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THE BRITISH HERPETOLOGICAL SOCIETY

BULLETIN

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BRITISH HERPETOLOGICAL SOCIETY

c/o Zoological Society of London
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Correspondence, membership applications, subscription renewals and purchase orders for the British Journal of Herpetology should be sent to the above address.

The British Herpetological Society was founded in 1947 with the broad aim of catering for all aspects of interest in reptiles and amphibians. Initiated by a small number of enthusiastic and well-known naturalists, including the first President and author of the standard textbook on British herpetofauna Dr. Malcolm Smith, the Society expanded rapidly and today enjoys national status with many international connections.

Activities of members range over a number of interrelated fields. In many cases the prime interest is in maintaining, breeding and observing various species in captivity and the Society acts as a forum for the interchange of experiences in this area. Others are concerned with the observation of animals in the wild state. There are active sub-committees which help to cater for these various tastes, notably the Captive Breeding Committee and the Conservation Committee. The former encourages the development of effective breeding techniques for captive specimens, thus providing animals for observation and study in vivaria, and for conservation purposes, while simultaneously reducing the need to take fresh stock from wild and possibly declining populations. The Conservation Committee is actively engaged in field study, conservation management and political lobbying with a view to improving the status and future prospects for our native British species. It is the accepted authority on reptile and amphibian conservation in the U.K. and has an advisory role to the Nature Conservancy Council (the statutory Government body). There are also professional scientists within the ranks of the Society engaged in increasing our understanding of all aspects of reptile and amphibian biology.

Publications

British Journal of Herpetology, published each June and December, contains papers or original research in herpetology.

British Herpetological Society Bulletin, published quarterly, contains notices, news items, articles and original papers on all aspects of herpetology.

The Care and Breeding of Captive Reptiles, a new book containing a collection of papers on recent developments in breeding reptiles in captivity. This publication is not included in members' subscriptions, but is available to members at a price of £3.00. Applications to purchase should be made to the Chairman of the Captive Breeding Committee.

Conserving Sea Turtles, by Nicholas Mrosovsky. A critical review of the current problems and controversies of sea turtle conservation. Price U.K. £5.00 + £0.75 postage (surface mail) or £2.80 (air mail), U.S.A. $10.00 + $1.00 postage (surface mail) or £5.00 (air mail).

Meetings

About ten meetings covering a broad sphere of interests are held each year.

Subscriptions

Ordinary Members £15. Junior Members £5. (Junior Members do not receive the British Journal of Herpetology). Institution rates £25 (U.S. $40).
All subscriptions become due on the first day of January each year.

The Bulletin is edited and produced by
John Pickett and Mike Matthewson

Contributions and correspondence arising from the Bulletin should be sent to:
John Pickett, 84 Pyrles Lane, Loughton, Essex IG10 2NW

REMAINING MEETINGS 1985

OCTOBER 8th	Dr Andrew Laurie (Dept. Zoology, Univ. Cambridge): Marine Iguanas on the Galapagos Is. (Pacific Ocean) and El Niño.
OCTOBER 23rd	Dr Alan Charig (Chief Curator of Fossil Amphibians, Reptiles and Birds, Dept. Palaeontology, British Museum (Natural History), London): Dinosaurs: myths and misconceptions.
NOVEMBER 19th	Paul Edgar: Reptiles of Costa Rica.

NORTH EASTERN GROUP MEETINGS WINTER 1985

SEPTEMBER 13th	The captive breeding of king and rat snakes. D. Brownlea.
OCTOBER 18th	Paul Walker (University of Leeds): Tropical Amphibians (Asia)
NOVEMBER 29th	Noel Jackson: Reptiles and amphibians of the Mediterranean region.

All meetings are held at the Adult Education Centre, 32 Old Evet, Durham, starting at 7.15 p.m.

PORTSMOUTH REPTILE AND AMPHIBIAN SOCIETY

Meets 3rd Monday of every month at the Central Library, Guildhall Square, 7—9 p.m. Further information from: Bob King, 88 Oxford Road, Southsea, Hants, PO5 1NR. Tel: 0705 752086.

AFRICAN CLAWED TOAD SURVEY

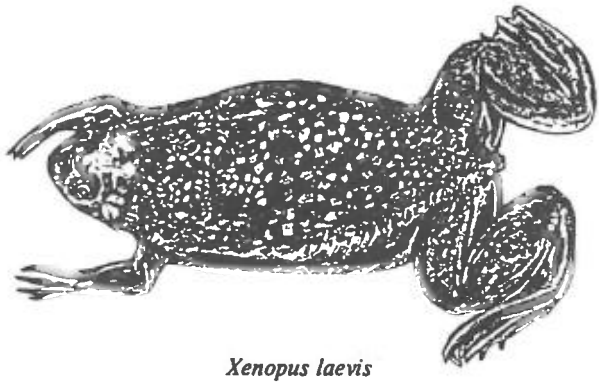
MARK P. SIMMONDS

Of the many species of amphibians introduced into the British Isles (see Lever, 1979) few, if any, would seem to have the potential for colonisation of the South African Clawed Toad *Xenopus laevis.*

Imported into many countries, once for use in pregnancy testing but more recently for schools and colleges, accidental and deliberate releases have led to the establishment of feral colonies. These exist in nine American States and on Ascension Isle (McCoid and Fritts, 1981) and in at least two areas of the British Isles. As there may well be others, a survey backed by the Nature Conservancy Council is in progress to determine the species' present distribution in the U.K.

Xenopus laevis is naturally found in ponds, lakes and even cool mountain streams in its native home. Man made dams and ditches seem readily colonised but determining the animals' presence may be difficult. They are almost wholly aquatic, feeding and breeding underwater, and would appear to venture onto land only very rarely and then during heavy rain. They possess a sensitive lateral line system, also present in fish but usually lost after the larval stage in the anura, and this ensures that they are aware of any vibrations near by. Despite frequently needing to come to the surface to breathe they expose only the tips of their snouts and nostrils. Thus, even by the most patient observer they may be rarely seen and especially so where there are emergent or floating plants.

A further problem to the survey may be difficulty in distinguishing *Xenopus* from native species. During an on-going 4 year study of feral clawed toads in South Wales the animals have occasionally been glimpsed by local people and often not recognised as exotic. Nonetheless, in many ways they are distinctly different from *Bufo* and *Rana.* They do not sit upright and hop or run on land but lie on their ventral surfaces with limbs outstretched and push themselves forward with their large, very muscular, hind legs. They are well camouflaged, usually with a dark brown and spotted dorsal surface. Ventrally they are much lighter and the hind legs may be yellow. The head, eyes and forelimbs are comparatively small and the latter used only to scoop food into the



Xenopus laevis

mouth. The large hind feet have veined membranes stretched between the toes; three of which bear small black claws. The filter-feeding tadpoles may prove useful in locating colonies. They can be visible in large shoals in clear water and the most obvious features of the largely transparent body are two tentacles, growing from the front of the head, two black eyes and a coiled, golden coloured, intestine. I would be most grateful for any reports of unusual "frogs or toads" in the British Isles and information may be sent to "Mark Simmonds, School of Biological Sciences, Queen Mary College, Mile End Road, London E1 4NS".

REFERENCES

Lever, C. (1979). *The naturalised animals of the British Isles,* St. Albans: Granada Publishing Ltd. 600 pp.

McCoid, M.J. and Fritts, T.H. (1960). Observations of feral populations of *Xenopus laevis* (Pipidae) in Southern California. *Bull. Southern California Acad. Sci.* 79(2), 82-86.

"EXOTIC ANIMALS IN THE EIGHTIES"

An International Conference on the health and welfare of exotic (non-domesticated) animals will be held in London from Friday 18th—Sunday 20th April 1986. The meeting will mark the 25th anniversary of the founding of the British Veterinary Zoological Society (BVZS).

This conference will include sessions on diseases, pathology, preventative medicine and welfare of vertebrates and invertebrates, with particular reference to species kept in captivity in zoological parks, in private collections and for education and research. The Proceedings will be published.

The provisional programme is as follows:—

Friday Opening and Introduction
a.m. Lectures and Discussion: Conservation and Zoological Medicine
p.m. Lectures and Discussion: Reproduction and Captive Breeding
Evening Reception and visit to Hunterian Museum, Royal College

Saturday
a.m. Lectures and Discussion: Welfare of Captive Wild Animals
p.m. Lectures and Discussion: Avian medicine; Anaesthesia
Evening Tour of London Zoo followed by formal dinner

Sunday
a.m. Lectures and Discussion: Reptiles; Fish and Amphibians
p.m. Lectures and Discussion: Open session
Summing up and close of Conference

Further details are available from Mike Chapman, MRCVS, 212 Brixton Hill, London SW2 1HE or via the Secretary or other members of Council of the BVZS.

POSTAGE STAMPS AND FIRST DAY COVER

In May 1986 the Post Office will be producing a special postage stamp issue with the theme 'Nature conservation — endangered species'. Appropriately, one of the four different stamps will feature a natterjack toad (the others being pine martin, barn owl and Scottish wild cat). This stamp issue has been designated as the Europa issue for 1986 — what this means is that other European countries will also issue stamps with the same theme on the same date, so there could be other stamps produced of interest to herpetologists.

To coincide with the British stamp issue, the BHS is producing a first day cover, featuring herpetology, the BHS, and the special issue stamps. The first day cover will consist of a specially produced envelope, with a colour picture of a Lancashire sand lizard, and the special issue stamps franked with a unique hand stamp which will have a simple herpetological motif. Inside the envelope will be a card with a short description of the BHS and the urgent need for conservation of our herpetofauna.

The costs of the first day covers will be as follows:

First day cover, with natterjack toad stamp	£1.75 + 25p postage & packing
First day cover, with all four special issue stamps	£3.75 + 25p postage & packing

The cost of the first day covers to BHS is nothing. However BHS will receive 50p for every one that is sold through the BHS, which could be a welcome sum in these days of ever rising costs. If you are not sure what a first day cover looks like, main post offices usually have a display showing the latest special stamp issues, often displayed on first day covers. First day covers are collectors' items, and often increase in value. So, if you are interested, watch out in the next Bulletin for more details.

CONSERVATION WORK IN EPPING FOREST

Epping Forest is unique in that its continued existence for the last 100 years has been due to a special Act of Parliament, the Epping Forest Act of 1878. The Act required that Epping Forest be administered by the Corporation of London, which employs the conservators of Epping Forest to carry out the various tasks necessary to 'maintain the natural aspect'. The Forest was originally part of the huge area of woodland that covered much of southern Britain, but it did not consist only of woodland, at least not during the last few hundred years. Deer and rabbits played their part in maintaining open areas by eating seedling trees along with other plants when they grazed, while local people had the right to turn their cattle into the Forest, which added considerably to the extent of grazing. Furthermore, Epping Forest was used extensively for timber, using a special method known as pollarding. Every fifteen years the crown of a tree would be cut, at about the height of a man's head. After another fifteen years the subsequent growth made substantial poles when cut.

Epping Forest then was a mosaic of woodland with areas of grassland, heath and recently pollarded trees. All these areas were, of course, suitable for our more common reptiles. However, pollarding stopped about one hundred years ago, the number of cattle grazed in the Forest is now a fraction of what is used to be, rabbits have declined and the herd of deer was rounded up and paddocked because they were suffering increasing disturbance. The result has been that open areas suitable for reptiles declined disastrously as they changed into woodland, until five years ago only a limited number of sites were suitable for reptiles, and fewer actually supported populations.

A small group of BHS members have been active over the last five years to help reverse this trend. Other groups involved in conservation management, but not only for the benefit of reptiles, have more recently also been involved, to great effect. Not only have the reptiles benefited, but herbaceous plants and insects have expanded their populations also. The sites we have worked on are now secured, with populations of slow-worm, common lizard, grass snake and adder, although clearance work must continue, to deter young trees and to expand the areas concerned. We need more help to continue the clearance work, which is mostly cutting trees and making wood piles, with some burning. The following dates have been arranged for this winter:

13 October 1985
10 November 1985
8 December 1985
5 January 1986
2 February 1986
2 March 1986
30 March 1986

If you would like to help out with this work, contact Graham Walters, 01-521 0134 or John Pickett, 01-508 6624.

A VIEW OF THE CONSERVATION COMMITTEE

HOWARD INNS

Newstead, Lodge Hill Road, Farnham, Surrey

Having been a member of the conservation committee of this society for some four years I sometimes feel that there may be members of the society who do not really understand what the conservation committee is all about. Every year our chairman, Geoff Haslewood, provides for the society's members a report of our activities throughout the year. This report is published in the Bulletin. My intention in writing this article is to try to give BHS members some more background to these activities and an idea of what it is like being a member of this part of your society.

My own interest in reptiles and amphibians started in a similar way to any herpetologist's, by collecting frog spawn and newts from local ponds and bringing common lizards home from holidays in Cornwall. In later years this interest developed more into going out looking for animals in the wild than spending my time at home looking after captive specimens. Owning a car enabled me to travel away from my home area of North West London to look for the rarer species, in all the wonderful places in Surrey and Dorset that I read about in Malcolm Smith's book. However places like Churt and Frensham in Surrey, where I expected to find Sand lizards leaping at me from every heather bush, did not live up to my expectations as I could find nothing but Common lizards and the occasional Adder.

