

REPRODUCTIVE BEHAVIOUR OF THE SAND LIZARD, *LACERTA AGILIS*, IN SOUTH-EASTERN DORSET, WITH A NOTE ON HABITAT MANAGEMENT

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INTRODUCTION

These observations form part of a general long term herpetological study in the area described. The Sand Lizard, *Lacerta agilis*, in Britain is at the extreme north-western edge of its range. Here it is a rare species and considered endangered enough to warrant protection through both national and international legislation. South-east Dorset is recognised as the last remaining stronghold for the species, containing 90% of the United Kingdom population (Moutlon & Corbett, 1999). It is here in this region that the Sand Lizard can still often be described as locally abundant. Such areas are exemplified by optimum habitat conditions or *foci*. These foci are essentially areas of mature dry heath with plenty of exposed sand and typically with a south-facing aspect. Areas of exposed sand are an essential prerequisite for successful egg deposition. All observations by the author were undertaken in such high profile areas over a period of five years or more.

STUDY AREAS AND METHODS

Specifically, the study sites are all contained in the Wareham and Purbeck area of Dorset and as already stated are all considered to be first class habitats. These foci are typically areas of mature lowland heath forming a rich mosaic in conjunction with associated heathland plant species. Many of the sites have been maintained or improved by active habitat management. Some sites are situated on fairly level ground, some along shallow ditches or gullies, and others on steep slopes. Most have a southerly aspect and in total area the study areas embrace eight separate

locations and all exhibit microhabitats well suited for the Sand Lizard. In fact, all six species of reptiles were present in good numbers throughout the study areas.

For the purposes of this particular study no lizards were actually handled; it was essentially an exercise of patient observation. The study was purposely female-biased and individual lizards were identified by photographing and recording dorso-lateral occuli markings. The general ground coloration also proved to be a valuable guide and this was seen to vary considerably even within local communities. Typically, ground colour can be virtually any shade of brown, yellowish, or light to dark grey.

The study areas were visited throughout the active period, April through to September, three or four times a week as weather permitted. From 1997 onward the study areas were visited more frequently during the later months specifically to record the occurrence of second layings and hatchings.

RESULTS AND DISCUSSION

It has been stated that the mating period for the Sand Lizard in England is at a peak in May, with egg laying occurring in late June and through July (Smith, 1951). Observations for this study have shown a peak egg-laying period for the middle of June. During 1999, for example, 70% of the study animals laid in the period between 9th and 18th June. This was not expected, for also in 1999 fighting males and mating pairs were observed between 28th April and 14th May, which represented approximately 60% of the total adult sand lizards regularly observed throughout the study areas.

During the study period observations were made where mating and egg-laying occurred simultaneously. This obviously involved separate individual females but was often seen to happen on the same day, and on three occasions within the same restricted egg-laying area. In one instance a female excavating a nest burrow was observed to become aggressive when disturbed by a mating pair. The female backed into the burrow with

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mouth gaping. Nest burrow excavation only continued when the female appeared satisfied that the mating pair had gone. Over a five year period results show an overlap of mating and egg-laying of around 14 days. It is perhaps interesting to note, but by no means conclusive, that many of the late matings involved young females probably in their first breeding season.

The occurrence of second laying has become apparent in recent years and with regard to this study involves approximately 25% of the study animals. The peak period for second laying appears to be from the middle to late July. However, despite careful searches, no mating activity was observed in the weeks prior to second laying, and in addition most adult males were seen to have dispersed to feeding grounds some distance away. This suggests the possibility that female Sand Lizards are capable of storing sperm in the short term. The likelihood of sperm retention is perhaps enhanced when further considering that in addition to the actual location of adult males these are unlucky to be in prime breeding condition at this time. There are a number of Sand Lizard captive breeding projects in progress, some of which have exhibited second layings, and it is interesting to note that here also no late matings have been observed (M. Preston, pers. comm.). Sperm storage is known in other reptile groups (Gist & Jones, 1987; Luiselli, 1993).

Throughout the study period close attention was given to the actual behaviour of individual female Sand Lizards during the egg-laying period. At around the second week of June many females were seen in exposed places exploring possible nesting sites. During these occasions they appeared vulnerable and certainly allowed a close approach, often within a metre. With care it was possible to follow a female and observe the efforts of each exploratory digging. Some females were seen to engage in up to eight such trial digs, while others appeared less fussy and made a positive burrow after just one or two tries. In areas that exhibited natural bare areas of sand, females were seen to excavate within a metre of good cover. Even so, female Sand Lizards appear to be



Sand Lizard nest burrows, Purbeck, Dorset. Photo by author.

especially vulnerable when busy excavating the nest burrow. Although it may be close to cover, digging with the head down the burrow makes a good target for a predator. However, female Sand Lizards were seen not to be totally oblivious to danger. All the females observed while digging retreated from their burrows and had a good look around every ten seconds or so. During the egg-laying period female Sand Lizards were seen to be bold and aggressive, and the intensity of boldness varied between individuals. The most usual behaviour was that if a female was disturbed when digging it would scuttle off into cover but return in a couple of minutes, often much sooner. Some females, however, would not retreat but stand their ground and gape with body arched; others appeared to be quite oblivious and would simply carry on digging. When disturbed by a pony, one notable individual just stood its ground with mouth agape in defiance. The boldness of female Sand Lizards during egg-laying has been observed by others over the years (Munro, 1967; D. Bird, pers. comm.).

Observations were also made regarding the interaction between breeding female Sand Lizards. This was particularly apparent in the study areas with a high population density. Behaviour of female Sand Lizards toward each other was seen to



Sand Lizard, *Lacerta agilis*; female excavating nest burrow. Purbeck, Dorset. Photo by author.



