International Waterfowl Research Bureau

WOODCOCK AND SNIPE RESEARCH GROUP

Newsletter No. 11 December 1985

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EDITORIAL

By this Newsletter number eleven of the Woodcock and Snipe Research Group we want to inform about recent publications, preliminary results of research going on and short notes of interest.

Meetings

At the 31st Executive Board Meeting of the International Waterfowl Research Bureau (IWRB), February 10 to 16, at Paracas (Peru) H. Kalchreuter reported on the group's activities as well as outlines of future research.

During the 32nd General Assembly of the Conseil International de la Chasse (C.I.C.) from April 15 to 19 at Dakar (Senegal) the financial questions of the 3-years International Woodcock Project were settled thanks to the generosity of C.I.C.-France, which will take over half of the costs. The remaining costs will be contributed by six other nations or organisations.

Research

After a two-years pause the ecological studies on the woodcocks of Whitewell Wood, U.K., could be continued by T. Johnson, under the supervision of G. Hirons. This study of the breeding season of 1985 is part of International Woodcock Project of the C.I.C.-Migratory Bird Commission. The results are published in this Newsletter, p. 8 to 29 . We are grateful to C.I.C.-France for financing this part of the project.

Publications

Proceedings of the SEcond Woodcock and Snipe Workshop are still available and can be ordered directly by H. Kalchreuter. Other publications concerning woodcock and snipes are reviewed in the Bibliography of this issue.

Second announcement:

Third European Woodcock and Snipe Workshop

After four years time since the last conference of woodcock and snipe researchers the third workshop will take place in

October 14. - 16., 1986 in Paris.

It will be hosted by the Office National de la Chasse. During the first two days scientific lectures will be given and discussed, and an excursion into a woodcock study area near Paris is on schedule of the third day. Participants should arrive on October 13. The organizers will ask for a registration fee to cover some of the costs. Simultaneous translation (English/French) will be provided.
The scientific program will cover various aspects of Woodcock and Snipe biology and management, such as

- Habitat, feeding and breeding ecology, behaviour, winter ecology.
- Ringing results, migration, population dynamics, hunting.
- Telemtry, kill statistics, wing sampling.

Especially persons actively working in woodcock and snipe research are heartly invited to present a paper (preferably in English). They should send title and abstract to

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not later than July 31st, 1986. Appropriate papers will be published in the Proceedings of the Third Woodcock and Snipe Workshop.
Participants are asked to contact

Yves Ferrand, ONC-Section Becasse, Quai Cot,
F-34800 Clermont L'Herault

for accomodation (Tel. 30418011).

We hope this third workshop will be as successful as the two previous ones, and beneficial to future woodcock and snipe research.

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NATIONAL NOTES

AUSTRIA

Philipp Meran

On the phenology of Woodcock Migration in Eastern Austria 1984

Spring migration: Alter a long and severe winter with deply frozen soil the overall number of woodcock observed was lower than in previous years. The first birds passed through during March 10 - 12, but no more were seen before March 24. Migration peaked around April 1 and ended abruptly after April 9. I assume that later woodcock might have passed through without being noticed during a period of high temperature after April 14.
The following table lists woodcock shot during morning and evening flight, spring 1984.

Date	Location	Sex	time (h)	weight (gr.)	bill-length (mm)	age
12.3.	Siegendorf, Mariaschl.	♂	18.20	275	7.0	juv.
24.3.	Siegendorf, Std.3	♂	5.05	300	6.8	ad.
28.3.	Strem, Altwald	♂	18.38	305	7.2	ad.
29.3.	Strem, 22-er Schl.	♀	19.41	368	8.2	ad.
30.3.	Strem, 22-er Schl.	♂	19.50	320	7.1	juv.
31.3.	Strem, Bach	♂	19.55	335	8.0	ad.
7.4.	Strem, 22-er Schl.	♂	20.05	380	7.1	ad.
7.4.	Strem, 22-er Schl.	♀	20.11	355	7.3	juv.
9.4.	Strem, 22-er Schl.	♂	20.06	370	6.9	ad.

Fallmigration: First woodcock were seen on October 8, migration peaked around beginning of November, higher up in the hills. The cold spell of mid-November obviously has caused the birds to leave the area, since only very few

had been observed thereafter at several localities. Generally woodcock didn't fly intensively this fall, most were seen at night sitting along forest road sites or on pastures, where the birds were probing in cow dung.
The following woodcock were shot at evening flights, fall 1984:

Date	Location	Sex	time (h)	weight (gr.)	bill-length (mm)	age
19.10.	Ligist,Kremser	♀	17.35	375	8.0	juv.
20.10.	Ligist, Stachel	♂	17.15	330	7.5	juv.
30.10.	Grambach, grieb	♂	17.19	335	6.7	ad.
4.11.	Rosenkogel,KALTHUBER	♀	17.12	355	8.1	ad.
4.11.	Rosenkogel, "	♀	17.15	305	6.7	juv.
12.11.	Gasseld.,Einschnitt	♂	16.58	365	6.8	ad.
18.11.	Gasseld., "	♂	16.51	352	7.1	ad.
19.11.	Gasseld.,Feld	♂	16.40	318	6.6	juv.

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BRITAIN and IRELAND

Feeding and breeding of Common Snipe in Lowland Britain.

Rhys Green

Common Snipe Gallinago gallinago breed on seasonally flooded pastureland on the Ouse, Nene and Cam Washes (Cambridgeshire and Norfolk, UK) at the highest population densities so far recorded (up to 110 pairs/km^2). Some of the dwindling area of lowland wet grassland in England is now owned by conservation organizations and research is in progress to improve grassland management for wildfowl and wader populations.

Snipe feed by probing moist soil or mud with a sensitive bill for lumbricid worms and insect larvae. Pastures have a higher biomass density of suitable prey than wet mud at ditch or pool margins but pasture becomes difficult to probe as the soil dries out during the summer. Measurements of soil penetrability indicate that Snipe cease to nest when the soil becomes too dry for them to probe and regular nest counts show that the date upon which nesting ceases varies between areas by up to 40 days. This effect of drainage and evaporation of soil water strongly influence the length of the nesting season and the opportunities for Snipe to nest again after losing nests to predators or livestock.

Snipe chicks are fed by their parents on soil invertebrates obtained by probing. A partial analysis of the growth rates of 75 broods of Snipe chicks indicates that the biomass density of soil invertebrates and the soil penetrability within the brood's home range both influence growth rates. Hence careful manipulation of water levels may allow improvement of breeding success by lengthening the breeding season and enhancing the availability of food for the chicks.

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National Game Census: The 1984/85 Season

Michael Rands and Stephen Tapper

Woodcock
Since the late 1960s there has been a steady rise in the numbers of Woodcock shot and last season was the highest national average we have ever recorded. Bags throughout the country were either average or above average with the greatest increase in the South West and Northern Ireland, probably because the hard winter drove them to these milder areas. The increasing bag may not reflect an increase in Woodcock populations but rather an increase in shooting pressure due to increased Pheasant shooting. (From: The Game Conservancy Annual Review No. 16: 86 - 87, 1985).

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A study on habitat preferences of the woodcock (Scolopax rusticola) during the breeding season

Graham Hirons and Thomas Johnson

This study is part of the International Woodcock Project of the C.I.C. Migratory Bird Commission.

During a four-year radio-telemetry study (1978 - 81) in Whitwell Wood, Derbyshire, England (Hirons (1983) Proc. Second European Woodcock and Snipe Workshop pp. 51-67) Woodcock were found to switch from feeding on pasture fields at night to feeding within the wood by day around the time breeding started (late March). Their distribution then corresponded closely with the abundance of earthworms, a major food of Woodcock; water-logged ground and areas of Beech and Pine were avoided.

Although the Woodcock is the most ubiquitous of European quarry species, the above study has provided the only quantitative information so far on the habitats they utilise during the breeding season.

Objectives of the pilot study in Whitwell Wood, April-July 1985

The primary aim was to develop field and analytical methods for assessing the basic essentials of good Woodcock breeding habitat for use in future studies. Vegetation structure and composition, and soil parameters, including earthworm numbers, were recorded for quadrats containing the feeding or nest locations of radio-tagged birds. This information was then compared with that for randomly located plots.

Ancillary to the main telemetry study, information was also obtained on nesting success, behaviour patterns and numbers of roding birds for comparison with that obtained previously. In addition, faecal analysis was employed to enable the diets of chicks and breeding adults to be assessed for the first time.

STUDY AREA

Whitwell Wood in N.E. Derbyshire comprises 171 ha of Forestry Commission plantations mainly dating from the period 1932 - 1947. Most of the plantations have been thinned within the past two years. The dominant overstorey species are Sycamore Acer pseudoplatanus (97.4 ha)

and Beech Fagus sylvaticus (62.6 ha), sometimes planted in mixed stands, with smaller areas of Scots and Corsican Pine Pinus sylvestris and P. nigra (94 ha), Ash Fraxinus excelsior (2.9 ha) and Birch Betula spp. (1.5 ha). The other principal tree species are Oak Quercus robur and Rowan Sorbus aucuparia which are dotted irregularly throughout the wood, and Alder Alnus glutinosa which dominates the marshy borders of the stream at the wood's northern boundary. The only other wet area is one small pond.

Whitwell Wood has a comprehensive network of rides and paths much used for walking by the public, particularly at weekends. In general, the area is gently undulating agricultural land; the wood itself is situated on a plateau at an altitude of 140 m above sea level.

The distribution of the major habitat types and rides are shown in Fig. 1.

METHODS

Capture of birds

Woodcock were trapped at dusk or dawn in mist-nets set across rides or clearings. One female with chicks was caught with a hand-net.

Radio-tracking

Captured birds were fitted with single-stage radio transmitters weighing approximately 4 g (ca. 1.5% of body weight). Transmitters were sewn onto pieces of cloth which were then glued onto the back feathers with "superglue". The potential field life of the transmitters was around 60 days; one was shed and recovered after 56 days.

