Pu 284

Studies on the diet of the Common Snipe (*Gallinago gallinago*) and guidelines for habitat management

Philippe Granval[1], Nicola Beck[1] and Guy-Noël Olivier[2]
[1]*Office National de la Chasse, Domaine de St. Benoist, 4, F-78610 Auffargis, France.*
[2]*Migratory Birds of the Western Palearctic (OMPO), 5 av, des Chasseurs, F-75017 Paris, France.*

The staple food of the Common Snipe, *Gallinago gallinago*, is earthworms. The composition of the diet varies however, due to location, time of the day and the season. Management practices are described to increase the lumbricid biomass and to control vegetation height. Cattle-grazing is a suitable tool for managing wetlands in favour of Common Snipe.

Introduction

For feeding, the Common Snipe prefers freshwater habitats with a great variety of food items: insects (mostly *Coleoptera* and *Diptera*), molluscs, *Crustaceae* and annelids (Glutz von Blotzheim *et al.* 1977, Cramp and Simmons 1983). Earlier studies have revealed Snipe as opportunistic feeders, searching for the most abundant prey species (Tuck 1972, Veiga 1984).

The Common Snipe is very often seen feeding in wet pastures, meadow swamps or inundated fields. These habitats are characterised by considerable lumbricid biomasses (Bouche *et al.* 1988, Granval *et al.* 1993). In an investigation of 183 stomach contents in Great Britain, Swift (1979) found earthworm remains in 54% of them. As far as we know, there have been no analyses of the proportion of earthworms in the diet of Common Snipe feeding in freshwater habitats since then. This study concerns the stomach-contents of Common Snipe captured during the day while wintering in four departments in the north of France.

Methods

As a first step, food items found in the gizzards were analysed under a binocular 6x-magnifying microscope; gastrolithes larger than 1 mm, seeds, plant fragments and animal prey items were also counted.

Then the stomach contents were deposited in petri dishes with gritted bottoms, and *setae* are counted under a binocular 25x-magnifying microscope. There are eight lumbricid *setae* per segment. According to Bouche and Gardner (1984) there are 130 segments per earthworm in a normal population of *Oligochetes*.

Frequency of occurrence (Foc) of different food items and other elements found in the stomachs was expressed by the formula:

$$Foc = \frac{Xi}{N}$$

where X means the number of stomachs containing item i and N the total number of stomachs analysed.

The proportion of the number of a category of prey (Pi) of the total number of analysed prey (Np) was expressed as relative frequency (Fri) (Henry 1983):

$$Fri = \frac{Pi}{Np}$$

Complete individuals of prey were dried on blotting paper and weighed. The mean fresh weight for each category of prey was thus determined.

The index of abundance (IB) was expressed by the frequency of occurrence (Foc) multiplied with its mean fresh weight (Mi) of prey i in relation to the total number of Foc.

$$IBi = \frac{Foci \times Mi}{? Foc}$$

The energy content of the average content of prey item i (PEi) is expressed by the formula:

$$PEi = \frac{Fri.Mfi.Msi.Kji}{?Fri.Mfi.Msi.KJi}$$

where Fri = relative frequency, Mfi = mean fresh mass, Msi = dry mass and Kji = energy content of a prey in kilojoules.

The (corrected or uncorrected) values of Fri and the Mfi are the results of this study, while Msi and Kji refer to data cited by Vega (1984) and Granval (1988).

The intensity of feeding per time unit is expressed by the feeding index (IA). This index was determined by the number of complete lumbricids found. Since it takes less than 30 minutes to digest them, their presence allows us to determine the diurnal feeding intensity. In our case IA corresponds with the number of stomach contents with more or less complete earthworms in relation to the total number of stomachs analysed.

Results

Lumbricids

Earthworms were found in 89% of the Snipe stomachs analysed. However, it is important to extract the stomach content immediately after death and to stop digestion by putting the samples in formol. Otherwise complete specimens of earthworms disappear quickly. In samples not treated this way the number of earthworms found has to be multiplied by 1.7 (x^2 = 5.5, p<0.01) for correct data. The situation is similar for diptera larvae (x^2 = 5.1, p<0.05).