I did find Sand lizards in Dorset but I was shocked when I visited some of the classic heaths around Bournemouth to find that they were burnt, overgrown and generally in a pretty grim state. This fruitless searching in Surrey and disappointment in Dorset led me to write to the conservation committee as I thought I could spend my time better doing something in an organised fashion rather than wandering aimlessly around the Surrey heaths. My letter was answered by Jonathan Webster who invited me to attend the first of the winter management tasks in Surrey. I agreed and drove down early one Sunday morning in September with some trepidation as my only other experiences of organised natural history jaunts were with local societies populated by elderly ladies whose sphere of awareness of the things around them did not extend beyond birds and wild flowers. Needless to say the people I met on this day were nothing like that but were friendly, open and enthusiastic. I realised several things on that first task, firstly that it can be quite warm in late September and cutting down pine trees makes you very thirsty, particularly if the only liquid you have is a flask of hot soup. I also realised that the people I was with knew an enormous amount about British reptiles and amphibians and the work they were doing had been carefully planned and well organised. That winter I went on most of the clearance tasks and from then on my interest in reptiles and amphibians has grown, as has my involvement with the conservation committee.

The duties of the committee, which has existed since 1969, are to understand the status and distribution of British reptiles and amphibians and advise on their conservation, to carry out habitat management to improve the status of these species and to carry out other projects which contribute to their conservation. The main emphasis is upon the practical management of the habitats in which the rarest of these animals live, in particular dry lowland heath — the home of the Sand lizard, Smooth snake and one of the habitats used by the Natterjack toad (the other major one being coastal sand-dunes). These three species without doubt absorb the majority of the resources of the committee and although we know that our work is effective and we have succeeded in safeguarding some populations, these rare animals are still in a very bad way.

The BHS conservation committee has been instrumental in helping to develop effective management techniques for dry lowland heath and we are now directly responsible for managing several hundreds of acres and advise on the management of thousands more. However, even though we, and others, may view ourselves as an authority on this subject we cannot simply choose a suitable looking piece of heath and march in with our saws and billhooks. One fairly obvious fact of life is that every inch of this fair land, including the scruffiest of our heaths is owned by somebody and very few of these lucky people or organisations would take kindly to

groups of well meaning people removing trees, digging sand patches or spraying herbicide all over the place.

Heathland is owned by a variety of organisations who need to be persuaded that trees are not a good thing and snakes and lizards are. This job may be a little easier if the landowners happen to be the National Trust or the Nature Conservancy Council who understand our aims and methods but is not so easy if the landowner is the Forestry Commission, whose business is growing trees, or a private owner who is lucky enough to own a large chunk of heathland as a back garden and does not want his garden party guests disturbed by errant reptiles, however rare and endangered. Luckily, to some of the well established members of the committee, such delicate negotiations are second nature and they have, over the years, built effective working relationships with almost all the major owners of heathland, in particular the Ministry of Defence who use heaths for training and the local authorities in Surrey and Dorset who own heaths as public amenities. In the early days of the conservation committee this task was even harder as the idea of "conservation" particularly of animals as universally unpopular as reptiles and amphibians, was not quite as acceptable as it is today. Even when the owner of the land has been persuaded, that it is often not the end of the story as other natural history groups such as the County Trusts for Nature Conservation or the Royal Society for the Protection of Birds may have interests in the area. All of the organisations who have any involvement with a site will require plans of the work we intend to carry out and reports of its progress and success.

The other negotiations that have to take place are those which provide us with the funds to carry out our work. We receive generous grants from the Nature Conservancy Council, World Wildlife Fund and a number of other organisations. Such grants are all greatly appreciated and we are, of course, duty bound to provide these organisations with details of how their money has been spent.

There is therefore an enormous amount of work that has to be done simply to enable us to carry out habitat management and it occupies a great deal of the time of many committee members notably Keith Corbett, Jon Webster, Dave and Marion Dolton, Trevor Beebee and Tom Langton.

Much of this preparatory work took place some years ago and the management that was subsequently carried out has resulted in some very impressive heathland sites, the success of which has enabled us to gain the respect of the organisations and individuals whose land we manage and the respect of other organisations involved in conservation. All of these sites require regular maintenance to keep them in optimum condition and we still regularly take on the management of new sites. There is therefore enough work to keep us all busy!

The sort of heathland that we manage, dry lowland heath, exists on sandy soils of Surrey, Hampshire and Dorset. It is dominated by various species of heather which supports a rich insect fauna, in turn supporting the rest of the heathland ecosystem including the reptiles. Apart from the nature of the soil, another important factor that restricts certain plants, animals and birds to this habitat, is the fact that heathland is hot. Dry sandy soils warm up far more quickly than wetter heavier soils, the lack of tree cover exposes the heath to the sun and the generally undulating nature of the heathland landscape creates many sheltered hot-spots. The sort of heath that can support Sand lizards and Smooth snakes is generally sloping roughly to the south, must not be overgrown with trees, must have old heather with a well established litter layer of mosses and lichens and areas of open sand which Sand lizards need to lay their eggs. A full account of the conservation of dry lowland heath, written by Jonathan Webster, appears in the March 1985 edition of the Bulletin (No. 11).

We manage heathland like this either because we know that rare reptiles live there or because we plan to re-introduce them. The principle threats to heathland are complete destruction by development, complete destruction by fire or gradual destruction by the growth or trees or bracken. The first two of these threats cannot (legally) be controlled with saws, billhooks or herbicides but the third can. To give members an idea of the work involved in heathland management, here is a typical year.

January would find us half way through our schedule of winter clearance tasks of which there are about 10 between early October and the end of March. These are principally designed to make

you realise how unfit you are and in making this discovery you cut down agood many pine and birch trees, these being the main species that turn heathland into woodland and destroy the heathland ecosystem of which our friends are part. Trees are cut by bow-saw, bill-hook or power-saw (by those qualified to use one) and they are either burned on site or stacked for later burning. Fires are good for keeping warm and for cooking spuds on but bad for eyebrows and hair if you get too close on a windy day. If sites lack sufficient open sand we also dig, either by hand or by rotivator, sandy patches for the Sand lizards to use for egg laying. Winter tasks are hard work, particularly if it rains, but they are well attended and very social occasions, much discussion and planning for the summer ahead takes place as the work is done.

After the winter comes the start of the most important and busiest season of the year, the spring. This is the time when most of the monitoring is done for all species of reptile and amphibian. It is, for me, the most enjoyable time of year. Successful reptile monitoring relies roughly 40% on the weather, 40% on skill and 20% on luck, the skill comes with experience and after many years of looking for reptiles I still feel that I am serving my apprenticeship. Monitoring tends to be done alone or in small groups when a certain amount of competition is inevitable and even it is does not improve your skill, it certainly increases your determination.

Monitoring and more particularly the recording of results is the most important of our activities as it is the only way that we have of judging the success of our management techniques and of being able to see changes in the status of animals either locally or nationally. Reptile and amphibian monitoring reaches a peak during May but can continue in suitable weather until about October.

July and August are not the most popular months for the members of the committee as during these months we deal with another major heathland pest, bracken. This fern is a real problem on heathland as it likes the poor sandy soil and grows profusely, shading and eventually killing the heather (and the rest of the heathland ecosystem). The most effective way we have found of controlling bracken is by spraying it with a selective herbicide called Asulox. This chemical is delivered to its intended victim from a knapsack sprayer worn by some willing volunteer usually on one of the hottest days of the summer. These sprayers hold up to 20 litres, so you know they are there when you are wearing one, and the herbicide can only be absorbed by the bracken, if it is sprayed on a hot sunny day and if no rain falls to wash it off within the next couple of days. It is difficult to describe one's frustration after a day's spraying when you are lying in bed with an aching back and sunburnt neck listening to a thunderstorm!

That almost brings us to the start of the winter tasks so if you have the time and the inclination there is something to do all year round and many members spend nearly all of their spare time involved in this work.

What I have just described follows very much my own bias which is toward reptiles and dry lowland heath particularly as I am lucky enough to now live very close to the S.W. Surrey heaths. The committee also spends a considerable amount of time trying to improve the lot of our rarest amphibian, the Natterjack toad. Trevor Beebee, Brian Banks and John Buckley organise much of this work which involves heathland management on the few remaining heathland sites, and work in the coastal dunes notably in Lancashire and Cumbria. Much work has been done on the construction and maintenance of breeding pools for the Natterjack and more recently some experimental re-introductions have been carried out. A fairly intensive period of monitoring takes place every year between April and June, when the toads are breeding, so that we can keep a close eye on the size of the populations at the sites that we have an interest in.

We have also, particularly in recent years got more and more involved in pond work, principally for the Great Crested newt but also for the other amphibians and of course the Grass snakes which they feed. Most members have got involved in surveying for amphibians, usually night-time torching, none more so than Tom Langton who last year carried out a London-wide survey of over 1000 ponds. Such surveys can generate a lot of local interest and have led to the restoration of many notable ponds, often carried out in conjunction with local groups. We try to organise pond tasks in late August or September as by this time most of the amphibian and insect species will have left the pond and its water level will be at its lowest. These tasks are fairly obviously wet and muddy affairs involving the removal of the usual collection of supermarket trolleys, car tyres and fallen trees and also quite a bit of tree clearance to let sunlight get to the

pond. Rewards from this work come the next and in subsequent springs when the increase in pond vegetation and improvement in the pond ecosystems, including the amphibians, can be clearly seen.

Another facet of our work is the captive breeding and re-introduction of Sand lizards. Mike Preston looks after our Sand lizard captive breeding programme and has surrendered much of his garden to provide open air vivaria either in the style of sand-dunes for the extremely rare Lancashire Sand lizards or in the style of heathland for Surrey and Dorset animals. Other members assist in this work by also having vivaria in their back gardens. Mike currently raises approximately 300 animals each year which are released directly into suitable hibernacula in the autumn or in the following spring. Captive bred animals are released onto sites that we manage and all re-introductions are carried out under licence from the Nature Conservancy Council. Before the NCC will consider the granting of such a licence we need to provide them, quite rightly, with a lot of information. We need to know that the animals used to live on the site we intend to release onto, we need to know why they no longer live there and we need to be able to show that whatever caused them to die out is no longer a threat. This does make re-introductions quite complex affairs but, certainly in the case of the Sand lizard, we have some quite impressive results which prove that they do work.

On top of all this the committee does a lot of work to bring the status of Britain's reptiles and Amphibians to the attention of the general public. This may take the form of illustrated talks, exhibitions, the provision of animals for television documentaries as well as television or radio appearances by some members of the committee. We also get deeply involved in helping to protect reptile or amphibian sites that are threatened by development and in advising other organisations on habitat management which will benefit these animals. Special projects are also undertaken, such as the Smooth snake survey that we are currently carrying out for the Nature Conservancy Council which provides the team involved with a lot of additional work as well as some interesting results, and the Toads on Roads campaign which has been organised by Tom Langton for the last two years. Some members of the committee are lucky enough to work full time in herpetology, Richard Griffiths spends his time studying in detail the amphibian populations of mid-Wales and Mark Jones is involved in similar work for both reptiles and amphibians in East Anglia. All members invariably get involved in local projects which may be local herpetological surveys, pond management or other practical work such as the provision of Grass snake breeding sites.

Because of the amount of work that the committee is already committed to doing we are not able to devote as much time as we would like for the more widespread reptile and amphibian species but we are increasingly trying to encourage regional herpetological groups and local natural history groups to get involved in local surveys and pond management. Hopefully our imminent appointment of a full time Conservation Officer will enable us to co-ordinate this work and take some of the strain off members of the committee who, believe it or not, also have full time jobs and families.

The conservation committee has enabled me to increase my knowledge of British reptiles and amphibians in the wild far more than I would ever have been able to do on my own. I have always been impressed by the immense amount of knowledge which exists within this group of people which is freely shared and always expanding. I have also been impressed with the people who constitute the committee who are of varying ages and come from all walks of life and I feel that I have made many good and lasting friends. It is important for all members of the BHS to maintain an interest in the conservation committee because it is a sub-committee of your society, as our chairman takes great pains to point out in his reports, and of course we always need volunteers to help with the work that we are doing to improve the status of and protect the creatures that we all share an interest in.

REFERENCES

Smith, M.A. (1973) The British Amphibians and Reptiles. Collins New Naturalist Series, No. 20.

THE HERPETOFAUNA OF KASTELLORIZO (MEGISTI) ISLAND (SE AEGEAN ARCHIPELAGO)

STRATIS VALAKOS and DIMITRIS PAPAPANAGIOTOU

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SUMMARY

Nine species of reptiles and one species of amphibian are reported from the island of Kastellorizo. One of the reptiles *(Ophiomorus punctatissimus* (Bibron and Bory)) is new for the Eastern Aegean Islands. Some zoogeographical conclusions are also reported.

INTRODUCTION

The herpetofauna of the eastern Aegean islands has been little studied.

During the fall of 19812 and 1982 we visited the island of Kastellorizo which lies in the south-east part of the Aegean Archipelago, near the peninsula of Lycia. Kastellorizo is 140km. from Rhodes island and 2km. from Lycia.

The area of the island is approximately 10km^2. The vegetation is mainly phrygana with *Genista acanthoclada* and *Thymus capitatus.* The cultivated areas do not exceed 0.5km^2. The only known species of the herpetofauna of the island is the amphibian *Mertensiella luschani* (Steindachner, 1891) mentioned by Kiortsis and all, 1974.

