 200m of a popular part of the Pennine Way, prior to it being resurfaced, when 30% of people strayed from the path. However, when the path had been resurfaced only 4% of people strayed from the path and the Golden Plovers' avoidance distance reduced to 50m. Species show differences in susceptibility to disturbance. Yalden and Yalden (1989) found that Dunlins are less sensitive than Golden Plovers to the presence of humans, as the alarm-calling distance was approximately 200m for Golden Plovers compared to just 50m for Dunlin. Habitat type (e.g. Kentish Plover: Schulz & Stock 1993), breeding stage (e.g. Common Eider: Bolduc & Guillemette 2003) are also factors that affect the susceptibility of a species to disturbance. With ever-increasing use of the countryside for recreational purposes, the importance of assessing the impact of human-generated disturbance and promoting responsible use of our natural heritage has never been more timely. The Countryside Agency guided by English Nature (now Natural England) have carried out Nature Conservation Assessments on over 1000 SSSIs identifying the need for either Positive Access Management measures or limited use of s26 nature conservation restrictions to protect breeding birds in particular sites. There remains, however, a need to monitor the impact of the Act on breeding bird populations.

To this end, the Countryside Agency (CA) working closely with English Nature (now Natural England) has developed an Open Access National Monitoring Programme to monitor access land across England. As part of this programme, the British Trust for Ornithology (BTO) was commissioned to develop a method to monitor the impact of increased access on breeding bird populations. The best way of determining whether increased disturbance, due to the CRoW Act, is having an impact on upland birds is to monitor bird populations over the period over which the impact is likely to occur. The best tool for this purpose is the BTO/RSPB/JNCC Breeding Bird Survey (BBS), an extensive annual survey organised by the BTO. Each year, BBS participants use standardised recording protocols to survey their randomly-allocated 1-km squares (more than 2500 per year) and collect information on all bird species detected. The BBS has been running since 1994, and the data collected enables the BTO to generate annual UK (and England) population trends for more than 100 species.

The BBS dataset enables a BACE approach to be carried out to monitor the impact of the CRoW Act on upland bird populations. Firstly, as the BBS has been running since 1994, it provides an historical dataset from which to assess the population trends before (B) and after (A) the implementation of the

CRoW Act.. Secondly, starting with the baseline year of this project, bird population trends on sites with high visitor use (E for experimental) can be compared to population trends on control (C) sites with low visitor use..Earlier analyses (Noble et al. 2006) revealed that approximately 70 currently surveyed BBS squares can be defined as Open Access land, defined as covering at least 25% of the 1-km square. These sites are the basis for the before-after analyses. The existing BBS sites also provide a basis for the second set of analyses - to compare trends on Open Access land to control sites, but an important advantage is that this sample can be augmented by additional surveys to increase the power to detect population changes.

1.2 Scoping Study and its Findings

The first step was a scoping study (Noble et al. 2006) to assess the capability of existing national bird monitoring programmes to provide the information required, and to explore the feasibility of increasing survey coverage to improve the power to monitor any impact of the new Act. This was achieved through power analyses on existing BBS data to determine whether the current BBS sample was adequate to detect significant population changes that may arise due to the implementation of the CRoW Act over a five year period. Increases in coverage on Open Access upland areas were also simulated in power analyses to determine the degree to which this would improve the power to detect population changes in key species. The target measures for the simulations were 10% and 25% declines over 5, 10 and 25 years.

The current BBS sample on open access land (ca 100 sites altogether) was estimated to have a high enough power to detect an amber-level (25%) decline over five years in three key ground-nesting passerines (Skylark, Meadow Pipit and Willow Warbler) and one wader (Curlew). It was therefore recommended that the BBS sample in open access land be augmented by carrying out additional BBS-style surveys targeted on upland open access land. The power analyses suggested that doubling the BBS sample would, over the initial five-year period following the implementation of CRoW, significantly increase the power to detect 10% declines in species such as Curlew, Meadow Pipit, and Skylark, and to detect 25% declines in Pied Wagtail, Cuckoo, Chiffchaff and Yellowhammer. Quadrupling the BBS sample (an additional 210 1-km squares) would increase capacity to detect 25% changes in Golden Plover, Snipe, Tree Pipit, Whinchat and Buzzard, and 10% declines in the more widespread species such as Meadow Pipit, Skylark and Carrion Crow.

During the scoping exercise, it became clear that coverage of lowland open access areas (<30% of total) would need to be increased at a much higher rate than upland areas in order to be able to generate robust population trends for key species such as Dartford Warbler characteristic of lowland heath habitats (Noble et al. 2006). Even quadrupling the BBS sample would be insufficient. Moreover, lowland areas tended to be more fragmented and less amenable to the BBS line transect methodology. For these reasons, and because many of these species are monitored effectively, although periodically, by bespoke national surveys (e.g. Dartford Warblers and Woodlarks in 2006) it was decided to limit the augmentation of BBS to upland Open Access areas. Hence, the rest of this report relates to upland areas only.

1.3 Current Research and Aims of this Report

Following the pilot analysis, the Countryside Agency contracted the BTO to augment the BBS as recommended to more than double the existing coverage on upland access land. Following from the findings of earlier work, the target of 100 additional 1-km squares, were to be surveyed in pairs (i.e. one main random square plus one of the adjacent squares), on upland land only. Quadrupling the sample would have been preferable, in order to generate more robust trends for a larger number of species, but to test the methods and because of budget constraints, this level of coverage was agreed. This report describes the findings of the baseline year of surveys.

As part of a parallel initiative in the CA programme, an Open Access On-Site Visitor Monitoring Survey has been developed alongside the BTO Pilot Bird Survey Project. The aim of the On-Site Visitor Monitoring Survey is to gain a better understanding of:

- visitor awareness of access land,
- their rights and responsibilities,
- the use of the new access rights,
- the potential impacts on sites with nature conservation value and concerns
- opportunities for recreation on access land.
- the changes in levels and patterns of use across access land

It is hoped to make use of this information in the next phases of this project, in order to relate patterns and trends in bird abundance to visitor use (see Conclusions and Recommendations).

2. METHODS

2.1 Survey Square Selection

ArcView was used to create GIS layers of open access land and upland land in England, where upland was defined according to the standard CEH land classes (Environmental Zone 3 in England; Haines-Young *et al.* 2000). This was then used to select a sample of 300 squares at random from areas where the open access and upland layers overlapped. The design of this survey means that each site is a pair of adjacent 1 km squares. However, the selection of sites was achieved by randomly selecting 'main' squares and then allocating one of the adjacent squares to also be surveyed. Any squares that contained less than 50% open access land were removed from this sample. Of the remaining 250 squares, the first 90 squares were looked up on Ordinance Survey maps to assess, for health and safety purposes, their terrain. Any squares that appeared to contain dangerous or very difficult terrain were removed from the sample. Due to practicality and time constraints any squares that had a walk in to the site of greater than 3 km were also removed from the sample. 15 sites were lost due to these reasons.

Adjacent squares were then selected for these main squares. This was done by selecting the southern square unless it was rejected due to either containing less than 50% open access land, or containing dangerous or very difficult terrain, e.g. MOD training sites, cliffs, or lakes. If the southern adjacent square was rejected for any of these reasons then the western square was considered, followed by the northern square and then the western square until a suitable square was found. All of the main selected squares had at least one adjacent square that was suitable for surveying. Consideration was also given to reducing the length of the walk in to the site by selecting an adjacent square that minimised this if the walk in was between 2 and 3 km.

The open access pages of the Natural England website was also used to ascertain whether there were any access restrictions on the sites to be surveyed. There was one site that had to be excluded completely due to a nature conservation restriction, whereas various other sites just restricted the dates on which visits could be carried out.

Five observers were allocated the first 55 sites (main squares plus adjacent squares) from the remaining 75 upland 1-km squares. Fifty-five sites were allocated so as to allow for a few sites not being surveyed due to bad weather, whilst not falling below the target of 50 sites. Ten of the remaining 20 'spare' squares were allocated to the fieldworkers as they discovered that ten of their squares access or terrain problems when they arrived for their reconnaissance visit. These replacement squares were always in the same area (e.g. Peak District) as the rejected square.

All fieldworkers visited BTO headquarters at the start of their contract for instructions on the survey, background on the aims of the project and for health and safety inductions. They were provided with BBS instructions and recording forms (habitat, mammal and bird recording forms), two copies of maps for each of their sites, health and safety mobile phones, an upland bird song CD to aid identification, and a copy of the spreadsheet for data entry.