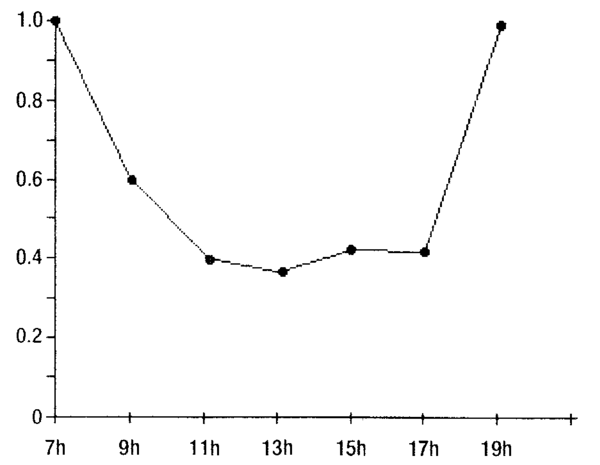
Moreover, earthworms are the second-heaviest prey items after leeches, which are present in just 3.8% of the stomach contents. The latter were found in the Pas-de-Calais area only. Two species of hydrophilic earthworms, *Eiseniella tetraedra* and *Allobophora chlorotica*, are consumed in great numbers.

Generally, earthworms found in our samples seemed to be in poorer condition than those described by Bouche (1972). The differences may be due to:

- weight loss (10–30% according to the species) caused by their conservation in formalin (Cuendet 1985),
- the effects of post-mortem digestion, or
- differences in body weight of the local populations (Bouche, pers. comm.).

In spite of these discrepancies, the earthworm indices of abundance and their value as a source of energy, stress the importance of earthworms in the Snipe diet. Other prey items (*coleoptera*, *diptera larvae*, *crustaceae* and *molluscae*) are not as well represented as in our earlier studies, though the same methods of analysis were used. These variations may be due to the opportunistic, non-specialised behaviour and feeding habits of the Snipe, and thus to peculiarities of the habitats frequented by the bird and to prey availability. Daily feeding indices also show that the time of feeding significantly affects the number of prey (i.e. earthworms) found in the digestive tracts. Earthworm frequencies of occurrence were highest at dawn and dusk, but largest quantities of earthworms were found in birds shot before 10:00 a.m. (x^2 = 11.2, P < 0.05). Feeding activity is lowest at midday (Figure 1). The feeding activity budget and hence the composition of ingested prey may also be affected by disturbance during the hunting season (Granval 1988).

Figure 1. Index of feeding intensity of Common Snipe during the day.



Common Snipe collected in freshwater habitats had obviously mainly preyed on earthworms which therefore made up the most important part of their diet. Thus, when earthworms are massively available, the Snipe consumes a great number of them at a high frequency of intake. However, earthworms ranked second in the diet of the birds from the Seine-Maritime region. Of the 38 stomach contents analysed, 23 (60%) were taken in a brackish marsh. In such habitats, the degree of salinity has a limiting effect on the development of lumbricids (Lee 1985). In the stomachs of those birds, the highest frequencies of gastropod mollusca and crustaceans had been found, while earthworms may replace diptera larvae.

Lead shot

Lead shot was found in higher frequencies of occurence in the stomachs of Snipe collected in the Pas-de-Calais region than in those of the Camargue (Foc = 7.6%, n = 38; dry weight concentrations in the liver of Pb = 3ug/g, Pain 1991). Since all the birds analysed from this region came from the same pond, lead poisoning is certainly a matter of concern.

Variations in the diet

Which factors are responsible for variations in stomach contents? A factor analysis revealed the place of feeding to be most important (geographic variation). Second ranks the degree of post-mortem digestion (methodological bias), then the time of the day, when the Snipe was shot, and finally the season. There was no difference in the age or sex of the birds (Beck 1993).

The results of the factor analysis are confirmed by a non-parametric x^2 -test. The stomach contents of birds collected in the Pas-de-Calais region differed from those collected elsewhere in the large quantities of earthworms present in macro- or microscopic form. In general, these birds contained greater quantities of *diptera* than the stomachs of birds from the Calvados region. In contrast, such important differences were not observed between the stomach contents of the Seine-Maritime and Pas-de-Calais birds. Smaller numbers of earthworm *setae* were found in the stomachs of Seine-Maritime birds than in those of Calvados. The number of other food items are not subject to such pronounced variations (Beck 1993).

Summary of results

- The composition of different earthworm species consumed reflect peculiarities of the habitat of the bird. Two hydrophilous species, *Eiseniella tetraedra* and *Allolobophora chlorotica* are massively consumed.
- Earthworms, however, may be readily replaced by other prey when they are scarce or no longer available. The results of this study, resembling those of Veiga (1984), revealed that the feeding habits of the Common Snipe are more flexible than those of the Woodcock (Granval 1988).

Snipe continue feeding over most of the day. There is evidence that snipes, like other *Limicolae* (Evans 1987) continue feeding at night to compensate for the low availability of lumbricids on short daylight in winter.

