Sand Lizard (*Lacerta agilis)* Breeding and Reintroduction: Optimisation of Protocols

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The sand lizard (*Lacerta agilis)* is Britain's rarest lizard and a European Protected Species. Due to loss, degradation, and fragmentation of favoured dry heath and coastal dune habitat in the nineteenth and twentieth centuries, sand lizard populations in the country were left small and isolated. Reintroduction efforts over the last fifty years have utilised a captive breeding programme, now coordinated by the Amphibian and Reptile Conservation Trust, to return the species to its former range in areas of restored habitat. Conservation charity Marwell Wildlife, who owns and operates Marwell Zoo near Winchester, Hampshire, has been involved in the captive breeding programme for over thirty years, initially providing lizards for release at sites in the New Forest. Their involvement since has extended across southern England, within the range of the genetically distinct Dorset race. Marwell Zoo is home to an adult captive-breeding population of sand lizards that lives in a large naturalistic south-facing outdoor vivarium in a quiet, off-show area. This offers ample opportunities through sandy soils and heterogeneous vegetation structures for basking, sheltering, oviposition and brumation (Fig. 1). Sand lizards typically emerge post-winter in March/April, begin breeding in May and lay their eggs in June and July. Locations of the back-filled test burrows dug by females are noted before eggs are carefully excavated (Fig. 2) and artificially incubated until hatching 4-6 weeks later, in July and August (Fig. 3). In favourable spring and summer conditions, mature females often lay two clutches. Hatchlings are kept in smaller outdoor vivaria until release, typically in early autumn.

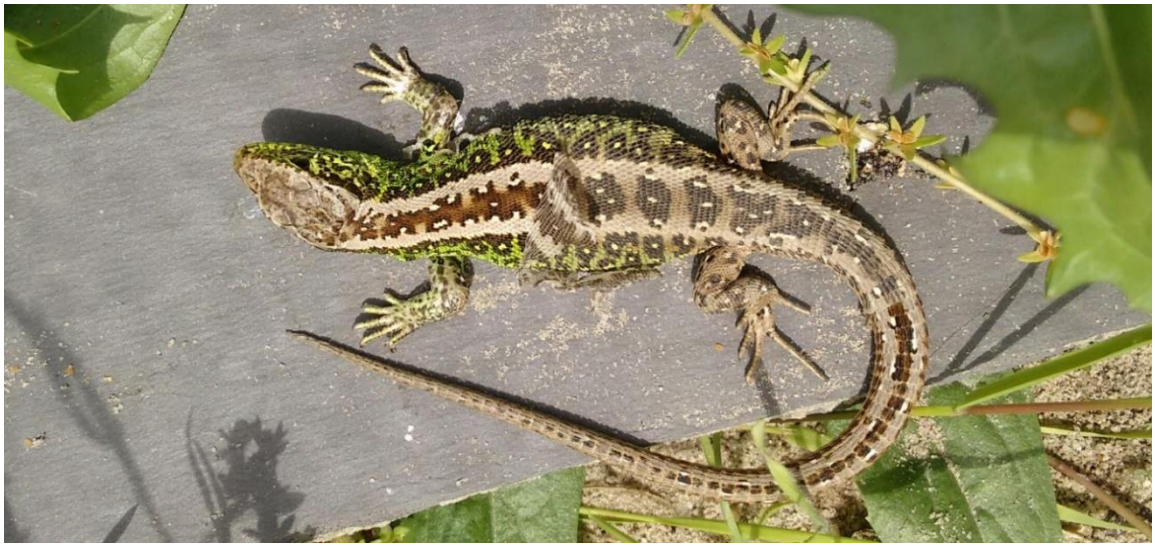

Fig. 1. Adult male sand lizard basking in vivarium at Marwell Zoo. (Photo: R. S. Gardner).

The vivaria are surrounded by an outer breezeblock and mesh enclosure with electric fencing to prevent avian and mammalian predation. The wild invertebrate food source is supplemented by vitamin-dusted black crickets of appropriate sizes for adult and hatchling lizards. During warm conditions, the vivaria are misted with rainwater. The captive breeding population undergoes late spring (adult) and pre-release (juvenile) health screening annually.

Sand lizards are a cryptic species and typically poor users of reptile refugia (also termed artificial cover objects), a common reptile survey tool; this raises challenges for monitoring in the field. During a PhD, joint-funded by Marwell Wildlife and University of Southampton, three cohorts of approximately 80 sand lizards were released at Eelmoor Marsh SSSI, Farnborough, annually between 2017 and 2019. Data were collected pre-, during, and post-release to inform and make recommendations for optimising longstanding reintroduction protocols (Fig. 4). The research assessed: spatiotemporal behaviour of sand lizards, considering microclimatic, microhabitat and for sand demographic factors; best survey protocols for sand lizards and the widespread native reptile assemblage, accounting for environmental conditions; and demographic and individual factors affecting post-release movement and survival of released lizards. Individual lizards, identifiable by unique dorsal ocelli patterns, were followed from hatching through to release and establishment at the site. Behavioural and morphometric data enabled individual differences to be incorporated into analyses, with broader demographic variables also considered, in relation to post-release survival and movement. Systematic surveys within the dry heath at Eelmoor Marsh during the reptile active season followed each release for a full year. Oviposition was observed in 2019 and a wild hatchling sighted in 2020. Research data are currently being prepared for publication. Monitoring and management continue at the site, ensuring open sandy areas and varied habitat structure to support persistence of the population into the future.