2.2 Field Methods

Field methods were identical to BBS methods (Raven *et al*. 2005). In summary, all surveyors made two visits (first visit in April or early May, second visit in late May or June) to count birds along a 2 km pre-selected transect route through each 1-km square. All birds seen and heard were recorded in distance bands and in transect sections as for BBS, thereby providing a potential spatial resolution of the data to 200m x 50m, and 200m x 200m, for subsequent analyses as required. Fieldworkers also recorded habitat type for each transect section and any mammals or mammal field signs observed (see Appendix for detailed information on the BBS methodology). Estimates of abundance of all bird species on each 1-km square were estimated from the maximum count, summed over distance bands

and transect sections, of the two visits. Comparisons of species richness and the occurrence and abundance of individual species were carried out between surveyed squares that contained section 15 land and those that did not.

Fieldworkers also recorded information on the numbers of people they observed during both their early and late visits to the sites to provide us with an indication of the level of human disturbance at each site. The information recorded consisted of the number of groups seen (broken down into size categories of 1, 2-10 and more than 10 people in the group) and whether there were dogs present, and if so whether they were on a lead or not. This allowed us to compare the levels of disturbance between Section 15 areas and non Section 15 areas.

3. RESULTS

A total of 53 Open Access sites (106 squares) were surveyed by five professional field staff in 2006 (see Appendix for list of 1-km squares). The locations of the Open Access sites surveyed in 2006 are shown in Fig. 1. Upland Open Access squares make up a relatively small proportion (<5%) of the core BBS, but cover about 50% of upland in England. This means that when all of the volunteer data for 2006 is received and verified (by spring 2007), it should be later possible to compare measures of bird abundance in uplands defined as Open Access with other, non-access areas of upland. We did carry out preliminary examination of species occurrence rates on 2006 Open Access squares compared to their mean occurrence rate between 1994 and 2004 on upland BBS squares in Open Access areas (the data used in the power analyses in the scoping study). Of the 25 upland specialists considered, occurrence rates for nine species were approximately the same, five were higher and four were lower. For seven species there were insufficient data for a difference to be clear. However, because Open Access land is defined as open (moorland, heaths, etc), there may be habitat differences between this land and the remaining uplands, which could include enclosed pasture, wooded areas and urban conurbations.

3.1 Description of New and Old Access Land Designations

Currently, the data collected by the professional fieldworkers on Open Access land provide an opportunity for one comparison that could potentially provide an insight into the possible future effects of increased visitor use as a result of the CRoW Act. Some of the land designated as Open Access had existing open access rights for the public provided by Acts and agreements previous to Part 1 of the CRoW Act 2000 (under (Part 1) Commons Act 1899, Law and Property Act 1925 and National Parks and Access to Countryside Act 1949). This land is classified as Section 15 of (Part 1) CRoW Act 2000 and is often referred to as 'Section 15 land'. Some areas of Section 15 land will have had historically higher levels of visitor use than other Open Access land that has only been opened up to the public within the last two years. It is also the case that access rights for other areas of section 15 land have not been exercised by the public prior to CRoW due to some of these areas not being known by the public. Historical differences in access may also influence current visitor use because people have been used to visiting some 'Section 15' areas and more people are likely to be aware of their access rights in those areas newly mapped Open Access Land. Lastly, some Section 15 land has higher access rights than other Open Access land, allowing activities such as horseback riding. For all of these reasons, comparisons between the two types of access land ('old' and 'new') provide preliminary insights into the possible impacts of visitor use. Interpretation of the differences must, however, take into consideration the fact that 'old' access land may be found in particular areas or landscapes (e.g. Peak District National Park) and also that 'old' access land will have had varying degrees of access pressures.

3.2 Comparing Species Richness, Occurrence and Abundance in New and Old Access Land

Of the 106 1-km squares surveyed in 2006, 22 contained Section 15 land, allowing comparisons between section 15 land and non section 15 land. A total of 91 species were seen on the survey squares, 56 species on Section 15 squares and 86 on non Section 15 squares. However, there was no significant difference in the total number of species recorded between Section 15 land and non Section 15 land (Section 15: mean = 10.41 ± 5.93, n = 22; non Section 15: mean = 12.61 ± 5.81, n = 84; $t = 1.57$, $p = 0.12$). Of the 24 upland specialists seen during this survey, seven were not seen at all on squares containing Section 15 land, whereas Twite was not seen on non Section 15 land.

Species-specific analyses were restricted to upland bird species and those that occurred in at least 15% of Open Access surveyed squares. There were six species that showed a significantly higher occurrence on squares containing no section 15 land than on those that had section 15 land on them (Table 1). These were mostly ground-nesting wader species (Curlew, Golden Plover, Lapwing and

Snipe), but also Wren and Red Grouse. Only one species - Raven - showed a significantly higher occurrence on Section 15 squares compared to non Section 15 land.

There were two species, both upland specialists, where abundance was significantly greater on non Section 15 land than on Section 15 land, Meadow Pipit and Curlew (Table 2). Another upland specialist, red Grouse, showed a strong trend towards greater abundance on non Section 15 land ($t = 1.98$, $p = 0.0503$). Four species showed a significantly greater abundance on Section 15 land. Two of these are upland species, Buzzard and Siskin, but two (Chaffinch and Swallow) are not. Note also that in some cases differences, though significant, were small, For example, of the species exhibiting significant differences, only the two species found to be more abundant on non Section 15 land (Meadow Pipit and Curlew) showed a mean difference greater than or equal to two.

When mean abundance was calculated only for the squares on which the species occurred, only three species had significantly different abundance between Section 15 squares and non Section 15 squares. Meadow Pipit was significantly more abundant on the non Section 15 squares (and occurred on 100% of squares). However, Chaffinch and Lesser Redpoll were more abundant on the Section 15 squares than on non Section 15 squares (Table 3). However, the number of Section 15 squares on which Chaffinches and Lesser Redpolls were seen in this survey, was only eight and two respectively.

3.3 Visitor Use Information

A mean visitor use value was calculated for each of the five categories of visitors for each square. There was only a significant difference in occurrence rate of groups consisting of 10 or more people (Table 4), however the sample sizes are very small, with visitor use data available for only 17 squares containing Section 15 land. There was also no significant difference between Section 15 and non Section 15 squares when the data was pooled to create a value for the occurrence rate of 'disturbance events' (pooled the data for groups of 1, 2-10 and more than 10 people; $\chi^2 = 0.47$, $p = 0.49$).

3.4 Habitat data

There was a significant difference in proportions of general habitat types found on non Section 15 and Section 15 squares ($\chi^2 = 65.17$, $p < 0.0001$; comparing proportions of semi-natural grassland/marsh, heathland and bog, and 'other'; see figure 2). Section 15 squares consisted of approximately three-quarters semi-natural grassland/marsh, and one-quarter heathland and bog, whilst non Section 15 squares contained approximately 45% of both semi-natural grassland/marsh and heathland and bog, and just over 10% of 'other' habitat (woodland, scrubland and farmland). Comparing grazed and non-grazed habitat, Section 15 squares contained a significantly greater proportion of grazed land than non Section 15 squares (Section 15: 92.0% grazed, 8.0% non-grazed; non Section 15: 79.6% grazed, 20.4% non-grazed; $\chi^2 = 17.74$, $p < 0.0001$). The vast majority (98.6%) of the grazed land had sheep grazing on it, with 100% of the Section 15 grazed land, and 98.1% of the non Section 15 grazed land, having sheep grazing on it, and the rest cattle grazing.

4. DISCUSSION AND RECOMMENDATIONS

The main aim of this survey was to collect data on upland breeding birds that could be used to assess the potential impact of human disturbance as a consequence of the CRoW Act. This is the first baseline year of this pilot survey, and the complementary data collected by BBS volunteers has yet to be fully collated. Both sources will be used in subsequent analyses in the next phase of the work. With one year of data, it is only possible to relate spatial differences in bird abundance to factors of interest (such as patterns of visitor use) but the longer-term plan is to investigate the influence of visitor use on temporal trends as well as spatial patterns. This year's data, and data collected in subsequent years, can be combined with the earlier BBS data collected by volunteers (1994-2004) to test for differences in population trends of key upland bird species before and after the implementation of the CRoW Act. Moreover, more comprehensive information on visitor use patterns, planned as part of NE's research programme, could be used to compare bird population trends on areas with different patterns of visitor use (e.g. low, medium, high) in order to better assess whether any observed declines are due to increased visitor usage of sites, or for other reasons. Data collected in subsequent Open Access surveys and by BBS volunteers would be combined for these analyses.

