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The wintering ecology of common snipe *Capella gallinago* at Sevenoaks

John A. Swift

1. Introduction

Shorebirds of many species pass through the Sevenoaks area in Autumn and Spring and a proportion stops to rest and feed. Drainage of farmland in the 1960's destroyed much of the habitat which attracted them and, as a result, records became less frequent. The creation of artificial habitat reversed this decline (HARRISON *et allü* 1972/73; HARRISON 1974), and demonstrated the value of this approach to wildlife management.

This study considers the above habitat creation in relation to Common Snipe and illuminates the ways in which the Snipe's abundance and distribution may respond to changes in habitat.

Snipe wintering at Sevenoaks have been intensively studied since 1972 in 3,267 hectares of mixed farmland in a river valley (Fig. 1). The creation of marsh habitats in this valley by man has resulted in greater use of the area by Snipe; but their numbers are also affected by the quality of natural habitats.

The problem is to decide which factors are significant in determining the *Snipes'* lifestyle at different times of year, and how their influence is brought to bear. In making such an investigation a distinction needs to be drawn between the Snipes' tactics for survival in the short term, and strategies for coping with the normal range of environmental conditions which they are likely to encounter. In order to do this, the non breeding months are divided into different periods for which broad generalisations can be made; periods in which one strategy may predominate or certain tactical responses be commonly observed. For example the migration period is likely to differ from times when birds have more time to explore their surroundings.

In order to study both strategic and tactical aspects of the ecology of Snipe in winter, it is necessary to collect a wide range of data: on Snipe abundance and distribution, body weight and wing length, diet, food, and prevailing weather conditions. This is subjected to continuous evaluation and built into a framework based on the different winter periods and on which further data and observations may be hung.

