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**A CAPTIVE BREEDING AND RELEASE PROGRAMME
FOR SAND LIZARDS AND NATTERJACK TOADS
AT MARWELL ZOOLOGICAL PARK:
AN APPEAL FOR SPONSORSHIP.**

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THE DECLINE OF THE SAND LIZARD

The Sand Lizard (*Lacerta agilis*) in Britain is confined to mature dry heathland in the south plus a few coastal dune systems, including the most northerly population on Merseyside (Frazer 1983, N.C.C. 1983). Lowland heath is an endangered habitat and much has been destroyed by housing and industrial developments, roadbuilding, agricultural reclamation, the planting of conifers, military activity and mineral extraction (N.C.C. 1983, Tubbs 1985, Webb 1986). The remaining areas are now fragmented and far more vulnerable than the vast heaths of Thomas Hardy's day to fires, trampling, erosion, motorcycle scrambling and the spread of bracken, scrub and trees. These factors together with illegal collecting (mostly by small boys), predation by cats and the gassing of rabbit burrows, often used for hibernation, can all lead to local extinctions of Sand Lizards (Corbett 1988a, Corbett & Tamarind 1979, N.C.C. 1983).



Plate 1. Male Sand Lizard (*Lacerta agilis*).

AS A RESULT THERE HAS BEEN A 73% LOSS OF SAND LIZARD COLONIES IN RECENT YEARS.* In Dorset the known colonies (concentrations of breeding adults) have been reduced from 169 to 24 over 15 years. All known breeding populations in the New Forest are extinct and only a handful survive in Surrey and on Merseyside. Dorset remains the stronghold of the Sand Lizard but heathland is still being destroyed at an alarming rate there (Edgar 1988). Some experts estimate that less than 5000 adult Sand Lizards remained in Britain in 1987 (Corbett 1988a) and this figure is undoubtedly lower today as the pressures on their habitat have continued.



Plate 2. Gravid female Sand Lizard (*Lacerta agilis*).

THE DECLINE OF THE NATTERJACK TOAD

The Natterjack (*Bufo calamita*) is confined to heathland and coastal dunes and marshes (Beebee 1983, Frazer 1983, N.C.C. 1983, Smith 1973). It was once widely distributed on many sandy coasts in the south, east and north-west of Britain and some 70 inland heaths, in East Anglia and southern England. Many of the reasons for the decline of the Sand Lizard also apply to the Natterjack and, in addition, this amphibian has been affected by pollution, drainage, acid rain and increased competition from Common Toad and Frogs as a result of habitat changes (Beebee 1983, N.C.C. 1983).

THE NATTERJACK TOAD HAS SUFFERED A VERY SEVERE DECLINE OF 95% IN LESS THAN 40 YEARS*. It is now confined to about 30 coastal sites in north-west Britain and East Anglia and just 2 inland heath sites, 1 in Norfolk (where the colony is all but extinct) and 1 in Hampshire (N.C.C. 1983).

THE B.H.S./MARWELL PROJECT

BACKGROUND. The endangered status of the Sand Lizard and Natterjack Toad is recognised in their protection under the Wildlife and Countryside Act 1981. It is illegal to disturb, catch, kill, possess or sell any individual without an appropriate licence, issued by the Nature Conservancy Council. Their habitat is also afforded some protection under this Act, but in practice a loop-hole clause allows destruction or damaging actions which were "the incidental result of an otherwise lawful operation and could not reasonably have been avoided". Consequently the granting of planning permission on a heathland site overrides the Wildlife and Countryside Act and, for example, legalises the destruction of an entire Sand Lizard colony (Corbett 1988b, Edgar 1988).