4.1 Preliminary assessment of the impact of historical access on bird abundance: influence of habitat?

In respect to the spatial patterns of bird abundance, we have focused in this report on comparing bird occurrence and abundance in land classified as Section 15 (where there has been historically higher levels of access) and the 'new' access land. Species richness was not significantly different between Section 15 and non Section 15 land but there were some differences between the two areas in terms of occurrence and abundance of individual species. Due to the random allocation of sites within upland areas of England, survey coverage is proportional to the proportion of land classified as Section 15, which means that most sites were not in this category. It is also not clear yet whether changes in visitor use patterns will be greater or less in 'old' or 'new' access land – this is one of the aims of the On-Site Visitor Surveys. It may later be possible to investigate the effects of region (Lake District versus Peak District) but in the absence of the BBS volunteer data, the sample size of squares for these areas are small.

Differences in both the occurrence and abundance of some bird species, particularly ground nesting waders (Curlew, Golden Plover, Lapwing and Snipe), exist between Section 15 and non Section 15 areas. The reasons for these differences are not clear but may well be a combination of habitat and visitor use factors. Section 15 land includes more marginal upland habitat, possibly including more hill farming, and so have more semi-natural grassland and marsh, rather than heathland and bog, which is likely to be the preferred habitat of many upland specialists. The Section 15 areas are also under higher grazing pressure, which could affect ground nesting birds as their nests would be more likely to be trampled. It is theoretically possible to correct for habitat differences, in this one year 'snapshot' of data, in order to assess the impact of access land category ('old' or 'new') - but this is made more difficult by the fact that Section 15 categorisations are to some extent confounded by habitat differences. This arises inevitably from the fact that whole regions, usually close to major conurbations, are defined as Section 15 (1899CA Urban Borough District, Registered Common Land, 1899 Commons Act (Part 1) & S193R Law and Property Act 1925). It is therefore important to note that the differences in species occurrence and abundance between Section 15 and non Section 15 areas discussed in this report are the results of preliminary analyses, which need to be developed further by subsequently including the visitor use data being collated through the Open Access National Monitoring Programme. This will help to clarify the extent to which the differences seen are due to differing visitor usage or differing habitat types.

4.2 Assessment of field protocols

The survey was successful in achieving its target of 100 1-km squares (106 were surveyed) and the protocol of surveying two adjacent squares on the same day worked well. Feedback from the professional fieldworkers employed this year suggested that surveying three adjacent squares would probably be too difficult, as many sites required a long walk in from an access point of several kilometres. We recommend that surveys are continued using the same protocols as in 2006. *However, we also found that due to distances between sites and the long time required to access the 1-km squares, these required on average a day each and it was not possible to carry out reconnaissance visits in the afternoons following morning survey visits elsewhere. Hence, the survey effort must be increased.*

4.3 Assessment of survey design to detect declines in populations of key upland bird species

In terms of species coverage achieved by the modified sampling design, the results of this pilot are encouraging, with equivalent or slightly higher rates of detection of Red Grouse and key ground-nesting waders (such as Lapwing, Golden Plover, Curlew) than those used in the simulations in the scoping study. This suggests that for all species with higher measures of abundance on the 2006 survey squares, the power to detect population declines is actually greater than predicted in the simulations, at least using the current stratification for upland Open Access land. This is most pronounced for Golden Plover, which is a species of conservation concern and designated on a number of English SPAs, but also includes species such as Skylark. Whinchat, Tree Pipit and Redstart are among the species found to be less abundant in the 2006 survey and so the power to detect population declines may have lessened slightly. For species characteristic of wooded areas (e.g. Redstart and Tree Pipit) this may reflect the fact that Open Access Land is by definition open, and excludes the wooded areas also found in the uplands. Carrion Crows were also found in greater numbers outside Open Access land. Another potential reason for these differences is timing. The occurrence rates in the power analyses were based on data from 1994 to 2004, and any species that declined during this period would be less likely to be detected in 2006.

Detection rates of scarcer upland species such as Ring Ouzel, Merlin, Dipper and Common Sandpiper were as low as, or lower than those based on historical BBS data used in the power analyses, but most of these are in any case too scarce for significant population declines to have been detected over five years even at the occurrence used in the power analysis. The data collected by BBS volunteers in 2006, when it become available, will help to assess the significance of these findings,

The main conclusion from these findings is that a survey sampling design targeted on upland Open Access areas would be most effective in detecting population declines in the key species – mainly ground-nesting waders.

However, the requirements of this programme – to assess the impact of the CRoW Act – need to be considered in relation to other requirements for information, in order to make most effective use of resources and surveyor effort. In Noble et al. (2006), we recommended that Open Access monitoring in uplands should be integrated with the new upland bird surveys proposed across the UK to better assess the conservation status of upland birds and generate comprehensive upland bird indicators. Many of these species in this study also occur on the other 50% of upland area in England not designated as Open Access, and for generating indicators and assessing their status, NE is interested in monitoring populations of upland species in all habitats where they occur. Apart from the squares surveyed as part of this study, some information on population trends outside Open Access uplands will be obtained from the volunteer-based BBS sites, which cover all habitats. However, there is another reason to consider a strong focus on the Open Access stratification, and that is because in England, designated sites (SPAs, SSSIs) in uplands also fall almost entirely within the Open Access designations. NE has an international obligation to periodically monitor site condition and a number

of key upland species in designated sites, and hence a focus on land that is Open Access and/or a SSSI would be advantageous for both programmes.

We therefore recommend that Open Access monitoring is integrated with Upland Bird Surveys in England, covering all uplands but potentially with a higher intensity of coverage on land including all Open Access land and all SSSIs and other designated sites.

4.4 Assessing changes in populations over time

Comparison of temporal changes in species abundance is another means of assessing the effect of visitor use, especially as an increase in the level of disturbance in a species' breeding habitat is most likely to have an impact. For example, if the birds return to their breeding grounds and find increased levels of disturbance from significant changes in levels and patterns of visitor use they may either choose not to breed (therefore have an immediate effect on recruitment particularly if there are limited places to breed) or stay and attempt to breed. If they stay and attempt to breed, but the increased level of disturbance causes the birds to have lower survival or lower breeding success, both would affect numbers in future years. Poor breeding success may cause the adults to move to a different area to breed in subsequent years and there would be fewer young birds recruited. To determine whether increased visitor access, due to the CRoW Act, is having an impact on bird populations, populations should be monitored before and after implementation of the Act, and population trends in areas of different levels of visitor use compared. The latter comparison of trends corrects for habitat differences as they use measures of population change rather than absolute measures of abundance, which vary considerably across different habitat types and regions. The more detailed data on the level of visitor usage of the areas being surveyed will be essential in determining whether population changes are in fact due to changes in levels and patterns of access use as opposed to underlying population changes.

In the power analyses, we tested the capacity of various sampling designs to detect significant population declines over different periods of time, but the recommendation to quadruple the current sample size was based on the need to increase the power to detect population changes in key upland species in five years – approximating the first four years of the CA's Open Access Monitoring Programme. However, some changes in upland bird populations may take several years to be manifested as people respond to the rights of the new Act. Moreover, the requirements of NE for monitoring of upland birds for assessing their conservation status and producing upland bird indicators is a long-term issue.

We therefore recommend that the Open Access surveys and Upland Bird Monitoring be integrated in a long-term programme that will (i) provide the necessary data within the first five years to assess the impact of the CRoW Act over this period, and (ii) continue, using the same sampling framework to provide the necessary data to assess the impact of visitor use patterns over the long term, as well as for use in upland bird indicators and periodic assessments of the conservation status of key upland species.

4.5 Assessing the impact of visitor use patterns

One of the findings of this pilot study is that fieldworkers undertaking bird surveys encounter few other people. This is partly due to the timing of surveys during the day (early morning), during the season (April to June prior to most holidays) and in areas often distant from roads. This may explain why there was very little difference between the visitor use rates on Section 15 squares and non Section 15 squares. Only the occurrence of groups consisting of more than 10 people showed any significant difference, with more occurring on Section 15 squares. However, by inspection of the data it appeared as though there was higher visitor use on Section 15 squares. That this was not significant is quite possibly due to small sample size, particularly for Section 15 squares (n = 17). In subsequent

analyses, we would hope to draw on other data collected by NE on recreational use of Access Land. The Countryside Agency (now Natural England) has commissioned a contract with Faber Mounsell in 2006 to carry out the on-site monitoring visitor survey to monitor the change in the levels and patterns of use, and people's understanding and awareness of the new rights across newly mapped areas of access land over the next 3 years (Faber Mounsell, 2006).

We recommend that analysis of the BBS data against visitor use are developed further in future years of the project with more focused comparison and associations with actual visitor use via direct comparison with the on-site monitoring visitor survey data being collated through the National Monitoring Programme. This could be achieved in two ways:

- Through the use of GIS modelling of actual visitor use, data collected through the On-site Monitoring Scheme could potentially be used to extrapolate levels and patterns of use to gain a national picture of visitor use at a High, Medium, Low levels, which can be compared against the BBS monitoring data in future years.

