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MAMMALS AND OTHER ANIMALS

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ABSTRACT

Apart from the birds and the fish, dealt with Elphick (1996) and Kennedy (1996), academic studies on the fauna at Slapton Ley NNR have been restricted principally to the ecology of otter and mink. The relationship between the two is of particular interest, and scientific study has been important in elucidating the impact of Britain's only widespread escaped predator. The evidence suggests that the native otter is not at risk from the denizen mink. Rather that mink populations are governed by the availability of prey, and by its own territorial behaviour.

Observations and records of mammals, reptiles, amphibians and invertebrates have been made by staff of and visitors to Slapton Ley Field Centre, and comments on some of these are made. Freshwater invertebrates are seen as an appropriate group for further research, given their ecological significance in the eutrophic freshwater system. Studies of other invertebrate groups regularly reveal new and interesting taxa, contributing to Slapton Ley's status as one of the most diverse areas for wildlife in Britain.

RESEARCH ON OTTER AND MINK

Introduction

In Devon, detailed studies of the feeding ecology of these two predators was begun by Chanin (1976, published in Chanin & Linn, 1980). He collected and analysed faeces, or scats, from the native otter and the introduced mink, comparing the eutrophic lake system at Slapton with an oligotrophic river system rising on Dartmoor, the River Teign. The latter, incidentally, is the site where the first known self-sustaining population of the mink was found in 1956. Chanin's study at Slapton was based on 57 mink scats and 389 otter scats (also known as otter 'spraints'), collected in 1972–74. The method involved drying and crumbling of scats to enable examination and identification of the contents.

Further work on scats was done by Wise (1978, published in Wise, Linn & Kennedy (1981), who analysed 513 mink scats containing evidence of 698 prey, and 1547 otter spraints containing 2906 prey items. These were collected over two years (1974–76), and the results were related to the availability of prey, whose populations Wise assessed. Broadly similar prey preferences at Slapton and the riverine site (this time the River Dart and its tributaries) were demonstrated. Wise found that otters specialised in taking fish (92.7% of their diet) whereas mink took approximately equal thirds of aquatic, riverside and terrestrial prey. Fig. 1 shows Wise's comparisons of otter and mink at the two Devon sites. These percentages are based on bulk estimates, whereby the proportion of material (identified as of a certain species) in a scat (of known weight) is estimated. This method gives a more reliable and realistic estimate of dietary importance than recording the number of individual prey items. Further details of the findings are discussed below.

Following initial live-trapping studies on mink by Chanin (1976), Birks (1981, published in Birks & Linn 1982, and Birks 1989) engaged in extensive trapping during

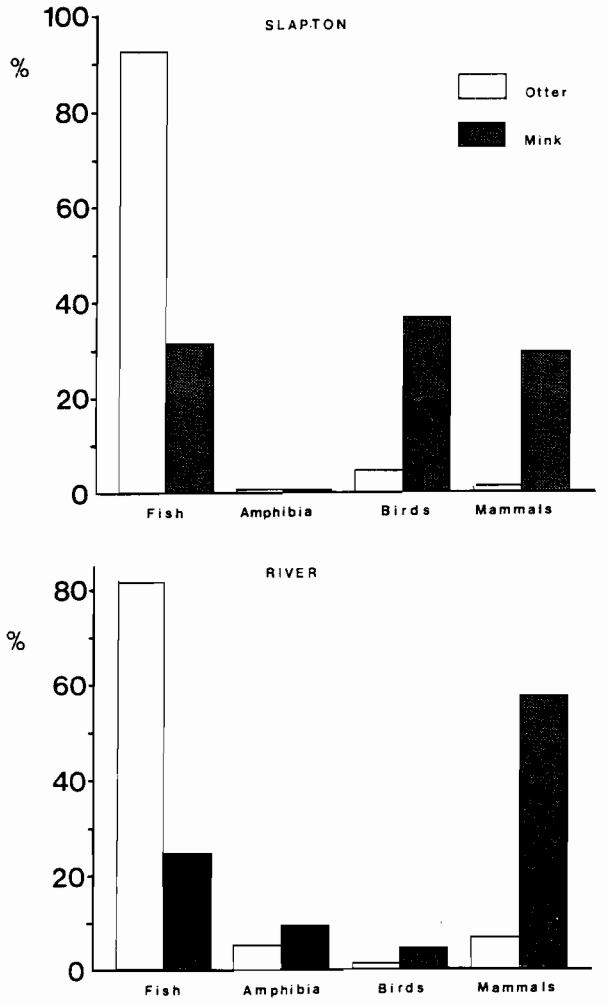

FIG. 1
Bulk percentages of the vertebrate groups taken by otters and mink (after Wise, 1978)

the period January 1978 to March 1980. A total of 25 individuals were captured, ear-tagged and released on Slapton Ley. Again comparisons with the River Teign were made, and movements at the two sites were explained in terms of territorial and reproductive behaviour.

