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Correspondence, membership applications, subscription renewals and purchase orders for the Herpetological Journal and British Herpetological Society Bulletin 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.

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 Simon Townson

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FRONT COVER.
Natterjack Toad *(Bufo calamita)*, resident in a B.H.S. Conservation Committee vivarium for captive breeding purposes.

See article on captive breeding programme for Sand Lizards and Natterjacks, by Paul Edgar, on page 3.

LONDON MEETINGS 1990

Meetings are held either in the Lecture Theatre of the Linnean Society of London, Burlington House, Piccadilly, London W1 (*), or in the Lecture Theatre of the Zoo Studies Centre, Zoological Society of London, Prince Albert Road (opposite Ormonde Terrace), London NW1 (**), and start at 7.00 pm, ending at 9.00 pm, unless indicated otherwise.

Please note that the June London meeting is to be held on Tuesday, 12th June, not 10th June, as previously published in the Winter 1989 Bulletin.

June 12th	Dr T.R. Halliday (Open University; Chairman, BHS Research Committee) (organiser): Behavioural ecology of newts and salamanders. Other contributors: Dr J.W. Arntzen (Institute of Taxonomic Zoology, University of Amsterdam, the Netherlands) and Dr R.A. Griffiths (North-East Surrey College of Technology; Deputy Chairman, BHS). Meeting starts at 5.00 pm in the Lecture Theatre, Zoological Society of London, Outer Circle, Regent's Park, London NW1. BHS members welcome.
July 25th*	*Amphibia and Reptilia worldwide: their care and breeding.* A discussion organised by the Captive Breeding Committee (Chairman, Mike Linley). Members are encouraged to bring live animals, preserved specimens, amphibian voice recordings and 35 mm colour slides for display and to illustrate discussions.
September** – *date later*	*Care and breeding of amphibians and reptiles: an open meeting.* Contributions from members – live animals and photographic displays. There will be the opportunity for the sale and exchange of members private home-bred stock. A Saturday Afternoon meeting from 2.00 to 5.30.
October 10th*	Mr Mark O'Shea (Wolverhampton): Reptiles, especially snakes, of Papua New Guinea.
November 13th*	To be arranged.

TRITURUS-4 MEETING

14th-18th September

VALSAIN (SPAIN)

The purpose of this meeting will be, as in previous years, to provide a unique opportunity of bringing together workers of different disciplines with a common topic of study: European newts of the genus *Triturus*. Participants will be asked to give short informal talks on their current research on *Triturus*.
Registration fee: 5000 Ptas.

For further information write to:

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

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THE DECLINE OF THE SAND LIZARD

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

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

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

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

THE DECLINE OF THE NATTERJACK TOAD

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

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

THE B.H.S./MARWELL PROJECT

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

ACKNOWLEDGMENTS

The total sponsorship received, to February 1990, for this project has been just under £4600 (now all spent). Several companies also supplied materials for vivaria construction at a considerable discount. Grateful thanks are therefore due to the following:- Agriframes Ltd., Ark Aid, D. & M. Ashe, C. Ashton, Association for the Study of Reptilia and Amphibia, C. Beadle & Family, B.H.S. Conservation Committee, Bournemouth School, R. Buckland, D. Chapman, A. Clark, J. Compton, S. Curry, East Hampshire District Council, R. Eaton, A. Foden, B. Ford, Formerton Ltd., Mr. & Mrs. J. Foulston, Freemantle First School, Friends of Poole Aquarium, C. Gardiner, W. George, R. Grimond, Horndean Parish Council, W. Jupe, Liphook Junior School, A. Lloyd, H. MacKenzie, Marwell Oryx Club, Marwell Preservation Trust Ltd., Metwood (of Fareham) Ltd., M. Miller, D. Ormond, Petersfield Post, K. Pickard-Smith, Pink & Son Ltd., K. & I. Randall, J. Sandison, P. Thorpe, W. Urry, Vauntberry Ltd. and C. Weatherby.