METHODS AND LOCALITIES

We collected animals especially from 3 localities: 1. Agios Ioannis; 2. Acheres; and 3. Megisti (Fig. 1). The first locality is rocky and covered by phrygana, the second is in planted and abandoned cultivations and the third is around the only village of the island. Furthermore we walked around all the island and collected animals also from Agios Stefanos and Agia Triada.

RESULTS

Nine species of reptiles and one species of amphibian were determined from the collected specimens. From the reptiles 2 species belong to *Gekkonidae,* 2 to *Scincidae,* 1 to *Agamidae,* 1 to *Amphisbaenidae* and 3 to *Colubridae.* The Amphibian belongs to the family *Salamandridae.*

Amphibians

Mertensiella luschani (Steindachner, 1891)
52 specimens from all localities.

The species is distributed on Karpathos Island (Pieper, 1963), Kastellorizo Island (Kiortsis and all 1974) and Asia Minor where 5 subspecies are mentioned (Basoglou 1978).

Reptiles

Cyrtodactylus kotschyi (Steindachner, 1870)
2 specimens from localities 1 and 2

One of the specimens found on a stone in A. Ioannis region and the other on a wall on Acheres region. It is distributed in S. Italy, Balkans, Greece, Israel and Iran (Mertens, 1960).

Hemidactylus turcicus (Linnaeys, 1758)
1 specimen from locality 3

It was found on a wall. It is distributed in all the Meditteranean area (Mertens, 1960).

Ophiomorus punctatissimus (Bibron and Bory, 1833)
1 specimen from locality 1

It was found in the soil. It is distributed in the Pelloponese, Kythera (Arnold, 1978) and Turkey in Xanthus (Anderson and Leviton 1966).

This is the first report of the species in the Eastern Aegean Islands.

Ablepharus kitaibelli (Bibron and Bory 1833)
1 specimen from locality 3

It is distributed in the islands of the Aegean Archipelago and Asia Minor (Mertens, 1960).

Agama stellio (Linnaeys, 1758)
2 specimens from localities 1, 4

They were found lying on the ruins of buildings. It is distributed in some islands of the Cyclades in the eastern islands of Aegean, in Asia Minor, West Asia and North Africa except Egypt (Mertens, 1960).

Blanus strauchi (Bedraga, 1884)
1 specimen from locality 1

It was found on the soil. It has been reported from Rhodes, Kos (Wettstein 1953), Turkey (Basoglou 1977), also from a small islands near the south west coast of Asia Minor (Baran, 1984).

Coluber ravergieri (Rauss, 1833)
2 specimens from localities 1 and 2

They were found in cultivated fields. It has been reported from Rhodes (Wettstein, 1953), Kalymnos (Schneider, 1983) and Turkey (Basoglou, 1980).

Eirenis modestus (Martin, 1838)
2 specimens from localities 1 and 2

They were found under stones. It is distributed in Asia Minor, Mytilini Island, Chios Island, Samos Island, Cyprus, Mesopotamia and N.W. Iran (Mertens, 1960).

Malpolon monspessulanus (Hermann, 1804)
1 specimen from locality 2

It is distributed in all the Mediterranean area.

DISCUSSION

The presence of the species *E. modestus, C. ravergieri, B. strauchi, A.* and *M. luschani* shows that Kastelorizo is a typical eastern island, like all the islands near the Asia Minor coasts. The other species have a widespread distribution in all the Mediterranean, Balkan and Asia Minor regions.

The presence of *O, punctatissimus* in Kastelorizo and also in the Peloponesses and Kythera and its absence from the islands between emphasises one of the main zoogeographical problems of the Aegean, since many other species show the same distribution, for example *Zonites algrirus* (Gastropoda, Zonitidae) mentioned by Riedel, 1979.

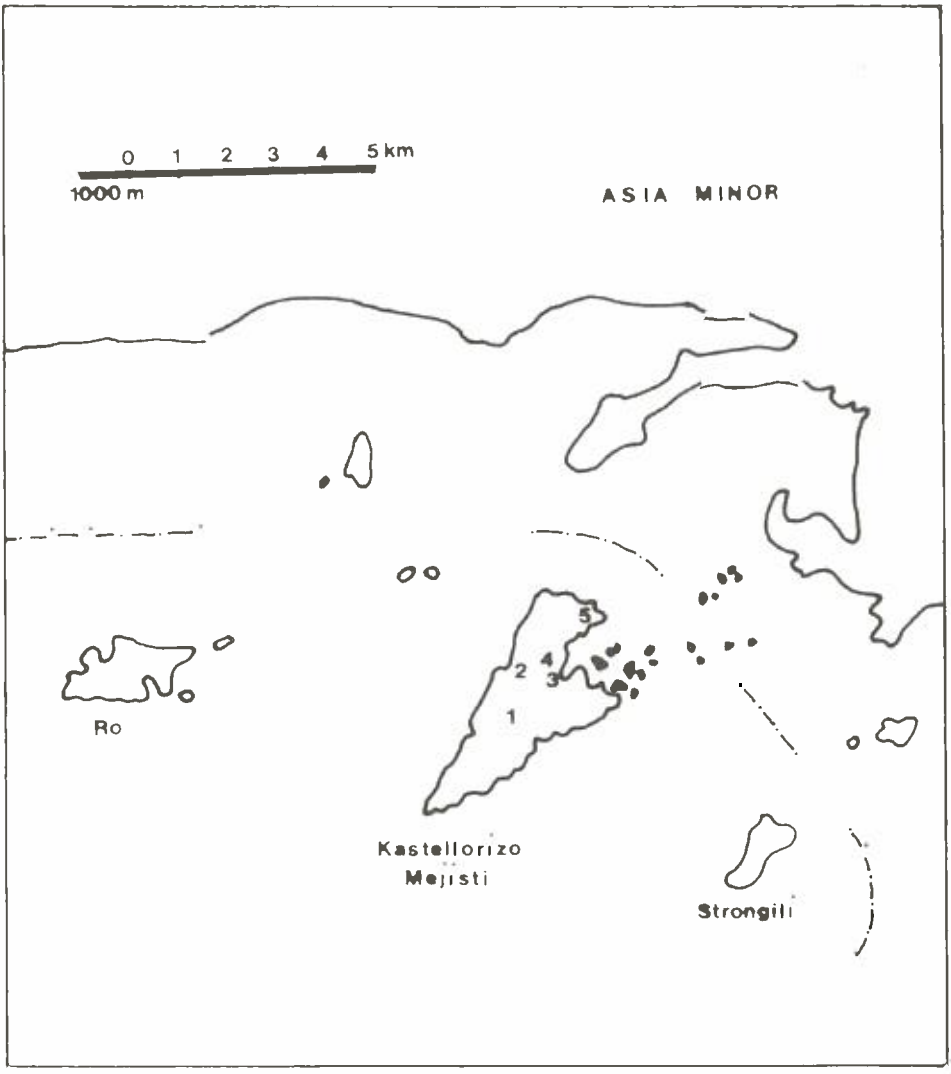

FIGURE 1. Map of Kastellorizo Island

1. Agios Ioannis
2. Acheres
3. Megisti
4. Agia Triada
5. Agios Stefanos

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SPAWNING DATES OF THE NATTERJACK *(BUFO CALAMITA)* THROUGHOUT ITS RANGE IN BRITAIN

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With considerable help from the voluntary bodies, the Nature Conservancy Council has collated information from natterjack *(Bufo calamita)* sites on an annual basis since 1979. In the report for 1981, information on spawn dates was presented for certain sites, and it was suggested that spawning tended to occur at Merseyside and Cumbrian sites earlier in the year than at east coast and Scottish sites (Cooke, 1982).

Recently, Beebee (1985) has updated this analysis. Amongst his main conclusions were that (1) eastern populations tended to spawn later than those on the Irish Sea coast but (2) there was no significant difference between the spawn dates for the 'southern' Irish Sea colonies (Merseyside and Lancashire) and those in the 'north' (Cumbria and north Solway). It is the aim of this note to demonstrate that north Solway populations do in fact tend to spawn later than those further south.

Beebee (1985) calculated the mean first spawn date for 13 records from southern Irish Sea colonies to be 18 April (SD = 13 days); while that for 16 records from four northern colonies was 15 April (SD = 11 days). The latter group contained a colony on the north Solway, and there were evidently considerable inter-site differences within this group with natterjacks at one of the Cumbrian sites tending to spawn very early in April or even in March (Fig. 1 in Beebee (1985) and pers. comm.).

I have assembled spawning data from the two Scottish Solway colonies that have been best studied (Table 1). There was no significant difference between the mean dates for the two colonies. Combining the data, the mean first spawn date was 1 May (SE = 2 days). This was significantly later than Beebee's mean for southern Irish Sea colonies ($t_{25} = 3.2$, P 0.01).

It was also later than Beebee's mean date for northern colonies ($t_{26} = 4.4$, P 0.001), despite his sample containing information from one of the north Solway populations represented in Table 1. There was, however, no significant difference between this mean for the north Solway and Beebee's mean for eastern England.

Data from other sites on the Scottish Solway are fragmentary, but these two sites are believed to be typical as regards first spawn date (G. Fry, pers. comm.; M. Wright, pers. comm.; Cooke, Banks and Langton, 1984). Thus, in its strongholds on the coasts of Merseyside and southern and central Cumbria, the natterjack toad tends to begin spawning in mid April, but there is considerable and often consistent inter-site variability. At the edges of the species' known range on the north Solway coast and in eastern England, the natterjack tends to spawn later, at the end of April or in early May. The Cumbrian colonies on the south Solway tend not to have been so well monitored, and it is not possible to be precise about when natterjacks start to spawn in that area. Suffice to state that although spawn has been recorded in two sites as early as the second week of April, spawn strings have only rarely been recorded before the beginning of May (Cooke, 1981; Cooke and Banks, 1983). Within an area, the interval between the onset of the spawning season of the frog *(Rana temporaria)* and that of the natterjack is roughly 5-6 weeks (Table 2).

I thank Dr. T. Beebee, R. Bridson, Dr. G. Fry and M. Wright for providing information on spawn dates.

TABLE 1. First spawn dates for two natterjack colonies on the north Solway coast, 1977-1984. Information provided by R. Bridson, G. Fry, M. Wright and the Scottish Wildlife Trust.

	Site 1	Site 2
1977	30 April	—
1978	5 May	20 April
1979	—	29 April
1980	1 May	26 April
1981	7 May	3 May
1982	8 May	20 April
1983	10 May	12 May
1984	24 April	25 April
Mean± SE)	4 May (± 2 days)	29 April (± 3 days)

TABLE 2. Approximate first spawn dates by area for the frog (Savage, 1961; Cooke, 1976) and the natterjack (Beebee, 1985 and this paper).

Area	Frog	Natterjack
Merseyside	Late February/early March	Mid April
South and central Cumbrian coast	Early March	Mid April
South Solway	Early March	Mid April — early May?
North Solway	Late March	Late April/early May
Eastern England	Late March	Late April/early May

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NATTERJACK *(BUFO CALAMITA)* TADPOLE BEHAVIOUR IN CAPTIVITY

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INTRODUCTION

There has been an increasing realisation over the past 20 years or so that tadpoles are more complicated in their behaviour patterns than was once supposed. For example, anyone with more than a passing acquaintance with common frog and toad tadpoles can scarcely fail to have noticed how secretive the former become as they grow up, while in comparison common toad tadpoles are often to be swimming conspicuously in open water. In fact tadpoles of the *Bufo*-type toads sometimes demonstrate a dramatic shoaling behaviour that has been witnessed in both North American and European species. It has been much argued as to whether this shoaling serves to stir up food particles from the pond bottom, constitutes a defence against predators or is for some as yet unknown purpose. Natterjack tadpoles are usually easy to see, though unlike those of the common toad they have not been reported to form proper shoals. Searching for natterjack tadpoles and trying to assess their numbers in a pond has become a widely applied practice among conservationists monitoring the various colonies in Britain, since it is one way of assessing breeding success over a period of years. However, this approach does presuppose that the tadpoles always behave in much the same way (i.e. are equally "seeable") whatever the weather or their stage of development, and some observations in the field have indicated that this assumption might be wrong. In particular there have been cases where whole cohorts have apparently disappeared within a week or so of expected metamorphosis, to be followed a while later by reports of toadlets around the ponds. To try and clarify what might be going on in the breeding ponds, I set up a simple observation tank to record how natterjack tadpoles behave under conditions intended to simulate the edge of a breeding pool.

METHODS

Natterjack spawn was obtained (under licence) for captive rearing as part of a general research and conservation programme. Soon after hatch, 16 tadpoles were transferred to a container with about 5 litres of water arranged as shown in figure 1. A fibre mat was used to support a layer of sand the full length of the angled slope and thus prevent it accumulating at the deepest point. This sand and suitably arranged flat stones provided potential refugia for the tadpoles, which also had available to them water varying from 0 to 12 cm in depth. The tank was set up in a position receiving direct sunshine from at least 0700 to 1900 hours, and the water kept clear of algae etc. for easy observation by gentle periodic flushing with a hosepipe. Food, in the form of rabbit pellets, was added periodically as required and always after the final observations of the day.