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- An alternative is to carry out access assessments of all the BBS squares involved in the survey. This could be done through a review method and access predictions looking at proximity to towns, ease of access, car parking, existing linear routes etc. This would give a 'score' or weighting for each square that could be used in all future analyses and assessments of the data by BTO. Similar work has already been carried out for the whole of the South and North Pennine SPAs and other sites using a Predictive Levels and patterns of use GIS model, but does not include National Parks.

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References

Burger, J. (2003) Personal watercraft and boats: Coastal conflicts with common terns. *Lake and Reservoir Management* **19**:26-34.

Burton, N.H.K., Evans, P.R. & Robinson, M.A. (1996) Effect on shorebird numbers of disturbance, the loss of a roost site and its replacement by an artificial island at Hartlepool, Cleveland. *Biological Conservation* **77**: 193-201.

Fernandez-Juricic, E. & Telleria, J.L. (2000) Effects of human disturbance on spatial and temporal feeding patterns of Blackbirds *Turdus merula* in urban parks in Madrid, Spain. *Bird Study* **47**: 13-21.

Finney, S.K., Pearce-Higgins, J.W. & Yalden, D.W. (2005) The effect of recreational disturbance on an upland breeding bird, the golden plover *Pluvialis apricaria*. *Biological Conservation* **121**: 53-63.

Gill, J.A., Sutherland, W.J. & Watkinson, A.R. (1996) A method to quantify the effects of human disturbance on animal populations. *Journal of Applied Ecology* **33**: 786-792.

Liley, D. & Clarke, R.T. (2002) *Urban Development adjacent to heathland sites in Dorset: the effect on density and settlement patterns of Annex 1 bird species.* England Nature Research Report **463**. English Nature, Peterborough.

Mikola, J., Miettinen, M., Lehikoinen, E. & Lehtila, K. (1994) The effects of disturbance caused by boating on survival behaviour of velvet scoter *Melanitta fusca* ducklings. *Biological Conservation* **67**: 119-124.

Murrison, G. (2002) *The impact of human disturbance on the breeding success of nightjar* Caprimulugus europeus *on heathlands in south Dorset*. English Nature research Report **483**. English Nature, Peterborough.

Noble, D.G., Davis, S.E. & Joys, A.C. (2006) Phase 1 Report: Pilot Breeding Bird Monitoring Survey.

Raven, M.J., Noble, D.G. & Baillie, S.R. (2005) *The Breeding Bird Survey 2005*. British Trust for Ornithology, Thetford.

Riddington, R., Hassal, M., Lane, S.J., Turner, P.A. & Walters, R. (1996) The impact of disturbance on the behaviour of Brent Geese *Brenta b bernicula*. *Bird Study* **43**: 269-279.

Ronconi, R.A. & St Clair, C.C. (2002) Management options to reduce boat disturbance on foraging black guillemots *Cepphus grille* in the Bay of Fundy. *Biological conservation* **108**: 265-271.

West, A.D., Goss-Custard, J.D., Stillman, R.A., Caldow, R.W.G., Le V dit Durrell, S.E.A. & McGrorty, S. (2002) Predicting the impacts of disturbance on shore birds mortality using a behavioural model. *Biological Conservation* **106**: 319-328.

Woodfield, E. & Langston, R. (2004) *Literature Review on the Impact on Bird Populations on Disturbance due to Human Access on Foot*. RSPB Research Report no. **9**. RSPB, Sandy.

Yalden, D.W. (1992) The influence of recreational disturbance on common sandpipers *Actitis hypoleucos* breeding by an upland reservoir, in England. *Biological Conservation* **61**: 41-49.

Table 1. The occurrence rate of individual species in Open Access survey squares in 2006. Only species that were defined as upland species in the Phase 1 Report (in bold), or that have a higher than 0.15 occurrence rate on all of the Open Access surveyed squares are shown. Species are given in order of occurrence rate on the Open Access squares. P-values are derived from either Chi squared 2 x 2 contingency tables or Fishers exact test. * $p < 0.05$, ** $p < 0.01$, otherwise not significant.

Species	All Open Access squares (n = 106)	Non Section 15 (n = 84)	Section 15 (n = 22)	P-value
Meadow Pipit	1.00	1.00	1.00	----
Skylark	0.85	0.85	0.86	1.00 -
Curlew	0.74	0.82	0.41	<0.0001**
Wren	0.64	0.69	0.45	0.04*
Red Grouse	0.58	0.67	0.27	0.0008**
Golden Plover	0.56	0.61	0.36	0.04*
Carrion Crow	0.41	0.37	0.55	0.13
Wheatear	0.40	0.37	0.50	0.26
Pheasant	0.40	0.42	0.32	0.40
Lapwing	0.40	0.47	0.14	0.005**
Chaffinch	0.34	0.33	0.36	0.79
Swallow	0.31	0.29	0.41	0.27
Willow Warbler	0.30	0.33	0.18	0.17
Rook	0.26	0.30	0.14	0.13
Snipe	0.24	0.29	0.05	0.02*
Woodpigeon	0.23	0.25	0.14	0.39 -
Jackdaw	0.22	0.25	0.09	0.15 -
Buzzard	0.19	0.17	0.27	0.36 -
Black-headed Gull	0.19	0.21	0.09	0.24 -
Raven	0.18	0.13	0.36	0.02* -
Lesser Black-Backed Gull	0.15	0.15	0.14	1.00 -
Cuckoo	0.15	0.17	0.09	0.51 -
Stonechat	0.14	0.12	0.23	0.30 -
Oystercatcher	0.11	0.13	0.05	0.45 -
Ring Ouzel	0.09	0.12	0.00	0.12 -
Grey Wagtail	0.09	0.11	0.05	0.68
Merlin	0.08	0.08	0.05	1.00 -
Short-eared Owl	0.06	0.07	0.00	0.34 -
Peregrine	0.06	0.07	0.00	0.34 -
Lesser Redpoll	0.06	0.05	0.09	0.60 -
Whinchat	0.05	0.04	0.09	0.28 -
Tree Pipit	0.05	0.04	0.09	0.28 -
Redstart	0.05	0.06	0.00	0.58 -
Siskin	0.03	0.01	0.09	0.11 -
Goshawk	0.02	0.01	0.05	0.37 -
Dipper	0.02	0.02	0.00	1.00 -
Wood Warbler	0.01	0.01	0.00	1.00 -
Wigeon	0.01	0.01	0.00	1.00 -
Twite	0.01	0.00	0.05	0.21 -
Common Sandpiper	0.01	0.01	0.00	1.00 -

Table 2. The mean (± SD) abundance of individual species in Open Access survey squares in 2006 (also split into squares containing section 15 land and not containing any section 15 land). Abundance is based on the maximum count taken on each square over the two visits. Only species that either were defined as upland species I the Phase 1 Report (in bold) or that have a higher mean than 0.40 birds per square on all surveyed Open Access squares are shown. Species are given in order of abundance on all Open Access surveyed squares. T values test the difference between means. * $p < 0.05$, ** $p < 0.01$, otherwise not significant.