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A REPORT ON THE REPTILE LIFE OF SOUTH CENTRAL FRANCE

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INTRODUCTION

Herpetological notes were made during a trip to France in the summer of 1989.

My wife and I were stationed for a week in the Perigord area and for three weeks in the Tarn region. Furthermore, shorter trips from one to three days were undertaken to other places, including Andorra. The localities are indicated in the accompanying maps and are referred to by site numbers in the text. Altitudes were determined from local maps and an aneroid altimeter, calibrated in feet. These measurements have been converted to metric values to accord with general practice. Heights were double checked wherever possible and any error is very small. Locality references are given below together with a descriptive account.

The author has had no recourse to detailed literature on French reptiles and amphibians. Species identification proved no problem except in the case of Green and Brown Frogs but these are taxonomically difficult in any case. Whereas by no means an exhaustive survey it is hoped that the observations made may prove useful to other herpetologists in an area which is not so frequently visited as the more popular Mediterranean regions.

SITES VISITED

1. Hamlet of Champeau-et-la Chapelle Pommier. 150-200 metres. July 9th. to July 14th.
2. a) Forêt de la Garrigue near Montricoux. 250-300 metres.

   b) River valley below site 2a. 180 metres July 16th. to August 5th.
3. Artificial lake dammed by the Barrage de Roucarie. July 21st.
4. Parc Naturel Regionel south of Monts de Lacaune.
5. French Pyrenean foothills. a) 1400 metres b) south of Ax-les-Thermes 1000 metres.
6. Northern Pyrenees, Andorra principality.

   a) Canillo 1600 metes b) Arans 1500 metres c) near El Sarat 2000 metres
   d) Pas de la Casa 2096 metres.

PHYSIOGRAPHICAL DESCRIPTIONS

1. The village of Champeau-et-la-Chapelle Pommier lies in the Perigord region between the Massif Central and the Atlantic. More precisely it is situated 15 kms S.W. of Nontron which is roughly central in the triangle formed by Limoges, Périgueux and Angoulême. The village is located in the valley of the Nizonne river, one of several small rivers and streams that empty into the Dronne. There is contrast in habitat from lush water meadows, fields, hedgerows, woodland, which is mainly deciduous though with some conifer plantations as replacement forest, to dry scrubby hillsides that lie on the limestone escarpment that rises to the north of the valley, one of many such limestone ridges in the region. Here one finds a more "Mediterranean" aspect with dwarf oak, juniper and low aromatic plants. The countryside otherwise is gently rolling with light agriculture, mostly grazing and wheat. Little habitat destruction was evident apart from controlled tree-felling for the timber mills. The area represents an unspoilt natural environment. We were stationed on the south side of the valley.

2a. The Forêt de la Garrigue lies 30 kms. from Montauban which is about 60 kms. north of Toulouse by Autoroute. The forest itself is on a limestone plateau and is densely wooded with mixed farmland, a good deal of which has been neglected allowing large fields to revert to natural vegetation in places. The region is especially dry in summer and by August a lot of trees were turning brown.

Of interest are the several artificial ponds. Some of these are used as watering holes for cattle but others were found to be stocked with fish, both "goldfish" and catfish. The ponds measured about 10 metres by 4 and the water table seems high enough to maintain the water level. From the state of the vegetation round the margins of these ponds they must be of considerable antiquity. We were stationed at the Gîte "Le Figat" which is let out as a holiday home. Forêt de la Garrigue is separated by another densely wooded plateau, Forêt de la Domaine Gresigne, by the Gorges de l'Aveyron. These areas of relatively high ground 250-450 metres high, link through to Les Monts de Lacaune to the south east.

2b. The river valley in the above named Gorge at the confluences of the Aveyron and Vere rivers below the medieval valley of Bruniquel. The river is flanked with woodland and lush meadows.

3. The lake lies in another extension of the higher ground mentioned under 2a. The lake is fed by a small river which acts a hydro-electric plant. Fairly open country with grassy borders to the lake, some woodland containing small ponds.