The continuing loss of colonies of both species (especially the Sand Lizard), through destruction or lack of management, places them in a more and more precarious position in Britain. Even National Nature Reserves are not immune to severe fires (Moore 1976) and each accidental, or otherwise, local extinction threatens the status of these animals in Britain still further. Spellerberg and House (1982) describe the rescue of a Sand Lizard colony on a burnt heath by moving the surviving animals to a large, on-site vivarium where they were safely housed until the habitat had suitably regenerated. After several years the lizards were released and successfully recolonised the heath (Spellerberg 1988).

In many cases, however, Sand Lizards and Natterjacks have already disappeared from heaths which are now surrounded by unsuitable habitat. Amphibians and reptiles have very poor dispersal abilities and often the only way they can recolonise such heathland "islands" is to be physically taken there and released by man. This practice, called translocation, is a proven conservation technique (N.C.C. 1983), already employed by the B.H.S. Conservation Committee with good results. Several Sand Lizard colonies, in particular, have been established in this way and are thriving many years after the initial releases.

CAPTIVE BREEDING. Translocations require a number of animals for starting new colonies and these can sometimes be obtained from areas that are being destroyed for development. Such rescues (Edgar 1988) should not have to be necessary at all for a protected species and are a very poor alternative to actually conserving such sites. Hopefully, and perhaps over-optimistically, this source of animals for translocations will disappear if the government and local councils start to live up to their self-stated green images, and take their conservation responsibilities seriously. Whatever the origin of the animals, it makes sense to attempt to breed some in captivity, so that larger numbers are available for translocations on a regular basis. If successful, captive breeding removes the need to take animals from the wild once the initial breeding stock has been obtained.

The B.H.S. Conservation Committee has bred Sand Lizards and, to a lesser extent, Natterjack Toads for many years, under licence from the Nature Conservancy Council. Most vivaria are in members' back gardens, which limits their size and the number of animals that can be housed. In 1989 the B.H.S. Conservation Committee established two large, outdoor, heathland vivaria in the grounds of Marwell Zoological Park, near Winchester, to increase its output of captive bred Sand Lizards and Natterjack Toads (Edgar 1988).

THE MARWELL VIVARIA. The Sand Lizard vivarium is 12 x 5 m, while the Natterjack enclosure measures 6 x 5 m. The original chalky soil was excavated to a depth of about one metre and the holes filled with some 50 tonnes of brick rubble, slates and drainage pipes (to facilitate drainage and provide hibernacula) and 90 tonnes of sand. The sand was obtained from a development site on Canford Heath, Dorset, which was also the source of the heather used and some of the Sand Lizard breeding stock. The vivaria were then planted with some 300 heather plants. A third of these are mature plants, which were delivered with the sand, and the rest are young plants, regenerating after a fire, which were dug up by hand. Smaller heathers seem to survive relocation better, probably because their root systems can be kept more intact. Despite the move, and the 1989 drought, only about 20 plants appear to have died in the vivaria.

Ling, *Calluna vulgaris*, dominates the vivaria, as it did the donor site, but Bell Heather, *Erica cinerea*, Cross-Leaved Heath, *Erica tetralix*, Dwarf Gorse, *Ulex minor*, and various heathland grasses (*Molinia* and *Agrostis*), flowers, mosses and lichens are also well established. The Natterjack vivarium has large areas of open sand (preferred by this species), stabilised with logs, and a site for installing a butyl liner each spring, to create a shallow, temporary pond. The Sand Lizards have extensive vegetation cover and a patch of bare sand for egg-laying. The site is on a sheltered, south-facing slope and the vivaria have been landscaped to provide a varied topography for the animals (see Plate 3). The vivaria walls are constructed of perspex sheeting and both enclosures are protected from birds by a large fruit cage. This also has additional rat and rabbit-proof wire mesh round its base. There is some scope at Marwell for the building of further vivaria, depending on the success of the project and sponsorship appeals.