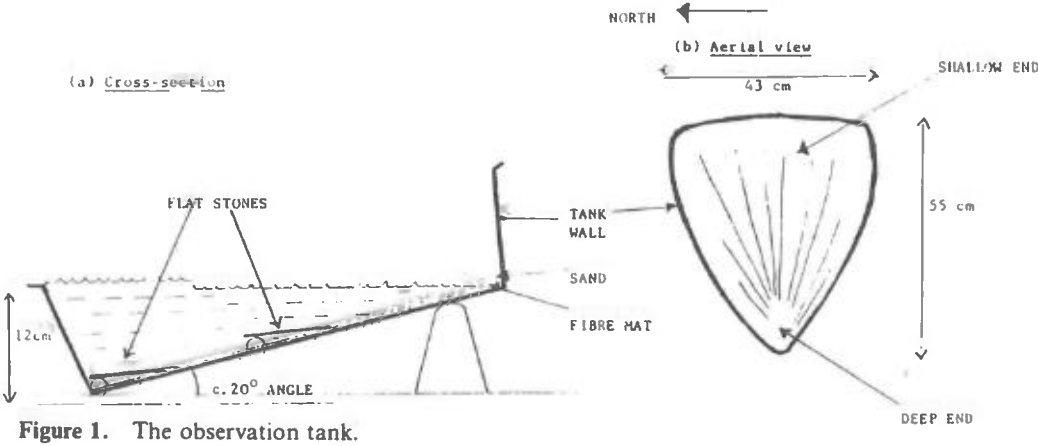

Figure 1. The observation tank.

Observations were made up to 3 times each day, at 0800, 1300 and 1900 hours. Record was made of: (a) the number of tadpoles visible (i.e. not concealed in sand or under stones); (b) the number actively swimming, as opposed to resting on the bottom. Occasional tail-wiggling was not recorded as active swimming, the whole tadpole had to be moving through the water. (c) numbers of tadpoles visible in the top (shallow) and bottom (deep) halves of the tank; (d) % cloud cover; (e) water temperatures at the shallow and deep ends (1cm and 12cm depths), using a thermoprobe digital thermometer.

After metamorphosis, the toadlets were released at the site from which the spawn was taken.

RESULTS

For most of their lives in the tank, the natterjack tadpoles were easily visible and did not hide in silt, under stones or in the small pieces of weed also available to them. From the start of the observations (shortly after hatch) until full grown at 25mm or so some 3 weeks later it was unusual to see less than 70% of them at some time each day; on average more than 80% were visible (figure 2a). However, during the final stages of development there was a dramatic decrease in observability coinciding with elongation of the back legs until, during forelimb emergence, all the animals remained hidden (mainly under the submerged stones) at all times of day irrespective of weather.

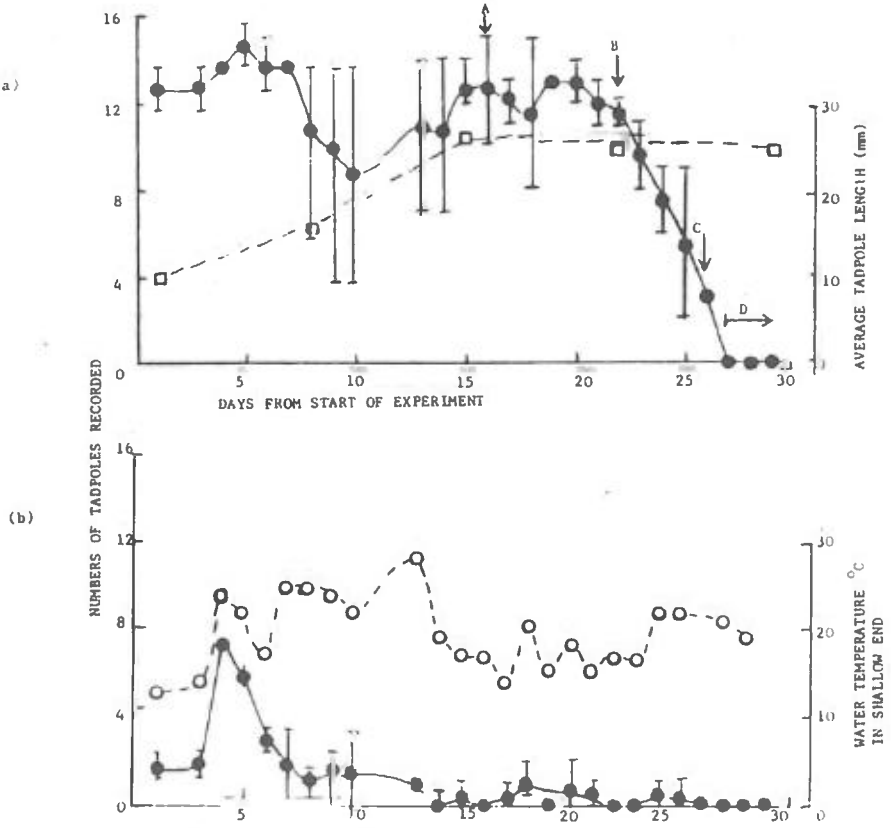

Figure 2. Tadpole behaviour during development.

Figure 2. ●, Numbers of tadpoles visible (average, with range of values for 1-3 records of each day); □, average size of tadpoles; · · , water temperature (average of 1300 and 1900 hour measurements in shallow end); in figure (a), tadpole numbers represent total visible; in figure (b) they represent the numbers actively swimming (in this case the average and range of just 1300 and 1900 hour records). A = Hind limb buds appear; B = Elongation of hind limbs; C = Forelimbs appear; D = Metamorphic climax.

Although readily visible, natterjack tadpoles were singularly inactive for most of the time. As shown in figure 2b, apart from a brief burst of activity early in life (at 12-14mm long) where up to 50% of them could be seen actively swimming at any one time for just 2-3 days, more than 90% were usually resting virtually motionless on the sandy tank bottom. Although the early peak of activity coincided with warming weather conditions, equally high temperatures later on did not have this activating effect. It appeared that natterjack tadpoles became more sedentary as they grew larger.

TABLE 1. Daily patterns of tadpole behaviour.

Time of day	Average no. tadpoles visible			Average no. tadpoles actively swimming	
	Total	Tank top (shallow end)	Tank bottom (deep end)	Days 2-6	Days 6-20
0800	9.1(4.0)	3.2(3.5)	5.3(2.6)	0.5(0.7)	0.2(0.4)
1300	13.2(1.6)	8.7(3.0)	4.3(2.8)	3.0(1.4)	1.2(1.0)
1900	11.8(3.0)	4.9(4.1)	6.7(4.0)	4.5(2.4)	0.5(0.7)

Standard deviations are given in brackets.

There were tendencies to select different water depths at different times of day (table 1). The usual situation was for the fewest tadpoles to be visible early in the day, and these would generally be inactive in the deeper part of the tank. By mid-day most had moved into the shallows, swimming activity was greater and the highest proportion of animals visible. In the early evening a move back towards deeper water and/or concealment was detectable, though small tadpoles could be very active at this time (1900 hours).

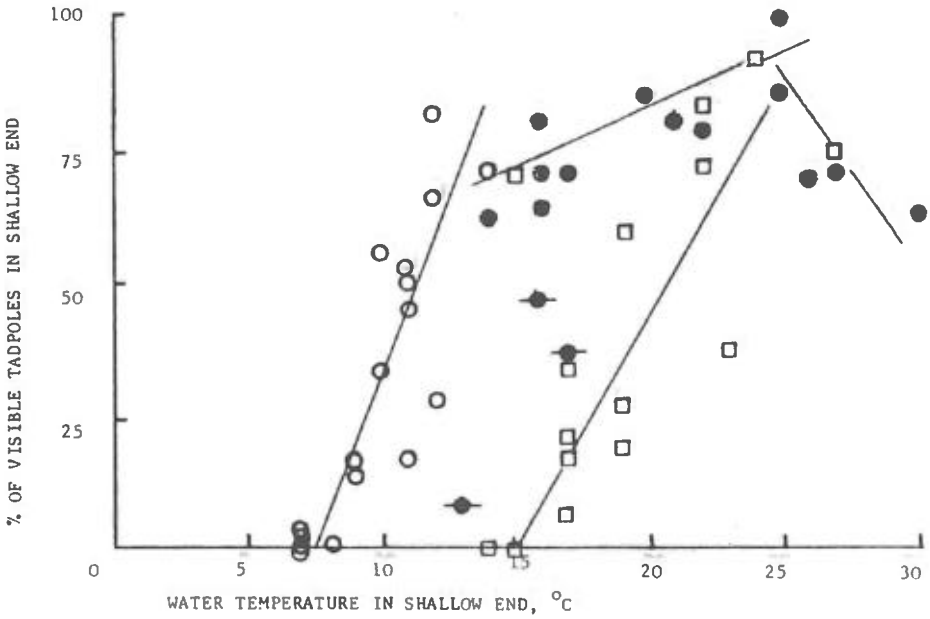

Figure 3. Tadpole behaviour and water temperature.

Figure 3. -●-, records taken at 0800 hours; ●, records taken at 1300 hours; ● , 13 hour records in which the deep water was warmer than the shallow end; □, records taken at 1900 hours.

There were clear correlations between water temperature and the part of the tank selected by the tadpoles (figure 3). At 0800 hours, cloud cover was poorly (insignificantly) related to water temperature (data not shown) but the warmer the water, the more tadpoles accumulated in the shallow end ($r=0.857$, $p = 0.001$) indicating a response to warmth rather than light intensity. All this despite the fact that the temperature gradient across the tank was never more than 1° (data not shown). By 1300 hours the water was approaching its daily maximum temperature and up to about 25° there was still a significant (but different) correlation between numbers of tadpoles in the shallow end and water temperature there ($r= 0.735$, $p = 0.01$). Above 25° the situation seemed to change, selection for shallow water dropping off markedly. Observations at 1900 hours indicated yet another significant but different correlation between tadpole positioning and water temperatures ($r=0.680$, $p = 0.01$); at this time of day tadpoles accumulated in the deeper water at temperatures which, at 0800 hours, would have enticed them all into the shallows (i.e. 14-17°). At both 1300 and 1900 hours there were strong inverse correlations between cloud cover and water temperature, making it impossible to distinguish between the effects of temperature and light intensity on the behaviour of the tadpoles.

DISCUSSION

These observations were made under conditions which neither completely mimicked a pond (there was a very restricted range of water depths, for example) nor permitted separate control of factors such as light and temperature. It is important to realise these limitations, and what was seen cannot be taken to reflect the full repertoire of natterjack tadpole behaviour by any means. Nevertheless I think the results are of some interest and seem to relate to aspects of behaviour noticed in the field. The relative inactivity of natterjack tadpoles, and their tendency to live on the pond bottom, contrast with the more active and mid-water existence of common toad tadpoles to the extent that behaviour might even assist with identification in the field. Telling common and natterjack toad tadpoles apart by appearance alone is notoriously difficult.

It looks as if we should expect natterjack tadpoles to be readily visible (i.e. not hidden in silt, etc., or in deep water) for most of their development, except perhaps on very hot days when water temperature exceeds 30° in the shallows. This can certainly happen, I once recorded 38° (warmer than blood heat!) in a shallow natterjack pond on a sunny day in June. Observers should expect to see few, if any tadpoles under such conditions since the lethal limit is 30-33° and the animals are likely to be seeking cooler surroundings at the pond bottom. The above observations also appear to explain why whole populations of tadpoles sometimes seem to disappear just before metamorphosis. They become very secretive at this time, and not seeing any cannot be taken to mean that they are not there. At earlier stages of development, up to the appearance of distinct hind limb buds, the middle of the day (except when very hot, as above) is probably the best time to look for natterjack tadpoles around the pond margins. It looks as if there may be a basic diurnal rhythm, with tadpoles retiring to deeper water at night but preferring shallow pond edges by day, subject to modification by environmental factors the most important of which is probably water temperature. There is obviously scope here for more systematic study under controlled conditions.

Finally, it is tempting to use these observations to help explain the different responses of common and natterjack tadpoles to food shortage. Food stress causes early mortality of common toad tadpoles leaving the survivors to grow normally (i.e. there is intense competition) whereas natterjack tadpoles respond by a general reduction in growth rates and little or no mortality. The greater activity of common toad tadpoles perhaps leads to a rapid utilisation of metabolic reserves, thus putting weaker animals at high risk of mortality quite quickly if food runs short. The more leisurely natterjack tadpoles should use up their reserves more slowly, and thus be more likely to survive in a situation where encounters with food are infrequent.

FURTHER NOTES ON THE CAPTIVE BREEDING OF NATTERJACKS *BUFO CALAMITA*

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Following my article detailing the successful captive-breeding of Natterjack toads of Norfolk origin (BHS Bulletin No. 10, December 1984), members may be interested to learn of further developments during 1985 in relation to outdoor colonies maintained by myself and by Lowestoft-based BHS member Roger Gouldby.

Of the 15 individuals which went into hibernation in my enclosure during the late autumn of last year, most, if not all, have survived. My uncertainty on this point is due to my not being able to gather together more than 14 at any one time; a conclusive count would involve removing the entire contents of the enclosure including all the sand therein, which would be a gargantuan and destructive task.

Most of the toads dug down into the sandy interior of the enclosure to overwinter, and several congregated around the roots of a particularly large *Erica carnea* for this purpose. Only one used the purpose-built hibernation chamber, the floor of which was also lined with sand, with a layer of dry moss above it.

On 31st March several toads were seen to have emerged from hibernation, and the rest appeared in ones and twos during the next ten days or so. They gathered in the hibernation chamber and sat under the asbestos roof, out of sight but absorbing the heat of the sun conducted through that material during the daytime.