4. The National Park is a richly forested region with both deciduous and coniferous forest. There are more open areas with paths, fields and streams. A small lake was present near our camp. To the north rises Les Mons de la Lacaune with summits of over 1200 metres and to the south Du haut Languedoc.

5a. and b. Two sites along the route from France to Andorra between Foix and the border post at Pas de la Casa. These represent the progressive change from lowland to highland aspects. The road runs up a steep-to valley and stopping here was difficult.

6a. and b. These sites were on the only route through Andorra. Steep mountains flank the valley in which there are tobacco plantations and small streams.

6c. Well-watered valley running up to the alpine zone at the N.W. of the country. Stone walls, hedgerows, fields and woodland.

6d. and e. High open meadows with tumbled rocks and numerous small rivers and streams.

OBSERVATIONAL METHODS

Due to the length of time spent at site 1 and 2 there was plenty of scope for observations at all times of day from sunrise to after dark. This enabled some quite interesting and detailed notes to be made on activity patterns in the case of certain species, notably *Vipera aspis*. In other cases as much walking was done as circumstances and weather conditions permitted. Weather conditions experienced on this trip were variable and since these are important in relation to reptile activity a section of this report is devoted to a summary of these.

WEATHER CONDITIONS

Considerable extremes of temperature were recorded. Very high daily maxima alternated with periods of more normal temperatures preceded by thundery outbreaks. Thunderstorm activity was general when it occurred causing local damage. This was especially bad just before our arrival in the area. Otherwise thundery conditions prevailed on July 9th. and 10., July 21st. to 24th., July 30th. and August 5th. The storms that occurred in the Pyrenees on July 30th. were more or less confined to the mountains. At Champeau maxima were in the range 25-30°C whereas at Site 2, Gîte Le Figat, maxima were mostly between 30° and 35° though exceeding 40°C on July 20th. and 21st. and on some other days were around 37°C. Lower temperatures were recorded on the 24th., 25th. and 27th., maxima 24°, 26° and 26° respectively. The 50 year mean maximum at Mountauban is 27.8° for July and 27.2° for August. In Andorra temperatures were also variable. A sunrise temperature of 12.5° rose to 34° maximum at Andorra la Vella (altitude 1024 metres) due to katabatic wind effect. At 12.30 hrs at Casa de la Pasa the temperature was only 12.5° under sunny conditions. The previous day's maximum had been 18° with a minimum of 6°.

SPECIES ACCOUNT

BUFONIDAE

Bufo bufo bufo (Linnaeus)

Site 4. One example was found after dark following rain alongside a path. It was a largish adult measuring 80 mm. Temperature 20°C.

RANIDAE

Rana dalmatina Bonaparte

Brown frogs referrable to this species were found at Site 4. The small lake yielded several individuals which were found in the late evening and after sunset at the water's edge and in long grass.

Rana temporaria Linnaeus

Sites 6c. and 6d. Brown frogs observed at these sites are tentatively assigned to this species. At 6c several were found active in the early afternoon under sunny conditions by the edge of a stream. At 6d. a few were glimpsed sitting on rocks in a stream and dived into the water when disturbed. The reader is referred to Arnold, Burton & Ovenden (1978) concerning the problems surrounding the precise identification of Brown Frog populations.

Rana esculenta/Rana lessonae

The precise designation of Green Frog populations to one species or another, in both western and eastern Europe, is a major taxonomic problem: Arnold, Burton & Ovenden (1978). No attempt is made here to assign Green Frogs observed on this trip to a particular species. Within a population some frogs were bright green, olive-green or more brown in ground colour. Some had a light vertebral stripe while others lacked it. Whereas at times this range of colouring could be linked to the background at others it could not. Green coloured frogs basking on muddy banks were as common as darker coloured animals.

