

ECOLOGY AND CONSERVATION OF REPTILES IN THE NEW FOREST

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ABSTRACT

The historical and biological aspects of New Forest reptiles are outlined. Recent ecological research on the reptiles is described and gaps in knowledge are identified. Abundance of the New Forest reptiles is not easily estimated and it is not possible to calculate total populations of most reptile species. Information is lacking on the changing patterns of reptile distribution over the last few decades. Carefully designed distribution maps of New Forest reptiles could provide an important basis for their future conservation.

INTRODUCTION

The New Forest in Hampshire, southern England, embraces a mosaic of more than 27,000 ha of woodlands, heathlands, acid grasslands and forest plantations. Rich in variety of habitats, there are many conflicts about uses of the Forest resources (Tubbs 1982), and grazing pressure in particular has been at the centre of many debates.

The nature and variety of plant communities within the New Forest, particularly the heathlands and ancient woodlands, are of considerable importance for nature conservation (Tubbs & Tubbs 1985). For centuries the New Forest has provided important habitats for both reptiles and amphibians. But even in the New Forest there have been changes in land use: there has been fragmentation of habitats, there has been exploitation of the reptile populations, and in recent years the area has been under increasing public pressure. Without good conservation and management practices aimed at the herpetofauna, the New Forest will not continue to be an important refuge for both reptile and amphibian populations.

The aim of presenting this paper is two-fold. Firstly, with several years of ecological research having been directed at reptiles in southern

England, a review of the current state of knowledge seems timely. Secondly, and on the basis of what is now known about the ecology of the reptiles, future research and conservation programmes for the reptiles of the New Forest are considered. In addition to describing the reptile fauna of the New Forest, a brief mention is made of the amphibian fauna.

REPTILE FAUNA OF THE NEW FOREST

Slow-worm

The slow-worm (*Anguis fragilis*) belongs to the family *Anguidae* which includes a number of snake-like lizard species as well as many other species which have well developed limbs. The slow-worm has a fairly distinctive sexual colour dimorphism; the males usually have a uniform greyish-brown colouration whereas females are usually dark-brown or black underneath and light-brown on their dorsal surface. Most females have a dorsal vertebral stripe and it has been suggested that females with this stripe are mimicking the adder (Smith 1974). Blue-spotted slow-worms are not uncommon in the New Forest but the cause or significance of the blue spots is not fully understood (Voipio 1962). Large adults are 30-40cm in total length (i.e. including the tail which is longer than the body length). Slow-worms are viviparous, giving birth to about eight slender, golden-brown young in late August or early September. Slow-worms may live for a very long time and, although some have been kept in captivity for at least 20 years, their mean life expectancy is unknown.

Sand Lizard (Fig 1)

The sand lizard (*Lacerta agilis*) is noticeably larger and heavier than the common lizard



Fig 7. The Sand Lizard (*Lacerta agilis*).

(*Lacerta vivipara*). Sand lizards examined at the edge of the New Forest were found to have a mean snout-vent length (length excludes the tail) of between 7–9cm whereas common lizards in the New Forest were found to have a mean snout length of 5–6cm (Spellerberg 1982b). In a previous study of sand lizards in Dorset, Nicholson (1980) reported weights of 10–13g for adult sand lizards which contrasts with an average of 5g for common lizards in the New Forest. Like most lizards, this species lays eggs. During July they excavate small burrows in the soft earth or sand and lay about six small white eggs. The hatchlings emerge in late August (House & Spellerberg 1980).

Common Lizard

The small, delicate common lizard gives birth to live young. Adults become sexually mature after two years and between five and eight dark coloured young are born during late July or early August. The common lizard is notable for its wide distribution. It occurs throughout Europe, and to the east its range extends to the Pacific coast of Asia. In the south of its range, populations are largely confined to montane and wet areas. Like the adder its distribution extends as far north as the Arctic circle. Despite this very widespread distribution, there is little geographical variation between populations and no sub-species have yet been recognised.

Smooth Snake (Fig 2)

The scales of the smooth snake (*Coronella austriaca*) are soft and smooth whereas the scales of the adder and the grass snake have a small ridge (keel) giving them a rough texture. Although the colour is variable most are brown or brownish-grey with a black stippling effect and a dark stripe extending from the corner of the mouth across the eye to the neck. Adult smooth snakes in the New Forest are 50–60cm in length, and are more slender in appearance than adders or grass snakes. Smooth snakes give birth to between four and eight young and it is not unusual to find the new born snakes gathered together under the shelter of a piece of heather. Although sometimes described as a rare snake it is probably more correct to say that it is rarely seen. For example there is evidence to suggest that they are not uncommon in the New Forest (see below) but their secretive habits make them very difficult to find.