No breeding behaviour was noted amongst my colony until mid-May, when some pairing off took place. However, there was no sign of the males calling and no spawn resulted from these liaisons. In contrast, a pair of Roger's toads produced a spawn string on 6th May. This seemed to be fertile but, possibly due to very cold weather, only around 100 tadpoles eventually hatched out and Roger's toads did not subsequently produce any more spawn, although further breeding behaviour continued during the next few weeks.

On 8th June one or more of my male toads was heard calling during the day, for the first time since emergence from hibernation. On the 10th, following persistent calling and pairing off amongst various individuals, a string of spawn was found in the enclosure "slack". I should point out that the "slack" remained very cloudy throughout this time and did not clear until some time after all the spawn had hatched, so I had to locate new strings by "dragging" the bottom with my fingers every day for about two weeks, and memorising their locations. Not an easy job, to say the least! The following day there was another string, and the third (and final) string came to light on the 13th June. All three strings appeared to have been laid during the preceding nights. Males were heard calling at all times of the day and night. Regular checks indicated that these strings were mainly or wholly fertile, but the unseasonally cold weather which followed may have had a damaging effect, as I never saw the large numbers of tadpoles in the slack that I expected from this quantity of spawn. Despite the removal of some sections of spawn to two aquariums in order to ease possible overcrowding in the pool, the total number of tadpoles raised was less than 1,000. This was despite a low mortality rate following hatching. Observation of the tadpoles during their early stages in the pool was badly hampered by the cloudy water.

Most of my tadpoles were released at an advanced stage of development, at an introduction site on heathland on the Suffolk coast. They were released during July, in two batches of 500 and 450, respectively and, it is hoped, will form the basis of a new colony; the first Natterjacks to be found wild in Suffolk for over 20 years, since the species finally became exinct in the county.

Of the 100 or so tadpoles reared by Roger Gouldby, most did well until metamorphosis, but the toadlets were reluctant to feed in the majority of cases, and only about 15 have survived at the time of writing.

It is worth mentioning that Natterjacks have cannibalistic tendencies and, as Roger and I can both verify, they will eat their own toadlets if there is enough of a size difference for this to be possible.

As I mentioned in my previous article, I have more female Natterjacks than males, and I had expected seven or eight spawn strings this year, especially as all the females appeared to be well-grown and mature. The reason for such low productivity is hard to pinpoint, but could be due to a number, or a combination, of reasons such as overcrowding, stress, unseasonal weather or lack of competition amongst males. Roger Gouldby considers that his females were gravid but that the males were not particularly interested. The season was of short duration this year, with breeding and courtship behaviour in my enclosure mainly confined to the second and third weeks in June, apart from a brief spell during the first half of May.

The measurements (snout to vent) or the 14 Natterjacks located in my enclosure on 11th August, and therefore just over three years old, ranged from 68mm down to 52mm with the majority measuring around 60mm.

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THE CARE AND BREEDING OF THE COMMON BRITISH REPTILES AND AMPHIBIANS — PART IV THE PALMATE NEWT (*TRITURUS HELVETICUS*)

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INTRODUCTION

Although first identified as a separate species by the Swiss naturalist, Razoumowski in 1787, the Palmate Newt *(Triturus helveticus)* was not recognised as a distinct species in Britain until 1843 when it was identified by Bell after its discovery by a Mr. Baker near Bridgewater in Somerset. However, even as late as 1863 the authorities at the British Museum were of the opinion that "the Palmated Newt of Mr. Bell" was "merely a variety of the smooth newt" (Wood, 1865).

The males of the two species are quite distinct but the females are admittedly very similar in size and appearance; juveniles are virtually indistinguishable. Palmate Newts are more aquatic than smooth newts and I have found that in close confinement they remain in the water for most of the year.

DESCRIPTION, HABITAT AND DISTRIBUTION

The Palmate Newt is Britain's smallest amphibian, up to 9cm including the tail; females are marginally larger than males. The skin is smooth in texture and the head is shorter and slightly more rounded than that of *T. vulgaris.*

The basic colouration is olive or light brown above, frequently with small spots which sometimes form two distinct lines along the back, especially in females. The underside is pale yellow with a central yellow or light orange stripe; there may be small spots present but the throat is almost always immaculate.

Males in breeding dress have a very low smooth-edged dorsal crest. It is well developed on the upper and lower edges of the tail, being truncated and ending in a dark filament. The hind feet are dark and conspicuously webbed. The head and body are sprinkled with dark markings and there is a central orange band on the sides of tail bordered by two rows of large spots.

The Palmate Newt will breed in large or small volumes of still or running water, but appears to favour clear and acid water. It is often found in hilly or wooded country at altitudes up to 2500 metres. But these are not preferred habitats as it is equally at home in lowland areas down to sea level, being tolerant of brackish water. It is more of a rural dweller than *T. vulgaris* or *T. cristatus.*

Its distribution is confined to Western Europe and it is found only in West Germany, Belgium, Holland, France, Switzerland and Northern Spain. In Britain it is most plentiful in the North, West and South-West, but is absent from Ireland and very rare or absent altogether from the whole of East Anglia and Lincolnshire.

CARE IN CAPTIVITY

I first obtained a female and two males from a pond containing large numbers of breeding adults while on holiday during May 1982. The female laid eggs whilst in transit and continued to do so after being placed in its new home, an all-glass aquarium measuring 90cm x 30cm x 38cm. The tank contained water to a depth of 15cm, with an island consisting of a pantile placed on top of suitably sized stones. A thin layer of peat/sand mixture was spread in the trough of the pantile which was then planted with sphagnum moss and a couple of maidenhair ferns. Finally, a few pieces of bark were added for the newts to hide under should they wish to. A sheet of glass was kept over the top of the tank to prevent escape and also to provide a humid atmosphere which newts enjoy.

I discovered that water milfoil, willowmoss and Canadian pondweed were favoured sites for egg-laying by the female newt. These eggs were similar in size and colouration to those of the smooth newt as was the courtship procedure preceding egg laying which I discussed at length in the previous article.

The female continued laying eggs until mid-June when she became noticeably thinner and lighter in colouration. None of the three newts showed any desire to leave the water permanently at this time although they could often be seen at night sitting on the island. During August and September they would spend most of the time on land but by October they were back in the water again, hardly leaving it at all.

Meanwhile, the eggs, having been removed from the original tank to prevent the adults eating them on infusoria, graduating to *Cyclops, Daphnia* and bloodworms as they grew larger. newly hatched larvae were really minute, no more than about 8mm long. I started by feeding them on infusoria, graduating to *Cyclops Daphnia* and bloodworms as they grew larger.

By late August the first tadpoles were leaving the water, having grown to a total length of 25mm. I put a few in a vivarium, releasing the remainder in the garden in the hope that they would survive to be the pioneers of a breeding colony.

I placed a layer of peat and sand mixture on the floor of the vivarium to a depth of about 4cm, carefully planting turves of grass and moss on the surface. Whiteworms were introduced which multiplied in the soil providing natural prey for the newtlets. They were also fed on aphids plus a multitude of small creatures caught by hedge or grass beating.

Towards the end of November I brought their vivarium indoors (it had been kept in a shady part of the garden away from direct sunlight) in an unheated room where they were occasionally hand-fed on whiteworms and baby mealworms. The following spring I released these young newts in the garden; their sizes varied between 30mm and 35mm.

The adults were overwintered in an outhouse, where they spent the entire winter in the water. The males had developed full breeding attire before December was out and were first observed engaging in courtship display during mid February. Actual egg-laying commenced late in March lasting until the last week of June.

Feeding posed no problems through the winter months: *Daphnia* and *Tubifex* were introduced into the tank at regular intervals. During milder spells the newts would feed quite voraciously on these. In fact, I found they remained active even when the water was barely above freezing but ceased showing interest in food at temperatures below 2°. At no stage of the winter did they become completely inactive.

It would appear, therefore, that an aquatic set-up is satisfactory for Palmate Newts as they leave the water for only a short period in late summer, being happy underwater for the remainder of the year. They will readily breed in confinement; an individual female can lay up to 450 eggs each year of which a considerable number can be reared for subsequent release. I have liberated large numbers of youngsters in my garden since 1983 and have also received several more adult pairs from BHS members, most of which I placed in my large outdoor enclosure where I also have *T. vulgaris* and *T. cristatus*. Every year during late summer I collect all the newly metamorphosed newts I can find in the enclosure for release in the garden.

CONCLUSION

The Palmate Newt is an ideal species to keep, thriving in captivity and proving very easy to breed in confinement. The eggs and larvae have a high survival rate as do the young newts. The adults will live and breed in the garden where they happily co-exist with smooth or crested newts.

In my next article I will discuss our most widespread and common British reptiles, the Viviparous Lizard (*Lacerta vivipara*).

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THE WINTER HABITATS OF AMPHIBIANS IN MILTON KEYNES, ENGLAND

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INTRODUCTION

Where do amphibians go in the winter? Most biologists would probably answer that they 'hibernate' under rocks and logs in the terrestrial environment. However, it seems that this answer is too general. In this paper, I briefly review some of the European literature on amphibian overwintering habits and then present some new data on the winter habitats of amphibians in Milton Keynes, a 'new-town' in southern England.

I examined the literature for references to the winter habits of common frogs *(Rana temporaria)*, common toads *(Bufo bufo)*, smooth newts *(Triturus vulgaris)* and crested newts *(T. cristatus)* in northern Europe. The common frog appears to be the most aquatic of these amphibians; overwintering in water, usually at the breeding site but sometimes in rivers or streams, has been reported in England (Hazelwood, 1969; Verrell & Halliday, in press, *a*), Germany (Blab, 1982), Poland (Kowalewski, 1974), Sweden (Hagstrom, 1982) and Finland (Koskela & Pasanen, 1974). Several of these authors note that males are more likely to spend the winter at the breeding site than are females. Some also describe overwintering on land. Ashby (1969) found that frogs residing in an English walled garden remained in dense vegetation and gaps in the wall over the winter.

Although common toads may also spend the winter in water in England (Waddington, 1952) and Sweden (Hagstrom, 1982), most authors report that toads overwinter on land. It seems that, after wandering quite extensively during the summer, toads migrate towards their breeding site in the autumn and remain close to the water over the winter (Heusser, 1969; Moore, 1954).

Smooth newts have been recorded as overwintering in water after autumnal migration in England (Bell, 1977) and Germany (Blab & Blab, 1981); these newts are thought to be newly-matured adults about to breed for the first time. Older adults spend the winter on land. Griffiths (1984) found that smooth newts reside under stones in the early part of the winter, migrating vertically into the soil as the temperature decreases. He suggests that aquatic overwintering may only occur in large bodies of water; then, temperature fluctuations may be sufficiently buffered to prevent extensive freezing with subsequent 'winterkill' (see also Bradford, 1983).

The crested newt is similar to *T. vulgaris* in its winter habits. Autumnal migration and aquatic overwintering have been noted for small adults, although most authors agree that at least part of crested newt populations remain on land in England (Verrell & Halliday, in press, *b*), Germany (Blab & Blab, 1981) and Sweden (Hagstrom, 1982).

METHODS

Five amphibian breeding sites within or near Milton Keynes were monitored to varying degrees from 1979 to the present. These sites were:

(1) Yrrell Pond, Soulbury: an extensively studied site on private arable/pasture farmland.

(2) Marigold Pond, Conniburrow: situated on a council housing estate, this site was subject to heavy dumping of domestic refuse and garden debris.

(3) Cleavers Pond, Conniburrow: as (2) above.

(4) University Pond, Walton Hall: Situated in the managed gardens of the Open University campus.

(5) Walton Lake, Woughton: a large, marshy site in managed parkland, with some grazing pasture nearby.

All of these sites were known to contain common frogs, common toads, smooth and crested newts, except for Cleavers Pond, which contained only toads and smooth newts. At each site, I searched the water and adjacent terrestrial habitat, and recorded in which type of habitat amphibians were found. In this paper, I summarize data collected over the months of November to March; I regard this period as 'the winter'.

RESULTS AND DISCUSSION

Data on the winter habitat selection of amphibians at the five sites studied are summarized in Table 1.

The only adult amphibians known to have overwintered in water were common frogs and crested newts at Yrrell Pond. This pond was encircled by a drift fence in 1983 and part of 1984, making the autumnal migration of these two species very obvious (see Verrell & Halliday, in press, *a, b*). Frogs were not found in the terrestrial habitat around Yrrell Pond during the winter, but their appearance at the drift fence in the spring indicated that they were present in the vicinity. Although adult smooth newts were never found in water over the winter, larvae are believed to have overwintered in Yrrell Pond in 1983 (Verrell, in press).

Newts were more frequently encountered in the terrestrial habitat during the winter, and common toads exclusively so. All three species were found in garden debris consisting of dumped soil and/or rotting vegetation, with some individuals buried to a depth of up to 10cm. This finding supports Griffiths' (1984) suggestion of vertical migration in cold weather. Amphibians were seldom found under single rocks and logs. It was more common to find newts, especially *T. vulgaris,* 'sandwiched' between the bark and wood of logs and fallen trees. This microhabitat is probably ideal for an overwintering newt; it is damp, contains a plentiful supply of invertebrate prey and, due to microbial activity, is probably relatively warm. At Walton Lake, small groups of smooth newts (from between three to six individuals) were often found in physical contact beneath the same piece of bark. The possibility that individuals in such groups experience some advantage in terms of temperature regulation and/or water conservation awaits empirical investigation.

