Woodcock 2003

Title
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Description and Summary of Results
The Eurasian Woodcock *Scolopax rusticola* breeds widely throughout Britain, with notable absences only on the highest ground in parts of Scotland, SW England and S Wales. However, during the 1990s the species was 'amber-listed' as a *Bird of Conservation Concern* because of an apparent long-term decline in breeding numbers (-76%, 1974-1999) and range (-31% between the breeding atlases of 1968-1972 and 1988-1991). The species' population size in the early 2000s was unknown but with an estimate of 5000-12500 'pairs' based on sightings of Woodcock made during the course of general bird surveys rather than counts from dedicated surveys.
Cryptic plumage, secretive behaviour and nocturnal habits make the Woodcock a difficult species to survey and it seems likely that its presence in many woods is often unnoticed during general surveys. Hence there is uncertainty about the reliability of the data and its true status. The BTO's Common Birds Census index certainly suggested a decline in breeding numbers between 1967 and 1988, but the data were somewhat geographically biased towards southeast England. It was also unclear whether the apparent differences in distribution and abundance of Woodcock between the two BTO Breeding Atlas periods were, at least in part, a result of the difference in methods between the two surveys.
Woodcock are likely to be sensitive to habitat change because of their specific requirements, particularly during the breeding season. The species is also shot in winter, although a high proportion of the birds shot in Britain and Ireland are likely to be immigrants from the continent.
The 2003 survey was the first specific national survey of breeding Woodcock in Britain, the aim of which was to produce reliable population estimates for England, Scotland and Wales. Counts of roding Woodcock were made at a total of 907 points, 807 of which were in randomly selected woods and 100 selected by the observers. Of the randomly selected woods where Woodcock were present, 82% were visited three times and 93% were visited at least twice.
Roding Woodcock were present at 340 (42%) of random survey sites. Weighting by the availability of 1-km squares within each region-wood size class stratum gave a national estimate of 35% presence in squares containing at least 10ha of woodland. The occupancy was highest in northern Scotland (recorded in 69% of woods), and lowest in the southern Midlands (11% of woods). (For definitions and notes on the regions used see Notes on Survey Design.)
Closer examination of occurrence at individual sites revealed several distinct aggregations in large forests, such as Kielder, Dalby, Newtondale, Thetford, the Forest of Dean and the New Forest, and heavily wooded regions, such as Derbyshire and Nottinghamshire, West Sussex and N Hampshire. They were more widespread in Scotland and in England north of a line from the Wash to the River Mersey, than in the rest of England and Wales.

The survey estimated a population of 78346 roding males in Britain (95% confidence limits (CL) 61717-96493) and with substantial differences in density between regions and woodland type, a total which far exceeded the most recent estimate. It also greatly exceeded both the 1968-1972 and the 1988-1991 Breeding Atlas estimates. The population sizes in Scotland (39251 males with 95% CL 24173-56632) was estimated to be similar to that in England (37328 males, 95% CL 30101-44089), but only 1767 males (95% CL 541-3259) in Wales. The estimate for northern Scotland, however, should be treated with some caution, as there are a large number of 1-km squares with less than 30% woodland in this region, but only three squares were surveyed. In England, the total number of breeding males in the three 'northern' regions (19119 males) was estimated to be similar to that in the five regions to the south of this line (18210 males).

Methods of Data Capture

In summary the survey counted roding males in randomly selected woods which had been stratified by region and woodland area.

The aim was to survey at 1000 randomly selected locations (about 1.25% of 1-km squares containing at least 10% woodland), stratified by region and by woodland area. Because roding Woodcock are generally associated with woodland, the biologically appropriate sampling unit is the stand of trees, and there is evidence to suggest that in the UK the Woodcock does not breed in woods smaller than 10 ha.

Regions were selected which contained about equal numbers of potential surveyors and similar proportions of each of the various wood-size classes. Random 1-km squares with more than 10% woodland were selected from within these to obtain the survey sample and with a further proviso that sites should be more than 2km apart.

Observers made a preliminary visit at dusk in April to assess each site and determine an appropriate survey point. Observers then made three survey visits, at least one week apart, to each site during May and June 2003. These months cover the seasonal peak of roding activity and three visits were considered appropriate to account for variability in roding activity between evenings. However if no roding Woodcock were encountered on the preliminary visit or on the first survey visit, observers were not obliged to do the second and third surveys, because data from a pilot study had shown that at sites where no birds were seen on the first two visits, Woodcock were never seen on the last two visits.

Observers were asked to conduct a survey in the largest wood within the random square, but were permitted to move up to 400m outside the square to find a suitable observation point if the wood partly overlapped an adjoining square. This happened in 49 cases and meant that in practice the minimum distance between all survey points was at least 1.2 km.