The feeding ecology of otters

The European otter (*Lutra lutra*) is a member of the family Mustelidae (Mammalia: Carnivora), and is native to the British Isles. Slapton Ley has always been an ideal place for otters, with abundant food and undisturbed areas for lying-up and breeding. If breeding does not occur on the Reserve itself (it has never been proved), it almost certainly occurs in a related riverine system not far away, such as the River Gara.

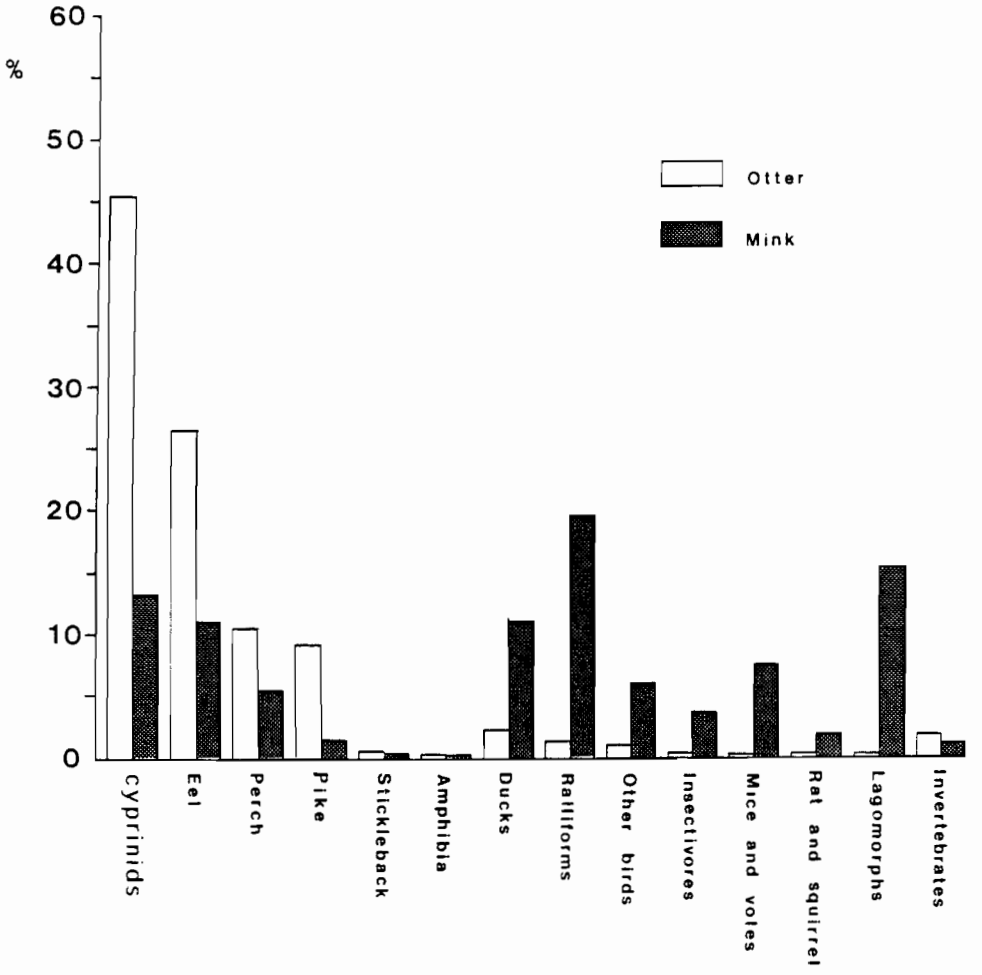

FIG. 2
Bulk percentages of the main prey items taken by otters and mink at Slapton overall (after Wise, 1978)

The fish species taken by otter (Wise, 1978) were identified from characteristic hard parts, particularly vertebrae and scales. However, two cyprinid fish which cannot be separated in this way are roach[1] and rudd. Wise assumed that remains in scats were mostly of roach as these were by far the commoner of the two fish in the Ley at the time. Cyprinids turned out to be the fish most eaten by otter, on average, at 45.4% of its diet. Other fish species taken (Fig. 2) were eels (averaging 26.6% of the diet), perch (10%) and pike (9.2%).