Green Frogs were found at sites 2a, 2b, and site 3. At Site 1 calling was heard in the evenings but no animals located. At 2a a small population was found in one of the artificial ponds, see site description. This population was comprised of a very few small individuals some 25-35 mm. in length. How this population originated is hard to see since the area is very dry and the nearest body of water lies two to three kilometres distant. Whether it represents a breeding colony is open to doubt since no adults were seen. At site 2b frogs were common in open stone watering troughs, in a drying pool and on the banks of a nearby stream feeding into the river. At site 3 newly metamorphosed juveniles and tadpoles on the point of change were abundant in the grass and lake shallows respectively. A colony of adults was discovered in a muddy pool amongst overhanging trees a short distance from the like itself. No Green Frogs were found at sites 4, 5 and 6.

LACERTIDAE

Podarcis muralis muralis (Laurenti)

This lizard was found at all the localities visited with the exception of sites 6d and 6e occupying an altitude range of about 150 metres to 1600 metres. It was found in a wide range of biotopes and showed no particular preferences: buildings both occupied and deserted, the edge of roads and paths, light woodland, forest clearings, stone walls, hedgerows, leaf debris and the margin of streams wherever there were boulders and vegetative cover. At Sites 1 and 2a the same individuals could be identified day after day having prescribed territorial limits foraging defined distances from their hiding places in crumbly stone work and round houses. Where it was found around buildings it would climb high up to the eaves when alarmed. Males were rather more common than females and recently hatched juveniles were seen at 2a and 2b. Adult males at site 1 were rather less heavily built and less heavily patterned with flank reticulations than at the localities further south. A lot of photographs were taken of Wall Lizards at all the places visited and special note was taken of the populations in Andorra because of the possibility of confusion with *Podarcis monticola* and *P. hispanica* which might be expected in the region. These two latter named species were not found however.

P.muralis had a broad activity range even tolerating the very high temperatures on some days though keeping to the shade at the hottest times of day. At Champeau activity continued

up to 21.00, the lizards either basking in the evening sun or moving around on shady stonework still warm to the touch. Morning activity began one to two hours after sunrise and rather later on some days at site 1 which began chilly and foggy.

Lacerta viridis viridis (Laurenti)
The Green Lizard was found in all the areas visited except sites 6d and 6e. It was common, especially amongst undergrowth, woodland paths and the margins of fields. At site 1 it was plentiful in the water meadows near the Nizonne river. At site 4 the lizard was found under partly sunny conditions between thundery showers and the lower temperatures caused by these conditions and the altitude resulted in the lizard displaying itself more prominently and basking more openly than at site 2a where it occupied shady woodland and thickets often being detected only by the rustling of undergrowth. At site 1 it was also fairly easily seen sunning itself on the edge of cover and along paths. *L.viridis* was sympatric with *P.muralis* though it avoided stone walls and the more rocky biotopes. No juveniles were seen. Colouring and patterning was most variable. Some brilliant green males with minute black speckling were found at sites 1, 4 and 6b. Females ranged from dull olive green to bright moss-green with variable dark dorsal blotches. Others were more uniform or nearly so. The more brilliantly coloured specimens seemed, perhaps coincidentally, to be less shy than the duller specimens and could often be approached quite closely and photographed. At site 4 a pair were seen chasing each other along a dry ditch near some undergrowth and seemed undisturbed by being observed.

Lacerta vivipara Jacquin
Although sites 6d and 6e were but briefly visited very careful searching was done for small lacertids. A single specimen was found at 6e (no *P.muralis* was found at these locations – see above) which was identified as *L.vivipara*. It was found at 13.00 under sunny conditions in tussocky grass near a small stream. The specimen measured 82 mm in total length of which 47 mm was tail (undamaged) and was a female. Ground colour bronze-brown with a narrow vertebral stripe. There were a few dark dots along the dorso-lateral aspect and the venter was whitish with a metallic sheen. Although no hand lens was available some scale counts were possible:

Rostral not in contact with fronto-nasal.
Supralabial series had 3 shields anterior to the subocular.
Dorsals fewer than 45
Infralabials 6 + 6
Temporals 10/12 on each side
Masseteric small
Preanal single.

COLUBRIDAE

Coluber viridiflavus viridiflavus Lacépéde
This striking snake was found at sites 1, 2a and 5a & 5b. At the latter two localities a single example was found at each place as road casualties. 5a at 1400 metres would appear to be near the altitudinal limit for this species.