Feeding activity of radio-tagged birds was detected by monitoring changes in received signal strength with a portable receiver and hand-held Yagi antenna. Initially, birds judged to be feeding were located by triangulation at a range of 100 - 200 m and then approached cautiously until visible through binoculars, usually at 10 - 20 m range.

Fig.1. Distribution of principal tree species and rides in Whitwell Wood, Derbyshire

(In dense vegetation "fixes" instead were made from this distance). Feeding locations were marked with plastic strips tied to prominent vegetation. The positions of random sites were determined by generating random map co-ordinates using an electronic calculator.

Nest finding

Nests were located by searching or by the use of a trained spaniel.

Habitat research

Habitat measurements were centred upon a 0.25 m^2 quadrat placed over each feeding, nest and random site. Definitions of the habitat variables recorded for each site are given in Table 1.

Earthworm biomass

At feeding and random sites (and adjacent to nests after hatching or failure) vegetation and litter were cleared from the quadrat. A solution of 25 ml of formalin in 4.5 l of water was then poured evenly onto it so that the soil was thoroughly infiltrated without run-off. All earthworms emerging within 10 minutes were collected. Adult Lumbricus terrestris were discarded because this nocturnal, deep-burrow species would be unavailable to Woodcock feeding by day.

Faecal analysis

Faeces were collected by holding chicks over a plastic cup and by flushing the accompanying radio-tagged female. They were stored in 70% alcohol and subsequently examined for invertebrate fragments under a microscope.

Statistical analysis

Multivariate discriminant analysis was used to determine the combination of habitat variables which best differentiated feeding and

random sites, and between utilization classes (i.e. nests, broods and solitary birds). A stepwise procedure was employed to eliminate variables which did not contribute significantly to the discriminating power of the function. Only discriminant function coefficients of habitat variables that individually accounted for more than 10% of the discriminating power in a function were considered to be important.

RESULTS

General Observations

Roding

The average number of observations of roding birds per evening in May/June (17.7 ± S.E. 5.2) over the "heath", a small clearing near the centre of the wood (Fig. 1), fell within the range recorded during the previous study (Table 2). A second clearing, "the coppice", was created 950 m away in 1984. Here the average number of observations of roding birds in May/June was 14.0 ± S.E. 7.5, similar to that for the heath (Table 2).

Radio-tracking

Nine Woodcock were trapped during 28 mist-netting sessions on which on average 15 nets were set. All were fitted with radio-transmitters as was a female caught with a hand-net. Details of these birds are given in Table 3.

One radio failed immediately but the other nine birds were monitored for a total of 281 transmitter days (Table 3) during the period 3 April - 6 June. Seven birds remained in Whitwell long enough to provide locations for the habitat study (see Fig. 2). One of the others usually spent the day in a wood 3.2 km away, but roded over Whitwell.

Table 1: Definitions of habitat variables measured at Woodcock feeding, nest and random sites. All distances were measured from the centre of the quadrat.

Variable	Definition
Vegetation structure	
Stand age	Age of stand in which quardrat was located
Tree density	No. of trees per ha.
Basal area	Basal area (m^2) of trees per ha
Mean basal area	Mean basal area (cm^2) of trees at point quarters
Sapling density	No. of saplings within 2.9m radius
Shrub stem density	No. of shrub stems within 1.8m radius
Brushwood density	No. of cut branches (cm diam.) from thinning within 2.9m radius
Vegetation cover	% of ground surface within quadrat covered by livin vegetation
Height of dominant vegetation	Height (cm) of dominant species of ground cover
Height of co-dominant vegetation	Height (cm) of second most dominant species of ground cover
Litter cover	% of ground surface within quadrat covered by litte
Litter depth	Mean depth (cm) of litter within quadrat
Bare ground	% of ground surface visible within quadrat
Distance to edge	Horizontal distance (m) to nearest natural or man-made edge
Vegetation composition	
Tree species abunddance	Proportion of trees of a given species at point quarters
Herbaceous species abundance	% of ground surface within quadrat covered by a given species
Soil variables	
Soil moisture	Mean moisture content (% net weight) of three 7cm deep cores taken immediately adjacent to the quadra
pH	pH of soil core immediately adjacent to the quadrat
Earthworm biomass	Biomass ($g\ m^{-2}$) of worms (excluding *L. terrestris*) extracted from the quadrat

Table 2 Average number of observations of male Woodcock per evening in May/June over "the heath" in Whitwell Wood, Derbyshire. In 1985 birds were also counted at "the coppice".

Year	No. of obs.	Mean No.(± 1 S.E.)	Range
1978	5	18.0 ± 2.35	12 - 24
1979	15	14.3 ± 1.04	8 - 20
1980	11	14.9 ± 1.17	8 - 24
1981	22	14.3 ± 1.21	5 - 26
1985	3	17.7 ± 5.20	12 - 28
1985 (coppice)	4	14.0 ± 3.75	8 - 25

Table 3 Details of Woodcock radio-tagged in Whitwell in 1985

Date	Ring No.	Age/Sex (if known)	Name	Last date monitored	Remarks
3/4	EK84761	- -	Noddy	15/4	Moved out of area
4/4	EK84762	- M	Big Ears	31/5	Roded Whitwell; spent days in wood 3.1 km W
5/4	EK84763	1y -	Margaret I	16/4	Moved to wood 3.7 km NNE; returned 14/4. Killed by sparrowhawk
6/4	EK84764	1y M	David	15/5	Moved out of area or transmitter failed
17/4	EK8476	1y M	Gerald	27/5	Alternated between Whitwell and wood 2.2 km NNW
17/4	EK84765	Ad F	Sylvia	16/5	Incubating. Last chick probably lost (22 days). Then moved?
27/4	EK84767	Ad -	Margaret II	6/6	Remained in Whitwell
28/4	EK84768	1y -	---	---	Transmitter failed
28/4	EK84769	1y F	---	3/6	Moved out of area, returned on 3/6
21/5	EK84770	- F	Dee	6/6	Single chick (16 days old on 6/6)

Feeding behaviour

Two of the radio-tagged birds, both first-year males (David and Gerald, Table 3), initially fed at night on the same pasture field 1.8 km and 1 km from their daytime roosting places respectively. Gerald last fed there on 26 April, David on 10 May after which both adopted the same feeding pattern as the other birds i.e. feeding by day in woodland.

Nesting success

Eight nests were located, most in April (Table 4). Excluding one which was trampled, probably by a stray dog, and another that had already been predated when found, half produced young. Ten chicks were ringed from four broods.

Habitat Research

Habitat variables (30) were measured at 50 feeding locations (28 for single birds, 22 for females accompanying broods (n=4)), 50 random sites and for seven nests.

General habitat characteristics

1. Nests

Seven of the eight nests found were in areas of the wood dominated by Sycamore, the other was in a mixed Beech and Sycamore plantation (Fig. 2).

2. Feeding sites

Like nests, feeding sites occurred disproportionately in stands dominated by Sycamore (Table 5) and the areas in which Beech and pine were the dominant overstorey species were avoided by feeding birds (Fig. 3)

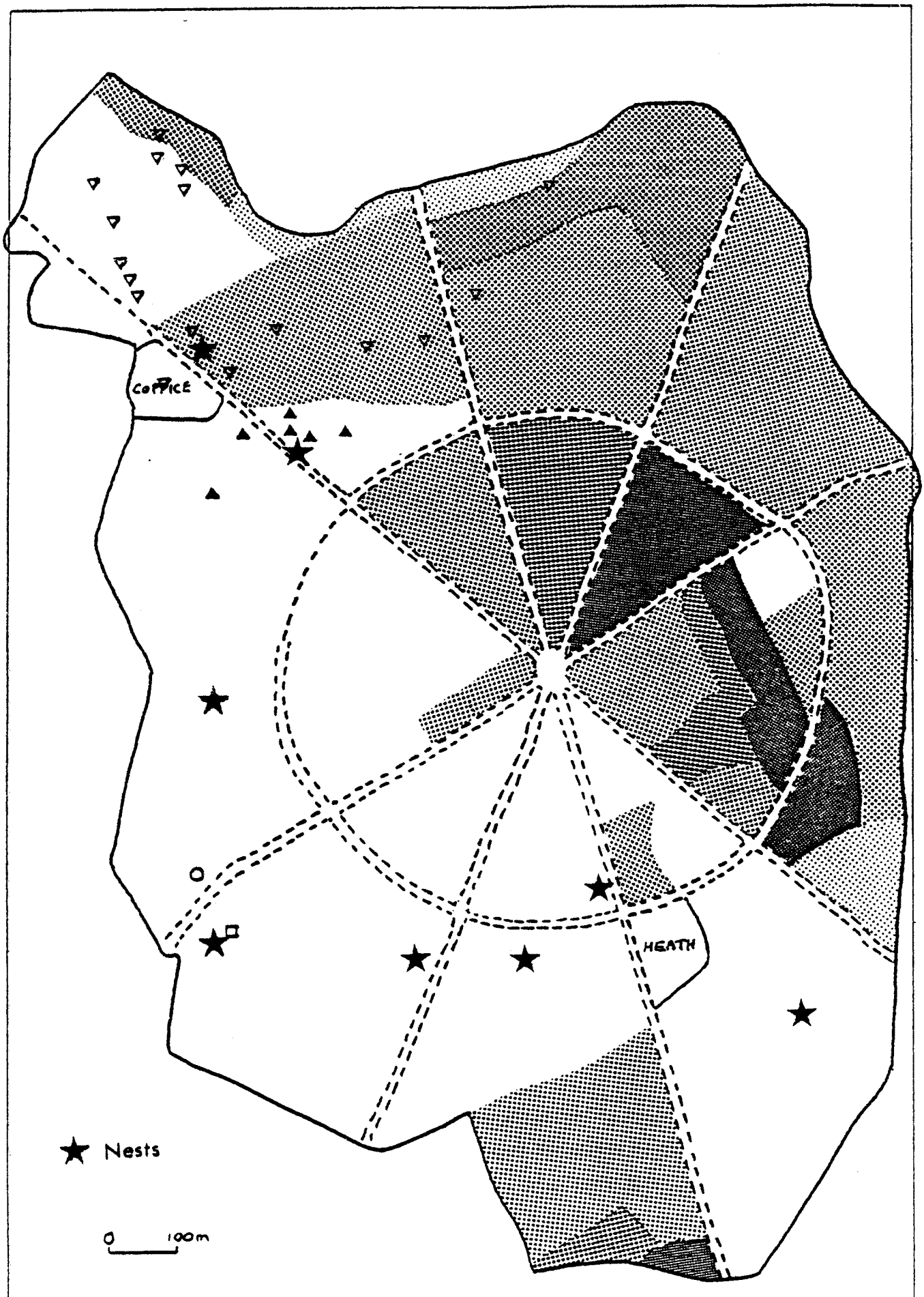

Fig. 2: Locations of Woodcock nests (n = 8; stars) and broods (n = 4; trianles, circle, quadrat) in Whitwell in 1985

Table 4 Nests found in Whitwell 1985. All contained four eggs.