Surveys were undertaken from ride intersections, glades or felled areas within mature woodland. They commenced 15 minutes before sunset and lasted 60 minutes. On average this timing is known to ensure detection of 83% of Woodcock passes. On each occasion that a Woodcock was seen or heard, a separate registration was noted with the time to the nearest minute.

The total number of registrations during each survey was defined as the sum of all Woodcock seen and/or heard. Wet or windy evenings (with continuous rain or wind speed exceeding Beaufort force 3) were avoided, and preliminary work showed that numbers of registrations were unaffected by cloud cover, light wind or drizzle.

Woodland habitat was classified at two scales: the 1-km OS grid square and the stand level. At the 1-km square scale, survey squares containing woodland that was 70% deciduous or coniferous, based on Land Cover Map 2000 data were classified as such with the remaining squares classed as mixed. For stand scale classification, observers recorded the dominant and sub-dominant tree species and the dominant and sub-dominant species of ground vegetation at four points 50m from the count location in the cardinal directions. This information was used to classify conifer plantations according to the tree species and deciduous woods into those of basic, neutral or acid soils, beech woodland or wet woodland on the basis of characteristic National Vegetation Classification species. Woodland was defined as mixed at the stand level where conifers were planted in an intimate mixture with deciduous species, such as Beech *Fagus sylvaticus* with a spruce *Picea* spp. nurse crop. At this scale, woodland was also defined as mixed if the 1-km square classification was mixed woodland and the ratio of conifer to deciduous tree species records, or vice versa, was at least 25%:75%.
Data checks were made to ensure that surveys commenced at the appropriate time. Where observers continued to count birds for more than 60 minutes, the data were truncated. The wood size class was reclassified according to the new 1-km square at the 49 random sites where observers located their observation point outside the allocated square. Some data from self-selected sites where landowners, foresters or gamekeepers wanted to participate were accepted for inclusion in habitat analyses, but population estimates were based solely on randomly selected sites. Data for 28 self-selected sites which were within 1.2 km of a random site were excluded.

Purpose of Data Capture
To estimate the breeding population size of Woodcock in Britain using a dedicated survey method, to enable assessment of current status and the creation of a baseline for future monitoring.

Geographic Coverage
All of Britain, sampling the largest block of woodland in a random selection of 1-km squares with more than 10% woodland. The country was divided into regions.

Temporal Coverage
May and June 2003 with the request to do 3 visits at least a week apart.

Other Interested parties
It was run as a joint survey with the Game Conservancy Trust (now Game and Wildlife Conservation Trust).
The survey was funded by the Shooting Times Woodcock Club and an anonymous English charitable trust.

Organiser(s)
Deborah Lang and Rob Fuller at BTO with Andrew Hoodless from the Game Conservancy Trust.

Current Staff Contact
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Publications
The main results of the survey have been published as:
Hoodless, A.N., Lang, D., Aebischer, N.J., Fuller, R.J. & Ewald, J.A. 2009. Densities and population estimates of breeding Eurasian Woodcock *Scolopax rusticola* in Britain in 2003. *Bird Study* 56: 15-25.
The project was also noticed in *BTO News* numbers 244 and 253.

Available from NBN?
No.

Computer data -- location
BTO Windows Network central area.

Computer data -- outline contents
All the data are in one file (Excel spreadsheet). Various letters, publicity material, talks etc; files relating to the pilot survey of 2002.

Computer data -- description of contents
The one datafile (Excel spreadsheet) has 4 sheets in it:
Site+Visit Details: Name and Address of Observer, Date, Time and Weather for up to 3 visits;
Bird Data: Grid Ref of Observation Point, Date, Time, Number of birds seen, heard, seen+heard;
Habitat Data: Site and then many variables of vegetation and access by people;
Tick List: Grid Ref, Date, Species seen and/or heard with Count and any comments
Sheets sorted by Grid Reference of Observation Point except Habitat as some values missing.
There are 5 directories:
Full survey -- the data in batches as sent to Game Conservancy -- amalgamated into the above file in July 2010.
Letters 03 -- various letters from Deborah Lang to surveyors and local organisers.
Miscellaneous -- publicity material, talks, images, notes from meetings, drafts of cards and instructions.
pilot -- files relating to the pilot survey of 2002 including data files and various letters.
website -- contains some material used for the web pages publicising the survey.

Information held in BTO Archives

The original paper records (data cards and others) are held by Game Conservancy Trust. In the BTO Archives there is 1 Archive Box containing photocopies of the original data cards, and 1 Transfer Case containing papers relating to the Pilot Survey.