Female excavating nest burrow. Purbeck, Dorset; May 2000. Photo by author.



Defensive behaviour of female near nest burrow. Purbeck, Dorset, 1999. Photo by author.



Female entering nest burrow. Purbeck, Dorset; May 2000. Photo by author.



Female laying eggs. Purbeck, Dorset, 1999. Photo by author.



Sand Lizard nest site after egg-laying. Purbeck, Dorset, 1999. Photo by author.

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be inconsistent; some tolerated intruding females, even allowing them to excavate a nest burrow just a short distance from their own. On one occasion two females digging in the same patch of sand were observed to exchange burrows, each laying their eggs in the other's burrow. Other females were very territorial, chasing off intruders and even biting if the chance arose.

The total amount of time taken to excavate the burrow, lay the eggs, and then cover the nest, varied considerably. A number of factors were involved, not least the weather; if it was too hot or raining then the lizards would retreat into cover. Similarly, if disturbed too often this obviously had a disruptive effect. The nature of the substrate also seemed to be an important consideration; even though they were excavating with much enthusiasm, some lizards suddenly stopped and moved elsewhere. This was after all other exploratory efforts, and on examining such a burrow it would be found to have an obstruction in the form of a stone or root. On two of the study areas the lizards sometimes dig into clay spoil; this was hard work for the lizard but it was still successful and many Sand Lizards have been hatched from these sites. On good, loose, sandy soil, a female Sand Lizard can complete the whole task of excavating, egg-laying, and nest-covering in as little as thirty minutes, although the longest session recorded, in sand, was 2½ hours. In clay spoil, a total time of 3 hours is not unusual.

NOTES ON HABITAT MANAGEMENT

The habitat requirements and the relevant management strategies for the Sand Lizard in Britain are now well known and documented (Moulton & Corbett, 1999). Despite this information, more general management techniques which include grazing, burning, and mowing, are still being employed on foci to the detriment of the Sand Lizards and other reptiles. Grazing, for example, is more applicable to wet heath areas, but where stock is allowed to roam at will it causes serious erosion and presents a particular threat to egg-laying sites which eventually may become habitual thoroughfares for



Excavation at Sand Lizard management site, Wareham, Dorset. 1999. Photo by author.

ponies and cattle. It is appreciated that these general management policies have been implemented as a long term strategy for maintaining and restoring heathland. However, in areas where rare species foci have been confirmed it is necessary for management techniques to conform to guidelines as set out by specialist groups such as The Herpetological Conservation Trust. A positive part of Sand Lizard management is to create and maintain areas of expose sand; this complements any existing natural exposure and provides a boost for breeding potential and population expansion. Depending on topography, an area of focus should contain between 2 and 20% of bare sand.

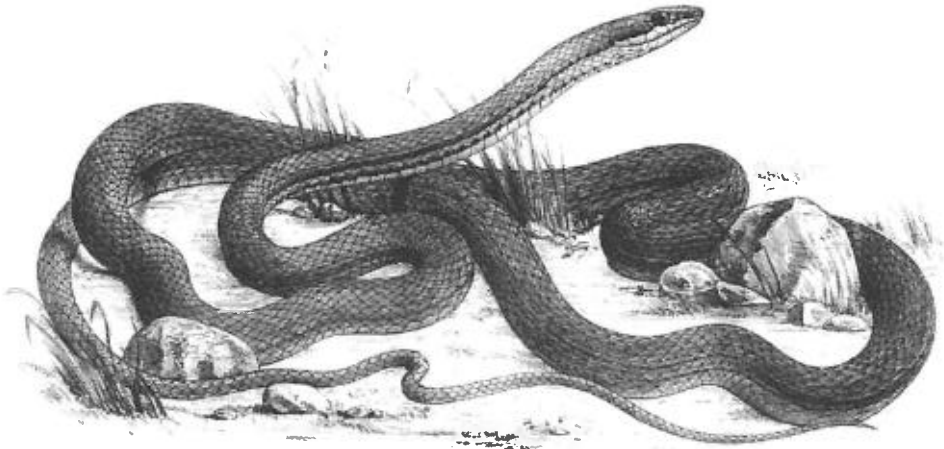
There are a number of ways of creating sand patches. On steep slopes or areas without vehicular access 'turbing' is the only option. This involves removing turves with a spades to a depth where clean bare sand is exposed. These patches are typically 2 x 1 metre in size. When practical, sand is exposed by mechanical means and such excavations usually follow natural features such as banks and tracks in the form of strips.

Sand exposure is a management feature of several of the study areas and these have been monitored carefully since their creation. Although clearly successful, it is hard to define just how successful. The number of lizard sightings alone may not be enough until correlated with records

begun prior to active management (in prep.). Although there is no ideal size for a mechanically created sand patch it is thought that apart from such features as firebreak edges and sandy tracks, the creation of very large patches should be discouraged. On one study area sand patches have been created which measure about 9 x 3 metres. Observations here have shown that both male and female lizards move around these patches well away from cover. On three occasions nest excavation was seen to take place more than two metres away from cover. This also meant that the subsequent hatchlings would be particularly vulnerable. Other reptiles, particularly the snakes, were seen to lie out on the peripheries of such patches. Potential avian predators were also often seen around these patches and included Buzzard (*Buteo buteo*), Kestrel (*Falco tinnunculus*), Carrion Crow (*Corvus corone*), Magpie (*Pica pica*), and Pheasant (*Pasianus colchicus*).

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Sonoran Whipsnake (*Masticophis bilineatus*) from a lithographed plate in *Biologia Centrali-Americana* (Albert C.L.G. Günther, 1902). Reproduction courtesy of The Natural History Museum, London.