Grass Snake

The grass snake (*Natrix natrix*) is by far the largest of the three British snake species and some specimens in the New Forest have exceeded 80cm in length. Most adults are 60 to 70cm long. Typically found in wet heathland habitats, they move quickly and noisily when disturbed. The areas around emergency water supplies in some of the New Forest enclosures often support good populations of grass snakes. In June or July the female grass snake seeks out suitable incubation sites and lays between 10 and 20 eggs. If the weather has been warm, then hatching of the grass snakes occurs towards the end of August or in early September. As well as being widespread throughout the New Forest, grass snakes have also become part of the suburban wildlife. Many gardens in or near the New Forest are frequented by grass snakes and clusters of grass snake eggs are not uncommonly found in compost heaps.



Fig 2. The Smooth Snake (*Coronella austriaca*).

Adder

The adder (*Vipera berus*) is a thick bodied snake, reaching up to about 50cm in length. The zig-zag vertebral stripe is a well known characteristic but in some specimens, particularly the dark coloured forms and the melanic form, no zig-zag stripe is visible. Unusual amongst snakes is the sexual dimorphism in colour. The females are usually reddish-brown while males tend to be a contrasting black and pale grey (Spellerberg 1975a). During late summer between six and twelve young are born. Their striking, brick-red colour sometimes leads to the mistaken impression that they are a different species. Adders are tenacious in their basking habits; not only do they bask for long periods, but they also seem to use the same basking site time and time again. They can flatten their bodies so as to increase the surface area exposed to sunlight. The adder is the only venomous species of snake in Britain and often is unnecessarily maligned for this characteristic (Spellerberg 1984).

Introduced species

From time to time there have been reports of European tortoises in the New Forest. Once imported for the pet-trade in hundreds of thousands (Spellerberg 1976), some tortoises have either escaped or have been deliberately released in the New Forest. There have also been reports of dice snakes (*Natrix tessellata*), green lizards (*Lacerta viridis*), and wall lizards (*Podarcis* sp.) in the New Forest, which were almost certainly abandoned pets.

AMPHIBIAN FAUNA OF THE NEW FOREST

The amphibian fauna of the New Forest includes all the three species of newts found in Britain: smooth newt (*Triturus vulgaris*), palmate newt (*Triturus helveticus*), and great crested or warty newt (*Triturus cristatus*). The work of Frazer (1983) and others shows that the parameter most closely linked to newt distribution is tolerance of metallic ions in the water. Of 76 ponds and streams in the New Forest examined in one

survey (Frazer 1983), palmate newts were found in 36, smooth newts in 21, and great crested newts in eight. It appears that the palmate newt can tolerate a wide spectrum of metallic ions but prefers soft water.

Both the common frog (*Rana temporaria*) and the common toad (*Bufo bufo*) are widely distributed throughout the New Forest. In contrast, populations of the natterjack toad (*Bufo calamita*) have seriously declined in the south of England and much is now being done to conserve this species (Beebee 1979).

The European tree frog (*Hyla arborea*) has been introduced deliberately to the New Forest on more than one occasion and at least one population, although small in size, seems to have survived for many years despite drought, collecting and predation.

ORIGINS OF NEW FOREST REPTILES

Compared to the reptile fauna of continental Europe, the reptile fauna of Britain is poor. Three species of lizards and three species of snakes are found in Britain today whereas in central Europe there are 15 species of reptiles and in Spain at least 26 species. North Africa has at least 72 species of reptiles excluding marine turtles and introductions. Moving from north to south across Europe there is an increase in the number of reptile species but there is no obvious explanation for this latitudinal zonation in reptile species richness. It can not be explained simply by the heliothermic behaviour of reptiles and their dependence on external sources of heat, because many reptiles live in cool temperate regions and have physiological adaptations to cold (Spellerberg 1982a).

Within Britain there is also a latitudinal zonation. Adders, common lizards and slow-worms are found throughout England, Wales and Scotland. Apart from a few populations, grass snakes are absent from Scotland; this may in part be explained by the incubation requirements of the eggs (Spellerberg 1982b). Sand lizards are restricted to the south and south-east of England apart from a small remnant population on the north-west coast. Their incubation

requirements may in part explain this limited southern distribution (House & Spellerberg 1980). The smooth snake is also found only in the south and was first discovered in Britain, close to the New Forest last century.

