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

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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 (Gliutz 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; gasterolites 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:

\[
\text{Foc} = \frac{X_i}{N}
\]

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 (\(P_i\)) of the total number of analysed prey (\(N_p\)) was expressed as relative frequency (\(Fri\)) (Henry 1983):

\[
\text{Fri} = \frac{P_i}{N_p}
\]

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.

\[
\text{IB}_i = \frac{\text{Foci} \times \text{Mi}}{? \text{Foc}}
\]

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

\[
\text{PEi} = \frac{\text{Fri} \times \text{Mfi} \times \text{Kji}}{? \text{Fri} \times \text{Mfi} \times \text{Kji}}
\]

where \(\text{Fri}\) = relative frequency, \(\text{Mfi} = \text{mean fresh mass, Mi} = \text{dry mass and Ki} = \text{energy content of a prey in kilojoules.}\)

The (corrected or uncorrected) values of \(\text{Fri}\) and the \(\text{Mfi}\) are the results of this study, while \(\text{Msi}\) and \(\text{Kji}\) 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 cutting the samples in formal. 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 fetida and Allotobophora 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,
- 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, crustacea and mollusca) 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).

Common Snipe collected in freshwater habitats had obviously mainly preys 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 crustaceaens had been found, while earthworms may replace diptera larvae.

Lead shot

Lead shot was found in higher frequencies of occurrence in the stomachs of Snipe collected in the Pas-de-Calais region than in those of the Camargue (Foc = 7.8%, 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 fetida and Allotobophora 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 Vega (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 Limicola (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 boxies 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 (Nicalie 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 rototillers 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 (Grasser 1968). 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 (UO, 50P, 100K), input of chalk, and wise use of the meadows doubled plant production in 20 years to feed 2.3 cows per hectare. The 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 Amitriazole. 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


65