Species	All Open Access squares (n = 106)	Non Section 15 (n = 84)	Section 15 (n = 22)	t value
Meadow Pipit	18.44 ± 9.40	19.80 ± 9.68	13.27 ± 6.00	2.99**
Skylark	9.56 ± 8.75	8.83 ± 7.82	12.32 ± 11.46	1.67
Rook	8.97 ± 30.50	11.05 ± 33.95	1.05 ± 3.58	1.37
Curlew	8.15 ± 8.55	9.11 ± 8.51	4.50 ± 7.85	2.28*
Red Grouse	3.13 ± 4.51	3.57 ± 4.67	1.45 ± 3.39	1.98
Lapwing	2.70 ± 6.16	3.21 ± 6.75	0.73 ± 2.10	1.69
Golden Plover	2.50 ± 3.61	2.80 ± 3.86	1.36 ± 2.11	1.66
Starling	2.43 ± 19.62	3.07 ± 22.02	0.00 ± 0.00	0.65
Wren	1.92 ± 2.35	2.12 ± 2.48	1.14 ± 1.61	1.75
Jackdaw	1.73 ± 4.79	2.00 ± 5.23	0.68 ± 2.34	1.14
Carrion Crow	1.54 ± 2.72	1.42 ± 2.73	2.00 ± 2.71	0.89
Chaffinch	1.08 ± 2.16	0.83 ± 1.50	2.05 ± 3.63	2.39*
Willow Warbler	0.97 ± 2.14	0.95 ± 2.02	1.05 ± 2.61	0.18
Pheasant	0.97 ± 1.70	1.02 ± 1.79	0.77 ± 1.34	0.61
Wheatear	0.90 ± 1.71	0.85 ± 1.79	1.09 ± 1.38	0.60
Woodpigeon	0.78 ± 1.93	0.93 ± 2.12	0.23 ± 0.61	1.52
Black-headed Gull	0.66 ± 2.07	0.80 ± 2.30	0.14 ± 0.48	1.32
Swallow	0.62 ± 1.53	0.45 ± 0.80	1.27 ± 2.95	2.27*
Greylag Goose	0.46 ± 1.69	0.58 ± 1.88	0.00 ± 0.00	1.44
Snipe	0.42 ± 0.92	0.49 ± 0.98	0.14 ± 0.64	1.59
Raven	0.28 ± 0.69	0.23 ± 0.66	0.50 ± 0.74	1.67
Stonechat	0.27 ± 0.74	0.23 ± 0.66	0.45 ± 0.96	1.29
Buzzard	0.26 ± 0.62	0.20 ± 0.49	0.50 ± 0.96	2.02*
Ring Ouzel	0.25 ± 1.16	0.32 ± 1.29	0.00 ± 0.00	1.16
Oystercatcher	0.20 ± 0.74	0.24 ± 0.82	0.05 ± 0.21	1.09
Grey Wagtail	0.13 ± 0.50	0.15 ± 0.55	0.05 ± 0.21	0.91
Lesser Redpoll	0.12 ± 0.56	0.07 ± 0.34	0.32 ± 1.04	1.84
Tree Pipit	0.11 ± 0.67	0.06 ± 0.36	0.32 ± 1.29	1.63
Whinchat	0.08 ± 0.36	0.06 ± 0.32	0.14 ± 0.47	0.89
Merlin	0.08 ± 0.27	0.08 ± 0.28	0.05 ± 0.21	0.59
Short-eared Owl	0.06 ± 0.23	0.07 ± 0.26	0.00 ± 0.00	1.28
Redstart	0.06 ± 0.27	0.07 ± 0.30	0.00 ± 0.00	1.10
Peregrine	0.06 ± 0.23	0.07 ± 0.26	0.00 ± 0.00	1.28
Wigeon	0.04 ± 0.39	0.05 ± 0.44	0.00 ± 0.00	0.51
Siskin	0.04 ± 0.27	0.01 ± 0.11	0.14 ± 0.47	2.23*
Common Sandpiper	0.03 ± 0.29	0.04 ± 0.33	0.00 ± 0.00	0.51
Wood Warbler	0.02 ± 0.19	0.02 ± 0.22	0.00 ± 0.00	0.51
Goshawk	0.02 ± 0.14	0.01 ± 0.11	0.05 ± 0.21	1.02
Dipper	0.02 ± 0.14	0.02 ± 0.15	0.00 ± 0.00	0.72
Twite	0.01 ± 0.10	0.00 ± 0.00	0.05 ± 0.21	1.97

Table 3. The mean (± SD) abundance of individual species on Section 15 and non Section 15 Open Access survey squares for the squares on which the species occur. Abundance is based on the maximum count taken on each square over the two visits. Only species that either were defined as upland species I the Phase 1 Report (in bold) or that have a higher mean than 0.40 birds per square on all surveyed Open Access squares are shown. Species are given in order of abundance on all Open Access surveyed squares. T values test the difference between means. * $p < 0.05$, ** $p < 0.01$, otherwise not significant. The number of squares the species occurred on in parentheses.

Species	Non Section 15	Section 15	t value
Meadow Pipit	19.80 ± 9.68 (84)	13.27 ± 6.00 (22)	2.99**
Skylark	10.45 ± 7.44 (71)	14.26 ± 11.14 (19)	1.77
Rook	37.12 ± 54.56 (25)	7.67 ± 7.64 (3)	0.92
Curlew	11.09 ± 8.13 (69)	11.00 ± 9.03 (9)	0.03
Red Grouse	5.36 ± 4.82 (56)	5.33 ± 4.84 (6)	0.01
Lapwing	6.92 ± 8.55 (39)	5.33 ± 3.06 (3)	0.32
Golden Plover	4.61 ± 4.04 (51)	3.75 ± 1.75 (8)	0.59
Starling	36.86 ± 72.49 (7)	0.00 ± 0.00 (0)	--
Wren	3.07 ± 2.44 (58)	2.50 ± 1.51 (10)	0.71
Jackdaw	8.00 ± 7.93 (21)	7.50 ± 3.54 (2)	0.09
Carrion Crow	3.84 ± 3.32 (31)	3.67 ± 2.71 (12)	0.16
Chaffinch	2.50 ± 1.60 (28)	5.63 ± 4.07 (8)	3.34*
Willow Warbler	2.86 ± 2.63 (28)	5.75 ± 3.40 (4)	1.99
Pheasant	2.46 ± 2.05 (35)	2.43 ± 1.27 (7)	0.04
Wheatear	2.29 ± 2.33 (31)	2.18 ± 1.17 (11)	0.15
Woodpigeon	3.71 ± 2.80 (21)	1.67 ± 0.58 (3)	1.24
Black-headed Gull	3.72 ± 3.79 (18)	1.50 ± 0.71 (2)	0.81
Swallow	1.58 ± 0.65 (24)	3.11 ± 4.04 (9)	1.83
Greylag Goose	4.08 ± 3.34 (12)	0.00 ± 0.00 (0)	--
Snipe	1.71 ± 1.12 (24)	3.00 ± 0.00 (1)	1.13
Raven	1.73 ± 0.90 (11)	1.38 ± 0.52 (8)	0.99
Stonechat	1.90 ± 0.74 (10)	2.00 ± 1.00 (5)	0.22
Buzzard	1.21 ± 0.43 (14)	1.83 ± 0.98 (6)	2.01
Ring Ouzel	2.70 ± 2.87 (10)	0.00 ± 0.00 (0)	--
Oystercatcher	1.82 ± 1.54 (11)	1.00 ± 0.00 (1)	0.51
Grey Wagtail	1.44 ± 1.01 (9)	1.00 ± 0.00 (1)	0.42
Lesser Redpoll	1.50 ± 0.58 (4)	3.50 ± 0.71 (2)	3.77*
Tree Pipit	1.67 ± 1.15 (3)	3.50 ± 3.54 (2)	0.89
Whinchat	1.67 ± 0.58 (3)	1.50 ± 0.71 (2)	0.29
Merlin	1.00 ± 0.00 (7)	1.00 ± 0.00 (1)	--
Short-eared Owl	1.00 ± 0.00 (6)	0.00 ± 0.00 (0)	--
Redstart	1.20 ± 0.45 (5)	0.00 ± 0.00 (0)	--
Peregrine	1.00 ± 0.00 (6)	0.00 ± 0.00 (0)	--
Wigeon	4.00 ± 0.00 (1)	0.00 ± 0.00 (0)	--
Siskin	1.00 ± 0.00 (1)	1.50 ± 0.71 (2)	0.58
Common Sandpiper	3.00 ± 0.00 (1)	0.00 ± 0.00 (0)	--
Wood Warbler	2.00 ± 0.00 (1)	0.00 ± 0.00 (0)	--
Goshawk	1.00 ± 0.00 (1)	1.00 ± 0.00 (0)	--
Dipper	1.00 ± 0.00 (1)	0.00 ± 0.00 (0)	--
Twite	0.00 ± 0.00	1.00 ± 0.00 (1)	--

Table 4. The occurrence rate of disturbance types on Open Access survey squares in 2006. P-values are derived from Fishers exact tests and test the significance of differences between non Section 15 squares and Section 15 squares in the occurrence rates of disturbance types. * $p < 0.05$, ** $p < 0.01$, otherwise not significant. Sample sizes are reduced due to missing disturbance data for some sites.