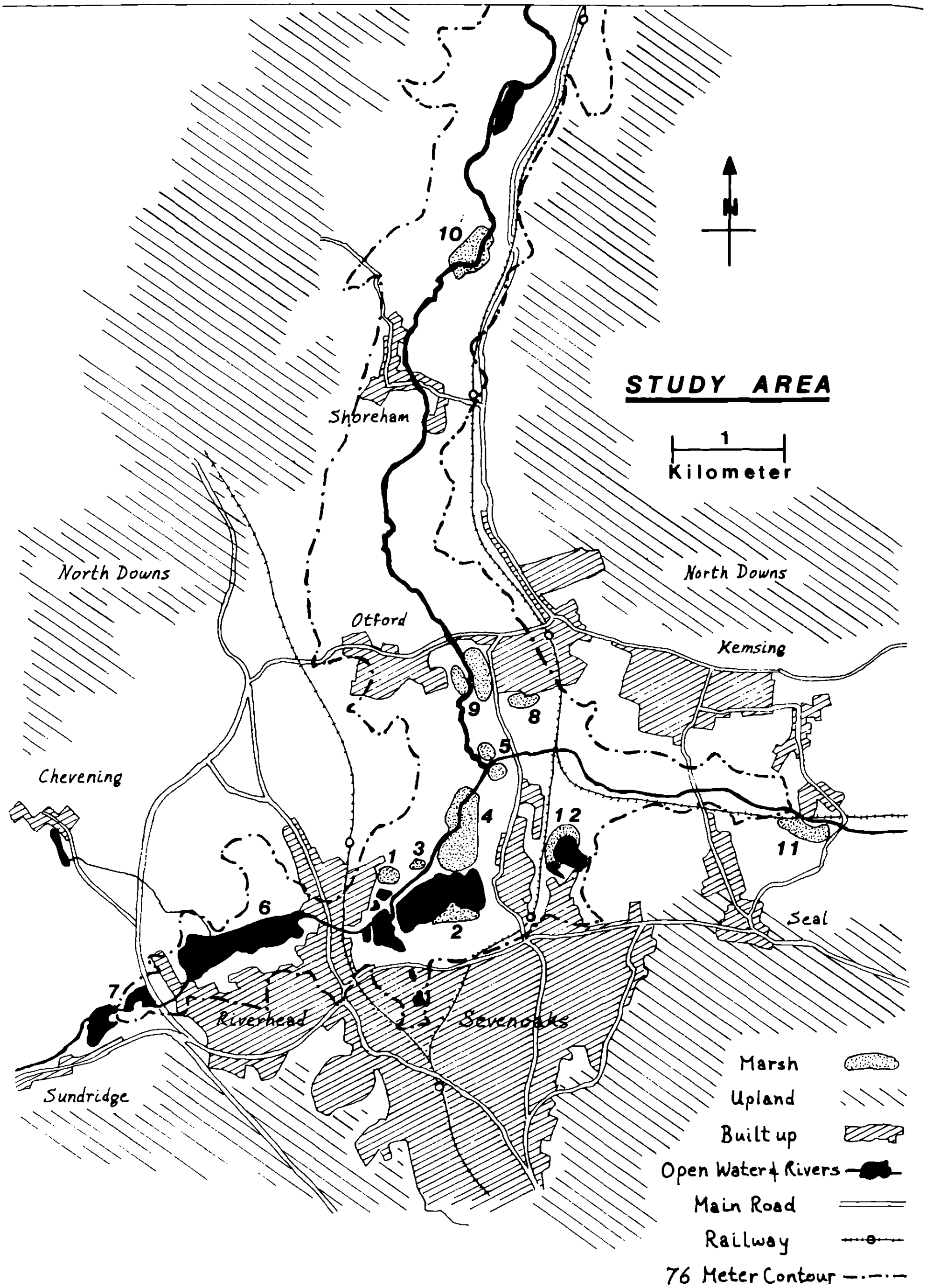

Fig. 1.
The Study Area – showing the principle sites for Snipe.
Das Untersuchungsgebiet mit den wichtigsten Plätzen für die Bekassine.

2. Methods and results

2.1 Abundance and Daily Movements

A detailed knowledge of the study area is important in making censuses of Snipe. Each estimate of abundance requires the combination of counts from several sites and thereby adds the errors of counting birds more than once and failing to count on sites which are not considered important. Allowance occasionally has to be made for these possibilities.

Three different calculations have been employed. Comparison of the results indicates that these estimates are sufficiently accurate for the purposes of the study.

The first method, in response to a need for a consistent way of treating the data, relies on counts made whenever a site is visit. The number of birds flushed is recorded. The counts from the principal sites are averaged over fortnightly periods. The averages are then added together.

Secondly, systematic daytime counts are made from time to time. They involve searching the study area closely. Flushed birds are watched until out of sight or they have pitched elsewhere. A dog is used on most occasions. Frequently sites are worked over twice to check that no birds are missed.

Another method of estimating abundance is used at dusk at the Snipe Bog. Experienced mist-netters estimate the number of birds seen. Such factors as the degree to which Snipe circled to be counted more than once, as well as the visibility and wind strength are considered.

This method has been checked by allowing the Snipe to arrive at the Snipe Bog and then flushing them in the headlights of a landrover. This indicates that these evening estimates err on the low side; probably because a proportion of birds may arrive after dusk.

Counts indicate that the number of Snipe present may be markedly different at similar times in different years. The first few birds however, always arrive during late July; and numbers build up to a peak of between 100 and 200 individuals in late November or December. Thereafter numbers decline steadily until the end of March or early April, when all birds have usually quit the area.

The counts suggest the occurrence of a daily pattern which involves an evening flight to the Snipe Bog followed by a dispersal throughout the surrounding countryside during daylight. Table 1 demonstrates that this daily pattern starts at a certain month during the winter; and that in different winters this has occurred in different months. This dispersal of the birds into the surrounding countryside produces a discrepancy between counts made in the study area during the day and those made at the Snipe Bog at dusk when all the birds are gathered together. This discrepancy is used to measure diurnal "dispersion" – by taking the day estimate as a percentage of the dusk estimate. Thus, for example, if the day estimate is 75% of the dusk estimate, diurnal dispersion is not held to be as great as when the day estimate is only 25% of the dusk estimate.

Table 1. Monthly estimate of the number of Snipe in the study area during the day and at dusk in different months.

		Month						
		Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.
1974/75	Day	– 70 –		75	57	32*	10	–
	Dusk	– 70 –		66	51	75	55	–
1975/76	Day	14	60	52*	37	12	40	7
	Dusk	24	56	68	81	60	61	35
1976/77	Day	52	58	49*	25	33	18	12
	Dusk	81	60	113	69	98	41	26

* = month in which day count fell below dusk usage of area.