Date found	Outcome
13.4.85	Hatched 25/4; two chicks ringed 1/5, one fledged (Female radio-tagged(Sylvia)).
13.4.85	Eggs broken by dog
14.4.85	Hatched 6/5
17.4.85	Predated by Jays before 25/4
25.4.85	Eggs cold when found. Deserted.
30.4.85	Hatched 21/5. Last surviving chick last seen 1/6. Female fitted with radio (Dee).
3.5.85	Already predated when found.
25.5.85	Not known. Still incubating 3/6.

Table 5 Feeding locations of radio-tagged Woodcock (n=8) in Whitwell Wood, Derbyshire in April - May 1985 in relation to the dominant overstorey species.

Dominant tree species	Area occupied (ha)	% Total area (% random sites)	No. feeding locations	Selection Index[1]
Sycamore	94.7	55.4 (58)	45	1.625
Beech	62.6	36.6 (36)	5	0.273
Ash	2.9	1.7	-	
Birch	1.5	0.9	-	
Scots Pine	7.9	4.6	-	
Corsican Pine	1.5	0.9	-	
Total	171.1	100.1	50	

[1] Selection Index = $\frac{\%\text{ feeding locations in habitat type}}{\%\text{ area occupied by habitat type}}$

Values >1 indicate preference, 0 - 1 avoidance

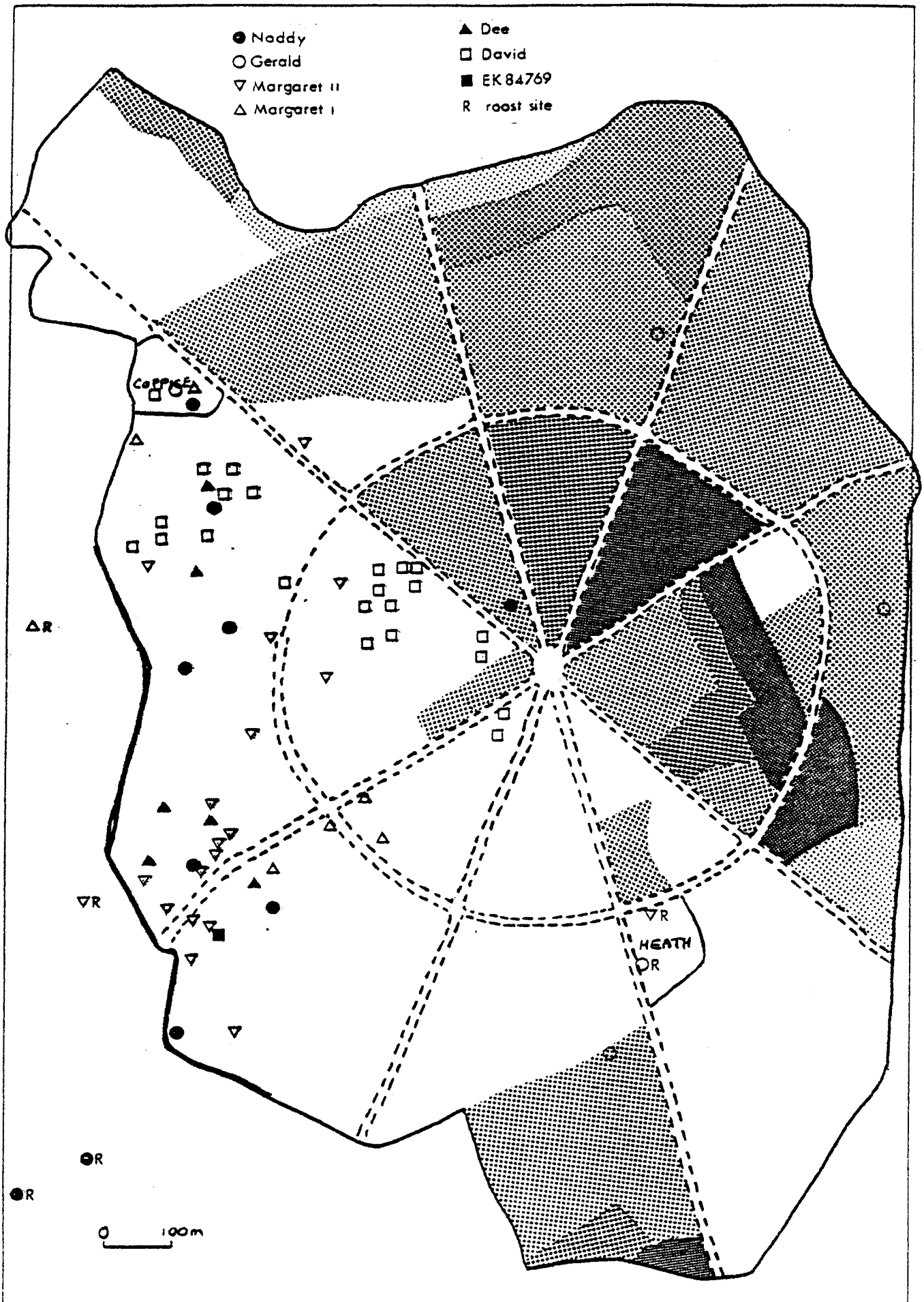

Fig. 3: Diurnal feeding sites of radio-tagged Woodcock in Whitewell in 1985.

Differences between feeding and random sites

Significantly different average values for feeding and random sites were found for ten habitat variables (Table 6). Feeding sites tended to be in younger stands, with a high ground cover of Dog's Mercury Mercurialis perennis and consistently higher values for pH and earthworm biomass. Random sites were more often in areas with Beech and therefore had on average higher values for litter cover and depth.

The results confirm that feeding sites were not randomly distributed within the wood, particularly as some of the random sites will have been in areas utilised by unmarked Woodcock for feeding.

Discriminant function analysis

The stepwise discriminant analysis resulted in a significant discrimination ($P=<0.0001$) between feeding and random sites based on six habitat variables.

The relative contribution of these habitat variables to the discriminant function can be determined from the standardised discriminant function coefficients (Table 7). Basal area of trees per ha and tree density were the most important variables differentiating feeding and random sites. Percentage cover of Dog's mercury and pH also contributed more than 10% to the discriminating power of the function. Distance to edge and height of the dominant ground vegetation were relatively less important.

The weighting of each discriminatory variable toward feeding or random sites can be determined from the signs of the standardised discriminant coefficients (Table 7). Density of trees, percentage cover of Dog's mercury, pH and distance to edge were weighted towards feeding sites. All other things being equal, high values for these variables increased the likelihood of a site being classified as a feeding location. Basal area of trees and height of ground vegetation were weighted towards random sites.

Table 6 Means and standard deviations of habitat variables that were significantly different (P=<0.05) between Woodcock feeding locations and random sites

Variable	Feeding Mean ± S.D.	Random Mean ±S.D.	Significance level
Vegetation structure			
Basal area of trees (m^2/ha)	2.8 ± 1.73	4.4 ± 4.20	<0.05
Mean basal area of trees (cm^2)	27.8 ± 10.5	37.7 ± 18.5	<0.01
Height of co-dominant vegetation (cm)	8.2 ± 6.96	4.9 ± 6.73	<0.05
Vegetation composition			
Dog's Mercury (% cover)	19.9 ± 13.43	1.3 ± 5.37	<0.001
Beech (% of point-quarters)	12.4 ± 25.3	40.6 ± 40.63	<0.05
Oak (% of point-quarters)	3.2 ± 7.78	0.3 ± 3.08	<0.05
Ground surface and soil characteristics			
Litter (% cover)	41.5 ± 14.52	62.6 ± 25.0	<0.05
Litter depth (cm)	1.5 ± 1.14	2.5 ± 2.67	<0.05
pH	6.3 ± 0.79	5.2 ± 1.15	<0.001
Earthworm biomass (g 0.25 m^{-2})	5.62 ± 3.21	3.08 ±3.27	<0.001
Earthworm numbers (0.25 m^{-2})	18.92 ± 1.74	10.41 ±1.80	<0.001

Table 7 Standardised discriminant function coefficients for discriminating between Woodcock feeding and random sites. Coefficients above the horizontal line individually account for more than 10 percent of the discriminating power of the function.

Importance rank	Variable	Standardised coefficient
1	Basal area of trees (m^2 ha^{-1})	-1.34204
2	Tree density (no. ha^{-1})	0.91905
3	Dog s Mercury	0.80342
4	pH	0.49606
5	Distance to edge (m)	0.42577
6	Height of dominant vegetation (cm)	-0.35730

The discriminant function correctly classified 85.5% of the sites suggesting good separation between feeding and random sites.