The only amphibians found at Cleavers Pond over the winter were smooth newts and common toads. I have observed both of these species emerging from rabbit burrows on mild nights in March; these burrows were situated about 3m or less from the margin of the pond. Indeed, the name of the housing estate in which this pond is situated, Conniburrow, comes from a derivation of the Latin word *cuniculus* (meaning 'rabbit') joined with 'burrow'! I have seen no evidence that these burrows are still inhabited by rabbits (e.g. faecal pellets), but they are undoubtedly suitable habitats for overwintering amphibians: damp and frost-free.

These data indicate that the majority of amphibian populations sampled in the Milton Keynes area overwintered on land. A variety of terrestrial habitats were occupied, including garden debris and domestic refuse provided by Man. I am most pleased to report that amphibians were present in ponds on a housing estate, despite illegal dumping and 'small-boy effects'. Following the survey work of Beebee (1979), I encourage householders in such areas to help conserve their amphibian fauna by constructing garden ponds suitable for colonization.

ACKNOWLEDGEMENTS

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Table 1. The winter habitats of amphibians at five sites in Milton Keynes, England.

	Common frog	Common toad	Smooth newt	Crested newt
In water at breeding site	1		1*	1
On land near breeding site:				
a. under single rocks			5	
b. under single logs		5	1	1
c. between bark and wood			1,4,5	1,5
d. in garden debris		1,4,5	1,4	1,4
e. in domestic refuse			2	
f. in mammal burrows		3	3	

Pond abbreviations:
1. Yrrell Pond; 1*. larvae only
2. Marigold Pond
3. Cleavers Pond
4. University Pond
5. Walton Lake

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HUSBANDRY AND CAPTIVE BREEDING OF THE SAND LIZARD (L. AGILIS) AS AN ADJUNCT TO HABITAT MANAGEMENT IN THE CONSERVATION OF THE SPECIES IN BRITAIN

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INTRODUCTION

Jon Webster's article in the previous issue of the Bulletin provided me with a timely introduction to the conservation of *L. agilis* in Britain.

In this article I wish to pass on my experiences with captive breeding of this species and the possible implications of my results for the future survival of the species in Britain.

My interest in the conservation of the rare British reptiles was sparked off when, in July 1982, my wife and I found three Smooth Snakes *(C. austriaca)* on South Canford Heath — a typical mature, dry heathland habitat. On visiting the site a couple of weeks later the first marker pegs for the planned Canford Heath relief road had appeared right in the middle of the site. It immediately occurred to us that if we didn't remove the snakes to a safer environment non-one else would.

So began our ever-increasing involvement with conservation of the British herptiles and with the BHS Conservation Committee.

Having discovered Sand Lizards on two other "doomed" sites on Canford Heath, one due for development as a school (now under construction) and the other as housing (with the associated additional threats to surrounding habitat outlined by Jon) we became heavily involved not only with collecting from these sites (under licence from N.C.C.) but also with the heathland management tasks carried out by the BHS Conservation Committee.

Having a dwindling supply of lizards as we gradually collected-out sites (lizards released at sites agreed between NCC and BHS CC) I felt that it would be useful to preserve part of the colonies by keeping a captive stock, with a view to breeding and releasing offspring on suitable sites, as has been performed by other BHS CC members.

I therefore set about constructing a reptiliary which I located in a south-facing spot against the side of my house, and an NCC licence followed in due course.

ACCOMMODATION OF ADULTS

The reptiliary design consisted of a glass barrier projecting about eight inches above the soil and about ten inches below. Rubble was buried along the lower edge of the glass to discourage lizards from burrowing underneath. Inside, the terrain was laid out as a sloping heather bank based on a pile of rubble (to give good drainage) extending eighteen inches underground, covered with a six inch layer of sand and topped with heather turf — obtained from a doomed site with the permission of Dorset County Council.

Care was taken to leave a six inch gap between the slope and the glass so that lizards could not jump over the glass. This worked very well and no lizards escaped — the only escape attempt comprising a two inch deep abortive scrape up against the glass.

The reptiliary, which measured six feet by four feet, was protected from our local domestic cats by a wooden framework covered with fine wire mesh. A hinging door in the top allowed access and the whole could be lifted off by two people, allowing photography at close quarters, and also weeding and pruning of heather to be carried out. The wooden framework stood on a layer of bricks to prevent rotting and to stop anything tunnelling into the reptiliary.

BREEDING

Lizards were caught from the end of May onwards and were therefore already gravid. It was while being held in the tank that I was presented with several clutches of eggs (see Appendix I for clutch sizes, laying and hatching dates).

These were laid under the piece of heather turf, against the bottom of the tank within six inches of each other — females obviously sensing instinctively that this was the optimal location. Prior to egg deposition females were bulging but after egg-laying were thin and wrinkled. Identification of the parent of each clutch was therefore a simple matter of spotting which female had become suddenly thinner on that particular day.

Eggs were examined carefully by digging away the sand surrounding them. When first laid eggs were a variety of shapes — one was virtually triangular — and the pinkish embryo could clearly be seen at one end. Within a couple of days, however, all eggs had filled-out to a more uniform cylindrical shape about 1.5cm long and 1.0cm across and the embryo was no longer visible (the egg wall having become more opaque). I raised all eggs about an inch away from the bottom of the tank and separated each from its neighbour to allow better gas transfer across the egg wall and prevent any anoxic spots. The sand was kept moist by occasional spraying, the frequency about once a week depending on the weather. The reptiliary was rapidly completed and the adult lizards installed in this to prevent damage to eggs by burrowing.

CARE OF EGGS

Eggs were left in situ, as described, until 42 days after laying when two eggs were brought inside and incubated in my cricket tank. These were buried up to their mid-line in moist sand (taking care to keep the original top surface upwards) in a plastic container with small perforations in the lid to allow entry of gases and to prevent the build-up of waste gases which might have suffocated the eggs.

This was incubated at a temperature of 25°C (±4°C) in the cricket tank, heated by a light bulb operated by a fish tank thermostat, laid flat on the bottom of the tank. The perforated lid prevented crickets gaining access to the eggs. The sand had to be carefully remoistened by spraying with warm tap water fortnightly — more often if required.

Eggs were inspected daily. Only two eggs (in situ in the outdoor tank) were affected by mould and these were treated by careful swabbing with cotton wool soaked in a weak household bleach solution (Christopher Mattison).

Once the first egg in the incubator had hatched (and I could therefore be sure that this method was successful) I brought the rest of the eggs inside and incubated them by the same method. This year I will incubate all eggs inside from the start which should, I hope, result in a shorter incubation period (the egg incubated inside hatched seven days before the rest of its clutch).

HATCHING

Several days before hatching beads of moisture appeared on the upper surface of each egg. "Sweating" is presumably a method by which the egg loses excess moisture. The moisture content of surrounding sand at birth is therefore likely to be critical for the successful hatching of the eggs — if too wet the egg will be unable to lose water properly (with unknown consequences), if too dry the egg wall may be too tough for the lizard inside to break out. The fact that three of the eggs (see Appendix I) contained fully-formed but dead lizards may be attributable to the sand being a touch on the dry side, or alternatively may have been due to the fact that no vitamin D3 or mineral supplements were given to female lizards in the three weeks between capture and laying of eggs. The latter would seem more likely (see Langerwerf) although I will ensure that the sand is on the moist side this year.

Beads of "sweat" were removed from the eggs using tissue paper as they would be lost to the surrounding sand if the egg was completely buried in its natural state. Immediately before hatching no more moisture was observed on the upper surface of the eggs, which became more spongy and started to collapse around the lizard within. Shortly afterwards a slit appeared at one end of the egg and the hatchling then emerged. The time from appearance of the slit to emergence of the lizard ranged from two to twenty four hours.

Only a small amount of yolk remained attached at the centre of the lizards belly showing that they had not hatched prematurely.

Of the thirty two eggs laid one was infertile, one was ruptured by a burrowing adult (embryo developing inside), three fully developed lizards were dead in their eggs, twenty-five eggs produced normal hatchlings and, strangely, two eggs produced twins (i.e. two hatchlings from a single egg). I have not heard of this being recorded before — both sets of twins (Mk I & Mk II) came from batch 2 and were approximately two thirds of the size of a normal hatchling from the same batch. Nothing unusual was noticed about any of the eggs in this batch, and twins emerged from apparently normal sized eggs. One of the Mk I twins later choked to death on a dried mealworm left by one of its larger siblings, but its twin was raised to adulthood and was ♀. The Mk II twins also turned out to be ♀ and I have retained them to see if they breed twins. Although this is of obvious interest I doubt whether breeding twins in the wild would be of any benefit to the survival of the species, as, although twice as many young could be produced, because of their relatively smaller size (compared to "single" hatchlings) they would take longer to grow large enough to be safe from predators that prey on young (but not adult) sand lizards, and their chances of survival would be consequently smaller.

The Mk II twins were of similar dorsal patternation but not identical.

Some hatchlings had kinks in their tails (including both Mk 1 twins) which may also have been due to calcium deficiency during development.

The period for all eggs in the same batch to hatch ranged from two to four days.

CARE OF HATCHLINGS

Hatchlings were housed in 12" x 10" x 10" aquaria with an inch of aquarium gravel on the floor. Heat was provided by a 25W tungsten light bulb suspended some four inches above the gravel surface. A sprig of dead gorse below this not only enabled the hatchlings to get nearer the heat source if required but also assisted in sloughing. Shade was provided at the end of the tank furthest from the heat source by several pieces of cork bark under which hatchlings could seek shelter. This is a safer means of providing shelter than pieces of slate or stone under which hatchlings could accidently be crushed.

Later when hatchlings had grown considerably they were transferred to a 36" x 12" x 12" tank with a 60W tungsten bulb giving a gravel surface temperature of 20°C. immediately below the bulb, and, on top of the gorse of 32°C. (which was also used as an occasional basking spot). In a 36" tank the far end of the tank provided a safe area for cooling off.

Hatchlings began to feed 2-4 days after emergence from the egg and were started on greenfly which were particularly plentiful on Nicotiniana plants with which I have planted our garden this year. Once feeding, my wife and I collected spiders from the gorse bushes on the heath which became a real chore as the hatchlings grew. I have boosted my breeding stock of crickets and mealworms so that I will be self sufficient in small insects to feed hatchlings on this year — important, as the site we collected spiders from has now been bulldozed in preparation for a new school!

Having read Bert Langerwerf's paper stressing the importance of calcium and vitamin D3 to the metabolism of lacertids I set about finding a vitamin/mineral supplement. Plenty of liquid preparations contained D3 but I could not find a soluble calcium source to complement this. Eventually I settled on a powder supplement manufactured for pigeons. It seemed not unreasonable that reptile and avian metabolism of calcium/D3 would be similar. So all prey items were dusted with Harker's Pigeon Minerals (see Appendix III for constituents) and all my hatchlings were raised on pink spiders and crickets! One kilogram of this powder cost £1.23 and I used about 200g to raise 27 sand lizards hatchlings to adulthood, making it considerably cheaper than many of the preparations intended primarily for reptiles. No signs of calcium/D3 deficiency (or overdose) were observed despite the fact that hatchlings received no direct sunlight or artificial UV, and I put this down to prophylactic use of Harker's from their first feed onwards (no deficiency ever being allowed to build up). Vitamin supplementation was completed by addition of Abidec drops to drinking water (one drop to 80ml. of tap water) which was available at all times in a shallow jar lid (to avoid any chance of hatchlings drowning). Water was changed

every second or third day as it dried up or was contaminated by lizards trampling through it. Having had success with this combination with hatchlings, I now use the same supplementation for my adults which I hope will result in greater propertions of eggs hatching successfully.

Newly sloughed mealworms (of suitable size) were fed to hatchlings in addition to spiders and crickets. Being soft these do not present the problems with digestion that "hard" mealworms do, although they did make the faeces rather fluid.

As the lizards grew the larger individuals were grouped together in separate tanks to enable their smaller siblings to get enough food and to stop them being worried or losing their tails (which happened to one of the Mk II twins).

First signs of sexual differentiation were noted in batch 1 lizards when several lizards started to develop a deep lemon colouration on the throat, flanks and belly at 40-43 days old. This lemon colour gradually turned to the green colouration of the adult ♂ at 50-58 days old in two individuals, where snout — vent measurements at that time were 5.00cm and 5.2cm respectively. Batch 3 and 4 males coloured up when 149-151 days old (snout — vent 5.4cm and 5.5cm); and 112-113 days old (snout — vent 5.5cm) respectively, which corresponds more closely with Malcolm Smith's statement that "The youngest breeding male that I have seen measured 55mm. in length from snout to vent."

I had expected colouration to develop at approximately this size and indeed it did. The difference in the time taken for lizards to reach this size will, I hope, be explained by my next comments.

While the reptiliary was under construction lizards were housed temporarily in a metal framed fish tank in the garden, containing a four inch layer of sand and a piece of heather turf. This had a secure wire-mesh lid and was protected from water, during storms, by a piece of slate raised above the top on two bricks. This prevented water getting into the tank while allowing sufficient air circulation to prevent lizards from cooking during hot, sunny spells.