There was considerable seasonal variation within these averages and eels, particularly, became more important in the summer. Wise explained this pattern in terms of fish availability and vulnerability at various times of year, given the otter's fishing

[1] The scientific names of species mentioned in the text are appended.

method. They are excellent swimmers and hunt mainly in the open water of channels and pools in the Ley system. Prey is located and chased underwater, and the speed with which the quarry can swim is crucial. In the warmer waters of the Ley in summer cyprinids swim faster, and slower moving eels are preferred. That fishing is harder in the summer might also explain why otters diversify more into non-fish food at this time of year: at Slapton more waterfowl were taken while rabbits became important in the river areas studied.

The fact that cyprinids were four times more important to otters than perch is not quite explained by availability, as the two types of fish occur in similar abundance. It appears that cyprinids are being selectively caught. Wise speculated on a number of reasons why this might be so, including palatability—perch have sharp spines on their dorsal fins.

Wise found that mammals formed only 1.2% overall of the otter's diet, consisting of shrews, mice, voles, rats, squirrels and rabbits (see Fig. 2). Birds comprised 4.6% of the otter's diet (see Fig. 2), two thirds of which belonged to the order Anseriformes (swans, geese and ducks, but mostly duck). An abnormal peak in predation on ducks occurred in the summer of 1976. Gruiformes (coot, moorhen and water rail) were taken in smaller numbers with little seasonal variation. Wise suggested the reason for this pattern to be that duck are more available in open water which are the otter's preferred hunting grounds.

The feeding ecology of mink

The American mink (*Mustela vison)* is another member of the family Mustelidae, and is a native of North America. The first escapes of mink from fur farms occurred shortly after these were established in Europe in the late 1920s, and breeding in the wild was confirmed in 1955 in Devon. Mink is the only introduced carnivore to have become widespread in the wild in Britain. It had acquired a reputation as a vicious and wasteful killer and concern was expressed about effects on populations of wild animals, both prey species and potentially competing predators. In the 1970s, the spread of feral mink was suggested to be correlated with the decline of otters in some parts of Britain; a better understanding of the ecology of mink was of paramount importance.

Scat analysis revealed mink to be a more generalised carnivore than the otter, with a diet at Slapton composed of approximately equal thirds of fish (31.6%), birds (36.9%) and mammals (29.5%) (see Fig. 1). According to Wise (1978), the order of importance of the different species of fish in the mink's diet was the same as that of otter, when averaged over the study period. Cyprinids were the most eaten fish at Slapton, at 13.2% of the mink's diet, then came eel (11.0%), perch (5.4%) and pike (1.5%)(see Fig. 2). Chanin (1976) found a greater importance of eels in the mink's diet at 26.4%, and rather less cyprinids (8.3%). These are results from scats collected at a different period (1972–74) and the proportion of fish overall in the mink's diet was found to be much higher, at 52.8%.

Mammals were more important to mink than to otters on Slapton Ley, especially rabbits comprising 15.4% of the diet according to Wise (1978). Small rodents (mice and voles) formed 7.6% of the diet, whilst insectivores (shrews) form 3.2%. Rats and squirrels were also taken occasionally (1.3% and 0.6% respectively) (see Fig. 2).

Gruiformes were the most important (at about 20%) bird group in the mink's diet at Slapton, with ducks constituting 12% of the diet. More moorhens and coots were eaten than might be expected by their abundance on the Ley. Wise suggested that the