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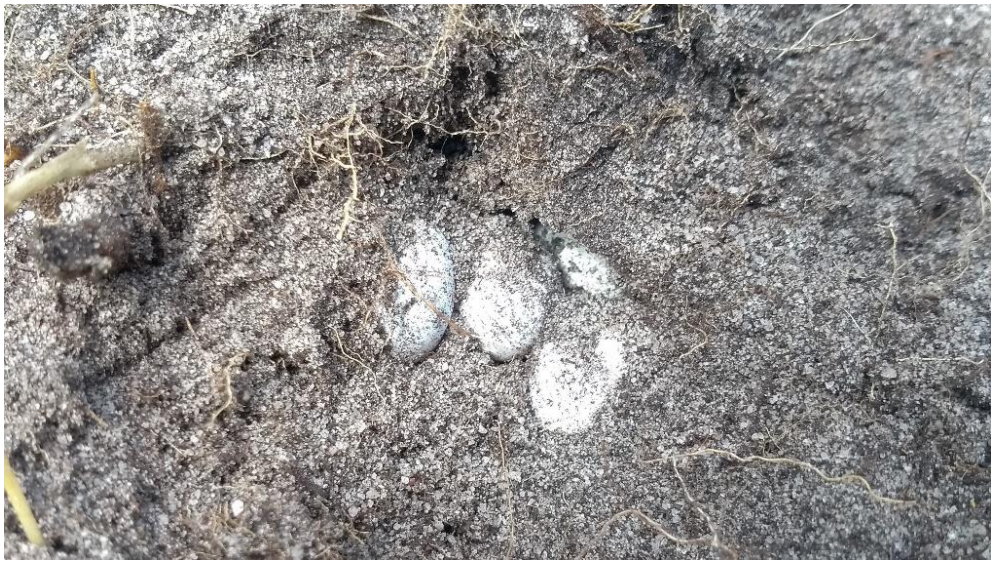

Fig. 2. Sand lizard egg clutch *in situ* during excavation at Marwell Zoo. (Photo: R. S. Gardner).

Fig. 3. Sand lizard hatchlings during transfer from incubation tub to rearing vivaria at Marwell Zoo. (Photo: R. S. Gardner).

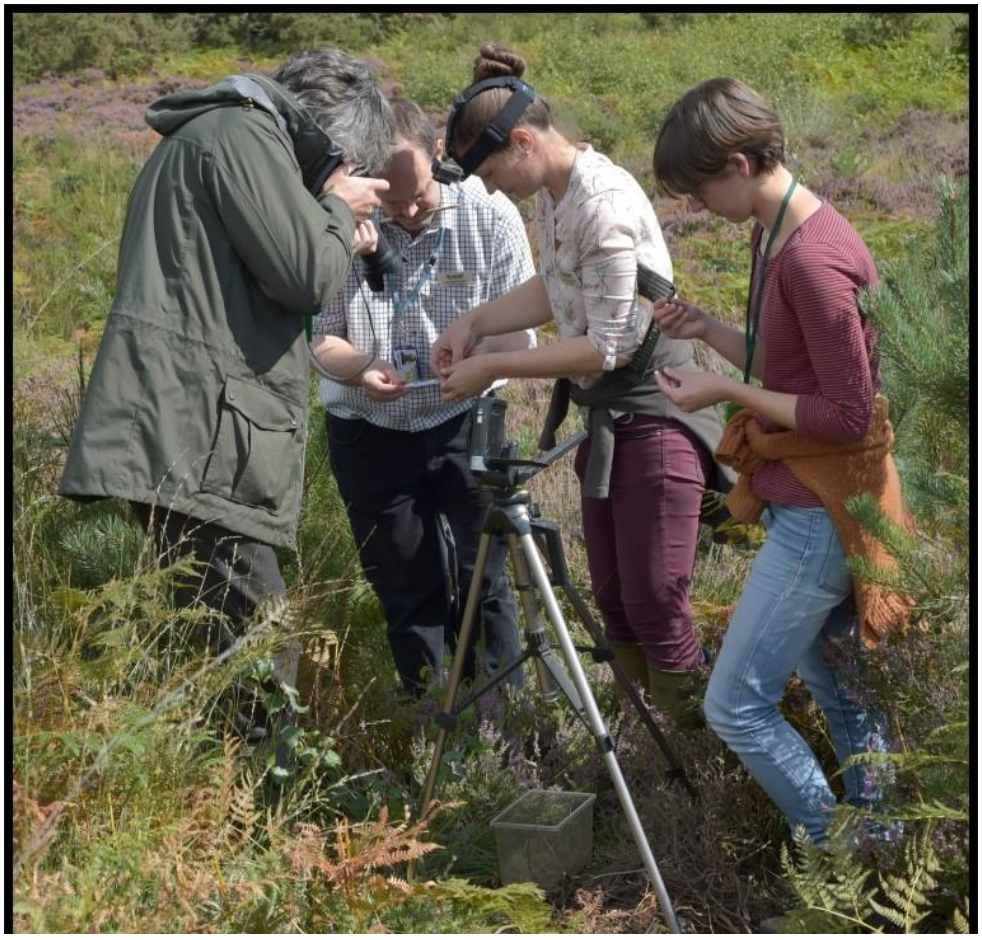

Fig. 4. Data collection during first of three sand lizard releases at Eelmoor Marsh SSSI, in 2017. (Photo: Paul N. Drane).