Numbers of wintering Woodcock *Scolopax rusticola* in woodlands in the Highlands of Scotland

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Summers, R.W. & Buckland, S.T. 1996. Numbers of wintering Woodcock *Scolopax rusticola* in woodlands in the Highlands of Scotland. *Wader Study Group Bull.* 80: 50-52.

The population of Woodcock in the Moray faunal area in the Highlands of Scotland in winters 1993/4 and 1994/5 was estimated at 17 000 (95% C.L. 12 000 - 25 000). Woodcock were associated mainly with conifer woods and to lesser extent with birch. Their density was lower in native pinewoods compared with other woodlands (primarily conifer plantations). They occurred in a wide variety of forest structures, from pre-thicket to mature plantation and old open native pinewood. Faeces contained earthworm chaetae.

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INTRODUCTION

Population sizes of the majority of waders wintering in Europe are well known (Smit & Piersma 1989). However, the Woodcock *Scolopax rusticola* has been notoriously difficult to census, both as a breeding bird and as a winter visitor, and there are no good estimates of their numbers. It is widespread in Britain in winter, occupying a wide range of woodland types and age classes (Wilson, in Lack 1986). Only the high ground is avoided. It is clearly an abundant bird given that 200 000 were shot as game in Britain in 1982 (Tapper & Hirons 1983).

This study provides an estimate of the number of Woodcock occupying mainly conifer woods in part of the Highlands of Scotland in winter, when both resident and migrant birds are present. Additionally, information is provided on the type of habitat in which they occur by day, and their diet.

STUDY AREA METHODS

The study was carried out during the winters (November-March) of 1993-4 and 1994-5. It formed part of a large piece of work estimating the population sizes of key pinewood birds.

Woodland in the Moray faunal area (Harvie-Brown & Buckley 1896) was stratified according to native pinewood and other woodland, primarily conifer plantations (Figure 1). Approximately 2 000 km^2 of woodland occurs in this region (Catt *et al.* 1994) of which 88 km^2 is native pinewood (Forestry Authority 1994). Thirty six transects within native pinewoods were selected systematically. Alternate 1 km squares were chosen, like all the white squares on a chess board, if the 6-number grid reference xx8yy5 fell within woodland. The distribution of other woodland was obtained from Bartholomew maps and 77 six-figure grid reference numbers were randomly chosen from this habitat.

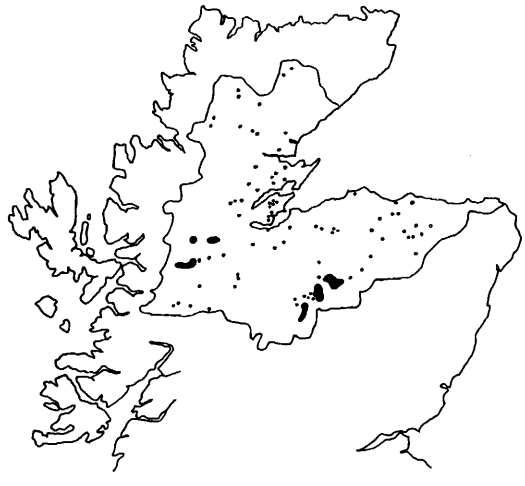

Figure 1. The distribution of transects in the study area. The native pinewoods are the large black areas whilst individual locations in other woodland are shown as dots.

Transects were drawn on maps such that the chosen grid reference fell mid-way along one side (the primary side) of an equilateral triangle whose total length for all three sides was 2 km (Figure 2). The angle of the primary side in native pinewoods ran north-south, but at random directions in other woodland. Although the chosen grid reference points had, by definition, to fall on the described habitat (native pinewood and other woodland), the transects laid out from these points did not always fall entirely within woodland. Therefore, in order to derive population estimates from sample units of 2 km, extensions were made along the length of one of the arms of the transect so that 2 km of woodland were surveyed in every transect (Figure 2). This does not bias the sample towards woodland edge; rather it compensates for those triangles partially in woodland that were not sampled because the reference point itself was outside the woodland.