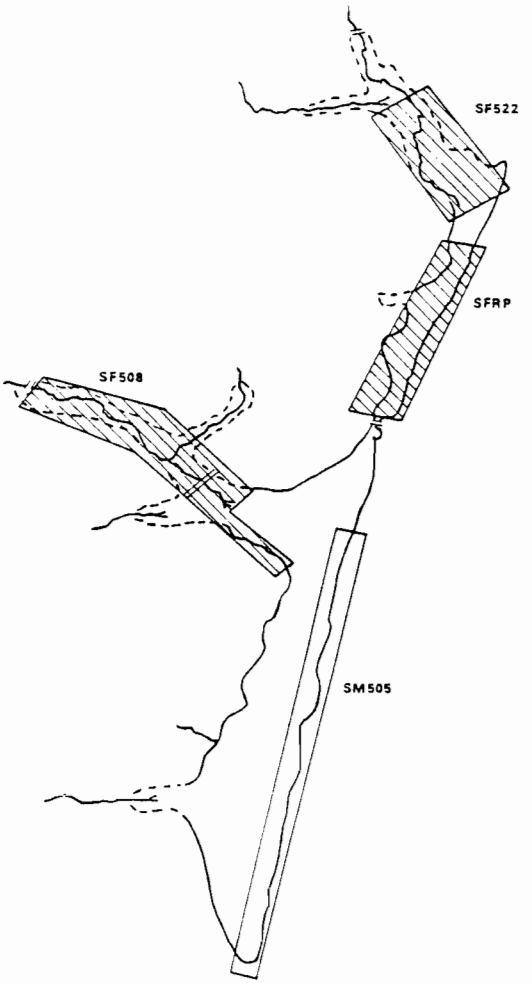

FIG. 3
The distribution of mink territories on Slapton Ley in November 1978. Male territory open, female territories cross-hatched. (After Birks, 1989)

gruiformes are more easily caught than duck, especially by mink, as they frequent the reed-beds and fringes of the Ley which are the mink's favoured hunting grounds. On the River Teign, birds were eaten less often than mammals (mostly rabbits), probably because of the lesser abundance of birds rather than of the greater availability of mammals.

As with the otter, Wise found considerable seasonal variation in mink diet. More fish were taken in the winter, and more birds and mammals in the summer. A pattern is indicated which reflects the availability of prey within an area at a certain time of year, given the mink's hunting method. Mink is a less well-adapted underwater predator than the otter, and prefers to hunt in the aquatic margins. When fishing, mink locate their quarry from above the water before diving in to give chase (Birks, 1986).

Birks' (1981,1989) live-trapping of mink demonstrated their territorial behaviour, with males and females holding separate territories. The 25 individuals trapped in the two year period at Slapton perhaps gives a false impression of the numbers that comprise a population in a given area. Many of those trapped were 'transients' (i.e. just passing through) and only 6 were resident animals. Between two and four (mean 3.1) were resident in the Slapton Ley system at any one time, and an example of a pattern of territories is shown in Fig 3. Six litters were produced at Slapton in the two year study period, giving 20–25 young.

Many transients were caught only once, and most were caught within two distinct periods, before and after the breeding season. Transients caught in the January to March period were all males in reproductive condition, presumably looking for females to mate with. (They then have nothing to do with the female or her young.) Transients caught in the August to October period tended to be juveniles, dispersing from their mother's home territory. In these periods, vacant territories would be quickly refilled. It is likely that mink which do not find a territory will die of starvation or disease.

Maintenance of territories provides a basis for the regulation of the numbers of mink, given a certain level of availability of food. Territories tend to be larger where food is scarce. Birks suggests, therefore, that availability of prey ultimately regulates the mink population, rather than the number of predators asserting an effect on the numbers of prey, as is popularly suggested.

Competition between otter and mink

The overall percentage of prey shared by otters and mink, averaged over a two-year period, was calculated by Wise (1978) as 38.3%, of which 82.2% was fish. However, dietary overlap does not automatically mean significant competition. The mink's nature as a generalised carnivore leads to selection of the most plentiful prey and a willingness to switch from one type of prey to another. This leads to *avoidance* of competition (Birks 1986). The dietary overlap is an indication of the abundance of that prey, especially fish at Slapton.

A paucity of otter scats in the summer of 1976 was thought by Wise to be due to the reduced availability of fish during the period of low Ley water-level and so reduced otter activity at sites monitored. This may have allowed the mink population to reach a higher level than 'normal', as evidenced by the greater abundance of mink scats.

The evidence suggests that mink has established a feeding niche alongside indigenous carnivores, in which it is causing no intense or widespread harm to populations of wild prey species, and where predation on domestic poultry is rather less than is commonly perceived. The presence of otters is considered to suppress the mink population, indeed an increase in otters seems to lead to a decrease in mink (Birks, pers. comm.). However, the mink's greater 'ecological amplitude' and tolerance of human activities guarantee it a place in areas sub-optimal to the otter.