2.2 Mistnetting

Mistnetting involve at least fourteen volunteers each weekend, who under licence from the Nature Conservancy Council, erect the nets and remove birds from nets as soon as Snipe get into them. They ring, weigh, and dose birds with an emetic, make records and in the end take down the nets and clear up. This exercise takes place every weekend from September to March.

All netted Snipe are weighed on a Pesola balance to the nearest gram. Wing lengths, flattened chord, are measured to the nearest millimeter. Bill lengths are measured to the feather margin.

The average body weight of Snipe captured in different months of different years are set out in Table 2.

Table 2. Mean monthly weights ± standard deviation (sample size) in different months and years

	Sept.	Oct.	Nov.	Dec.
1973/74	–	106 ± 8 (64)	110 ± 9 (80)	117 ± 9 (112)
1974/75	105 ± 6 (18)	109 ± 8 (17)	110 ± 8 (18)	116 ± 11 (32)
1975/76	103 ± 9 (12)	106 ± 7 (32)	109 ± 8 (40)	110 ± 10 (33)
1976/77	101 ± 7 (24)	106 ± 6 (23)	112 ± 7 (31)	120 ± 11 (14)
	Jan.	**Feb.**	**Mar.**	
1973/74	113 ± 8 (34)	108 ± 6 (39)	108 ± 7 (14)	
1974/75	110 ± 8 (15)	110 ± 8 (21)	111 ± 10 (7)	
1975/76	112 ± 11 (18)	110 ± 10 (32)	106 ± 4 (10)	
1976/77	119 ± 9 (22)	114 ± 13 (8)	–	

Considering all capture/recaptures from September to the end of December, the average rates of weight change in gram/day in different periods after the first weighing, for the different months, have been combined in Table 3.

Table 3. Average weight changes in gms/day (sample size) sustained over different periods of autumn and early winter.

Days between capture and recapture.

		0–15	16–30	31–45	46–60	61 to end Dec.
Months of	Sept.	0.22 (4)	0.17 (1)	0.09 (3)	0.20 (1)	0.26 (4)
initial	Oct.	0.44 (5)	0.17 (3)	0.22 (6)	0.24 (5)	0.22 (1)
weighing	Nov.	0.04 (10)	0.15 (8)	0.18 (7)	0.19 (3)	
	Dec.	0.06 (7)	1.67 (1)			

TOTAL.......0.17 gms/day (69)

N. B. Equivalent to 15.3 gms over 90 day period.

2.3 Diet of Snipe

Diet was studied during 1975/76 and 1976/77 (n. b. Swift (1979) provided data for 1977/78) again under licence from the NCC, by intubating captured Snipe with a soft rubber catheter of diameter 2 mm attached to a plastic disposable syringe. An emetic, Potassium Antimony Tartrate, in 1% solution is introduced into the proventriculus via this catheter. One person holds the Snipe whilst another introduces the wetted catheter until a slight resistance is felt. 0.5 cc of emetic is then introduced. The catheter is then withdrawn slowly and the Snipe placed in a shoebox with a secure lid and a lining of absorbant tissue paper. After twenty minutes the Snipe is removed and the vomitted matter cut out of the tissue. This "result" is then put in a labelled tube and preserved with 5% formalin solution pending examination.

183 birds were examined of which 72% produced a result after having been dosed with the emetic. Not all results contained recognisable fragments. 54% of Snipe treated produced fragments, or *chaetae*, of *Lumbricids;* and 37% produced fragments of *Tipulids.* Fragments from a range of invertebrate animals were recorded, including *Dytiscidae, Carabidae, Staphylindae, Hydrophiledae, Chironomidae, Hydrobia jenkinsii, Dreissensi polymorpha* as well as small *Oligochaetae* and unspecified *Cyclorraphous* dipteran larvae.

The average weight of ingested lumbricid fragments was 0.10 grams and the average weight of any ingested whole tipulids was 0.03 grams.

Table 4 gives a synopsis of the results obtained.

Table 4. Synopsis of diet study using Potassium Antimony Tartrate as an emetic 1975/76 and 1976/77.