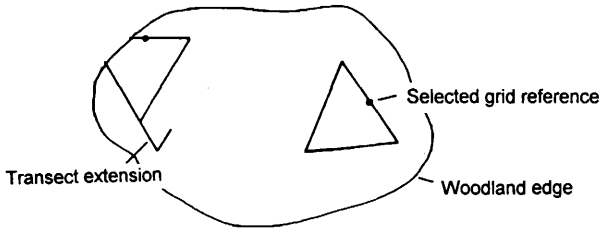

Figure 2. The layout of transects within and at the edge of woods. Extensions were made to transects at the edge of woods to give a total of 2 km transect line in each case.

Transects were walked on compass bearings and paces counted to estimate the distance. Once a contact was made with a bird (usually the birds were heard and seen as they flushed), two measurements were made: the angle between the bird and the transect line and the radial distance to where the bird was located. From these measurements the perpendicular distance of the bird from the transect line was calculated (Figure 3). Detection probability models of different types (Fourier series, Hermite polynomial and hazard-rate) were applied to the perpendicular distances and the selection of the best fitting model was based on the lowest Akaike Information Criterion (AIC) score (Buckland *et al.* 1993). This allowed estimation of the effective width of the transect and from this, estimates of density could be made using the DISTANCE programme (Laake *et al.* 1993; Buckland *et al.* 1993).

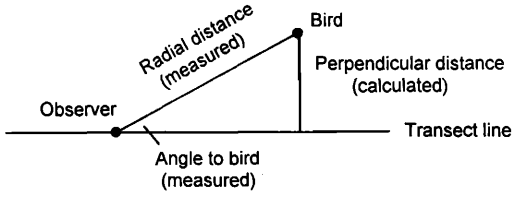

Figure 3. The measurements made to determine the perpendicular distances that Woodcock were from the transect line.

The tree nearest to the point where the bird was flushed was identified and allocated to a structure type: pre-thicket, thicket, post-thicket, pole stage and old open pinewood (Rose 1979). The latter type is characteristic of native pinewoods.

RESULTS

A total of 144 km was walked along the 36 transects through native pinewoods, and 250 km were walked along the 77 transects through other woodland in the two winters. Woodcock were encountered on 53 occasions. A truncation distance of 20 m was specified in the analyses and one bird observed at 31 m from the transect line was rejected. The inclusion of the distant bird would have adversely affected model fitting. The distribution of the perpendicular distances from the transect line for Woodcock seen in the native pinewoods was not significantly different from that in other woodland (X^2_1 = 0.9, P> 0.2). Therefore, the distance data for the two habitat types were pooled for estimating the detection curve (Figure 4). The best-fitting detection probability model was the half-normal without Hermite polynomial adjustments (minimum AIC = 285.3, goodness-of-fit test, X^2 = 7.21, d.f. = 6, P> 0.2) and the effective transect width was 9.6 m (95% C.L. 7.8 - 11.8 m) either side of the line.

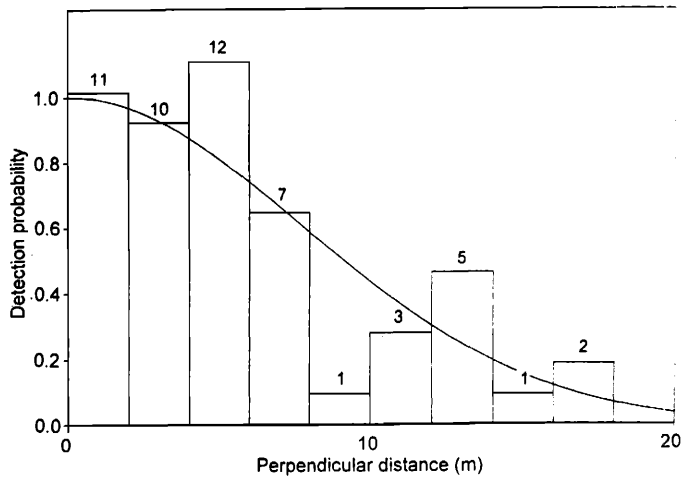

Figure 4. The distribution of perpendicular distances that Woodcock were seen from the transect line. Also shown is the fitted half-normal detection curve.