Differences between nest-sites and habitats utilised for feeding by solitary birds and broods

Discriminant analysis on the habitats utilised by three groups of Woodcock (solitary feeding birds, broods and nests) produced two significant functions that accounted for 81% and 19% of the among group variation (Table 8). The percentages of plots correctly classified indicates good separation of the three groups. The most important variables separating them in function 1 were Brambles, Beech and percentage cover by ground vegetation, grass and Bluebells Scilla nonscripta. Function 2, although significant, showed relatively little separation between the three groups (Fig. 4). The direction of increase for the major discriminating variables (Fig. 4) suggests a tendency for nests to be located in areas with more Brambles and a light ground cover of Bluebells and/or grass. Broods and solitary birds utilised similar areas characterised by more ground cover than nest sites. One brood frequented a mixed Beech and Sycamore stand (Fig. 2) which may have unduly weighted the importance of Beech for broods in Fig. 4.

Brood movements

One brood (Sylvia's, Fig. 2) moved 2015 m in 22 days after hatching, an average of 92 m per day. The brood was reduced to a single chick by day 13, and this could fly by day 19.

Earthworm numbers

Differences between habitats

The density of worms in three habitats, pasture, cereal fields and woodland, is given in Table 9. In April, the biomass of worms was 20 times higher in pasture than in cereals and five times higher than in woodland. However, by June the biomass of worms extracted from pasture had declined to a third of that in woodland.

The discriminant function correctly classified 85.5% of the sites suggesting good separation between feeding and random sites.

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Table 8 A comparison of habitat utilisation by three groups of Woodcock during April and May 1985 in Whitwell Wood, Derbyshire, expressed by two discriminant functions. The percent of among group variation accounted for is a measure of the importance of each function. The amount of group overlap is expressed by the percent of plots correctly classified, with 100% indicating no overlap. Largest differences between group means indicate the groups being discriminated. Variables contributing the greatest separation between groups in a function are identified by the largest absolute discriminant function coefficient. Coefficients contributing more than 10% of the discriminating power of the function are underlined.

	Discriminant function		
	1 (P=<0.0001)	2 (P=<0.01)	% of sites correctly classified
	Percent of among group variation accounted for		
	80.6	19.4	
	Utilisation group means		
Group (N)			
Nests (7)	-3.801	0.673	85.7
Broods (22)	1.319	0.689	81.8
Solitary birds (28)	0.014	-1.087	85.7
Variable			
Vegetation cover	<u>0.915</u>	-0.180	
Height of co-dominant vegetation	0.452	<u>-0.496</u>	
Shrub stem density	0.376	0.398	
Bluebells	<u>-0.623</u>	<u>0.489</u>	
Grass	<u>-0.662</u>	0.371	
Brambles	<u>-1.521</u>	0.214	
Beech	<u>1.343</u>	<u>0.883</u>	
Sycamore trees	0.142	<u>0.995</u>	
Sycamore seedlings	0.243	<u>-0.529</u>	

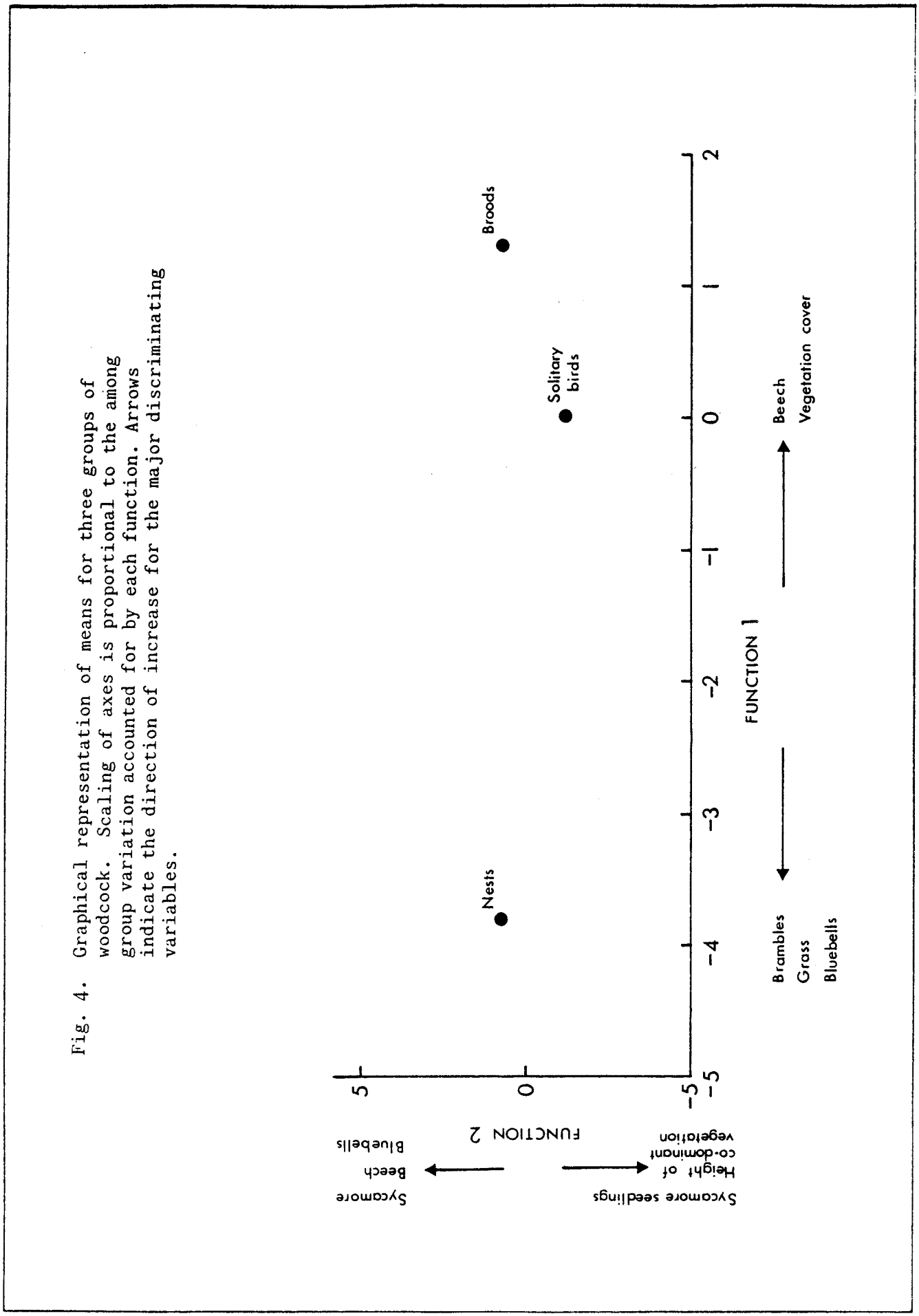

Fig. 4. Graphical representation of means for three groups of woodcock. Scaling of axes is proportional to the among group variation accounted for by each function. Arrows indicate the direction of increase for the major discriminating variables.

Distribution within woodland

Even within woodland, the distribution and abundance of earthworms are influenced by vegetation cover and soil characteristics. In Whitwell biomass of worms was highly correlated with pH (r_{74}=0.51). In a multiple regression, four habitat variables accounted for 43.5% (multiple r = 0.659) of the variation in earthworm biomass. In addition to pH, there were significant positive relations between earthworm biomass and the occurrence of Sycamore and Oak, and tree density.

Diet

Preliminary analysis of faeces from both chicks and accompanying females confirms that earthworms are probably the most important component of the diet (Table 10). Over 80% of the faeces in both categories contained many earthworm chaetae, and all contained at least some. Not all the invertebrate fragments have yet been identified but over half the samples contained traces of insect cuticle.

DISCUSSION

Transmitter attachment

In previous radio-telemetry studies of Woodcock, transmitters have been attached by means of harnesses, which can adversely affect behaviour. The results of this study suggests that attachment by glueing is preferable: fitting a transmitter takes less than one minute, birds resume their normal patterns of behaviour much sooner (e.g. roding, incubating, flying out of the wood to feed) and the beak cannot become entangled as sometimes happens with a harness. Only one radio was shed during the study, and this after 56 days, close to the theoretical field-life of the transmitter. By contrast harnesses last for up to 10 months by which time the radios have ceased transmitting and cannot be recovered except by recapturing the bird.

Table 9 The mean (±1 S.E.) number and biomass (g 0.25 m^{-2}) of earthworms extracted from Whitwell and nearby fields, April - June, 1985.

	Pasture		Cereal fields	Whitwell (all sites)
	April	early June	April	April/May
Number	22.2 ± 4.39	2.30 ± 0.44	1.50 ± 1.50	14.6 ± 1.35
Biomass	13.4 ± 2.65	1.40 ± 0.27	1.01 ± 1.01	4.3 ± 0.4

Table 10 The frequency of occurrence of major prey types in the faeces of Woodcock chicks, and accompanying female. Chicks (4 broods) were from one to 16 days old.

	Chicks (n=13)			Adults (n=11)		
	no.	%		no.	%	
Earthworm chaetae - some	2	15.4	100%	2	18.2	100%
- many	11	84.6		9	81.8	
Insect cuticle	7	53.8		7	63.6	

The intensity of roding in different years

The intensity of roding in May and June (i.e. the number of birds observed per roding session) was remarkably similar to earlier years in spite of prolonged hard weather in the previous winter. This suggests that the numbers of birds actually roding in Whitwell remains fairly constant from year to year.

Earthworm availability

(a) Woodland

Several American studies have suggested that Woodcock distribution and numbers are highly dependent upon the supply and availability of earthworms. In this study earthworm biomass was on average 82% higher on feeding than random quadrats and much less variable. The mean earthworm biomass (g dry weight per m^2) for feeding sites in Whitwell (22.5 g) is near the top of a range of values given in the literature for areas heavily used by American Woodcock (7.8 - 23.0 g m^2).