	Period	Number of snipe trapped	No. of positive results obtained	No. containing Lumbricid fragments	Tipulid fragments	Coleopteran fragments	Other items
1975/76	28.12.–25. 1.	29	24 (83%)	18 (62%)	14 (48%)	8 (28%)	7 (24%)
	8. 2.–14. 3.	37	14 (38%)	11 (30%)	5 (14%)	2	4 (11%)
1976/77	19. 9.–10.10.	31	21 (68%)	11 (35%)	8 (26%)	14 (45%)	7 (23%)
	17.10.–14.11.	26	24 (42%)	21 (88%)	14 (53%)	8 (31%)	18 (69%)
	21.11.–19.12.	32	24 (75%)	21 (66%)	12 (38%)	2 (6%)	15 (47%)
	2. 1.–27. 2.	28	24 (85%)	17 (60%)	14 (50%)	4 (14%)	12 (43%)
		183	131 (72%)	99 (54%)	67 (37%)	38 (21%)	63 (34%)

2.4 Foods Available

Both qualitative and quantitative surveys of invertebrates, recorded in the diet of Snipe, were made at favourite Snipe habitats. Only some of the results of this work are used in this paper.

Each soil core was 75 mm in diameter and 70 mm deep. Ten replicate cores were taken at each sampling site and time. In some instances there was a measure of subjective selection for suitable spots for taking the cores; mainly those which were likely to be favoured for probing by Snipe. In other instances, replicates were taken at 1.5 m intervals along a tape measure laid across a representative piece of habitat. This technique was necessary, for example, in order to estimate invertebrate densities for comparison between sites and times of day and night.

Qualitative surveys were also made in unconsolidated substrates by washing silt through Endicott Test Sieves.

In consolidated soils the densities of Lumbricids were obtained by hand sorting cores taken on transects across the site to be studied.

Some results for 1974/75 are given in Table 5. These demonstrate that the density of Lumbricids at the Snipe Bog was lower than that at a kale field on which the Snipe were feeding during the daytime, at that time.

Table 5. Densities per meter^2 of the principal Snipe prey, Lumbricids in the top 70 mm at different times of day. Each estimate based on ten replicates.

Site	Time	Date	No./m^2
Kale Field	1630	9. 12. 74	520
	1600	9. 1.75	678
	1800*	9. 1.75	610
Snipe Bog	1500	9. 1.75	271
	1730*	9. 1.75	384
	1200	15. 1.75	271
	1730*	15. 1.75	475
	1100	16. 1.75	136
	1730*	16. 1.75	452

* Samples taken after dark.

Table 5 also compares some Lumbricid densities before and after dark, giving an indication of increase in availability of Lumbricids after dark when they come to the surface to feed.

2.5 Behaviour, Feeding Rates, Feeding Success and Pattern of Feeding.

One site, namely the Sandbank, was particularly suitable for observing the behaviour of Snipe during the day. Two permanent hides are available for this purpose. From these it is possible to record numbers, as well as behaviours such as feeding, preening, sleeping, or displaying.

On other sites data were obtained either by using a Fensman portable hide, or in recent seasons by lying down in the open with a pair of 8×40 binoculars and a Phillips Casette tape recorder. When the latter method is used, Snipe which are disturbed on arrival usually return after twenty minutes and show no awareness of human presence after half an hour. Recorded data are transcribed into longhand notes afterwards.

Table 6. The numbers of observations made on Snipe on the Sandbank during the day and the % of Snipe observed feeding.

	Dawn→dawn+2 hrs.		< Mid-day <		Dusk−2 hrs.→dusk	
1975/76 Aug.	136	92.6%	101	49.5%	90	100.0%
Sept.	138	86.8%	81	65.4%	113	91.1%
Oct.	146	93.2%	54	79.6%	3	100.0%
Nov.	51	90.2%	30	100.0%	15	93.3%
Dec.	9	100.0%	16	31.0%	1	100.0%
Jan.	17	100.0%	9	88.9%	2	0.0%
Feb.	27	92.6%	18	61.1%	32	100.0%
Mar.	47	97.9%	3	33.0%	5	100.0%
1976/77 Sept.	32	90.6%	97	46.4%	9	0%
Oct.	87	100.0%	93	73.1%	53	67.9%
Nov.	132	98.5%	63	49.2%	98	29.6%
Dec.	29	96.5%	9	33.3%	13	69.2%
Jan.	16	100.0%	—		—	
Feb.	58	100.0%	—		15	0.0%