Otter spraints have continued to be found in typical sprainting locations around the Ley through to recent times. There is, therefore, no reason to assume that otter numbers have changed since the late 1970s, when the research described above was carried out. Indeed, there have been regular sightings, especially in the Higher Ley. Mink and their scats also continue to be seen on a regular basis, suggesting continued co-existence of mink and otter, both dependent on an abundant supply of food.

Other Mammals

Small mammals

Methodical trapping by Wise (1978) was carried out to investigate the relative abundance of small mammals around the Higher and Lower Leys to determine their availability as prey to otters and mink. 50 Longworth traps were set at each of four sites for 24 hours in each season, over seven seasons up to autumn 1976. The sites were Hartshorn Plantation (woodland), Shingle Ridge backslope (scrub), and a grassy bank and reed-bed margin on the southern fringes of Ireland Bay.

The wood mouse was the most frequent mammal caught, at 38%, closely followed by the bank vole (36.5%). These were each twice as numerous as the field vole (14.3%) and the common shrew (11.2%). The relative abundance for different habitats of these four species is shown in Fig. 4. Four other species were trapped occasionally: there were two occurrences of house mouse in the woodland, and two of yellow-necked mouse in the reed margin. Harvest mouse was trapped most commonly in the autumn, in all areas except the woodland, and water shrew was found in both the grassy and reed margin areas. Seasonal variation included a marked autumn increase in wood mouse.

The common dormouse is a species which has generated interest in recent times, as it has declined nationally and become a subject of English Nature's Species Recovery Programme. It has been recorded occasionally at Slapton, particularly found hibernating, in woodland and in more open locations such as the backslope of the shingle ridge. Wise (1978) recorded predation of dormouse by mink and otter, on one occasion each. Further study of this species, recording use of nestboxes for example, may be useful in elucidating its status and habitat requirements at Slapton.

Wise (1978) found no evidence of brown rats around the Ley, using footprint recorders, and very infrequent occurrences in the diets of mink, otters and barn owls.

Bats

Seven species of bat have been positively identified in the Slapton area. It is likely that further study will reveal more, as all fourteen native British species[2] have been recorded in Devon. Studies of the bats have been mainly by visiting enthusiasts in the course of study weekends at the Field Centre. Ultra-sound detectors are now commonly in use and inspection of known or potential roost sites has produced evidence of use by bats.

A number of roost sites have been recorded, but only for three species with complete certainty: pipistrelle, whiskered and lesser horseshoe bat roosts are known in houses in Slapton village. The bats inhabiting such roost sites use the National Nature Reserve and other surrounding countryside as feeding grounds. The lesser horseshoe breeding roost is particularly important, being the second largest in Devon. It consists of over a hundred females, as well as their young in season; the numbers are monitored regularly.

The other species recorded are the noctule, Daubenton's bat, Natterer's bat and the rare grey long-eared bat. The noctule and Daubenton's are characteristically tree-roosters, undoubtedly in trees within the NNR. Evening watches, for example at Slapton Bridge, would suggest relatively good numbers of these species, although noctules are considered to have declined throughout much of Britain.

It is clear that there is a lot yet to be learned about bats in the Slapton area, as knowledge and techniques develop nationally.

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[2] When this paper was written, all pipistrelle bats were regarded as members of a single species. Ed.