	All Open Access squares (n = 79)	**Non Section 15 (n = 62)**	**Section 15 (n = 17)**	**P-value**
Solitary	0.19	0.18	0.24	0.73
Group 2-10	0.27	0.23	0.41	0.14
Group >10	0.03	0.00	0.12	0.04*
Dog on lead	0.08	0.06	0.12	0.60
Dog not on lead	0.09	0.06	0.18	0.17

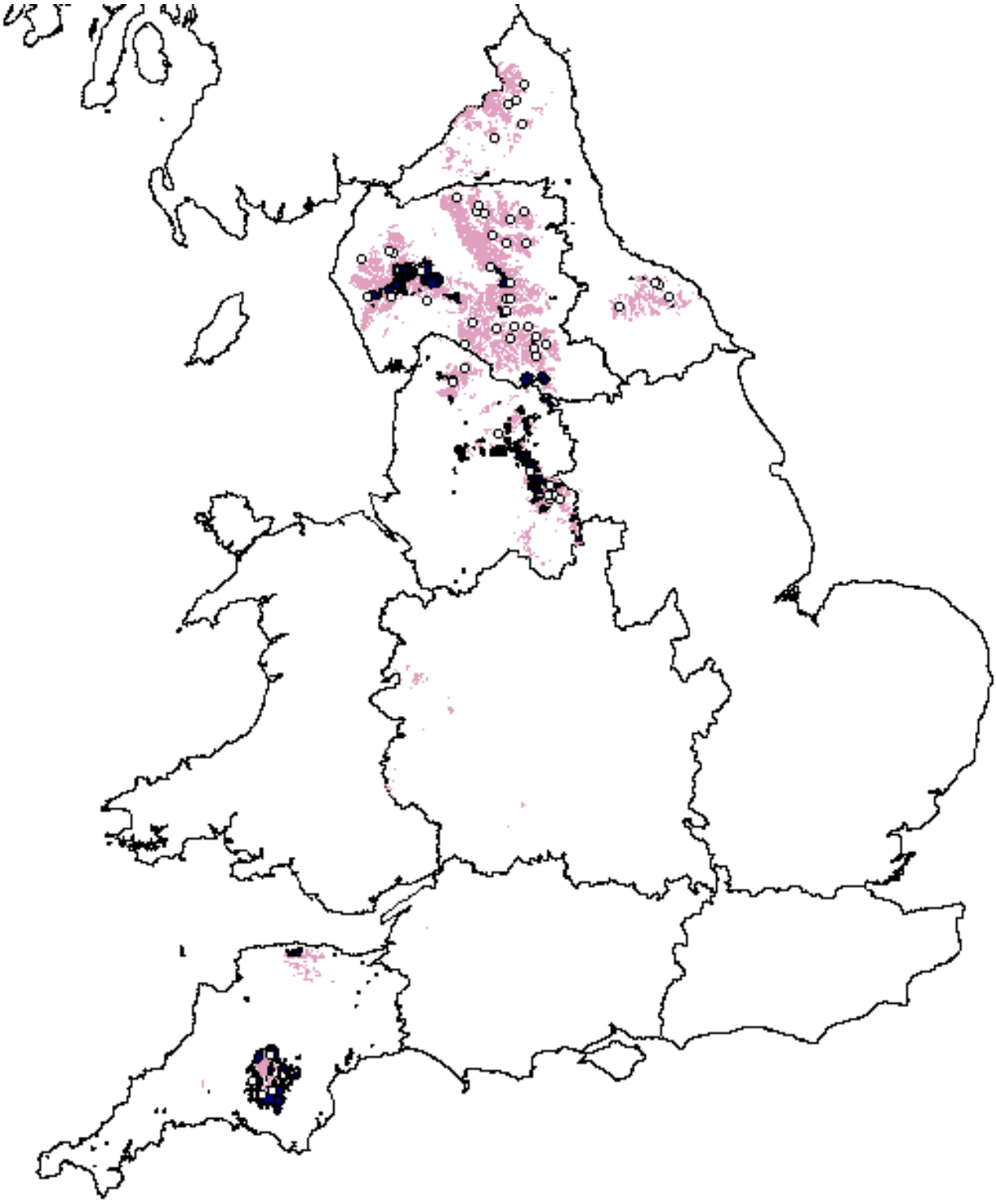


Figure 1. Open Access squares surveyed in 2006 (o). Areas in pink are upland Open Access land, with Section 15 land in black.

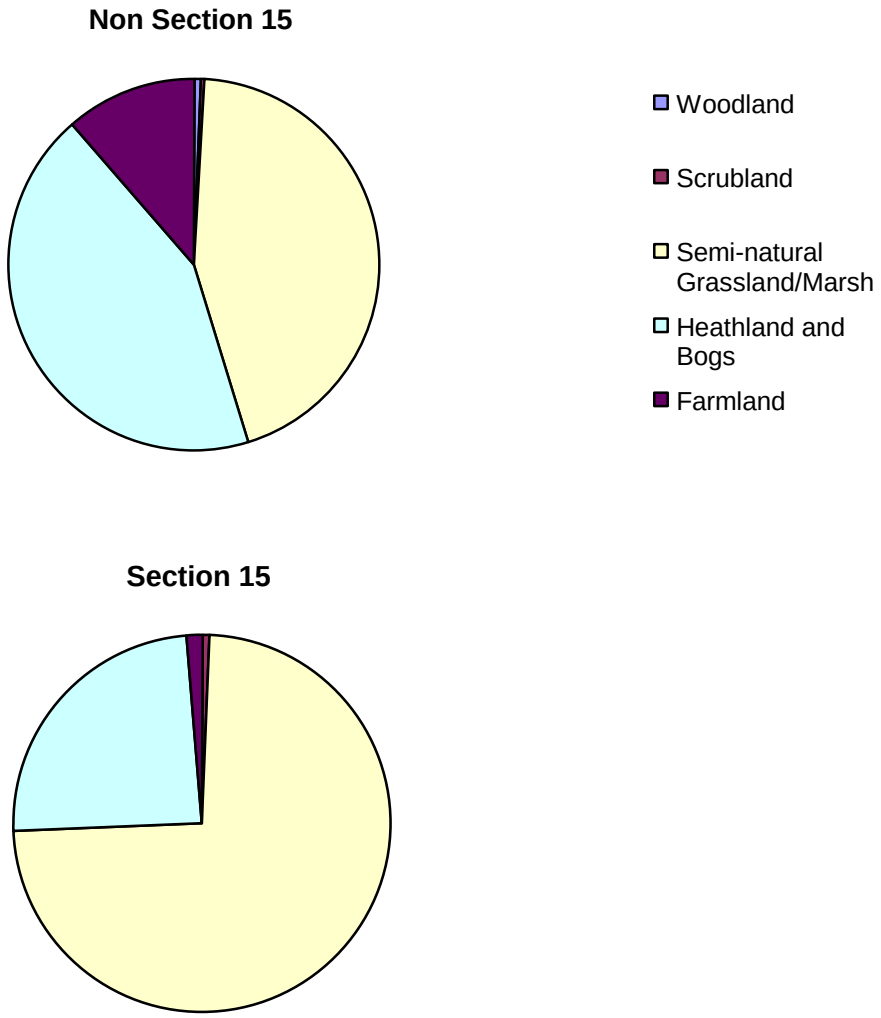


Figure 2. Pie charts showing the proportions of general habitat types that occurred on non Section 15 and Section 15 squares.

APPENDIX

List of Final 53 squares:

Main square	Section 15?	Adjacent square	Section 15?	Direction of adjacent square	Region
SX5374	Y	SX5373	Y	South	Dartmoor
SX5867	Y	SX5866	Y	South	Dartmoor
SX6289	Y	SX6389	Y	East	Dartmoor
SX6369	Y	SX6269	Y	West	Dartmoor
NY1223	N	NY1323	N	East	Lake District
NY1502	Y	NY1402	Y	West	Lake District
NY2727	N	NY2726	N	South	Lake District
NY2902	N	NY2903	Y	North	Lake District
NY3026	N	NY3027	N	North	Lake District
NY4516	Y	NY4517	Y	North	Lake District
NY4800	N	NY4900	N	East	Lake District
NT9107	N	NT9108	N	North	Northumberland
NT9610	N	NT9510	N	West	Northumberland
NU0018	N	NU0017	N	West	Northumberland
NY8489	N	NY8488	N	South	Northumberland
NY9997	N	NY9897	N	West	Northumberland
NY6356	N	NY6357	N	North	North Pennines
NY7449	N	NY7448	N	South	North Pennines
NY7552	N	NY7551	N	South	North Pennines
NY7948	N	NY7848	N	West	North Pennines
NY8219	Y	NY8218	Y	South	North Pennines
NY8336	N	NY8335	N	South	North Pennines
NY9031	N	NY9032	N	North	North Pennines
NY9345	N	NY9245	N	West	North Pennines
NZ0049	N	NZ0048	N	South	North Pennines
NZ0132	N	NZ0131	N	South	North Pennines
NZ7210	N	NZ7209	N	South	North York Moors
NZ7409	N	NZ7309	N	West	North York Moors
NZ7902	N	NZ7901	N	South	North York Moors
SE5297	N	SE5296	N	South	North York Moors
SD8627	N	SD8527	N	West	Peak District
SE0307	Y	SE0306	N	South	Peak District
SK1394	N	SK1294	N	West	Peak District
SK1491	N	SK1591	N	East	Peak District
SK1499	Y	SK1498	Y	South	Peak District
SK1694	N	SK1594	N	West	Peak District
SK2091	N	SK2090	N	South	Peak District
NY9001	N	NY9000	N	South	Yorkshire Dales
NY9301	N	NY9300	N	South	Yorkshire Dales
NY9310	N	NY9309	N	South	Yorkshire Dales
SD6155	Y	SD6055	Y	West	Yorkshire Dales
SD6863	N	SD6862	N	South	Yorkshire Dales
SD6876	N	SD6877	N	North	Yorkshire Dales
SD7288	N	SD7287	N	South	Yorkshire Dales
SD8585	N	SD8584	N	South	Yorkshire Dales
SD9095	Y	SD9195	Y	East	Yorkshire Dales
SD9379	N	SD9279	N	West	Yorkshire Dales
SD9586	N	SD9585	N	South	Yorkshire Dales
SE0286	N	SE0285	N	South	Yorkshire Dales
SE0674	N	SE0675	N	North	Yorkshire Dales
SE0770	N	SE0771	N	North	Yorkshire Dales
SE0781	N	SE0780	N	South	Yorkshire Dales
SE1276	N	SE1275	N	South	Yorkshire Dales