BREEDING STOCK. Every effort has been made to create optimum surroundings for the animals and, since Marwell is well within the normal climatic range of both species in Britain, breeding occurs naturally. Sand Lizards both rescued and captive bred by the B.H.S. Conservation Committee are providing the original breeding stock. Breeding will commence this Spring and it is anticipated that the colony will consist of about 5 males and 25 females (2 males and 5 females were obtained in 1989). Assuming an average clutch per female of 8 eggs (from previous B.H.S. captive breeding work) then the Marwell vivaria should produce some 200 or more eggs each year, depending on the size and age of the females.

Some clutches will be left in situ, to incubate naturally, while others will be removed from the vivaria and incubated artificially to avoid the vagaries of the British weather. Since eggs do not require sunlight for their development, this is the only stage when anything will be done indoors as artificial lighting, however successfully lizards can be bred and reared under it, is not considered suitable for this project. Animals to be released into the wild need to be acclimatised as fully as possible in outdoor vivaria (the overall health and vigour of the parent lizards is also important) and there is simply no artificial substitute for natural sunlight.

The hatchling lizards will be reared in a separate heathland enclosure, within the main vivarium, so they attain a larger size and are better able to survive in the wild. As with current B.H.S. releases, some will be released in their first year (September) and the rest overwintered until their release the following Spring. The construction of the Marwell vivaria allows other B.H.S. Conservation Committee vivaria to concentrate on breeding, for example, the much rarer Surrey "race" of the Sand Lizard.

Natterjack toadlets were obtained in 1989 from a North East Surrey College of Technology/Sussex University project, looking at competition between anuran tadpoles. A limited number of eggs were removed, under licence, from the only natural Natterjack site in southern England for this project. Once they had metamorphosed, some toadlets went to Marwell and the rest were used for a re-introduction in Surrey. The Marwell Natterjacks (16 in all) are being reared to breeding size, which should be attained in 1991 or 1992, because mature adult toads are just too rare to take from the wild.

The use of ephemeral water bodies by breeding Natterjacks negates the installation of a permanent pond in their vivarium. A shallow depression has been made and a butyl liner can be laid here and filled with water each Spring, once breeding commences. When breeding has ceased this liner can be removed to create a large patch of open sand again. Spawn strings, tadpoles or toadlets can all be used for translocations of Natterjacks. The mortality rate in the early stages of Natterjacks' lives is very high (Beebee 1983, N.C.C. 1983) so as many tadpoles as possible will be reared outdoors through to metamorphosis and several months beyond. The excess spawn can be moved to translocation sites soon after it is laid. As long as enough food is provided, the rearing of Natterjacks is relatively easy and growth can be rapid (Jones 1984). Survival can be greatly increased by rearing tadpoles and toadlets in the absence of predators. Some individuals, however, lack vigour, despite abundant food, and grow slowly, feed poorly and die at an early stage (pers. obs. and R.A. Griffiths, pers. com.). This may be an artifact of intra- and/or interspecific competition in the tadpole stage, or be a genetic phenomenon.

RESEARCH. The rearing of "weak" individuals for release, i.e. those that are weeded out of a wild population by predation etc., is a criticism sometimes levelled at this type of project. Long-term monitoring of both Sand Lizards and Natterjacks at the release sites is therefore imperative. Conducted properly, such research will provide information about the survival rates and dispersal of captive bred animals, released at different ages, in varying numbers and on a variety of sites, as well as the overall success of translocation as a conservation tool. It is often difficult, costly and time consuming to achieve significant, worthwhile monitoring results in the field, and there are also numerous variables to be taken into consideration, but this is one aspect of the project that cannot be ignored.

In addition, research on the reproductive biology and behaviour of captive animals can be valuable, especially when they are housed in semi-natural conditions and the results are compared to those obtained in the wild. The B.H.S. Conservation Committee is experienced in the captive breeding of Sand Lizards, and members have already made many useful observations. Producing hatchlings of this species is relatively straightforward. Breeding Natterjack toads, however, has proved to be a more hit and miss affair (T.J.C. Beebee pers. comm.). Research is planned on their husbandry, reproduction and behaviour in captivity, with the aim of improving the breeding results for this species.