FEEDING

Lizards were fed on mealworms, crickets, spiders and blow-flies. No vitamin or mineral supplements were given, although since the successful rearing of hatchlings I now dust all food with vitamin supplements. Drinking water was available at all times in an inch deep coffe-jar lid.

As autumn turned into winter the temperature in the "reptile room" fell to about 13°C. at night and after several weeks I noticed that many of the lizards had lost their appetites and had become noticeably skinny. Bert Langerwerf states that "..... *Lacerta agilis* and *Lacerta strigata* cease feeding and prepare for hibernation if the minimum temperature reaches 5-10°C ....". So I was quite surprised that mine had ceased feeding at this higher temperature. I overcame this problem by increasing the tank temperatures to a minimum of 15-18°C. at night. All lizards were soon feeding well again and filled out over several days.

Photoperiod at this time was 10-12 hours.

This cessation of feeding may explain the difference in time taken for males in different batches to develop adult colouration — batches 3 and 4 being at an earlier stage of development at this time, and therefore, perhaps, being slowed down at their most rapid time of development.

Batches 1 and 3 both included one individual which grew at a faster rate than other hatchlings in their brood. Both of these individuals were females (see Appendix II). One individual (also a ♀) in batch 4 turned out to be a runt, but all other lizards were more or less the same in their rate of growth.

HIBERNATION

Having returned the lizards to their former sleekness I decided to prepare them for a simulated hibernating — hopefully to induce reproduction in the spring. Those individuals (♂ and ♀) which seemed fullest in the body were selected and transferred to an 18" x 12" x 12" tank, the heat source in which was dropped from 40W to a 25W tungsten bulb to produce a lower temperature. A small box containing hay and a slit entrance was provided as a retreat. In this hibernation preparation tank lizards were starved for 7-13 days to allow the gut contents to be voided, thereby removing the risk of death during hibernation due to fermentation of recently

ingested food. Water was provided to ensure that lizards were fully hydrated at the start of their hibernation.

At the end of the starvation period most lizards had retired to the box of hay, not emerging during the day. They were then transferred to a large polystyrene box packed with polystyrene chips which was placed in a cool outside cupboard. Unfortunately the cupboard became too cold during the winter (—7°C.) so the box was transferred during cold periods to our hallway, resulting in a higher hibernation temperature than I had desired (0-14°C., average daily temperature 8.6°C.). Clearly this is not satisfactory and this year the hibernation box will be placed in a refrigerator at a constant 4°C. By keeping lizards at a low, constant temperature energy consumption should be minimal and they should emerge from hibernation in better condition as a result. Clearly the hibernation temperature must not drop below freezing point.

Hibernation period varied from 31-79 days (smaller lizards being brought on for longer before being hibernated, resulting in a shorter hibernation period). On being brought out of hibernation lizards were placed into the "hibernation preparation tank" to re-adjust. Water was provided and all lizards drank heavily. Several females were noticeably dehydrated particularly at the base of the tail which was virtually skin and bone. Mike Preston (pers. comm.) has also experienced this and has also lost lizards during hibernation of a longer period.

This year, therefore, I will add a layer of damp foam rubber at the bottom of the hibernation box to minimise dehydration.

Within a couple of days of emergence from hibernation all lizards had made good their water loss.

Only one lizard did not survive hibernation — a female which laid six eggs in the hibernation box and died as a consequence.

SEXUAL ACTIVITY

Lizards exhibited sexual activity some three weeks after coming out of hibernation, which was induced purely by chance. I was photographing and measuring individuals, and placed lizards in a single large tank for holding before release into the wild. About 45 minutes later I observed several males courting females; one pair copulated successfully.

Mating activity, and some violent aggression between males (described fully by Malcolm Smith) was also induced by turning on the "reptile room" light about two hours after dark — perhaps simulating daybreak.

It may therefore be possible to induce reproduction by keeping ♂ and ♀ lizards separately and placing single pairs in a new tank together, perhaps an hour before dark. If they receive direct sunlight the next morning one could reasonably expect courting to take place then, as is the standard procedure for spawning egg-laying fish. While this is an interesting theory, I did not follow it up as my aim was to raise lizards to sexual maturity for release into the wild, while disturbing their natural cycle as little as possible. From what I have seen of those that I have retained in my reptiliary as future breeding stock, they have integrated well and their behaviour is identical to that of the adult lizards which overwintered naturally. Speeding up their development rate does not, therefore, appear to have adversely affected them.

Although it may be possible to induce reproduction in captive-bred lizards, which are said to be less dependent on seasonal cycles, without hibernation, four males (two hibernated for 31 days, and two for 42 days) showed no signs of sexual activity which would suggest that a longer, more severe hibernation than these four received is necessary.

LIZARD INTRODUCTIONS/REINTRODUCTIONS

Corbett and Tamarind have commented on the success of sand lizard introductions on suitable sites. It seems likely that a single introduction of a sufficient number of lizards would result in the establishment of a colony provided that the site is chosen to meet, as closely as possible, the criteria set out by the above authors.

By introducing lizards which have been raised to sexual maturity and which can be expected to breed in the same year as introduction, successful colonisation of that site is even more likely, particularly given that survival of wild hatchlings beyond the second hibernation period (i.e. to sexual maturity) is only 5% (N.C.C.).

Twenty-two lizards (10 ♂, 10 ♀ and two wild-caught juveniles) were released on a site at Arne, Dorset (agreed between BHS CC and NCC) in mid-April. Future monitoring will assess the success of the introduction.

CONCLUSIONS

English sand lizards, bred from wild-caught adults from doomed sites, can be raised to sexual maturity in under seven months (including the period of simulated hibernation) provided the precautions I have outlined are taken. I hope to generate further data this year and particularly to standardize environmental conditions to make growth data comparable.

The purpose of my article is to stimulate interest in the conservation of *L. agilis* in Britain, particularly on the heathland sites that I know so well.

As my title implies, I see the role of captive breeding as secondary to the vital task of habitat conservation and management, in order to preserve, improve or reclaim sites for sand lizard habitation. This is the area where work is most urgently needed and must be given top priority if the rare reptiles are to maintain their slender foothold in Britain.

ACKNOWLEDGEMENTS

I am deeply indebted to my long-suffering wife Anne for her invaluable help in collecting food for the hatchlings, and to those members of the BHS Conservation Committee (particularly Dave Dolton and Mike Preston) for their advice and guidance. I would also like to thank Geoff Haslewood for sorting out the licensing details and the technicialities of the release.

Many thanks also to Brenda Burton for typing the manuscript.

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APPENDIX I: BATCH DETAILS

BATCH NUMBER	MEASUREMENT OF PARENT (cm)		DATE OF LAYING	NUMBER OF EGGS	INCUBATION PERIOD (DAYS)			NUMBER OF HATCHLINGS	NUMBER OF HATCHLINGS REACHING SEXUAL MATURITY	
	S–V*	TAIL			IN SITU	IN INCUBATOR	TOTAL		MALE	FEMALE
1	8.5	7.1**	16/6/84	12	42** 56	14 7–10	56 63–66	10	8	2
2	7.9	9.0	22/6/84	8	50	12–13	62–63	8	–	7
3	7.7	11.4	1/7/84	6	41	18–20	59–61	6	2	3
4	Not known	Not known	Not known	6	Not known	Not Known	Not known	5	2	3

* Snout-Vent Length
** Short tail due to loss and regrowth before capture
*** Two eggs given initial trial incubation.

APPENDIX II
GROWTH DATA

BATCH 1	MEASUREMENTS (cm.)						COMMENTS
DAYS FROM HATCHING	6 – 9 (+7)*		101 – 104 (+7)		235 – 238 (+7)**		
	S–V	Tail	S–V	Tail	S–V	Tail	
	3.1	4.3	5.6	9.1	6.4	10.1	
	3.0	3.8	5.9	9.1	6.4	9.5	
	3.1	4.3	6.4	9.4	6.5	9.9	
	3.0	4.2	6.7	9.8	6.6	10.2	
	3.0	4.1	6.0	10.5	6.3	10.3	
	3.1	4.6	6.2	9.8	5.9	9.6	
	3.1	4.8	6.1	10.3	5.6	8.6	
	3.3	4.4	5.2	7.9	6.35	11.1	
	3.2	4.5	6.2	9.7	7.0	9.6	
	3.2	4.1	7.1	10.1	7 2	10.2	

BATCH 2	MEASUREMENTS (cm.)						COMMENTS
DAYS FROM HATCHING	0–1		95 – 96		232 – 233		
	S–V	Tail	S–V	Tail	S–V	Tail	
	3.0	4.0	6.2	8.6	6.7	9.0	
	3.0	3.8	4.8	7.0	7.0	10.2	
	2.2	2.8	6.0	8.6	6.6	8.5)	Mk 1
	2.4	2.8	–	–	–	–)	Twins
	2.8	4.0	5.4	8.6	6.6	10.3	
	2.8	3.7	5.7	9.1	6.5	9.6	
	2.4	2.8	4.6	6.5	7.2	9.3)	Mk II
	2.3	2.3	5.3	4.7	7.1	5.9)***	Twins

* (+7) days refers to the single lizard that hatched 7 days before the rest

** Third measurement includes two non-growth periods – starvation period of 7–13 days and hibernation period of 31–79 days.

*** Shorter tail due to loss, at an early stage, and regrowth.

APPENDIX II (cont.)
GROWTH DATA

BATCH 3	MEASUREMENTS (cm.)						COMMENTS
DAYS FROM HATCHING	5 – 7		88 – 90		225 – 227		
	S–V	Tail	S–V	Tail	S–V	Tail	
	2.7	4.1	4.4	7.7	6.6	10.3	
	2.9	4.1	5.0	6.5	–	–	Kinked tail
	3.0	4.2	4.8	8.7	6.2	10 4	
	3.0	4.0	6.9	10.5	7.0	10.5	Toe missing
	2.9	3.9	4.4	7.3	6.1	10.1	
	2.9	3.8	–	–	6.4	9.6	

BATCH 4	MEASUREMENTS (cm.)						COMMENTS
DAYS FROM HATCHING	1		65		203		
	S–V	Tail	S–V	Tail	S–V	Tail	
	2.8	3.4	4.2	6.7	7.1	10.0	
	2.7	3.8	4.7	8.4	6.9	9.9	
	2.8	3.5	4.0	6.1	6.6	10.7	
	2.8	3.4	4.6	7.0	6.3	10.5	
	2.8	3.5	4.0	5.8	5.5	8.7	

APPENDIX III

CONSTITUENTS OF HARKER'S PIGEON MINERALS

Contents per kilogram:

Vitamin D3	40,000 i.u.
Calcium	328g.
Phosphorous	6,600mg.

Also vitamins A, B2, Iron, Cobalt, Manganese, Copper, Zinc, Iodine, Magnesium and Sodium Chloride.

N.B.
Abidec drops, used to complete vitamin supplementation, contain vitamin D2 (not D3) and are therefore not sufficient vitamin supplementation on their own (nor do they contain calcium).

APPENDIX IV
SUMMARY OF LOSSES OF EGGS AND HATCHLINGS

	Initial Number	REASONS FOR FAILURE TO SURVIVE					Number Surviving
		Infertile	Fatally Damaged by Adult	Dead in Shell	Choked to Death	Died in Hibernation	
Eggs	32	1	1	3	–	–	27
Hatchlings	29*	–	–	–	1	1	27

*Includes two sets of twins

OBSERVATIONS ON THE DEFENSIVE BEHAVIOUR OF THE CRESTED NEWT *(TRITURUS CRISTATUS CARNIFEX)*

FRANCO ANDREONE

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In 1984 I started a program of study on population dynamics and behavioural ecology of the Crested newt *(Triturus cristatus carnifex)* in a pond near Turin (North-western Italy), and in order to follow the migrations of the animals, I built a Drift-fence with several pit-fall traps, as described by many herpetologists (Harrison & others 1983; Van Gelder, 1973).

I don't want to deal with the results of this research, but instead to mention a particular behaviour observed in newts in terrestrial phase.

When I picked them up from the traps, they assumed a particular position with the tail all rolled up, the head turned on one side of the body, and the eyes closed, emitting in the meantime a sharp smell, and, if they were excited further, secreted a whitish exudate, obviously venemous.

It is clear that this is a defensive posture, observed in several species of salamanders and newts by Brodie (1977), and he associated this behaviour with the aposematic belly coloration of these animals. I have pointed out that the Crested newts usually don't make visible their belly when they are touched, and so I don't think that the coloration of this part of the body is useful in defending themselves from terrestrial predators.

I suppose that defensive behaviours may be divided in two different phases: the first consists of the mentioned posture, that makes evident a small yellow spot at the junction of the tail in the males, and a yellow stripe in the females.

In my opinion these are the real aposematic signals, directed towards small terrestrial enemies, such as Shrews (Brodie, 1979). The tail becomes the more evident part of the body, and therefore it is often eaten, and in fact I have found many newts partially eaten or without the tail in the traps, perhaps plundered by Shrews or other small mammals.

The Shrews are small enough to remain caught by the defensive behaviour of the newts and by their sharp smell, and after having found the tail disgusting and inedible they go away.

The yellow spot in the tail of the males may have another function in the courtship parade, when it becomes a signal of attraction for the female, but the two meanings may co-exist.

When the enemy is a greater animal we can observe the second phase of the defensive behaviour, since a simple exhibition of the small spot as described above is useless.