Several studies have found that populations of worms are greatest in soils with a pH of about 6.0 and least in soils with a pH below 5.0. Results from Whitwell were similar: the mean pH for feeding sites was 6.3 and for random sites, 5.2. Most of Whitwell is well- drained and all sites sampled were within the moisture range of 15 - 80 percent by weight considered to be optimum for earthworms.

In Whitwell earthworm abundance is also associated with stand type and tree density. A likely explanation for this relationship is the food preferred by earthworms. Lumbricids eat mainly leaf litter and find Sycamore and Oak litter more palatable than Beech and Pine.

As noted above, earthworm biomass was significantly correlated with pH which in turn was one of the major discriminating variables between feeding and random sites. However, formalin solutions extract only a proportion of the worms present and this probably varies with species, age and soil moisture. If the availability of earthworms to

Woodcock could have been measured as accurately as pH it might perhaps have been the more significant variable in the function discriminating feeding and random sites.

(b) Pasture fields

During winter and early spring Woodcock fly out of Whitwell to nearby pasture fields to feed at night. At this time earthworm availability is higher on pasture fields than in woodland or arable land. In this study, two of the birds continued to visit pasture fields at night until 26 April and 10 May respectively, before switching to feeding in woodland during the day and roosting at night. The factors which account for the change from "winter" to "summer" behaviour probably include a decline in the availability of earthworms in pasture to below that in woodland (Table 9), the increase in the length of grass, and the reduction in the time available for feeding at night.

Structural characteristics of habitats utilised for feeding during the breeding season

The discriminant function analysis shows that habitat structure is important in determining suitability for Woodcock. Feeding occurred where trees were smaller and also closer together than on random sites.

In Whitwell, both Tawny owls Strix aluco and Sparrowhawks Accipiter nisus take adult Woodcock during the breeding season and this partly explains why areas with Dog's Mercury are selected for feeding. Previous management of Whitwell has produced an impoverished shrub layer and the closed canopy of older stands prevents the herb layer developing to provide sufficient overhead protection from avian predators. Dog's Mercury not only provides good overhead cover but its stems are also sufficiently far apart for Woodcock to move through. A ground flora dominated by Dog's Mercury characterises the more open stands in Whitwell, particularly those of Sycamore. In addition, percent ground cover of Dog's Mercury was significantly correlated with pH ($r=0.53$; $p=<0.001$).

The most important factors in determining feeding areas are probably safety from avian predators and the availability of earthworms. The latter in turn is influenced by pH, soil moisture and the palatability of the leaf litter.

Several studies of the American Woodcock have demonstrated habitat preferences associated with structural features, particularly understorey structure. Generally, high use areas are characterised by a high density of shrubs and reduced herb cover but in woodlands with a poorly developed shrub layer, Woodcock select for herb stem density and cover. It appears that a similar effect operates for European Woodcock in Whitwell.

Both this study and the previous one in Whitwell have failed to demonstrate any preference by Woodcock for feeding in swampy patches although many habitat descriptions stress their importance. However, rainfall in April and May 1985 was above average and the presence of permanently damp areas might be more important in dry summers. Against this, water-logged ground probably contains low numbers of earthworms.

Nest and brood habitat

Neither pH nor earthworm biomass contributed to the discriminant function separating nest sites from those utilised by broods and solitary feeding birds. Presumably sites in all three classes were in good areas for feeding; incubating females usually walk off the nest to feed. The most important variables separating nest sites were (higher) percentage cover of brambles and more open ground vegetation which together provide the incubating female with overhead protection and good lateral visibility. Likewise American Woodcock nest in fairly open habitat, while broods move into heavier cover similar to that used by solitary birds, an effect shown here.

Research on American Woodcock suggests that nests are often sited close to "edges". However, in this study nests were not further from edges than random sites (nests 23.1 $\pm$ S.E. 3.56 m; random 16.4 $\pm$ 2.40 m).

Diet in the breeding season

The results of the faecal analysis confirm that earthworms are the most important component of the summer diet of Woodcock in Whitwell. Whether this applies in other areas deserves further study.

CONCLUSIONS

In Whitwell both habitat structure and food availability appear to influence the distribution of Woodcock in the breeding season. However, for a better understanding of the basic essentials of good Woodcock habitat, similar studies need to be undertaken in other habitats and in other countries where conditions are different.

In Europe the Woodcock is an important quarry species (3.7 million shot per annum (Hepburn 1983)) with an extensive breeding range and there is considerable scope for habitat management. Discriminant function analysis could be used to suggest which factors are important for habitat choice by Woodcock in the breeding season and to assess the potential for management of particular areas.

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FINLAND

Lennart Saari

Bag records of Woodcock and Snipe in Finland

During five seasons the following bags were reported from Finland:

	S.rusticola	G.gallinago
1978/79	2.500	2.000
1979/80	2.900	1.600
1980/81	3.600	2.300
1981/82	3.500	2.100
1982/83	4.800	4.800

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FRANCE

Charles Fadat & Yves Ferrand

Summary of the work of the Woodcock of the Office National de la Chasse, France during the season 1983/84.

1. Breeding Biology

In the spring of 1983 some preliminary work was undertaken in the forest of Rambouillet. Woodcock were present in lower numbers than in previous years and only four roding birds were ringed. Seven nests were found, four of which had already been predated.

2. Migration

Another ringing location (Morbihan, Brittany) was added to the two operated previously (Chizé, Deux-Sèvres and Marquenterre,

Somme). 49 birds were ringed at the new site in November/ December 1984. Three teams of two or three people ringed another 70 woodcock along the Atlantic coast using a 150 watt spotlight and a net at night; they made a total of almost 100 during the 1983/84 winter. About a quarter of the birds seen can be trapped by this method. The aim is to ring 200 - 300 birds every winter. However, given the 10 - 15% recovery rate in this species, even this considerable achievement is insufficient to compare mortality rates between years.

3. Analysis of hunting returns

Following a dry autumn on the Atlantic coast, the 1983/84 winter was wet and mild, apart from a cold snap in the centre and east of France at the end of November and in early December. As in previous years densities were compared using 'Indices Cynégétiques d'Abondance' ($\frac{B \times n}{n^2}$, where B is the number of woodcock killed, n the number of hunting excursions and n_1 the number of excursions on which at least one woodcock was killed). The index for 1983/84 (0.18) was 12% higher than in 1982/83 but lower than in 1981/82 (0.21) and previous years.

3.1 Distributions of woodcock wintering in France

The pattern observed was similar to that noted in 1982/83 probably due to the mild winter viz. lower densities in the Manche-Atlantic regions and increased numbers inland, especially in the Massif-Central.

3.2 Seasonal distribution of wintering woodcock

As in 1982/83 the highest densities and largest bags were obtained in early to mid-November, both inland and on the coast, rather than in mid-winter as is usually the case.

3.3 Distribution by sex and age

As in previous years, the wings (5113) returned by hunters enabled shot birds to be categorised as either adult,

early born young (ie. those presumed to originate in Western Europe) or late young (ie. those presumed to have been reared in Northern Europe). A nationally representative sample of 3130 woodcock was also sexed by dissection.

Sex ratio

Males made up 41.6% of those birds sexed. This figure is within 1% of the figure for the previous 7 years! As usual the proportion of males in the bag increased steadily throughout the autumn and winter. Only in the Alpes du Nord did males (57%) outnumber females in the bag. The sex ratio was most biased towards females (32 - 36% males) in the Alpes du Sud, Massif-Central Sud and Bretagne Nord.

Age ratio

70.7% of the wing sample were young, a 3% increase over 1982/83. Most of this increase was due to a greater proportion of young in the southern Massif-Central and S.E. France. One important difference was the higher proportion of 'late' young in the bags from nearly all areas. We suggest that Scandinavian reared young wintered in their normal areas in 1983/84 and not further as in 1982/83. The arrival in France of these young from the end of October to the end of November was chiefly responsible for the high densities of woodcock recorded at this time. However, as the usual big arrival of woodcock in winter did not occur, a high proportion of the normal wintering population probably remained outside France, presumably further north.

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National Club of Woodcock hunters in France

In 1951 the "Club National des Becassiers" was established in France to organize all hunters interested to hunt woodcocks with dogs. The device of the Club is to enjoy woodcock hunting as much as possible, but at the same time to reduce the bag to a minimum. In order to achieve this the Club initiated the following restrictions:

- ban of hunting woodcock on their morning and evening flights in winter
- ban of hunting roding woodcock
- ban of selling woodcocks.

While the latter two restictions are more or less respected, the Club considers hunting woodcocks during their daily flights in winter still a danger for the populations. To contact its members the Club issues a quarterly magazine "La Mordorée", by which also articles concerning woodcock research and conservation measures are published.

(Summary of a translation by A. Wadsack of an article published in "La Revue National de la Chasse", No. 450, March 1985).

H.K.

HUNGARY

Sandor Faragó

Trends of woodcock (Scolopax rusticola) bags in Hungary during the last 15 years (summarized from a manuscript in German by H.K.)

In Hungary the Woodcock is the only "wader" on the list of quarry species. The hunting season lasts from March 1 till April 20, thus for 51 days. Only roding birds are allowed to be hunted, but not more than two birds per hunter per day.

The total Hungarian woodcock bag has continuously inceased from 1.037 birds in 1974 to 2.040 in 1983. Fig. 1 exhibits considerable fluctuations but a more or less stable trend during the 1970ies, and an increase in 1983 and 1984. The bags in the wildlife management units over the last 15 years are given in Tab. 1. In Tab. 2 the bags of 1975 and 1983 are presented after correction with abundance fugures in different properties ("comitat") as well as per 1.000 ha woodland. By Fig. 2 the regional distribution of the woodcocks bagged are presented. Obviously woodcock avoid the lowlands with scattered woodlets, dry sandy soils and rather arid microclimate during their migration.