Implications for habitat management

The dependence of Snipe on earthworms sets the objectives for habitat management: increase the biomass of lumbricids and its availability to Snipe by the following four principles:

1. Hydrophilous earthworm species require sufficient water resources throughout the year, in particular in the summer.

2. Organic matter is an indispensable food item for lumbricids. This may be achieved by the following techniques:
   - Stubble or phragmites should not be burned to avoid a loss of plant biomass, and thus provide supply of fresh organic matter. The vegetation should rather be crushed.
   - Grazing has a beneficial effect since all deposited manure goes directly to the earthworms (Granval *et al.* 1993). For example, four marshy plots with identical soils, which for 15 years had been submitted to different agricultural practices, yielded the following earthworm biomasses: 1941 t/ha in grazed pasture, 1029 t/ha in hay meadows, 398 t/ha in maize and 151 t/ha in reed-beds.
   - Further studies exhibited that bovines and horses are more favourable to earthworms than sheep. After 30 months of extensive bovine grazing on the Rhône dykes, lumbricid biomasses had multiplied 20-fold to 1350 kg/ha even on potentially very low-grade soils. This increase was caused mainly by an increase in the number of individuals, as well as of the mean weight of the three species found (Nicaise 1996).

3. Tillage should be avoided. For example, there are three times less earthworms in soils that are ploughed every year than in soils that have only been tilled superficially (Granval 1994).

4. Increase the availability of earthworms to Snipe by:
   - Reducing height and thickness of the grass layer by extensive grazing.
   - Using rotor tillers at lesser intervals and restrict shallow ploughing since this destroys the systems of earthworm burrows and hampers earthworm growth. It is better to mow the grass or use a rotary cutter and leave the mulch on the ground. If the first cut is too abundant, it should be taken away. Vehicles with low pressure tires should be used rather than cage hubs that have a tendency to compact the soil and to slow down the degradation of organic matter.
   - Monitoring the water-level, since the Common Snipe cannot exploit sites with a water table higher than 10 cm (Grisser 1988). By controlling the water table, Snipe will not only be able to feed around puddles, but also in the whole submerged area. Soils saturated with water can easily be penetrated to probe for earthworms and other prey.

To attract Common Snipe and other earthworm predators frequenting these areas, like Lapwing (*Vanellus vanellus*) or Golden Plover (*Pluvialis apricaria*), soil management practices similar to those described by Granval and Muys (1992) and Granval (1994) for the Woodcock (*Scolopax rusticola*) in wooded habitats should be applied.

Agrotechnical use of lumbricids in hydromorphic soils

In the west of France, wintering Woodcock and Common Snipe frequent the earthworm-rich grazed pastures at night (Granval 1988). These habitats, however, are disappearing (at an annual rate of 160 000 ha throughout France), due to cultivation and consequently reduced lumbricid biomasses, because earthworms are destroyed by pesticides and tillage. However, the experiments conducted on the Vieux Pin estate (INRA, Orne) show that it is possible to combine productive agricultural practices and sufficient lumbricid biomasses for the benefit of Snipe and Woodcock (Granval *et al.*, this issue).

For 25 years, Laissus (1985) has been investigating how to improve grass production on the acid, hydromorphic, and shallow soils of the estate (80 ha). Drainage ditches, use of fertilisers (l00N, 50P, l00K), input of chalk, and wise use of the meadows doubled plant production in 20 years to feed 2.3 cows per hectare. Lumbricid biomasses increased 2.55 times and are presently stable at a level of 2300 kg/ha. Night counts with headlights mounted on a vehicle (Gossmann *et al.* 1988) revealed many earthworm predators using this site (80 ha) by day and night. Common Snipe are using this site during spring and autumn migration. Wintering Woodcock are using the site at night.

Degraded grasslands are restored and maize is sown without tillage. In autumn, weeds are removed from degraded grasslands with Glyphosate or Aminotriazole. In winter, earthworms are consuming the thick layer of dead litter. In this way all plant litter is consumed and the soil tilled by the end of winter. The seedbed for future grass or maize is prepared with a rotary harrow or a rotavator-like tool. The yields obtained with this new technique are comparable to those of traditional ploughing, and it is less expensive (Laissus 1985, Granval 1994). The vegetation in grazed pastures is very low or absent in plots prepared for new sowings; therefore, lumbricid predators, like Snipe and Woodcock, can feed more easily.

References

Beck, N. 1993. Regime alimentaire diurne de la Becassine des marais (*Gallinago gallinago*) hivernant en France. Contribution trophique des lombriciens. DEA Eco-éthologie Tours, 1–26.