TRANSLOCATIONS. Sites for the release of captive Sand Lizards and Natterjacks have to be very carefully selected, meet several criteria, and then be approved by the Nature Conservancy Council. They should be fully protected and in areas where the species once existed. The



Plate 3. The B.H.S. vivaria at Marwell Zoological Park. The Sand Lizard vivarium is shown and partially obscures the Natterjack enclosure in the background.

habitat should be suitable, and properly managed, and it is essential to ensure that the factors contributing to the previous extinction are now absent. It is also important that the various local races of each species (e.g. Surrey and Dorset Sand Lizards or heathland and coastal dune Natterjacks) are maintained as discrete populations, and are not able to interbreed, either in vivaria or the wild. Agreed translocation policies (B.H.S. Conservation Committee 1973, N.C.C. 1983) will be adhered to when Marwell bred animals are released.

Only one natural Natterjack colony has survived in southern England, but B.H.S. translocations are now re-establishing this species. Toads bred at Marwell in the future will be utilised for releases in Surrey, and possibly Hampshire and Dorset if suitable sites can be identified. In the case of Sand Lizards, the Conservation Committee's work has already been very successful in the Weald. It is proposed that Marwell bred lizards be used to re-introduce this species to the New Forest. This is to be a joint venture, combining Sand Lizards from Marwell with those bred by the Forestry Commission at Holidays Hill Reptiliary, near Lyndhurst, and by Martin Noble, Head Keeper (New Forest South).

HEATHLAND MANAGEMENT. Maintaining the natural and complete life cycle of heather, and preventing scrub and woodland succession, is the object of present heathland management for these species. Both Natterjacks (Beebee 1979) and Sand Lizards (Corbett & Tamarind 1979) require the maturer stages of heather development (see Figure 4) where they occur on heathland. Although fire is an often used method of managing heathland (Webb 1986), it tends to have disastrous consequences for these species, especially on isolated fragments of habitat. Sandy fire breaks therefore reduce the risk of a whole site going up in flames at once. As Sand Lizards require unshaded areas of bare sand for egg laying (Corbett & Tamarind 1979, Strijbosch 1987), firebreaks also act as an important habitat feature. Small patches of open sand, abundant before myxomatosis reduced the rabbit population, are also created for this purpose.

Plants which would ultimately shade and kill the heather, such as pine, birch, gorse and bracken, are removed from the best areas, leaving some for other wildlife to use. Succession in its early stages may increase the density of invertebrate prey, and have a sheltering effect, but must be brought under control by management before a release can occur. Overgrowth of heather by introduced pines, or other species, is detrimental to both Sand Lizards (Corbett & Tamarind 1979) and Natterjacks (Beebee 1977). In the latter case, not only do physical



Plate 4. Mature heather (*Calluna vulgaris*) in the New Forest (for scale; the dog is sitting up). The burning of heather too frequently, so it cannot reach this stage, is suggested as one of the causes of the Sand Lizard's extinction in the New Forest. This practice is now more strictly controlled.



Plate 5. Heathland nature reserve in Dorset, with a south to south westerly aspect, mature heather, few invasive trees or scrub, and an adjacent wet heath. An increasingly endangered habitat, often viewed as either wasteland or prime real estate.

habitat changes adversely affect the Natterjacks, but may also favour Common Toads and lead to destructive competition. Before releasing Natterjacks onto a site with suitably managed terrestrial habitat, it may be necessary to create shallow ponds for breeding and monitor the water pH to ensure it is kept at a suitable level for the toads.

Some heathland owners are increasingly sympathetic towards these management techniques. The only Natterjack colony in southern England, for example, has survived because of the co-operation of the Ministry of Defence, which owns the site, and the local Council with conservationists. The Forestry Commission is now very supportive towards herp conservation and is carrying out extensive management, in its New Forest enclosures, to prepare sites for Sand Lizards reintroductions. The attitude that heathland is waste ground is still widespread, however, and planning proposals have to be fought every step of the way, often unsuccessfully. Despite the fact that lowland heathland is extremely scarce on a world scale, and that Britain possesses more than any other country, current British wildlife laws still do not give this internationally important habitat the type of protection needed to prevent further losses.