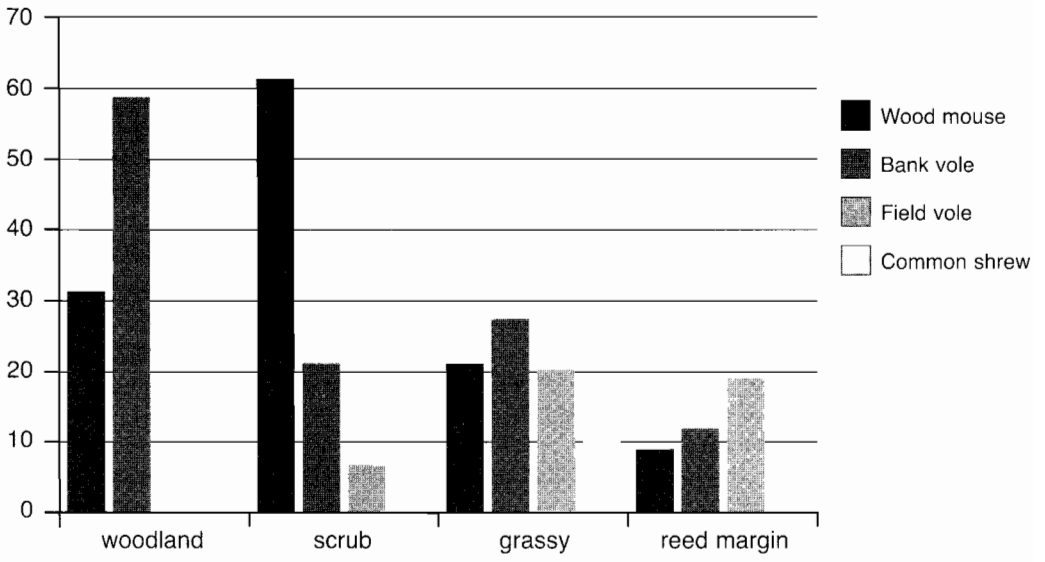

FIG. 4
Habitat preference of the commonest small mammals caught in Longworth traps (numbers of individuals, recalculated from Wise, 1978)

Other mammals

Regular recording of mammals has been rather scant, and the record card index at the Field Centre has been greatly under-used. Many species have not been recorded since the 1960s, though there is no reason to assume any change in status. The following species occur on the Nature Reserve or in the surrounding area, in characteristic habitats and presumably in typical abundance: hedgehog, mole, hare, rabbit, grey squirrel, stoat, weasel and red fox. Roe deer do not seem to have been recorded before 1992. Since then they or their evidence has been seen occasionally in and around Slapton Wood.

Badgers are abundant around Slapton, with at least 12 setts on the Nature Reserve itself. Activity has been monitored informally, with faeces in latrines providing evidence of food eaten, e.g. grain, beetle wing-cases. In 1983, McFarlane (unpublished) studied the home ranges around certain setts using coloured pellet markers in bait food. Considerable overlap of these ranges was demonstrated.

HERPTILES

Four species of amphibian are known from the Slapton area. As well as frogs and toads, the smooth and palmate newts have been recorded.

None of the four native reptile species is unusual either, though perhaps the grass snake is the most dependent on the wetland. The adder, slow worm and common lizard are frequent in the South Devon countryside. Introductions of unwanted pet terrapins have been made on a number of occasions. Though significant predators, they are unlikely to persist in the Ley for very long.

Invertebrates

Freshwater invertebrates

The community of freshwater invertebrates living in Slapton Ley forms an obvious link in the ecological chain between the producers (algae and macrophytes) and the predators. It is unfortunate therefore that there has been little research on them. This, along with the algae, has always been seen as a 'gap' in our knowledge of the system, research being limited to a few student projects. Lamont (1986) carried out a preliminary study in response to the sharp decline in the fish populations a short time before. She found, however, that the Ley was rich in invertebrate fauna, typical of a freshwater eutrophic lake. There was no evidence to suggest that factors (whatever they might be) affecting the fish populations were also influencing the invertebrates.

Smith (1990) carried out another invertebrate survey with a more structured method over a period of twelve months, at different points around the Ley. This constituted a baseline survey, and described again a rich and diverse fauna. The National Rivers Authority have carried out their own independent invertebrate monitoring programme, and results of visiting student groups are kept to maintain a long-term data set for specific teaching sites. More detailed analysis of data collected would be welcome, as would more directed research on the ecological processes which regulate invertebrate populations and their relationships with vertebrate and plant communities.

General invertebrate records

Records are held in the Field Centre card index system, which collects casual species records. Some groups are better represented than others, as recording is dependent on visiting enthusiasts. Lepidoptera, for example, have been extensively recorded, particularly by Spalding during courses based at the Field Centre. In addition, from 1973 to 1978 a light trap was operated as part of the Rothamsted Insect Survey. This was one of over a hundred traps around Britain monitoring pest and migratory Lepidoptera species.