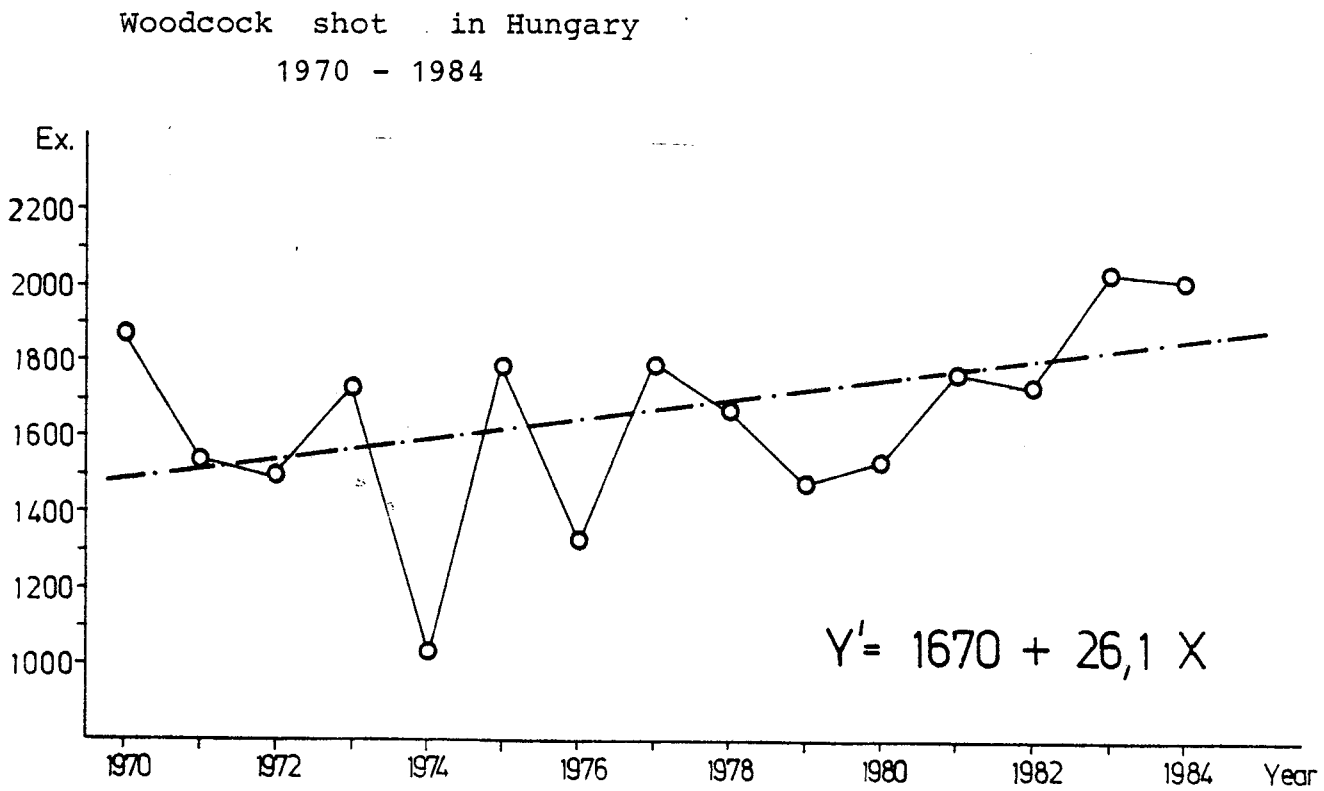

Fig. 1: Trend of woodcock bags in Hungary

The increase of the bags may be explained by the increase of the woodland areas. In the period of 1975 - 1984 90.000 ha had been afforrested in Hungary. In 1984 the bags have been below 1 woodcock/ 1.000 ha in only seven comitats, while in 1975 this has been true for 12

Wildlife management territory	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984
Hunting societies in Countries :															
1.Baranya	148	-	141	103	57	174	102	127	98	106	136	121	104	114	84
2.Bács-Kiskun	7	-	13	36	50	25	8	32	58	43	64	28	41	30	6
3.Békés	1	9	6	3	-	-	21	-	-	-	-	-	-	-	-
4.Borsod-A.-Z.	437	314	208	119	127	203	179	314	180	237	309	268	210	225	250
5.Csongrád	6	13	-	-	14	29	24	12	10	-	-	-	2	-	3
6.Fejér	51	72	66	71	22	19	16	41	11	17	13	-	28	80	82
7.Győr-Sopron	2	14	7	1	10	23	24	19	39	30	32	63	46	63	15
8.Hajdú-Bihar	10	16	-	-	43	12	15	31	20	36	14	20	39	82	85
9.Heves	84	80	127	39	56	114	65	89	131	45	57	-	113	136	139
10.Komárom	68	33	57	64	58	66	34	57	38	53	35	51	45	70	59
11.Nógrád	143	109	152	112	-	88	153	145	328	148	145	188	180	194	149
12.Pest	161	230	159	552	132	221	121	192	113	203	162	147	142	142	159
13.Somogy	188	270	148	189	173	191	191	240	80	106	134	118	147	140	162
14.Szabolcs-Szatmár	31	27	26	-	-	128	41	62	172	42	62	77	14	29	98
15.Szolnok	29	26	6	35	-	23	8	-	1	3	-	-	2	3	2
16.Tolna	46	64	40	31	32	7	2	15	40	36	26	20	17	-	6
17.Vas	119	67	73	63	37	75	71	69	80	70	140	61	88	155	101
18.Veszprém	51	-	103	37	21	87	91	62	55	49	98	63	69	100	107
19.Zala	18	81	-	125	80	67	34	50	126	44	41	99	73	50	34
State Hunting Territories															
Forestry Management	42	15	24	9	80	151	79	176	69	182	227	291	272	322	263
Hunting Management	129	38	75	110	20	51	10	9	6	14	13	17	8	13	12
State Farms	62	21	18	22	-	21	17	30	11	8	8	43	85	77	204
Other State Territories	34	40	37	10	25	24	22	19	10	10	16	41	8	9	8
H U N G A R Y	1.867	1.539	1.494	1.731	1.037	1.799	1.328	1.791	1.676	1.482	1.732	1.777	1.733	2.040	2.028

Table 1: Number of woodcock shot in each of the Hungarian wildlife management units from 1970 to 1984

comitats. The bag had increased especially in the lowlands, while it was more ore less stable in the wooded areas of the country.

No.	Country	1975		1983	
		Ex.	Ex./1.000 ha Wood	Ex.	Ex./1.000 ha Wood
1.	Baranya	239	2,52	118	1,12
2.	Bács-Kiskún	25	0,19	30	0,26
3.	Békés	0	0,00	11	0,49
4.	Borsod-A.-Z.	233	1,45	225	1.23
5.	Csongrád	29	0,83	0	0,00
6.	Fejér	19	0.68	93	1,78
7.	Györ-Sopron	28	0,43	82	1,17
8.	Hajdú-Bihar	12	0,58	82	1,36
9.	Heves	114	1,04	136	1,52
10.	Komárom	107	1,78	70	1,31
11.	Nógrád	95	0,97	194	2,47
12.	Pest	272	2,37	262	1,63
13.	Somogy	212	1,48	275	1,74
14.	Szabolcs - Sz.	131	1,41	79	1,22
15.	Szolnok	23	0,46	3	0,11
16.	Tolna	7	0,16	0	0,00
17.	Vas	75	0,89	206	2,31
18.	Veszprém	111	0,76	118	0,86
19.	Zala	67	0,72	56	0,54
H U N G A R Y		1.799	1,14	2.040	1,23

Table 2: Woodcock bags corrected with abundance figures of properties and per 1.000 ha woodland

Fig. 2.

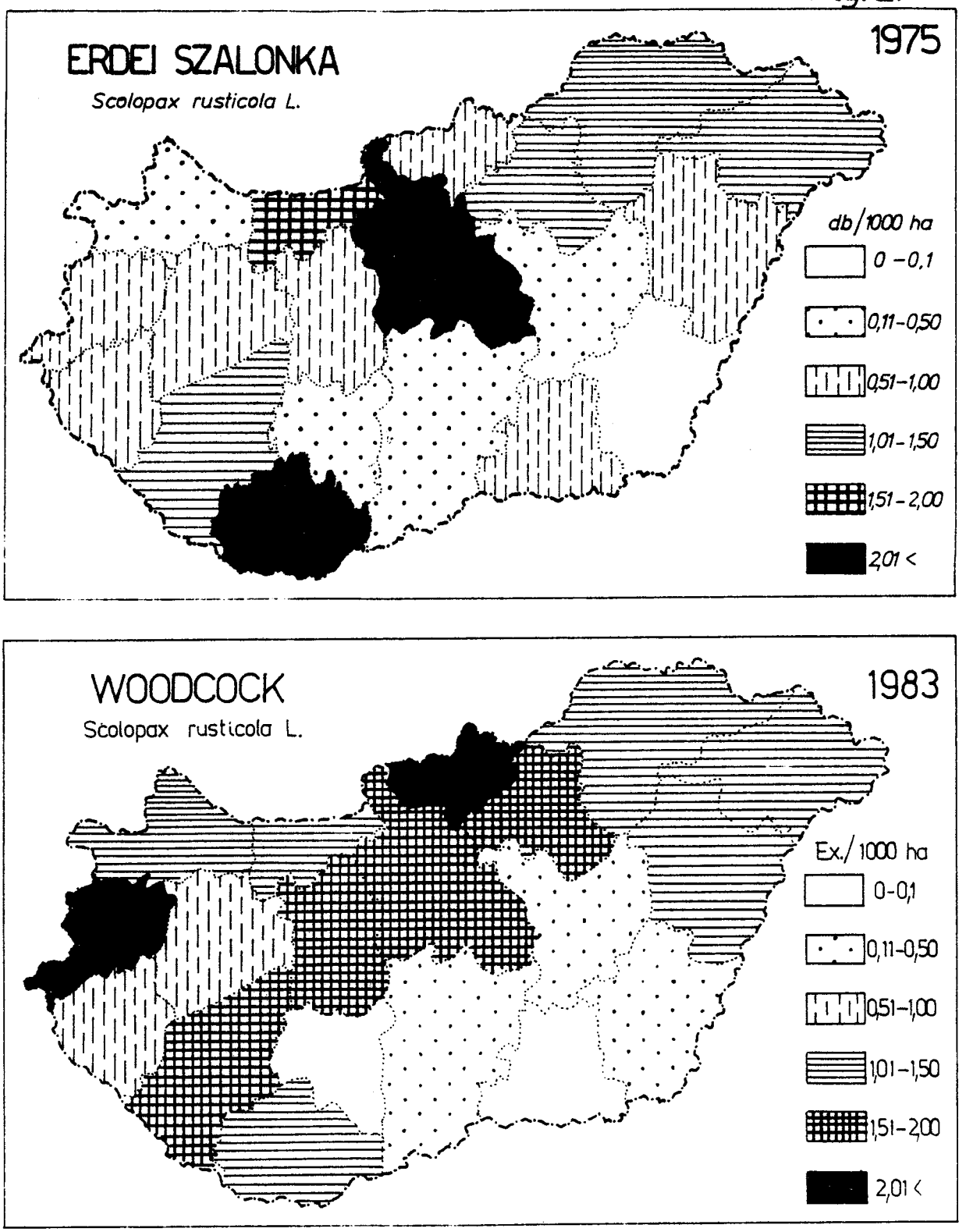

Fig. 2: Regional distributions of woodcock bags per 1.000 ha in Hungary in 1975 and 1983