Within native pinewoods, the density estimate was 4.0 Woodcock per km^2 (95% C.L. 1.8 - 8.7), giving a population estimate of 350 (95% C.L. 160 - 760) in the 88 km^2 of native pinewood. Within other woodland, all records were of single birds except one record of two birds. The latter observation occurred in November, so it is unlikely that they were a pair. The average group size was 1.02 (95% C.L. 1.00 - 1.07) and the average bird density was 8.8 per km^2 (95% C.L. 6.0 - 12.9). Extrapolating this to the entire 1921 km^2 of other woodland, the population size was estimated to be 16 800 (95% C.L. 11 400 - 24 700). By combining the values for the two types of woodland, an approximate total of 17 000 was estimated for the Moray faunal area (95% C.L. 12 000 - 25 000). When the data were analysed for the two years separately, similar estimates for the total population size were obtained: 16 900 for 1993/4 and 17 200 for 1994/5.

The majority of the Woodcock were associated with Scots pine, and to a lesser extent with other conifers and birch (Table 1). The forest structures where the Woodcock were flushed varied from young pre-thicket, through to mature plantation and old open forest (Table 2). Many sightings were in dense woodland, and even in open woodland, birds were flushed from cover; *e.g.* under fallen branches, suggesting that they were day-roosting. At one site there were several droppings close together indicating

regular use. Other records were from wet flushes and streams where birds may have been feeding.

Table 1. Numbers of records of Woodcock associated with different tree species.

	Native pinewood	Other woodland
Grand fir *Abies grandis*	2	0
Douglas fir *Pseudotsuga menziesii*	0	3
Western hemlock *Tsuga heterophylla*	0	1
Norway spruce *Picea abies*	1	5
Sitka spruce *Picea sitchensis*	0	7
Larch *Larix* spp.	0	1
Scots pine *Pinus sylvestris*	5	18
Lodgepole pine *Pinus contorta*	0	4
Juniper *Juniperus communis*	1	0
Birch *Betula* spp.	2	3

Table 2. Numbers of records of Woodcock in different woodland structures.

	Native pinewood	Other woodland
Pre-thicket	1	13
Thicket	2	14
Post-thicket	2	2
Pole stage	1	4
Mature plantation	1	8
Old open forest	4	1

Birds often defecated when flushed. Eight droppings were collected and all contained chaetae of earthworms. There was also some plant and insect fragments.

DISCUSSION

Hirons (1982) and Wilson (1982a, 1982b) showed that wintering Woodcock roost in cover by day and fly to fields at dusk where they feed on earthworms. However, they may also feed by day in woodland. Our observations of birds flushed from cover suggest day-roosting, but their presence at wet flushes and the sides of small streams also suggests some day-time feeding.

The density of Woodcock in native pinewood was lower than in the pooled category of other woodland. The latter has a greater density of trees so perhaps provides better cover than native pinewood.

Similar population estimates were obtained for the two winters. However, stability in the winter population size is unlikely because Woodcock are subject to cold-weather movements into and out of Scotland (Wilson, in Lack 1986). Also, annual variations in breeding success will influence population size. A longer run of years would be necessary to describe the annual variations.

Winter conditions in the Highlands are probably poorer than southern Britain for Woodcock, given the frequent snow and frost. Despite this, it was the most abundant wader wintering in the Moray faunal area. The second most abundant is the Oystercatcher, at 8 000 (Symonds & Langslow 1986). It is possible that Woodcock densities are greater in suitable habitat in southern Britain where the climate is less severe, and it should be possible to estimate populations throughout Britain using similar survey techniques.

ACKNOWLEDGEMENTS

The following helped with field work: Dr A.M. MacLennan, R.A. Mavor, R. Proctor and G. Rebecca. The draft was commented on by Drs M. Avery and I.P. Bainbridge.

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