None of these observations was, however, representative of Snipe behaviour on other than open habitat. During the day some Snipe hid in thick cover where it was impossible to observe them effectively. Occasionally however, they remained on the fringes of cover. From such instances the impression is that they are there in order to stand inactively, or to sleep. Even on habitats with little cover Snipe will often seek a clump of vegetation in, or against which to catnap and preen. It therefore seems unlikely that feeding activity in dense cover is greater than that which is recorded for more open areas.

During daylight some individuals are usually seen to be feeding. It is not known what proportion of the true number present these represent because, inactive and sleeping individuals may hide out of sight. The percentage of feeding individuals observed at different times on the Sandbank therefore only indicates a tendency for a greater or lesser proportion to be actively engaged in feeding – not the true proportion.

Table 6 sets out the numbers of observations made on birds in three different periods of the day, from dawn to two hours afterwards, from two hours before dusk until dusk, and the time between. The figures are based on records of the activity of observed Snipe; whether they are feeding, preening, inactive, asleep, or observed only after having been flushed. The percentage gives the proportion observed feeding.

Feeding rates on the Sandbank during the day are calculated, from one hour 25 minutes of recorded observation on actively feeding birds, to be 27 probes to the minute. On flooded grassland a probing rate of 32 probes per min. is recorded over 19 minutes observation: and 26 probes per minute on a waterlogged kale field over 4 mins. 40 sec. of observation. On grassland the success rate, so far, has been one worm fragment per seven minutes feeding, but only a short duration of accurate observation has been made. Success is difficult to quantify when Snipe are not feeding on Lumbricids, because although swallowing actions are observed the identity of the item swallowed is usually difficult to ascertain.

Agonistic display occurs on the feeding grounds during the day in August, September and October. This involves the aggressive bird crouching with its tail framed over its back before "bouncing" towards the victim. The victim crouches orientating its back towards the aggressor before flying a few meters away. One individual may be progressively moved on by several aggressors. This seems to cause some spacing out on the feeding area at this time – but only over distances of a few meters. It appears that new arrivals are more likely to receive this treatment. Occasionally over ten birds feed in confined locations.

At night, Snipe have been seen swarming closely over favoured feeding areas.

2.6 Weather and Habitat Quality

Data on weather have been collected throughout the study by an amateur meteorologist, Mr. P. R. ROGERS. Whilst it is recognised that his data are from only one location within the study area, they are held to represent conditions elsewhere satisfactorily. If anything, temperatures recorded by P. R. R. underestimate those on low lying habitats which are more prone to frost.

Some statistics relating to monthly weather are set out in Table 7.

Table 7. Some weather data for the study area.

	Min. on Grass °F	Number of days of Frost	Rainfall Inches
Sept. 73/74	—	—	
74/75	44	0	7.1
75/76	47	0	5.1
76/77	45	0	3.9
Oct. 73/74	40	5	1.2
74/75	39	4	3.6
75/76	41	0	1.2
76/77	45	0	4.0
Nov. 73/74	33	16	0.9
74/75	38	6	4.7
75/76	33	14	1.7
76/77	33	12	4.5
Dec. 73/74	34	13	1.5
74/75	40	6	1.9
75/76	32	14	1.4
76/77	30	20	2.7
Jan. 73/74	37	7	2.8
74/75	37	9	4.5
75/76	35	14	0.8
76/77	31	17	3.3
Feb. 73/74	35	11	4.3
74/75	31	15	1.1
75/76	30	17	1.2
76/77	34	8	2.6
Mar. 73/74	33	18	1.5
74/75	31	14	0.5
75/76	32	15	4.0
76/77	36	9	2.5

3. Discussion

The following framework is put forward on which to hang the data and observations and relates the various pressures on the Snipe at different times.

Period 1.

Migration (Aug.–Oct.)