Notes on Access and Use

Other information needed

Notes on Survey Design

The unique display or 'roding' flight performed by male Woodcock provides the best opportunity to confirm the presence of breeding birds and assess numbers. From late February to mid-July, males fly circuits above the woodland canopy at dawn and dusk, calling repeatedly, in search of receptive females. There have now been several detailed studies of roding behaviour and these show that flights of individual birds seldom last more than 20 minutes and typically two to four separate flights are made each evening. The roding areas of several males may overlap and the Woodcock's breeding system has been shown to be one of successive polygyny, whereby a few dominant males fertilize the eggs of most females in a given area. Counts of passes by roding Woodcock at fixed points provide the only feasible method for any largescale monitoring of breeding Woodcock populations, but until recently their interpretation has been hindered by the fact that they represent multiple registrations of an unknown number of males. The validity of using such registrations of roding Woodcock for assessing numbers of males has been demonstrated (Hoodless *et al*. 2008 *Ibis* 150: 80-89).

To target woods to be surveyed, all 1-km squares containing at least 10% woodland were identified from the Land Cover Map 2000, available at a 1-km^2 resolution through the Countryside Information System. Four woodland categories (10-30ha, 31-50ha, 51-70ha and 71-100ha) were specified within this, and then a GIS package was used to determine the number and size of regions to obtain similar proportions of squares belonging to each of the four wood size classes, whilst taking account of the number of potential surveyors within each BTO region.

A dataset containing the numbers of BTO members within the 118 BTO regions was obtained and regions were combined until the numbers of members within each new region were as similar as possible, whilst also considering geographic continuity. It was not possible to achieve exactly the same number of members in each region because of a strong bias in BTO membership towards areas of high human population density, particularly southeast England and East Anglia.

Survey site stratification resulted in 11 geographical areas each containing a similar proportion of 1-km squares of the four woodland size classes. It was not possible to further stratify by type of woodland owing to pronounced geographical differences in the extent of deciduous and conifer woodland: more deciduous woodland in southern England and more conifers in northern England and Scotland.

The proportion of total BTO members within each of the 11 regions was used to calculate the number of survey squares required per region. All selected squares had to be at least 2km apart to ensure the independence of counts at each survey point -- roding areas are typically 43-134ha. The desired number of woodland squares was then randomly selected from those available within each region and size class. In the Midlands and southern England, the desired number of squares in the 51-70ha and 71-100ha size classes exceeded the number of available squares that met our criteria, resulting in lower overall numbers of selected squares in these size classes. We used a random number generator to select 1-km squares for survey, ensuring that the centre of each new square was at least 3 km from the centre of all previously selected squares. Selected squares were ordered by the random number assigned to them. BTO regional organizers were asked to allocate or reject squares in random number sequence, based on their experiences of obtaining access permissions and the physical difficulties of gaining access to some woods, particularly at dusk. A large sample of squares (2677) relative to the desired coverage was therefore selected initially.

Specific Issues for Analysis

Woods surveyed once, twice and three times were distributed evenly between wood size classes and between regions. Comparison of the number of random squares surveyed with the number selected within each region-wood size class stratum revealed an overall difference from the stratification in the proportions of squares surveyed, with the main difference between regions being proportionately low coverage of squares in southwest England. Comparison of wood size classes showed that a lower proportion of squares containing 10-30% woodland was surveyed than selected and a higher proportion of squares containing 71-100% woodland was surveyed. This meant that the national population size had to be calculated from estimates for each region-wood size class stratum separately.

The number of individual male Woodcock (*W*) at each survey site was estimated from the maximum number of registrations (*R*) using the equation $W = 0.74\ R^{0.708}$, based on a calibration involving identification of individuals at 43 sites using spectrograms of calls (Hoodless *et al*. 2008 *Ibis* 150: 80-89). This relationship appears to be widely applicable because there were no differences in slope or intercept between broad regions (NE England and Scotland compared to central southern England) or habitats (coniferous, mixed, deciduous woodland). The maximum number of registrations was used because this was considered to provide a better estimate of the total number of males at a site than the mean count, owing to variation in roding activity between nights. The estimated number of males at each survey point was assumed to be equivalent to the density in the 1-km survey square.

National and regional Woodcock population estimates were calculated by expansion, based on the mean density per stratum used in the survey stratification, ie wood size class within region. Thus, the national population estimate was derived by combining density estimates from all 44 strata. Confidence limits were computed from 1000 boot-strap samples, of the same size as the sample of squares surveyed.

Regional Woodcock presence and density in occupied 1-km squares were calculated from weighted stratum means because these reflect the expected presence or density across each region, whereas estimates based on raw stratum means would simply represent the

sample of squares surveyed. Variation in Woodcock presence between regions and wood size classes was examined using a generalized linear model with binomial errors. Woodcock density in occupied squares was analysed using analysis of variance.