At this point the newts may make visible the yellow-orange belly, with a new aposematic significance, making the animal associate the bad taste of the newt with the coloration. Another observed behaviour is the attempt of the newts, especially the females to bite the aggressor, when they are squeezed in the back of the body.

I don't know if this is a defensive behaviour; or a reaction to the pain, considering that only on rare occasions the animals are able to reach the enemy who attacks them.

It is interesting to observe that the newts lose their rigid position when they touch the water and swim away. A defensive position in the water is described by Sparreboom & (1984) in genera *Paramesotriton* and *Allomesotriton,* where the males are very territorial.

The position of the animals in the water is very similar to the one assumed by terrestrial Crested newts, with the body curled sidewards around the head of the attacker, the eyes closed till the attacker loosens its grip.

The belly coloration could have a significance also in the water, i.e. against the attack of fishes or other aquatic animals, and in fact the dorsal coloration is well camouflaged, and defends the newts from attacks coming from above, while the belly coloration defends them when the newts must go to the surface to breathe.

Summing up, the defensive behaviours of the Crested newt are:

1) TERRESTRIAL PHASE
   — Defensive rigid posture, with the exhibition of yellow spot under the tail, with extrusion of venemous material.
   — Exhibition of belly coloration against greater attackers.

2) AQUATIC PHASE
   — Rapid flight
   — Attempt to bite the enemy, (behaviour observed also in terrestrial phase).
   — Camouflage coloration, exhibition of the belly against fish attacks.

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LETTERS TO THE EDITORS

Dear Sir,

Does *Emys orbicularis* aestivate on land?

Although the European pond terrapin *Emys orbicularis* (L.) is predominantly aquatic, it is not infrequently to be seen on land. I have found specimens, not far from water, in western Turkey, while Rollinat (1934) noted that some of his captive specimens would hibernate on land in heaps of manure. There are many records of hibernation in chelonians, but summer aestivation is less well documented. That this may sometimes occur is now suggested by the fact that my son Hugh Cloudsley saw a half-grown *E. orbicularis* in the almost dry bed of a stream flowing through the grounds of his villa near Moinho da Rocha, some 10km north of Portimão, Portugal, in late February, 1985. Between April and October, the nearest permanent water is about 3km upstream — apart from a 'baragem' or dammed artificial lake, which was constructed only a year earlier, about 500m downstream. Incidentally, I was once given a specimen of *Pelomedusa galeata* (Schoepff), which had been found, out of water and in a somewhat desiccated state, near Wad Medani, Sudan.

Rollinat, R. (1934). *La vie des reptiles de la France centrale.* Libraire Delagrave, Paris.

Professor J.L. Cloudsley-Thompson
Birkbeck College, University of London, Malet Street,
London WC1E 7HX

Dear Sirs,

Hydrophobic Geckos

In his interesting note on the viability of gecko eggs exposed to sea water (*British Journal of Herpetology*, **64**: 435-6 (1985)), Andrew Gardner comments upon the success of geckos in colonising oceanic islands, adding that it is not known how well adult geckos are able to survive rafting. In this context, my own observations on *Gymnodactylus scaber* (Heyden) may be relevant (*Entomologist's Monthly Magazine*, **107**: 10 (1971)). This species is common at Suakin, Sudan. When disturbed, it sometimes takes refuge by running into the sea where it swims quite well. Its skin is apparently hydrophobic and, although the body eventually sinks below the surface, the animal floats with the eyes and nostrils above water. My wife and I found geckos of this, or a related species, in a cave in a raised coral reef on an uninhabited island near Dar-es-Salaam, in December 1969. Experiments in the laboratory with *Tarentola annularis* (Geoffroy) suggested that the skin of this house gecko is likewise hydrophobic. When the body is submerged, it remains covered with a thin film of air. The above observation, therefore, does not imply any particular adaptation on the part of *G. scaber*. There does not seem to be any correlation between permeability of reptile skin to gases, or to water and solutes.

John Cloudsley-Thompson,
Birkbeck College, University of London, Department of Zoology,
Malet Street, London WC7E 7HR

Dear Sirs,

Grass-Snake Using Tongue as Lure when Feeding

I was prompted to record this observation when an expert colleague informed me that he had not observed this behaviour himself, nor had he seen it described elsewhere.

The observation, made some 20 years ago, concerned a large (circa 1 metre) female grass-snake *(Natrix natrix natrix)* which I kept in the garden in a glass vivarium. This was one of the largest snakes I had ever seen and had been caught near a pond on Peterborough's Milton Park Golf Course. In another vivarium I had a number of small toads which I offered to the snake. I used to observe the snake catching and eating the toads and on four or five occasions it adopted a pattern of feeding behaviour I had not seen in any captive or wild grass-snake. It appeared that the snake used its tongue to lure the toad in the following manner: On first detecting the toad the snake would shift its position slowly, orientating its head towards its intended victim. The normal

sensing flickering movement of the tongue was replaced by the protrusion of the tongue for a longer period than normal during which the tongue was moved more slowly than usual. In fact, it appeared to be a slow motion version of the normal flickering position. This movement caught the attention of the toad which then turned towards the moving snake tongue and moved towards it. When in range the snake would strike at the toad. On at least two occasions the toad actually struck at the snake's tongue first presumably taking it for an insect. When this happened the snake did not retreat from the toad but immediately struck in return and seized the toad.

As this snake had only been in captivity for a matter of days when this behaviour was first noticed, I presume this feeding adaptation was 'learned' in the wild. My observations were terminated when the snake was accidentally released.

Roger Mitchell
Nature Conservancy Council, Northminster House,
Peterborough PE1 1UA

Dear Sirs,

An exceptional spawning in *Euproctus a. asper*

The Pyrenean Mountain Salamander *(Euproctus a. asper)* produces large (3-5mm) whitish eggs which it attaches singly to the underside of rocks or inserts into crevices. The species is rarely kept in captivity and possibly as a result, reports of successful breeding are scarce.

The number of eggs laid is considered to be rather small. Thorn (1967) reports instances of three or four eggs being produced per year whilst around ten eggs were obtained after injecting gonadotrophic hormone. These observations have been borne out in our own collection (Wisniewski and Paull 1982) where a number of pairs have been kept and bred successfully for several years, each breeding pair occupying separate tanks.

During 1985, breeding was again recorded. One pair were particularly successful. Egg laying commenced on 1/5/85 with a total of eight eggs adhered to the sides of the tank, under pieces of slate and attached to a plastic flower pot. Spawning continued for over a month, the last egg being laid on 11/6/85. In total, 57 eggs were laid by one female *Euproctus*. The first eggs hatched on 27/5/85. The total young hatched amounted to 27, since many of the eggs became covered in fungus. This may have been partly due to damage, whilst the eggs were being removed from the parental tank to an 'incubation' tank. Newly hatched young were also prone to severe fungal attacks. However vigorous aeration seemed to greatly reduce the incidence of this disease.

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P.J. Wisniewski and L.M. Paull
Amphibian Breeding Centre, 38 Hesketh Road, Burscough,
Nr. Ormskirk, Burscough, Nr. Ormskirk, Lancs. L40 7SQ

The effect of blanket weed on the breeding of Triturus vulgaris and cristatus

On the land next to my house my company needed to irrigate the 3 to 4,000 container grown trees and shrubs it raised every year. I was, at that time, attracted by the cheapest method. A reservoir was dug 3 to 4 foot deep by 24 foot long and 12 foot wide. It was lined with heavy gauge polythene and a water supply from the mains was run to a ball cock valve over one end of the reservoir. Within three years I had run out of growing area and the reservoir had sprung a leak causing mains water to be continually pouring into it and topping it up. Consequently I moved my growing operation to a farm some two miles away. The Spring before I moved the growing operation, the reservoir had attracted several dozen Smooth Newts; *Triturus vulgaris.* After the move I maintained the water level in the reservoir as I had become quite fascinated by these creatures and would watch them for hours at night with a spot light. In the Autumn, leaves of the nearby trees would fall into the pond slowly building up a sludge at the bottom. It was from this sludge some two years on that I saw what I believed to be some form of Dinosaur emerging. It turned out to be a female Crested Newt *(Triturus cristatus).* Over the next couple of years the reservoir annually attracted about a hundred *vulgaris* and ten or a dozen *cristatus.* However precise numbers of *cristatus* were difficult to gauge as unlike the smooth newts they withdrew from the torch light and would hide wherever possible.

Despite a long and frenetic season of egg laying, few newtlets could be seen in the Summer and Autumn. I watched the newts and realised the newtlets were being eaten. In an uninformed attempt to protect the newtlets I introduced totally unsuitable plants, i.e. floating water chestnut. The plants died but to my dismay I realised during the next Spring and Summer I had introduced blanket weed which flourished, growing from the bottom of the reservoir forming a thick mat over the water surface. I was concerned for two reasons. Firstly, the air exchange at the water surface would be severely impaired perhaps providing an inadequate oxygen level for the demanding mating behaviour of the *vulgaris.* Fortunately the pond still leaked and there was and still is a substantial, continuous flow of mains water. Secondly, the newts and particularly the newtlets might become caught in the tough dense filaments of the weed. I checked many newts I saw in the weed, but on every occasion their movement was in no way impaired. The newts seemed completely uninhibited by the weed. I was unable to clear the pond of weed as I had no way of ensuring no newts remained in the weed whilst dragging it from the pond.

That season many more *cristatus* than usual were seen in the pond. The number of *vulgaris* may have been slightly down. From June onwards wherever I would gently part the blanket weed, as by now it totally covered the water surface, newtlets would emerge. I can only guess that the pond held several hundred newtlets of both varieties despite the dense weed coverage. In the past I had only rarely seen the occasional one year old *cristatus.* I decided that if the newts flourished in and under the blanket last year many one-year old *cristatus* would be sighted this year. This February I cleared much of the weed leaving enough to create total pond cover around July. This year the number of smooth newts is low but there are very high numbers of Warty Newts including many dozens of small *cristatus* about the size of an adult Smooth Newt. The males have not developed their courting crests. I have not seen, before, such large numbers of what I presume to be one year olds. There are again extremely high numbers of newtlets to be seen.

It would seem that under some conditions blanket weed favours the survival of recently emerged newtlets. I do not know how critical the continual flow of tap water is.

I would be very interested to hear from anyone on the matter, particularly if they have any experience or knowledge which may define the parameters further in relation to the use of blanket weed for newtlet protection.

Mel Glazer
The Nursery, Chapel Lane, Brockley,
Bury St. Edmunds, Suffolk

Dear Sirs,

Research into Shell Deformation (Pyramiding) by Pauline Christian

I have been made aware of the fact that one or two members are reluctant to reply to my research questionnaire (despite the fact that most of you sent a stamped addressed envelope) as they do not understand what information I require.

To clarify, I am amassing details of general husbandry of captive bred hatchling tortoises with special attention being given to diet and hibernation to try and find a solution to the problem of pyramiding, whereby the shields are raised into pyramids instead of the nice uniform smooth surface of 'wild' hatchlings. This pyramiding is not only unsightly but in severe cases causes limb deformities, externally leg bones are bowed, the nails abnormal and the tortoise cannot walk normally. The beak and mandible can be deformed. Damage to spinal cord and spinal nerves plus cramped intestines (Dr. O. Jackson 1985 personal communication).

These deformities are *not* to be confused with 'genetic deformities' which are apparent at hatching and present themselves as an increase in the number of shields or less often a reduction. In *Testudo hermanni hermanni* the supracaudals can be fused (Carapace malformation by Prof. W. Kirsche 1979-1981).

I have received many replies from home and abroad and require information on hatchlings suffering from this particular form of deformity as well as 'normal' hatchlings to compare diet etc.

The sooner I receive your replies the sooner I can perhaps draw some conclusions. Then we can all work towards rearing hatchlings as near perfect as possible. Thank you to everyone who has already helped.

P. Christian
11 Beagle Close, Abingdon, Oxon. OX14 2NU
Tel: Abingdon 28223.

Clarification of Conservation Committee Report

Sirs,

Chris Tydeman has asked me to make it clear that it was he who, through WWF, obtained £1200 from B.P. for John Webster to use for heathland management. This was misleadingly put in my Report (*Bulletin*, **12**, 8: 1985) and I apologise for this.

G.A.D. Haslewood
Chairman, Conservation Committee

MEMBERS' ADVERTISEMENTS

- **For Sale:** Oriental Fire Bellied Toads £3; Clawed Toads £3. This year's offspring, well grown. **Wanted:** Marbled Newts.
  N.E. Jones, 31A St. Georges Road, Leyton, London E10 5RH. Tel: 01-556 2979.

- **For Sale:** Parmenter, C.J. (1976). The Natural History of the Australian Freshwater Turtle, *Chelodina longicollis*, Shaw (Testudinata, Chelidae). Ph.D.Thesis, University of New England, Pp. i-xiii, 1-210 plus figs. Total 255pp. A detailed work on snake-necked turtles. £11.50 each (photocopy) postpaid (or equivalent amount in Danish Kr.)
  Henrik Bringsøe, Esthersvej 7, DK-4600, Køge, Denmark. Tel: 03-663023

- **Wanted:** contact with members interested in all aspects of gecko biology, taxonomy, ecology and distribution. **Also Wanted:** colour slides of named gekkonid species and scientific papers dealing either with geckos or with areas to which they occur.
  D. Garthwaite, 16 Brill Close, Luton, Beds. LU2 9RL.

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