One reason for this gradient in species richness across Britain may be the long period of colonization which took place after the last glaciation. As far back as 15000 years ago, northern Europe was beginning to recover from the cold, dry conditions of a glacial period; at this time Britain was linked to the European mainland which facilitated movement of plants and animals. Between that time and about 7500 years ago the six reptile species must have colonized Britain, perhaps along with other species of reptile which have since become extinct. Not all species would have arrived at the same time and once in Britain they may have spread at different rates. There is evidence that the climate has become cooler in the past five thousand years which may have brought about a decline and extinction of many populations. The sand lizard distribution with the remnant population in the north-west of England is evidence for such a pattern of events.

But why have all species colonized the area of land we now call the the New Forest? The more common reptile species (at least comparatively common today) may have been the first reptile species to reach Britain and the south coast may have had suitable woodland habitats for adders, common lizards and slowworms. Wet areas in the New Forest would have presumably favoured the grass snake or at least its prey such as amphibians and freshwater fish. The sand lizard must have at some time colonized lowland England but, as indicated above, a deterioration in climate may have fragmented the distribution of this species. The origin of the smooth snake and its distribution is perhaps the most difficult to explain. In view of its comparatively recent discovery in England and its now very limited distribution in the south, there is a possibility that this species was accidentally introduced. It is a docile species which frequently lies hidden amongst grass, heather or woodland litter and it could well have been brought across from Europe hidden in heather, straw or turf.

ECOLOGY, DISTRIBUTION AND ABUNDANCE OF REPTILES

For effective conservation we need information on the distribution and habitat preferences of a species. We must also consider changes that may have occurred in the distribution of the species either in terms of the total number of individuals or of number of localities or populations. Intensive and long-term field studies should provide this kind of information but there are many difficulties in assessing reptile numbers (Turner 1977) and in recording of patterns of distribution. In the case of some species of New Forest reptiles, there has been little or no research into these aspects. Published estimates of smooth snakes numbers in Britain have no scientific or ecological basis (eg. *New Scientist* 1985, 19 Sept p 15 and 10 Oct p 61). The distribution of smooth snakes in Britain has not been fully investigated and even at sites where long-term studies have been undertaken many smooth snakes are never located. The anecdotal basis for estimating smooth snake numbers in Britain is discussed by Goddard (1984).

Slow-worm

The slow-worm has only recently been the subject of ecological studies (Patterson 1983; Smith 1985). Individual animals can easily be distinguished from the colour patterns on the underside of the head and neck and this technique has provided an important and useful basis for ecological research. From limited recapture data (as yet the research is still in its early stages) straight line movement of 2.0 to 2.5m/day have been found to be typical. Home ranges overlap extensively and there is no evidence that slow-worms have territories. There has been no detailed study of the distribution of the slow-worm in the New Forest but they have been found at all locations where there are other reptiles. The total population in the New Forest is unknown.

Sand Lizard

Much more is known about the sand lizard. A recent study over four years (House & Spellerberg 1983) examined habitats of sand lizards at six sites in southern England, one of them close

to the New Forest. Results from this study suggest that they occupy two main kinds of habitat in southern England: one is open, exposed heathland or dune communities; the other is small, isolated areas of heathland or scrubland which have been disturbed by changes in land use. Sites presently undergoing succession from heathland to scrubland or woodland can support higher populations of sand lizards and other reptiles than more uniform vegetation. Such sites are less frequently burnt than large areas of open heathland and contain a greater variety and abundance of food for sand lizards. Another study using miniature radio transmitters to track the animals (Spellerberg & Wright 1982) showed that forest rides are an important habitat for sand lizards as well as providing corridors for dispersal within forest plantations. There appears to be no satisfactory method of

counting total sand lizard numbers, but the number of locations or populations can be established with a certain degree of success.

In 1975 an extensive survey was undertaken in the New Forest of locations reported by the Forestry Commission to be suitable for the 'rare' reptiles. At five of the 17 sites examined (Table 1: A-E) sand lizards had previously been seen; two of these locations were in the north-west and three were in the south-east of the Forest. From these rather discouraging results it was concluded that no viable populations of the sand lizard remained in the New Forest (Spellerberg 1975b). The few animals seen were probably the remains of populations which had declined as a result of collecting and habitat disturbance (recreation, grazing, burning). Over the last ten years some sand lizards have been introduced to locations in the New Forest where there has

Table 1. Results of the 1975 survey of 17 suspected sand lizard and smooth snake sites in the New Forest