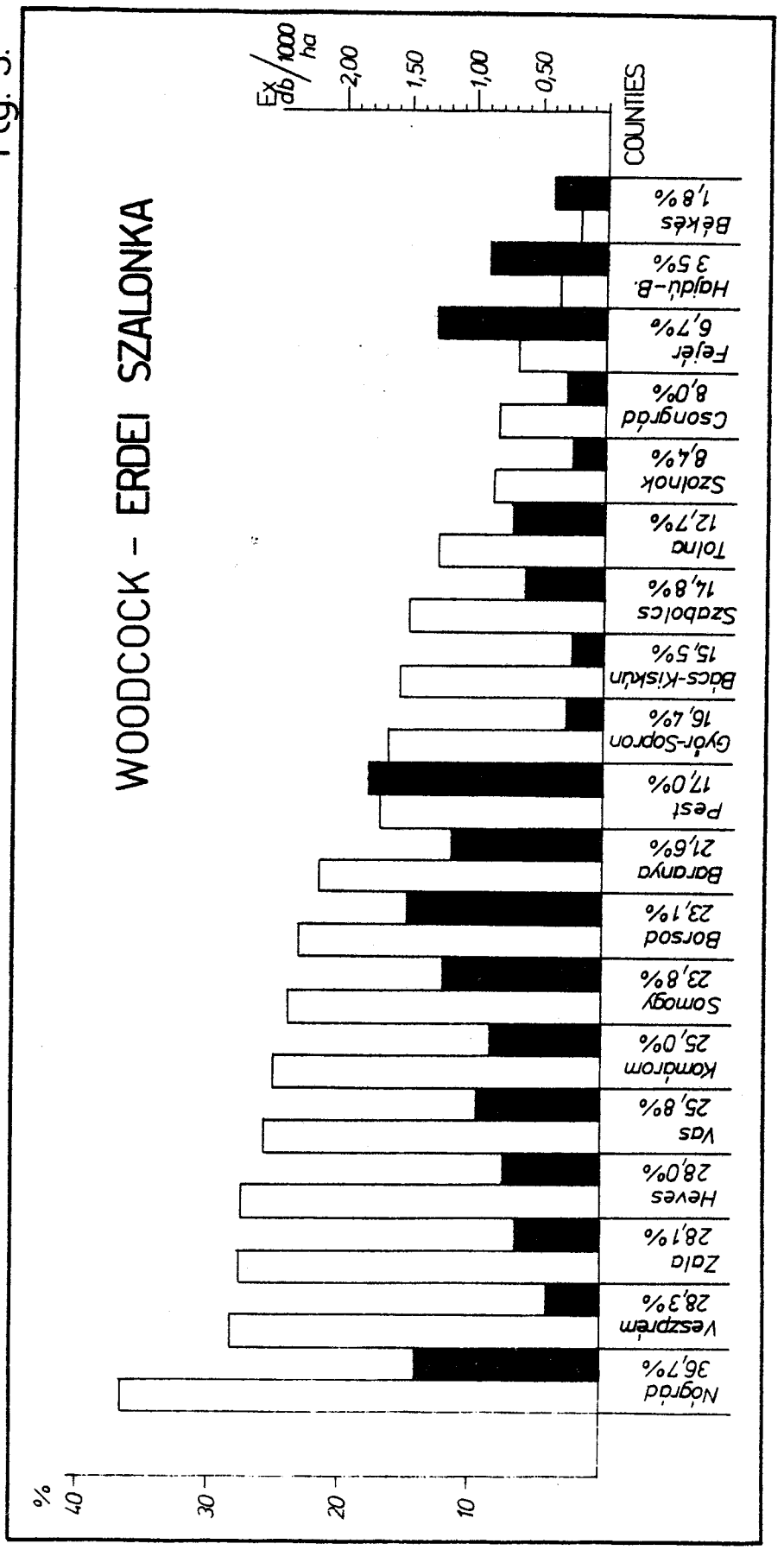

Fig. 3: Percentage of woodlands (white) and number of woodcock shot per 1.000 ha wood (black) in Hungarian wildlife management units.

The bag figures may not necessarily indicate the abundance of woodcocks, since there are considerable differences in hunting pressure between areas. In the larger woodlands hunters are occupied with big game shooting, while in the lowlands they can spend more time for woodcock hunting. This holds especially for areas around larger cities. Thus, as Fig. 3 points out, a larger proportion of migrating woodcock may be taken in the latter areas, ie. in the Pilis Mountains, where more than 100 birds are shot annually over an area of 21.500 ha, while in Western Hungary only a negligible portion is taken. However, no long term impact on the number of migrating birds has been recognized so far, but considerable annual fluctuations as is also obvious from Fig. 1.

These bag statistics exhibit an increasing interest of the Hungarian hunters in the woodcock, which may partly be caused by the decline of other small game species. Thus, an average bag of 2.000 woodcock or more may be predicted for future years.

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NORTH AFRICA

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Some notes on the woodcock season 1984/85 in Morocco.

The first woodcock could be stated during a boar hunt on 11 November 1984, others have been seen on 18 November (Larache and Ben Slimane). Larger numbers were not observed before the end of December, though they have not been really numerous. This might have been due to the better precipitation of this winter, which allowed a better distribution of the woodcocks over larger areas. On the other hand, according to our observations considerably fewer woodcock wintered in the Mamora forest since the drier years beginning in 1980/81. This might be a consequence of lower availability of invertebrate food items.
Just to give an idea of the woodcock density: during an average time of 3.8 hours spent hunting two hunters flushed an average of 2.1 woodcocks per day. The weight of 11 birds taken ranged from 270 to 375 grams, with a remarkable increase towards the end of the season at the beginning of March. 6 of the birds have been adults and five juveniles.

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SPAIN

Preliminary data on the winter population of woodcock (Scolopax rusticola) in Leon Province, Spain.

de Garnica and E. Becares

Introduction. Ornithological literature on the Woodcock in Spain is scarce (Vizoso & Shorten 1978, Bernis 1966, Ed.

Committee of Ardeola 1978 and other notes in Shorten 1974). More numerous, although often repetitive and/or speculative are hunter-oriented examples: Martinez del Espinar (1976), Delibes (1973), Arredondo (1982 a, b, c, and d), Espana Aguardo (1985).

Traditionally the presence of overwintering woodcock in the north Atlantic areas is mentioned, although some records are to be found of more or less constant occurrence of species in other zones: Bernis (1966), Costa de Rioja (1981) (Andalucia); Purroy (1981) (Baleares); Escudo Patino (1971) (Albacete). The Woodcock is known by various common names outside the northern parts of Spain ('Pitorra' in the old kingdom of Leon and Estremadura, 'Chocha' in Castille and 'Gallineta' in Andalucia, as opposed to 'Becada' generally in the north and 'Urogallo' in the Basque country. Varela, Purroy 1982).

To estimate the number and distribution of woodcock in Leon Province a number of counts were made in various areas and biotopes during winter, in addition to other observations during the breeding season (Purroy pers. comm.). Results are given here of counts made in areas of oak coppice, oak scrub and woodland from late October 1982 to the end of February 1983. Oak-bearing zones are thought to provide the typical biotope for overwintering woodcock.

Material and Methods.

The study areas are of woods, scrub and clearings in which various species and hybrids of oak found in the Cuenca del Douro region of Leon predominate. Some additional observations and counts were made in areas riverside poplar plantations, evergreen oak (encina) and pinewoods, in 1984 and 1985. The character of the studied areas was basically that of coppice/scrub oak two to six metres high, with some woodland of oak eight to twelve metres tall. Tree cover varied from 90% in most cases to 40% in a few instances. The altitude of the land ranged from 850 msnm to 1.000 msnm: the lower foothills in Leon (Garnica 1978). The predominant

species was Quercus pyrenaica; Q. petraea, Q. faginea and Q. robur were also present (Ortuno & Ceballos 1977). The census method involved covering the area on foot with a trained dog which wore a bell to facilitate the monitoring and control of the range which it covered (Zwickel 1971, Gagniard 1974). The dog worked upwind and across the route of the man, covering 75 m on either side of his path. Allowing for time lost whilst making notes speed was 1 km per hour, and the total area covered in one hour was about 15 ha. A count was made of all birds flushed, repetition being minimized by careful observation of the direction of flight and/or landing position. Only those birds clearly seen were noted, to prevent counting cases where the dog reacted to recently occupied positions. Complementary data gathered by an experienced specialist woodcock hunter were also used, his method of counting being broadly similar to that described here.