List of all species seen on survey:

Blackbird
Blackcap
Black-headed Gull
Black Grouse
Blue Tit
Buzzard
Carrion Crow
Canada Goose
Chaffinch
Coal Tit
Common Gull
Common Sandpiper
Cormorant
Cuckoo
Curlew
Dipper
Dotterel
Dunlin
Dunnock
Feral Pigeon
Great Black-backed Gull
Goldcrest
Golden Plover
Goldfinch
Goosander
Goshawk
Grasshopper Warbler
Great Spotted Woodpecker
Great Tit
Greenfinch
Greylag Goose
Grey Heron
Grey Partridge
Grey Wagtail
Hen Harrier
Herring Gull
House Martin
Jackdaw
Jay
Kestrel
Lapwing
Lesser Black-backed Gull
Lesser Redpoll
Linnet
Magpie
Mallard
Marsh Tit
Meadow Pipit
Merlin
Mistle Thrush
Moorhen
Oystercatcher
Peregrine
Pheasant
Pied Wagtail
Raven
Red Grouse
Red Kite
Red-legged Partridge
Redshank
Redstart
Reed Bunting
Ring Ouzel
Robin
Rook
Sand Martin
Sedge Warbler
Short-eared Owl
Siskin
Skylark
Snipe
Song Thrush
Sparrowhawk
Spotted Flycatcher
Starling
Stock Dove
Stonechat
Swallow
Swift
Tree Pipit
Twite
Wheatear
Whinchat
Whitethroat
Wigeon
Willow Warbler
Woodcock
Woodpigeon
Wood Warbler
Wren
Yellowhammer

Breeding Bird Survey Instructions

The survey is designed to be a quick, simple and, most importantly, an enjoyable birdwatching exercise. Plots are 1x1-kilometre (km) squares of the National Grid. Observers make just three visits to specially selected squares, the first to record habitat types and to set up a suitable survey route, and the second and third to record birds that are seen or heard while walking along the route.

Main aims

- To provide information on year-to-year, and longer term, changes in population levels for a wide range of breeding birds across a variety of habitats throughout the UK. Knowing to what extent bird populations are increasing or decreasing is fundamental to bird conservation. Monitoring birds has the added advantage that they act as valuable indicators to the health of the countryside.

- To promote a greater understanding of the population biology of birds and in particular to focus on factors responsible for declines. The BBS is a key component of the BTO's Integrated Population Monitoring Programme.

- To promote bird conservation through the involvement of large numbers of volunteers in survey work in the UK.

Which square should you survey?

Either your RO or National Organiser will have provided you with the Ordnance Survey (OS) grid reference of the 1-km square we would like you to survey. Grid references are in standard OS format (i.e. two letters for the 100-km square, two numbers representing the 'easting' and two numbers representing the 'northing'). Please check carefully the reference of the square you have been allocated. Squares have been chosen according to a formal sampling strategy to cover all habitats and regions. Comprehensive coverage is vital to the survey design. Please make every effort to cover the square that is assigned to you. **We will not be able to use data collected from additional or substituted squares.**

In cases where survey work proves impossible in a large part of the square you have been allocated, e.g. because it is physically impossible to visit or access permissions are not granted, please report this to your RO immediately so that a replacement square can be provided. It is very important not to reject squares on the grounds that they appear uninteresting - squares containing few species are just as valuable as squares with many species. For squares containing a large area of water, estimate how many of the 10 ideal transect sections are located on dry land (above Mean High Water). If this is less than 4 (i.e. less than 800m of transect) regard the square as 'uncoverable' and report it to Census Unit via your RO.

Tips to volunteers:

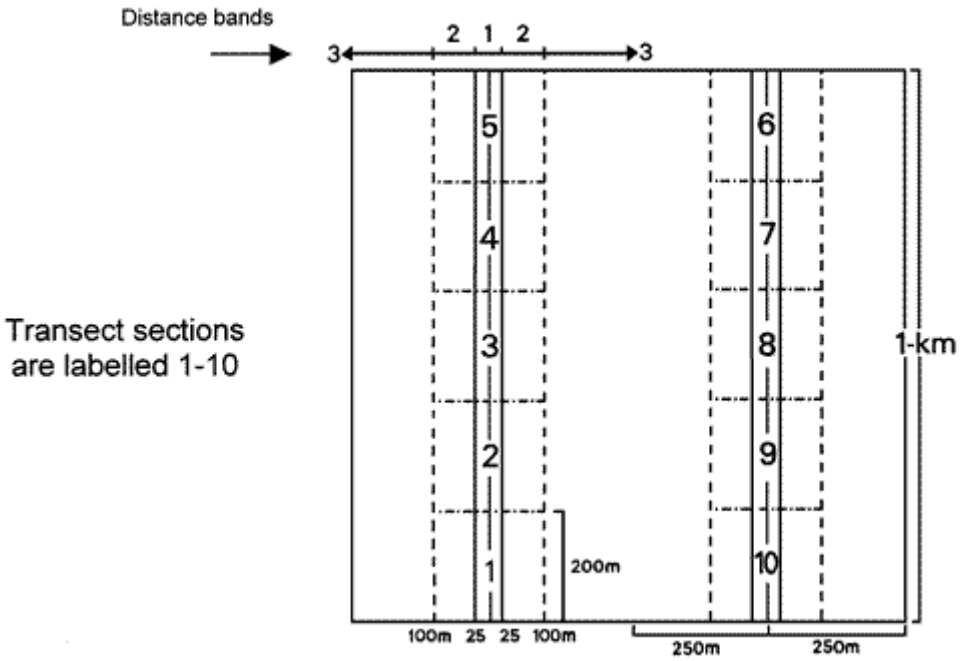
- Do not record birds you see or hear before or after your transect-line (i.e. behind your first 200m section or in front of your last 200m section).
- Record all birds to the sides of your transect-line.
- Record all birds from your transect-line that are beyond your 1km square (i.e. in adjacent 1-km squares) that are to the sides of your transect-line.
- Record habitat details each year. If you are only able to fill in the first two columns on the habitat form, this is still extremely useful.
- Ensure that only the number of birds recorded is written in each box on the count summary forms. Additional information such as "+" or "many" complicates the forms and should be avoided.
- Birds can be listed in any order on the Count Summary Sheet.
- Please put your forms in the following order on completion - from top to bottom: habitat, summary 1, summary 2, mammal, field 1, field 2. This will help speed up the processing of forms.

Finding and marking a route

If the square has been surveyed before, your RO should provide you with a sketch map of the counting route (the transect line) taken by the previous BBS observer. This route must be followed to ensure consistency of recording on that square (i.e. if a different route is taken, different birds will probably be recorded). If the route has to be changed because you can no longer get access to it, please consult your RO and return the completed Habitat Recording Form, with a sketch map of the new route on it. If, and only if the square has never been covered before (your RO will tell you this), will you need to create your own transect route across it.

The transect line through the square should ideally consist of two parallel lines, north-south or east-west, each 1-km long. **Please ensure that the route followed is the same as in previous years.** Transect lines should be 500 metres (m) apart and 250m in from the edge of the square. Each transect line should be divided into 5 equal sections of 200m in length, making a total of ten (2x5), numbered 1 to 10. It is important to note the starting points of each transect section either by using permanent landmarks (trees, hedges, boulders, houses etc) or by using temporary markers (coloured tape or cord etc).