Beck, N., Granval, Ph. and Olivier, G.N. 1995. Techniques d'analyse du regime alimentaire animal diurne de Becassines des marais (*Gallinago gallinago*) du nord - ouest de la France. Gibier Faune Sauvage, Game Wildl. Vol. 12, 1–20.

Boı

ıche, M.B. 1972. Lombriciens de France. Ecologie et systematique. Ann. zool. écol. anim., INRA, n° special, Bc 72, 2, 1–671.

uche, M.B. and Gardner, R.H. 1984. Earthworm functions. VLI. Population estimation techniques. Rev. écol. biol. sol, 21, 1, 37–63.

Bouche, M.B., Fayolle, L. and Richard, Ph. 1984. Mesure de l'importance des lombriciens dans le regime alimentaire de leurs predateurs. Gibier Faune Sauvage, 1, 57

Bouche, M.B., Aupetit, P. and Philippe, M.A. 1988. Etude agroenvironnementale intégrée du Marais Poitevin. Doc. pédozool., 1, 3: 1–126.

Cramp, S. and Simmons, K.E.L. 1983. Handbook of the birds of Europe, the Middle East and North Africa. The birds of the Western Paleartic. Vol. III., 1–973.

Cuendet, G. 1985. Perte de poids des lombriciens durant leur conservation dans une solution de fomaldéhydc et équivalents énergetiques. Revue Suisse Zoologie, tome 92, fasc. 4, 795–805.

Evans, A. 1987. Relative availability of the prey of wading birds by day and by night. Mar. Ecol. Prog., 37: 103–107.

Glutz von Blotzheim, U., Bauer, K.M. and Bezzel, E. 1977. Handbuch der Vögel Mitteleuropas. Charidriiformes, 7, 1–1270.

Granval, Ph. 1988. Approche écologique de la gestion de l'espace rural: des besoins de la bécasse des bois (*Scolopax rusticola*) à la qualité des milieux. Thèse doct. Nouveau régime, Université Rennes I, 1–186.

Granval, Ph. 1994. Gestion des habitats nocturnes utilisés par la Bécasse des bois. Proc. 4th Europ. Woodcock and Snipe Workshop. IWRB 31, 46–54.

Granval, Ph. and Muys, B. 1992. Management of forest soils and earthworms to improve woodcock (*Scolopax sp.*) habitats. A literature survey: Gibier Faune Sauvage, (9): 243–255.

Granval, Ph., Aliaga, R. and Soto, P. 1993. Effet des pratiques agricoles sur les lombriciens (*Lumbricidae*), Les bécassines (*Gallinago gallinago*) et la valcur pastorale du milieu dans les marais de la Dives (Calvados). Gibier Faune Sauvage, 10: 59–73.

Gossmann, F., Ferrand, Y., Loidon, F. and Sardet, G. 1988. Méthodes et résultats de baguages des bécasses des bois (*Scolopax rusticola*) en Bretagne. Proc. 3rd Europ. Woodcock and Snipe Workshop. IWRB: 34–41.

Grisser, P. 1988. Utilisation du milieu par la Bécasine des marais en période internuptiale. Proc. 3rd Europ. Woodcock and Snipe Workshop. IWRB: 20–22.

Henry, C. 1983. Intérêt de la notion de structure dans l'étude dcs regimes alimentaires. Bull. Soc. Franc. Zool., 108/3: 365–369.

Laissus, R. 1985. Resemis des prairies permanentes sans labour préalable, après emploi de désherbants totaux à l'automne, favorisant l'action des lombrics pendant l'hiver, sur la structure du sol. C.R. Acad. agric. de France, 71 (3): 229–240.

Lee, K.E. 1985. Earthworms, their ecology and relationships with soils and land use. Academic Press London: 1–411.

Nicaise, L. 1996. L'herbivore, factcur d'augmentation de la diversité biologique des mileiux artificiels: l'exemple des digues aménagés par la Compagnie Nationale du Rhone. Université de Roucn. 1–253.

Pain, D. 1991. Lead shot ingestion by waterbirds in the Camargue, France: an investigation of levels and interspecific differences. Env. Poll., 66: 273–285.

Swift, J.A. 1979. The wintering ecology of common snipe *Capella gallinago* at Sevenoaks. Verh. orn. Ges. Bayern, 23,: 203–216.

Tuck, L.M. 1972. The snipes: a study of the *Genus Capella*. Can. Wildl. Scr. 5, 1–439.

Veiga, J. 1985. Contribution à l'étude du régime alimentaire de la Bécassinc sourde. Gibier Faune Sauvage, 1: 75–84.