Locality (mountains)	No.Census	Time(min.)	Woodcock seen
Carbajal de la Lagua (Villalbara & Valdecastro	9	1,520	8
Lugan (Valderrodezno,Montemedio)	12	1,890	19
Villanofar	2	300	5
Santa Maria del Monte	3	270	2
Santovenia del Monte	2	180	1
Candonedo de Bonar	1	180	2
Valdealiso de Rueda	1	150	3
Total: 7 localities	30 counts	4,490 min.	40 woodcock

Table 1: Areas sampled and results of counts.

Results.

A total of 30 counts in seven lovalities were completed in 74

hours 50 minutes. If in each hour 15 ha of woodland were covered, then the total area was 1.125 ha. As 40 woodcock were observed, the time and acreage per woodcock seen was 112 minutes, 28.12 ha.
As a comparison the hunter saw 25 woodcock in 33 hours 30 minutes of hunting, or one bird per 80 minutes. It must be taken into account that two dogs were used, of a breed that ranges more widely covering 100 m on either side of the hunter's path. The speed of progress being equivalent to that used during the census, the area covered would be 670 ha. The result would thus be one woodcock per 26.80 ha.

Oak type	area (ha)	1/28.12 ha	1/26.80 ha
Q. pyrenaica	114,237	4063.19	4263.32
Q. robur, Q. petraea	23,283	827.98	888.91
total		4891.17	5152.23

Table 2: Calculation of woodcock density in Leon oakwoods.

According to these calculations the number of wintering woodcock in provincial oak-bearing areas lies between 4,891 - 5,152. The large size of the area, the location of sites chosen by woodcock within thus general area and the variations in the number of woodcock from time throughout the winter all demand that such figures, though indicative, must be used with all necessary caution.
The hunting pressure on this population is light for various reasons:

1. Specialist woodcock hunters are few in the province. In seven years the author has only met three.
2. Hunters after small game rarely use the areas of oak wood and coppice.
3. The kill rate is normally 1/3 as a maximum. (Woodcock specialists shot between 1/3.72 and 1/83 of woodcock seen during the winter of 1982-1983).
4. Sporadic kills of woodcock by hunters out after other game occur usually when the birds are forced to congregate and

shelter during inclement weather. Such birds may stay for only a short time. Although such data could be important in certain situations no study has yet been made of them.

Discussion.

The method used for these counts may be new in the Iberian peninsula but has been described by other authors for census work on other land game birds (Zwickel 1971). In Spain Alberto & Purroy (1981) have already commented upon the inadequacy of the general method of winter census of waterfowl when it is applied to woodcock. The method described in this paper permits some limited reuslts which can be used for comparative purposes provided that the observer and the method remain unchanged. The results are more realistic than those obtained from game bag data, especially when, as in Leon, there are few specialist woodcock hunters. If as stated by Hemery et al. (1978) there is a correlation between kill and density the method could be useful, especially as the counts record all birds seen, not only kills. It seems worthwhile to standardise and perfect the method for wider use. It is not easy to compare this method of census with others quoted. The most frequent (both in Europe and America) have been based on counts of displaying males (Dwyer & Storm 1982). Density data for France, some other European countries and N. Africa are to be found in the magazine La Mordorée which provides hunter's reports of woodcock arrival and departure dates, kills and sightings, throughout the season. The form of these reports is so varied that although they are indicative they are hard to combine or compare. Although the year of the present study in Leon was considered to be one of woodcock scarcity (Perez Martino 1984), there were no previous data for comparison except for general agreement among the few hunters consulted. It is concluded that the woodcock population in Leon although present each winter consits of few birds.

Summary.

Very little published information exists about woodcock po-

pulations in Spain. Records of occurrence are rather more frequent but usually refer only to the northern Atlantic area. Population density has been studied in oak-bearing areas in Leon by making counts on foot with a dog. One woodcock was seen 112 minutes over an area of 28.12 hectares, giving an estimate of a total population of between 4,891 (this estimate) and 5152 (comparative data from specialist hunter) in the winter of 1982 - 1983. Care must be taken to allow for error due to largeness of the area (c. 137,549 ha), erratic movements of the birds and their selection of preferred sites within the general area.

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Gregg, L. (1984): Population ecology of Woodcock in Wisconsin. Wis.Dep. Nat. Resour. Tech. Bull. 144: 1 - 51.

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Gromadzka, J., Stawarczyk, T. & Tomialojc, L. (1985): Breeding waders in Poland. Wader Study Group Bulletin 43: 29 - 33.

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Hollyer, J.N. (1984): Camouflage postures of Jack Snipe at day roost. Brit. Birds. 77: 319 - 320.

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G.H.

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Evaluation of recoveries of 2.337 American woodcock

(Scolopax minor) ringed 1968 - 73 in a coastal staging habitat. Percentage of juveniles obviously differs with habitat types. Recovery rate 6.2%; juveniles seem to be twice as vulnerable to shooting than adults. Recoveries provide evidence of the Appalachian mountains as a barrier between eastern and western woodcock populations.

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McKelvie, C. (1985): Short-billed Woodcock: Further Countrywide Reports. The Game Conservancy Annual Review No. 16: 74.

During the season of 1984/85 over forty Woodcock with short bills (32 - 61 mm, mainly 40 - 53 mm) have been reported from all parts of Britain and Ireland. There is no evidence of concentrations of this type in Europe, they are rather likely to occur anywhere. The birds examined were in excellent physical condition, their

shorter bills obviously being not disadvantageous in feeding. Two instances of woodcock with albino primary feathers have been reported. Continuation of this study might provide more insight into the phenomenon of developing and spread of short billed woodcock since its first record in Denmark in 1948.

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52 of 70 birds collected in diurnal coverts contained identifiable animal material. 63% of the identifiable items were earthworms and 16% centipedes. Earthworms also composed by far the greatest proportion of invertebrate items present in the habitat.

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An analysis of 100.000 woodcock shot between 1962/63 and 1973/74 over an area of 6 million ha exhibited a preference of damp habitats of medium soil quality, especially podsoil and clay. Precipitation and temperature obviously impact habitat use during summer, while severity of winters influences migration behaviour. The birds show a high preference for pastureland. Optimal habitats are obviously used by migrants year after year. A brief annex on woodcock hunting expresses more the authors opinion on this matter rather than any relevance to his study.

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Ortlieb, R. (1975): Zum Vorkommen der Waldschnepfe im Südostharz (On the occurrence of woodcock in the Herzynian mountains). Apus 3: 261 - 265 (in German).

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Preuss, N.O. (1977): Om Enkeltbekassinens traekforhold i Danmark (On the migration of the Jack Snipe in Denmark). Feltorn. 19: 37 - 39 (in Danish).

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Roberts, T.H. & Dimmick, R.W. (1984): Sexual segregation in American Woodcock Philohela minor during spring migration. J. Tenn. Acad. Sci. 58: 26

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800 woodcock shot in late winter in Ireland were sexed (by dissection), weighed, measured and aged by degree of wear on the tips of the primary feathers (Clausager's method). Age determination was more difficult after mid-February by which time the feathers of adults were becoming worn. Immatures were significantly lighter and smaller than adults. Females were significantly heavier, had shorter wings and tail and larger bill and tarsus than males, but for each parameter there was almost total overlap between the sexes. Only 1.7% of the sample could be sexed using the ratio of tail to bill (cf. 42 - 43% found by Claussager). Similarly, discriminant functions based on all measured parameters correctly classified just 23 - 25% of the sample.

Ringing and recovery information was obtained for 1.400 woodcock in western Europe. Populations become increasingly migratory towards the north-east of the breedy range in western Europe: in Britain the woodcock is largely sedentary, in Finland and the U.S.S.R., almost totally migratory. The general direction of migrations was south-west in autumn; aberrant movements can usually be explained by weather movements or re-orientation. Spring migration tended to follow a more easterly line giving rise to an apparent loop migration. Birds from further north migrate over longer distances to their winter quarters.

To investigate whether woodcock from the main geographical areas come from genetically discrete sub-populations, the degree of genetic variability was examined in 110 birds collected in Ireland, Sweden and Denmark. Variation in six enzyme systems was examined by starch-gel. electrophoresis of skeletal muscle, liver and heart extracts. Clear polymorphisms were established in only three enzyme systems. The low level of polymorphism and the absence of distinct regional forms of the enzyme is consistent with the mingling of birds in their winter quarters and some abmigration. Analysis of feathers for trace elements might be a better method of identifying the natal origin of individuals.

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During years of average (32.6 cm) or above average rainfall in May-August, most woodcock at the Moosehorn National Wildlife Refuge in northeastern Maine, U.S.A. were captured in alders and mixed growth. In 1978, when late spring and summer rainfall was 58% below normal, woodcock showed a marked preference for softwood covers. Earthworm biomass during the draught remained stable in conifer covers, but dropped significantly in alder covers. Use of fields for roosting also declined under drought conditions. Woodcock weights by the end of August during the drought were 19% below average and some woodcock were at the point of starvation. Wing submitted by hunters indicated that adult female woodcock delayed their moult, probably because of low food availablility in late summer. Delayed moult in adults would cause errors in aging and result in overestimation of the young/adult ratio in the bag.

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Description of roding and breeding habitats in Westerwald (Western Germany). Two peaks of roding activity. 21 records of brooding woodcock during 30 years.

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Stribling, H.L. (1983): Relations of agricultural practices to the ecology of the American Woodcock in coastal North Carolina. PhD. Dissertation, N.C. State Univ. (Raleigh) 112 pp.

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Woodcock preferred cutover soybean fields to other agricultural crops. This was attributed to earthworm quality (% protein) and microtopography (the plant debris accumulated between furrows prevented the soil from freezing). 75% of the birds were feeding in any given hour; feeding tended to peak in the middle of the night. Over 99% of the food ingested was of two earthworm genera, Aporrectodea and Diplocardia.

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