Several factors may conspire to keep weights low: body and tail moult; poor condition after breeding; poor condition after migration; no insulation fat required in warm weather or to guard against poor feeding conditions. Feeding is concentrated on sites adjacent to open water due to their being obvious migration stopping places. Lumbricids are scarea due to dry ground and tendency for them to be below 75 mm depth. Most Snipe feed during daylight.

Period 2.

Autumn (Oct.–Nov.)

Freshwater margin invertebrates become less abundant but lumbricids are increasingly available. A larger proportion of the Snipe population has time to forage more widely for lumbricids. Having completed moult and recovered from the effects of breeding and migration many Snipe deposit fat. Feeding takes place at night since Lumbricids them come to the surface. There is an evening flight to a gathering ground. Which changes if there is too much disturbance.

During unexpected cold weather birds either undertake cold weather migration or utilise their fat deposits. Feeding concentrates on unfrozen sites but long distances may have to be travelled to reach these.

Period 3.

Winter (Dec.–Jan.)

Falling soil temperatures make lumbricids go deep and night frosts increase the Snipes' energy requirement. Day feeding assumes importance again. Some birds quit the study area and counts start to decline.

Lumbricids remain abundant only in transiently flooded locations where they are available throughout the day. The Dusk gathering maybe a strategy for locating these new feeding areas as they become available. Body weights start to fall due to a shortage of food.

Late Winter (Jan.–Mar.)

Feeding becomes increasingly reliant on transiently flooded areas. Body weights continue to fall. Many birds continue southwards to seek less harsh conditions. Those remaining continue to gatherat dusk.

Period 4.

Migration (Mar.–April)

Dispersion becomes slightly reduced as the result of the arrival of passage birds at the obvious stopping places. Numbers decline rapidly as the Snipe start northwards.

The reasons for the Pattern ex dispersion need to be clarified. During November and December much longer trips are made away from the dusk gathering ground during daylight. Whilst high rainfall may produce good widespread feeding, no correlation exists between rainfall and dispersion.

If dispersion is plotted against the number of days of frost in the month, as in Fig. 2, an apparent correlation is obtained. If the effects of time are removed by plotting days of frost and dispersion for each month (Fig. 3) during the three years of study, there is indication that those months with the least numbers of days of frost have the lowest levels of dispersion. The latter observation is, as yet, not statistically significant.

During very cold weather Snipe show a tactical response by congregating on the few unfrozen sites which remain open to them. These include river banks, seepage marshes on the sides of the Downs and springs. In spite of such concentrations dispersion increases. Presumably Snipe disperse over a wide area in search of suitable areas in which to concentrate.

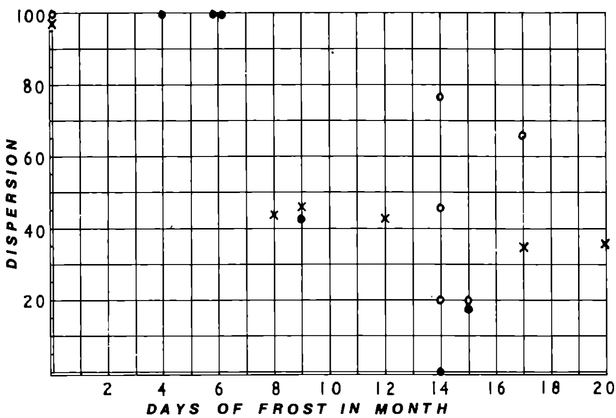

Fig. 2.
Monthly "dispersion" plotted against monthly "frost"
Monatliche Verteilung gegen Frosttage aufgetragen.

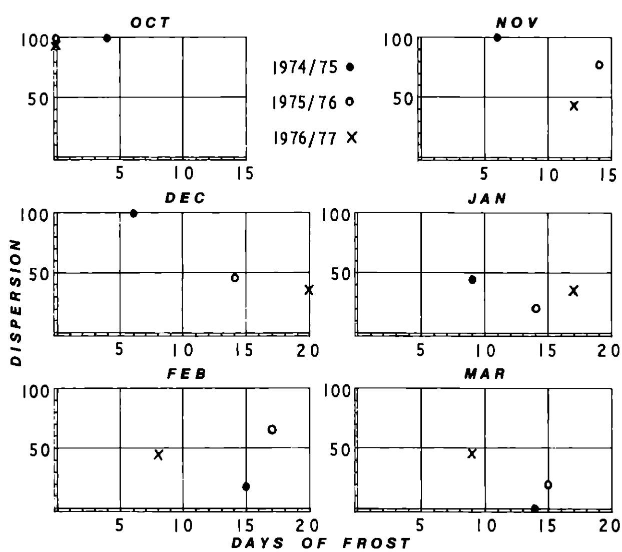

Fig. 3.
"Dispersion" plotted against "frost" for different months.
Verteilung gegen „Frost" für verschiedene Monate.