HEATHLAND PURCHASE. Captive breeding is merely an adjunct to habitat protection and management: there is not much point breeding a species if there is no habitat for them in the wild. The only sure way of safeguarding heathland sites is to purchase them. The B.H.S. Conservation Committee Land Fund (Banks 1987, Edgar 1988) was established to buy and lease areas of heathland as rare herp. reserves. Such reserves secure heathland against future development and benefit the full variety of plants and animals that depend on this important habitat for their survival. Sponsorship in excess of the Marwell project's requirements, estimated at £3-4000 per annum, will be donated to the Land Fund at the end of each year. Marwell Zoological Park already has an outstanding record for the captive breeding of foreign animals, and their return to the wild, and was very keen to help the Conservation Committee's work on two endangered British species and their habitat.

EDUCATION. Few members of the public have much sympathy for, or knowledge of, amphibians and reptiles so education is very important in their conservation. Marwell Zoological Park has over 250,000 visitors a year, and generates a lot of media coverage, and makes an excellent venue for publicising the Conservation Committee's efforts on behalf of rare herps and heathlands. The main vivaria are off-exhibit (except to sponsors), to avoid disturbance from so many visitors, but a display about the project is on view to the public. It is hoped that a walled vivarium will be built in the future to house some of the captive bred Sand Lizards for public view. The Education Department at Marwell is very involved in the project, and has prepared lectures for visiting schools about British amphibians and reptiles and their conservation. The author has also visited several schools to talk about the project, which has resulted in a variety of fund-raising efforts organised by the children themselves. Finally, the Marwell Oryx Club (the junior version of the Marwell Zoological Society), which has over 400 members, raised most of the money to pay for the vivaria and provided several volunteers to help with their construction.

SPONSORSHIP. The Sand Lizard and Natterjack project at Marwell is funded entirely by sponsorship and is independent of the zoo's other activities (because it is off-exhibit). The B.H.S. Conservation Committee and Marwell Preservation Trust are only able to afford limited financial support, as this is just one of many activities with which both are concerned. To ensure that the work continues the rest of the money needed must be obtained from members of the public, trusts, businesses, councils, and schools. Money is required for general running costs (enclosure maintenance, food bills, incubators and so on), expenses for those working on the project, research equipment, education, publicity, administration and monitoring of released animals.

If you would like to help support this B.H.S. project please complete and return the sponsorship form, sent with this issue of the Bulletin, together with your contribution. Donations of any size will be most welcome. The Marwell Preservation Trust Ltd. (M.P.T. Ltd.) is a Registered Charity, No 275433, so please indicate if you would like a deed of covenant form.

Please make cheques payable to "M.P.T. Ltd. British Herpetofauna Fund".

All sponsors receive regular information about the progress of the project. Remember that only sponsors are able to see the vivaria at Marwell, a good chance to see and photograph Sand Lizards and Natterjacks in a semi-natural setting. You should indicate on the form if you would like to attend a lecture about the project and view the breeding facilities in the warmer months. It is important to give prior notice of your visit so that the author or another Conservation Committee member can arrange to meet you. Financial constraints mean that you must pay the normal entrance fee when visiting Marwell to see the vivaria, although the rest of the zoo makes a good day out. However, those donating a minimum of £25 will be sent complimentary tickets, which allow you to enter Marwell free of charge. This does not include a car but there is a large, free car park at the entrance gate. Sponsors will also receive an acknowledgment in the public display, in the Marwell Zoo News and in updates in this Bulletin. Commemorative plaques, publicity and P.R. advice can also be arranged for companies or others interested.

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