Figure 1 - Transect route



In practice, your transect lines are likely to deviate from the 'ideal' because of problems with access, or barriers such as roads, rivers, and canals: possible solutions are given below. Once you have decided upon a route, it is of the greatest importance that the same route is followed year after year. In cases where the transect lines deviate considerably from the 'ideal', at no point should the two lines be closer together than 200m. **Minor intrusions into adjacent squares are perfectly acceptable and may provide the only practical way to carry out the survey. Please record the exact route taken in the box provided on the green habitat form.**

Summary of Fieldwork	
1. March - April	Reconnaissance visit to set up or check census route and record habitat
2. Early April - mid-May	Complete 'early' transect count
3. Mid-May - late June	Complete 'late' transect count
4. July - August	**BBS Online user:** Please ensure that you have entered all your data onto BBS Online.
	Paper form user: Return completed forms to your RO or directly to the BTO Census Unit if you have no acting organiser.
NB: The fieldwork should begin and end later in more northerly parts of the UK	

When to visit

The main part of the breeding season, roughly between 1st April and 30th June, in the lowlands of southern Britain, should be divided into two counting periods (early season visit = April to mid-May; late season visit = mid-May to late June) and one visit should be made in each half. **Visits should be at least 4 weeks apart.** The first should coincide with the main activity period of the resident breeding birds in an area, while the second should take place after the arrival of the latest migrant breeding birds. Where local conditions dictate, for example, at higher altitudes or further north, visits should be shifted later in the season, but the final transect count should be completed by mid-July. From late-June, counts will almost certainly include a much greater proportion of unidentified young birds, and most species will have reduced or stopped singing.

Counts should be made during the morning, beginning ideally between 6am and 7am, and no later than 9am. Please try to keep the starting times similar within a breeding season and across years, preferably to within half-an-hour. Please also try to keep the visit dates similar across the years. Counts will be more productive earlier in the day, with birds generally becoming quiet and inactive from late morning until mid afternoon (11am to 3pm). Starting times can be shifted to begin later in more remote and less accessible areas. If survey times extend beyond midday please use the 24-hour clock.

Weather

Please do not attempt to census birds in conditions of heavy rain, poor visibility or strong wind. Birds generally become inactive and quiet in windy and wet conditions, although activity often increases considerably after rain showers and therefore showery weather is generally okay to conduct a survey in. Bird activity also becomes quieter earlier in the day if there have been several previous days of fine weather, so an earlier start is therefore advisable. Please record weather conditions in the boxes provided on the forms that describe cloud cover, rain, wind speed, and visibility. Choose one number (1-3) from each of the four headings below and enter these in the box provided on the Field Recording Sheets. If the weather conditions change halfway through your survey, then record the mid-point; e.g. if cloud cover = 1 at the start of your survey visit and 3 at the end, then record 2.

Cloud cover		Rain		Wind		Visibility	
0-33%	= 1	None	= 1	Calm	= 1	Good	= 1
33-66%	= 2	Drizzle	= 2	Light	= 2	Moderate	= 2
66-100%	= 3	Showers	= 3	Breezy	= 3	Poor	= 3

Recording birds

Please record all the birds you see or hear as you walk along the two linear transects. Birds should be noted in the appropriate distance category, measured at right angles to the transect line. Do not record birds that are behind you as you begin a census or beyond the end of the transect.

From your chosen starting point, begin to walk the first half of your transect route at a slow and methodical pace. We recommend that you pause briefly to listen for bird songs and scan for birds flying overhead. Please remember to note the starting and finishing times of each transect (using a 24-hour clock, e.g. 0630, six-thirty in the morning, 1300, one o'clock in the afternoon). As a guide an average visit should last around an hour and a half. Record all the birds you see and hear on the Field Recording Sheets in the appropriate transect sections 1-10 and in the appropriate distance category (see below).

Birds should be recorded in one of the following four categories when they were first noted:

1. within 25 metres either side of the line;
2. between 25 and 100 metres either side of the line;
3. more than 100 metres either side of the line, **including birds outside the 1-km square boundary**; or
F. birds in flight only (at any distance).

The transect is divided into 200m sections for convenience; please don't worry about birds at the boundary of two sections: record them in the one that seems more appropriate, but not in both. At the end of the first half (section 5) of the transect, record the time and break from recording while you make your way to the start of the second half of the transect route. Commence recording again through sections 6-10. Try not to record the same individual bird twice. So for example, a Mistle Thrush that can be heard singing from several transect stretches should be recorded once, where it was first detected.

We would strongly encourage observers to use the standard BTO species codes. Please familiarise yourself with the most likely codes before you go into the field. If a species is not listed please give the full common name. There is no need to record the activity or sex of the birds you encounter, although you may wish to do so. Please distinguish juvenile birds recorded from adults in those species where this is possible (e.g. B.juv, juvenile Blackbird), because counts of juveniles should not be entered onto BBS Online or the Count Summary Sheets. Please also note any feral species on transects.

Please note that distances are measured perpendicular to the transect line (i.e. at right angles to the line). A bird seen 200m ahead of the observer but close to the transect line should be recorded in category 1. We recommend that observers measure out distance categories (25m and 100m) using a combination of a tape measure and pacing to familiarise themselves with these before fieldwork begins. Category F, Birds in flight, relates to those flying over. Draw an arrow through the species' two-letter code to indicate that it is in flight. If a bird is seen to take off or land it should be recorded in the appropriate distance category (1-3) at that position. **N.B. Skylarks in display flight and hovering Kestrels should be recorded in the relevant distance category.** Please record swifts, swallows and martins in the flight category, unless they are seen to land or fly into a nest site, such as a barn or the eve of a roof.

If you have difficulty distinguishing adult and young birds, simply estimate to the best of your ability how many adults were present. We appreciate that mixed-aged flocks of crows or Starlings, for example, will present problems later in the season and ask that you observe and record with great care. Colonial nesters should be entered in the box provided at the end of the summary form (paper form users only).

Juvenile birds

Juvenile birds can be recorded on the Field Recording Sheets, but must NOT be entered onto BBS Online or the Count Summary Sheets. If you have difficulty distinguishing adult and young birds simply estimate, to the best of your ability, how many adults were present. We appreciate that mixed-aged flocks of crows or Starlings, for example, will present problems later in the season and ask that you observe and record with great care. Colonial nesters should be entered separately on BBS Online or in the box provided at the end of the Count Summary Sheet (paper form users only).

Colonial nesting birds

Birds nesting in dense colonies within the square (Rook, Sand Martin and gulls) will not be adequately censused using the standard method, and we ask observers to count or estimate the number of nests in the whole 1-km square. Colony counts should be conducted separately from the transects, and only for those species listed above. Please do not exclude counts of adult birds seen at these colonies during your normal line-transect counts (i.e. record the number of adults seen during your two line-transect counts as well as the number of active nests counted on your separate colony counts).

Habitat recording

Habitat recording is an essential part of the BBS because it allows changes in bird numbers to be related to changes in habitat available to them. **Habitat forms must be completed each year** using the coding scheme that is common to a range of BTO projects. This is shown on the back of the green form. The habitat recording system can be used without specialist knowledge. We advise that habitat details are recorded on your reconnaissance visit or following a count. Please do not record birds and habitat at the same time.

Habitat should be recorded separately for each of the 10 transect sections. Please record what you feel to be the most appropriate codes for each section (i.e. the area within a box 200m long by 50m wide). Codes allow you to describe both the predominant habitat, termed the **First habitat** on the form, and the secondary habitat, termed the **Second habitat** on the form. In many cases, two habitats will have equal importance and the order they are entered does not matter. For each habitat, choose one habitat code from each of levels 1 and 2, and up to two codes from levels 3 and 4. Please complete as much detail as you feel able: the first two levels are most important. If there is no appropriate code in levels 3 or 4 please put a dash ('-') in that column.

Please note that for squares covered for the first time, we ask for the habitat actually covered and the habitat of the ideal (straight) transects. After the first year, observers can use the more simple form as shown above, recording only the actual habitat details. 'Ideal' transects can be either North to South or East to West, depending on your chosen route. If major habitat changes occur on your square through the course of the survey, these changes should be recorded in the box provided. Please enter the transect number and the new codes. Examples of major habitat change include ploughing of set-aside, introduction or removal of animal stock and tree felling.

Visits made to your square

Please tick one of the three boxes indicating the number of visits made to your square during this season (January to July). If you have only visited your square during the three BBS visits (one habitat & two counts) then tick the first box (BBS visits only); if you have made up to three extra visits tick the second box (1-3 extra visits) and if you have made more than three extra visits tick the third box (4 or more extra visits). If you have only managed one or two visits to your square during the season also tick the first box (BBS visits only).