The Invertebrate Site Register (ISR) compiled by the Nature Conservancy Council (now English Nature) in 1987 describes Slapton as an important site for a range of invertebrates, especially the flies. The document lists 75 species recorded at Slapton, comprising 19 Red Data Book species (including some craneflies and snail-killing flies), 41 nationally-notable species and 15 species of local importance. Moths are well represented, and include the Jersey tiger, *Euplagia quadripunctaria,* a spectacular moth familiar in Slapton in August but nationally notable because of its restricted distribution. Many coastal and wetland species are noted in the register, and several rare and local beetles are reported.

Visits from specialists in under-recorded groups usually turn up something interesting. Eccles (unpublished) searched for beetles in the shingle of Slapton Sands in 1987. He found an additional Red Data Book species, and seven notable species, six of which were not recorded in the ISR.

A species of millipede new to science was collected from Slapton Wood by Gregory (Gregory *et al* 1993) whilst searching for woodlice and other invertebrates. Slapton Wood was also productive for Monson (unpublished) collecting oribatid mites in June 1995. Visiting this and other habitats around the Ley, he found 101 species on one brief visit. This compares with the total of 302 species of oribatid recorded for the British Isles (up to June 1995).

FUTURE POTENTIAL

Despite the size and popularity of mammals, there is not a wealth of scientific knowledge on the class in the Slapton area, apart from otter and mink. The rest of the animal kingdom has had scant consideration as well, probably because of technical difficulties, particularly the need for specialist knowledge for each taxonomic group. Further research into the ecology of freshwater invertebrates is bound to be worthwhile, building on the wealth of knowledge of the eutrophic system. The chironomid midges, for example, are an important group in the Ley in terms of biomass, yet very little is known about them.

Aspects of national interest should develop alongside national schemes and surveys. As mentioned above, the status of the dormouse at Slapton is not clear, and study of the bats is an expanding arena. More locally-relevant monitoring of under-recorded groups might relate to habitat management on the National Nature Reserve, or to changes in agricultural practice. Further studies of small mammals would be particularly relevant in this respect, with a trend in the catchment towards extensification of farming practices, providing more diverse habitats for wildlife.

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Appendix
Scientific Names of Vertebrate Species Mentioned In The Text

Fish

Brown trout	*Salmo trutta* L.)
Roach	*Rutilus rutilus* (L.)
Rudd	*Scardinius erythrophthalmus* (L.)
Eel	*Anguilla anguilla* (L.)
Perch	*Perca fluviatilis* L.
Pike	*Esox lucius* L.

Amphibians

Common frog	*Rana temporaria*
Common toad	*Bufo bufo*
Palmate newt	*Triturus helveticus*
Smooth newt	*Triturus vulgaris*

Reptiles

Common lizard	*Lacerta vivipara*
Slow worm	*Anguis fragilis*
Grass snake	*Natrix natrix*
Adder	*Vipera berus*

Birds

Water rail	*Rallus aquaticus*
Common moorhen	*Gallinula chloropus*
Common coot	*Fulica atra*

Mammals

Hedgehog	*Erinaceus europaeus*
Common shrew	*Sorex araneus*
Pygmy shrew	*Sorex minutus*
Water shrew	*Neomys fodiens*
Mole	*Talpa europaea*
Noctule bat	*Nyctalus noctula*
Grey long-eared bat	*Plecotus austriacus*
Pipistrelle	*Pipistrellus pipistrellus*[3]
Natterer's bat	*Myotis nattereri*
Daubenton's bat	*Myotis daubentoni*
Whiskered bat	*Myotis mystacinus*
Lesser horseshoe bat	*Rhinolophus hipposideros*
Brown hare	*Lepus capensis*
Rabbit	*Oryctolagus cuniculus*
Grey squirrel	*Sciurus carolinensis*
Common dormouse	*Muscardinus avellanarius*

[3] When this paper was written, all pipistrelle bats were regarded as members of a single species. Ed.

Bank vole	*Clethrionomys glareolus*
Field vole	*Microtus agrestis*
Wood mouse	*Apodemus sylvaticus*
Yellow-necked mouse	*Apodemus flavicollis*
House mouse	*Mus musculus*
Harvest mouse	*Micromys minutus*
Brown rat	*Rattus norvegicus*
Stoat	*Mustela erminea*
Weasel	*Mustela nivalis*
American mink	*Mustela vison*
European otter	*Lutra lutra*
Badger	*Meles meles*
Red fox	*Vulpes vulpes*
Roe deer	*Capreolus capreolus*