It may be that dispersion is influenced by the intensity of migration: migratory birds being less disposed to foraging far from their stopping off place. In Spring however, dispersion continues, though to a reduced extent (see Table 1). For this reason dispersion is probably affected to a limited extent by the proportion of passage birds in the population.

The reasons for changes in body weight must be considered. The average body weights of captured Snipe increase to a peak in either December or January. Since average wing lengths do not alter during the winter the increase is not held to be due to larger individuals joining the population. On the other hand weight increase is most likely due to an increase in the amount of pre-dusk feeding as winter sets in, combined with increasing deposition of fat. Such evidence as exists points to the latter as making the larger contribution. Dissection of dead Snipe indicates that they carry more fat in December than September and October. This observation is confirmed by STRONACH (pers. com.) in Ireland. Further indications of fat deposition during the winter in shorebirds are supplied by PRATER (1975) for Knot, Dunlin and Redshank; and for Bar-tailed Godwits by EVANS and SMITH (1975).

A relationship also exists between body weight and the monthly average of daily minimum temperatures at ground level. Initially body weight increases as temperature falls, but later, body weight falls as temperatures approach freezing. In Fig. 4 this relationship is expressed on a monthly basis; and it is interesting to note that the cold Februaries and Marches result in the lowest mean body weights. At present it therefore appears that body weights in late winter fall in low temperature conditions; and it can only be assumed that this is due to a food shortfall.

Both dispersion and body weight can be linked through a relationship with cold weather. This could operate through a fall in food availability and increase in food requirements. The interaction of changes in food availability and requirement probably combine to induce 1. the consumption of reserves of fat, 2. a switch to a more suitable

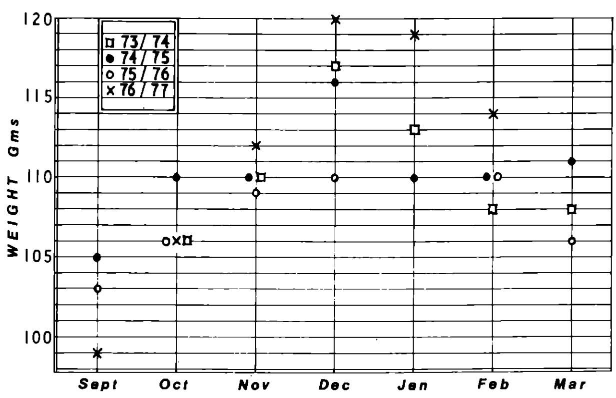

Fig. 4.
The average weight (gms.) of Snipe caught in different months during the study, plotted against monthly average minimum temperature (°F) at ground level.

Durchschnittsgewicht (Gramm) der Bekassine in den verschiedenen Monaten in Abhängigkeit von der monatlichen Durchschnitts-Minimaltemperatur (°F) am Boden.

feeding strategy, or 3. complete quittal of the study area. After many generations, switching feeding strategy or quittal of the study area may not have to be preceded by the stressful conditions. Snipe may respond to an annual rhythm demonstrated by their many pray which is earthworms.

The sudden onset of hard weather is most likely to induce either the first or the third response above, although feeding tactics will be modified to take in only unfrozen sites. By way of example, on 25th November 1973, 20 Snipe were caught, of which the mean weight was 112.7 gms. After one week, during which the habitat was frozen solid, only 11 Snipe were caught, although catching conditions were ideal. The mean weight was 103.8 gms. There was one recapture over that time interval for which the weight fell from 106 gms. to 97 gms. In the weeks following this freezeup mean weights rose from 103.8 gms. to 115.9 gms (n 31). There is again only one recapture within the month following 2nd December; and that by 23rd December had increased its body weight from 96 gms. to 129 gms. It may be that this rapid weight gain after the freeze was due to an increase in time spent feeding during the day. It is strongly indicated, however, that those individuals which do not quit the area in cold weather may fall back on fat reserves to finance an energy deficit.