Location	Characteristics	L.a	L.v.	A.f.	C.a.	N.n.	V.b.
A	Dry heathland in new conifer plantation.	0	3	0	2	0	1
B	Dry heathland & grassland. Many sandy banks and gullies. Heavily grazed.	0	0	0	0	0	0
C	Disturbed and heavily grazed dry heathland.	0	3	1	1	0	1
D	Large expanse of dry & wet heathland. Some parts affected by pressures of recreation.	1	3	3	2	3	3
E	Dry heathland. Heavily grazed.	1	3	3	3	3	3
F	Dry & wet heathland. Heavily grazed and burnt areas.	0	2	1	1	1	1
G	Mixture of plantations, heathlands and pastures.	0	2	1	1	1	2
H	Heavily grazed. Few remnants of heathland.	0	2	1	1	0	0
I	Dry heathland. Heavily grazed and many areas burnt.	0	1	0	1	1	1
J	Dry & wet heathland. Structurally diverse landscape.	0	2	0	1	2	0
K	Large expanse of dry & wet heathland. Grazing and burning in some areas.	0	1	1	1	1	1
L	Remnant heathland. Heavy grazing & recreational pressures.	0	2	0	0	0	0
M	Dry heathland recently burnt.	0	0	0	0	0	0
N	Large expanse of plantations, dry & wet heathlands. Some parts subject to high levels of recreational pressure.	0	2	2	3	2	2
O	Remnants of dry heathland.	0	1	0	0	0	1
P	Large area of dry & wet heathland. Structurally diverse.	0	1	1	1	0	1
Q	Mixture of deciduous woodland, remnants of dry heathland.	0	2	0	0	0	1

L.a = *Lacerta agilis*. L.v. = *Lacerta vivipara*. A.f. = *Anguis fragilis*. C.a. = *Coronella austriaca*. N.n. = *Natrix natrix*. V.b. = *Vipera berus*.

3 = abundant or many individuals seen. 2 = present or a few seen. 1 = one or two individuals seen or slough only found. 0 = not found.

been a dramatic decline in the original populations. In addition there are sand lizard populations on the edge of the New Forest and at least one nearby nature reserve was established primarily for the conservation of the sand lizard and smooth snake (Fisher 1980).

Common Lizard

The ecology of the common lizard has been well researched (Spellerberg 1974; Avery 1975; Nicholson 1980) but little of the work has been in the New Forest. Common lizards are found in a wide variety of habitats (heathland, mixed deciduous, woodland, roadside verges) and in the New Forest they are to be found in large numbers in grassland sites where there is also some woodland, particularly deciduous woodland. In two such locations in the New Forest I have counted more than 24 animals within two hours. Despite the ease by which these lizards can be located, it would be difficult to estimate the total population. Studies on the common lizard in both Britain and Europe have shown that spiders form a large part of their diet, and insects, particularly Homopterans, are also important. Although there is some overlap in their diet there is no evidence that common lizards and sand lizards compete for food. Sand lizards take a wider variety of prey including spiders, and also feed on hard-bodied insects such as beetles.

Smooth Snake

Ecological research on New Forest smooth snakes commenced in 1972 and has continued since that time (Spellerberg & Phelps 1977; Goddard 1984). The work has shown that smooth snakes give birth in alternate years and that they may live for as long as twelve years. They travel over considerable distances and home ranges seem to be about 0.7 to 2.9 ha in area. Small mammals (particularly nestling shrews and mice) and small lizards form the major part of the smooth snake's diet but there is no evidence to show that they take significant numbers of sand lizards. Smooth snakes actively seek out the nestling young of small mammals, though a number of reports indicate that small

mammals are scarce in the New Forest (Tubbs 1982).

In 1975, several New Forest smooth snake locations (reported by the Forestry Commission) were examined in detail as part of a continuing survey of reptiles in the New Forest. At that time, 14 out of the reported 17 locations were thought to have smooth snakes (Table 1; locations D to Q). The results of that survey were encouraging in terms of the number of smooth snakes seen and the number of sites where smooth snakes were found. Between 1975 and 1985 many other locations in the New Forest have been found to have smooth snakes. Recent studies using small radio transmitters attached to these snakes have revealed that smooth snakes are found in a greater variety of habitats than was previously thought possible. However, their secretive habits and scattered distribution throughout the Forest make it impossible to determine the total population.

The conservation of this species will depend on good habitat conservation and on a detailed knowledge of the feeding ecology, movement ecology and habitat requirements of the species.

Grass Snake

Although frequently seen in the New Forest, the grass snake is the least studied of the six reptile species. Indeed there is little scientific information on its diet, habitat or population ecology. Individual grass snakes are easy to recognise but although we have identified more than 60 individuals in the New Forest only three have been recaptured. This low recapture rate suggests that grass snakes are wide ranging and do not have a home range or 'limited movement area.' An estimation of the population size of this species is therefore impossible at present.

Adder

Adders are widely distributed throughout the New Forest, and occur in a variety of habitats (Spellerberg 1984) including woodland, plantation rides, heathland and rough grassland. A detailed ecological study of this species was undertaken more than 20 years ago, not in the Forest but on the Isle of Purbeck (Prestt 1971). That study provided much valuable information

on adder ecology and general biology. They have a biennial breeding cycle and each year about half the mature females will mate and give birth to live young. They overwinter in small groups. During dry, hot summers, the number of adder sightings is high and sometimes there are reports that adders are increasing in number. However as warm summer weather is an encouragement for humans to spend more time in the countryside, the simplest explanation is that more adders are seen. Although adders are found throughout the New Forest there is no information which could be used to estimate the total number of snakes or to show whether the populations are increasing or decreasing.

CONSERVATION

The information presented here on reptiles in the New Forest demonstrates why effective conservation measures are needed, at least for the rarer species. However, the threats to all reptiles and their habitats in the Forest are numerous. Natural predation, for example kestrels feeding on common lizards or buzzards feeding on grass snakes, must have an effect on populations. Numbers killed by man either intentionally or by accident are probably of less importance. Litter is a cause of unintentional deaths and it is not uncommon to find lizards trapped in discarded bottles and other containers left at car-parks and lay-bys. There seems no doubt that reptile collecting has had a serious effect on many reptile populations. Despite the wildlife and Countryside Act 1981, reptiles are still collected in the New Forest.

It is perhaps not surprising, with the many conflicting pressures on the New Forest, that the habitats of reptiles and other wildlife have been damaged, or have become fragmented and isolated. Overgrazing, intensive burning, afforestation, roads and recreation in its many forms have diminished the quality of reptile habitats. Fortunately the Forestry Commission recognised the need for habitat conservation and management and has readily collaborated in many ways to manage reptile habitats (Spellerberg 1982b). Many of the enclosures contain reptile habitats and the Forestry Commission

has responded to requests to make these enclosures as secure as possible from cattle and pony grazing. From time to time rides have been managed in such a way as to ensure that they can be used by reptiles as corridors for dispersal. However much more could be done within and around the many coniferous plantations to maintain or improve the quality of these habitats.

Education is an important part of the conservation process and to this end the Forestry Commission has established a good reptillary at Holidays Hill (SU 271 072) where, given suitable weather conditions, all the reptile species can be observed. The educational value of the reptillary would be improved if there was a greater provision for information and literature about reptiles and amphibians in the Forest.

MONITORING REPTILE DISTRIBUTION

Although much is now known about ecology of reptiles and particularly their diet, reproduction and movement, we know surprisingly little about their distribution and abundance in the New Forest. This is unfortunate in two respects. Firstly such information over a number of years could provide important data for use in assessing the conservation needs of particular species. Secondly, the reptiles of the New Forest could be used as indicators of habitat quality in general. As long ago as 1968 Tubbs recognised the value of the sand lizard and the smooth snake for this purpose; a reduction in the number of habitats or in populations strongly suggests a decline in heathland quality.

The population size of some large vertebrates can be determined by counting directly all individuals; as discussed above this is impossible with reptiles because not all individuals of any one species can ever be located. Long-term and intensive studies on small populations of some reptile species may provide information which could be used to calculate an index of population size but abundance cannot be measured on a large scale. Distribution of reptiles could usefully be monitored if sufficient information was available to establish a 'baseline' distribution map.

For this purpose the 1km distribution maps as used by The Dorset Natural History & Archaeological Society (see Thomas & Webb 1984 for an example) or the Sheffield City Museums (Whitely 1979) for illustrating the distribution of wildlife would seem to be particularly suitable. A scale of 1km would not enable the precise location to be identified but this scale is small enough to provide a good basis for detection of change in distribution patterns. Used in conjunction with more detailed monitoring of selected habitats, this approach could play an important role in the conservation of New Forest reptiles.

The task of mapping and then monitoring would require a lot of effort and the success of the venture would depend very much on the enthusiasm of participants. A centre for the processing of records and preparation of the maps would also be required for this venture; is

it perhaps a task for the Hampshire Field Club and Archaeological Society? With the ever increasing demands on the New Forest and the decline in the number and quality of wildlife habitats, the effort involved would surely be justified. One similar survey of reptiles and amphibians in the nearby Southampton area has been commenced by the Southampton Historical Society and this survey could usefully be extended to include the New Forest.

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