Another extremely important aspect of feeding is the time of day when feeding is most active. It appears that in December night feeding is actively engaged upon. Not only are Snipe observed to feed actively at night during December, but also Davies (in press) gives the weight of 38 Snipe caught at dawn at Uxbridge, Middlesex in December 1975/76 as 126.3 gms. This is notably heavier than Snipe captured at dusk at Sevenoaks: in 1973/74 117 gms. (n = 111); in 1974/75 117 gms. (n = 32); in 1975/76 110 gms. (n = 33); and 1976/77 120 gms. (n = 14). However, during the early autumn migration, the situation appears to be different. Snipe caught at dawn at Sevenoaks in September 1977 were not heavier than those caught at dusk. Moreover one dusk recapture in September 1977 of a bird previously weighed at dawn in the same month, showed a 7 gms. increase in weight.

It appears therefore that Snipe take to night feeding as the autumn advances, in the face of night frosts and generally cold weather.

Looking at the significance of day feeding during the mid-winter the following tentative exposition is made.

The average weight of earthworm fragments swallowed by Snipe is approximately 0.10 gms.: which is only a small fragment of a worm. Snipe probe at 25/30 probes to the minute and locate a lumbricid once every seven minutes. From French, Liskinsky and Miller (1957) the calorific value of lumbricids is taken as approximately 4.5 K-cals per gm. dry weight, and 16.3% of earthworm bodyweight to be dry matter. A bird weighing 120 gms. may have a 24-hour basal metabolic energy requirement of approximately 15 K-cals (Marshall 1961). From these figures it can be calculated that 208 fragments or 20.8 gms. of earthworm are required per day to satisfy the B.M.R. In order to acquire this a Snipe would have to probe continuously for $17^1/_2$ hours in every 24-hour period. In fact the daily energy requirement is probably at least 2.5 B.M.R. Although other prey species may be taken, the final outcome, namely that feeding success on pastureland during the day is insufficient to satisfy the total requirement for food, remains unaffected.

If the onset of cold weather and the amount of night frost does influence the feeding strategy, it may be expected that the proportion of birds feeding during the mid-day period will increase (Table 6). In 1975/76 this happened, whereas in 1976/77 it did not. However in both winters the total number of birds observed on the sand bank decreased and it may be that this reflected a need to seek food elsewhere.

The surveys of Snipe foods indicate that the density of lumbricids is lower on the areas to which the Snipe were flighting at dusk than on their day habitat; also that the availability of lumbricids may be three times greater after dark on unwaterlogged feeding locations.

GERRARD (1957) reported on the vertical distribution of earthworms at different times of the year. He found that from June to October most worms are deeper than 75 mm, but in November and December most return to the top 75 mm. Most earthworms are more than 75 mm deep in January and February when the soil temperature is around freezing. In midwinter all species are quiescent and most individuals remain below 75 mm. GERRARD also considers that cold soil temperatures influence this vertical movement. Hence only on waterlogged fields and marsh margins will worms be unable to go deeper than 75 mm when soil temperatures are low. It is therefore these areas, attraction to Snipe which it has hitherto been dry enough for worms to proliferate, which provide abundant food in late winter. The transience of such habitats is the key to their, since if they were permanently waterlogged worms could not live; and if they were well drained worms would be able to go deep.

The Snipe therefore, may actually require to seek out such transient habitats in late winter and adapt their feeding strategy accordingly. Observation indicates that Snipe in late winter are quick to exploit flash-floods on pastureland; but the test remains that of demonstrating whether they find them quicker by the use of the dusk gathering ground, than by random searching.

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4. Conclusions

The numbers of Snipe in the study area were low in the years immediately preceding the creation of artificial habitat (Fig. HARRISON 1974). Numbers have increased since the creation of habitat. The provision of dusk gathering areas, which need be only 0.12 Ha., enables Snipe to exploit transient feeding opportunities during mid and late winter, over an area of more than 3,600 Ha.

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John A. Swift, WAGBI, Marford Mill. Rosett, Clwyd., GB.