Site 1. Four adult specimens seen. One was taken at 17.30 amongst shrubbery at the base of a cottage wall and another nearby lying in grass at the edge of a field at 12.30 under partly cloudy conditions, air temperature 28°C. Both these were subsequently released. The next day the second snake was again found at the same spot. Diagnostic data on these two snakes is given below. The third example was briefly seen at 10.30 air temperature 25°C moving fast at the edge of a small wood and the fourth specimen on open dry scrubby terrain at the top of the escarpment under sunny conditions at 10.00, temperature 26°C.

Site 2a. 4 adults were identified but were very alert and cautious and disappeared swiftly when alarmed. Two were found between 08.00 and 09.00 at the border of a field, temperature 23°C and the next morning a further example under similar conditions. Not all activity was confined to the early morning. At 13.00 with an air temperature of 30°C one was briefly glimpsed as it disappeared into thickets bordering one of the artificial ponds. One subadult was observed on August 3rd. close to the Giîte lying about one metre from ground level on the rough trunk of an oak tree. This had the typical juvenile livery of the species being

a uniform grey/fawn with a bold neck marking. Although observed for a few minutes it made off into tumbled stone work at the base of the tree when approached more closely and could not be found. Total length was estimated at about 60cms. Time 11.00, temperature 21°C.

From the observations made it would seem that *C.viridiflavus* is a reasonably common species in the areas visited. It can also be concluded that this species has a broad range of diurnal activity during the summer, specimens being found through most of the daylight hours although admittedly under differing circumstances. Habitat tolerances are also wide ranging from cultivated areas, woodland and more open, wild and rocky terrain.

When caught *C.viridiflavus* bit with great ferocity and determination and it was difficult to prise the jaws loose. A mildly infected finger was experienced from a tooth that had become detached. One of the road casualties found at site 5a was slimmer in build than the two caught at site 1. This had a length of 95cms.

Diagnostic data on the two specimens caught at Site 1

Total length:	122 cms.	120 cms.
Tail length:	33 cms.	31 cms.
Ventrals:	205	199
Subcaudals:	113 paired	99 paired
Sex:	Male	Female

VIPERIDAE

Vipera aspis aspis (Linnaeus)

This viper was only found at Site 1. Although much searching was done at sites 2 and 4 no evidence of vipers was found and no road casualties were noted or cast skins.

A total of 6 specimens were found. One in an open clearing in woodland at 09.30, temperature 22°C and another on the dry escarpment coiled in a low juniper bush at 10.15, temperature 26°C. The remainder were found in a small area close to the edge of a field bordered by bramble thickets, hedgerows and woods. Of these four two were observed on two occasions and the third on no less than four separate visits to the site. The snakes seemed to have favourite basking places and were always found in precisely the same spot. Detailed notes were taken and are here reproduced in brief. The snakes are referred to by number, 1-4.

July 10th. 1, 2 & 3 found between 17.30 and 18.30. The weather during the day had been cloudy with thundery showers. In the late afternoon the cloud cleared and the snakes were found basking in the late aftrernoon sunshine. Snake 2 was found lying stretched out, motionless in long grass, the others were coiled up.

July 11th. 1, 3 & 4 in the late morning after a damp and foggy start. Sunny spells, air temperature 24°C.

July 12th. No. 4 found at 12.30 lying in partial shade. The weather was partly cloudy and humid. Air temperature 28°C.

July 13th. Viper No. 4 basking at 11.30. Weather sunny, temperature 28°C. No snakes were found in the evening, weather hot and still.

July 14th. The last observation on viper No. 4 which was spotted at 18.30.

V.aspis was found to be exclusively diurnal with an activity range from midmorning to early afternoon with a secondary period of activity in the early evening. No snakes were found abroad at the hottest time of day although searching was carried out. The snakes varied in size from 55-70 cms. though the one found in the juniper scrub was considerably smaller, about 40 cms. In no cases were the vipers aggressive. They could be approached closely for the taking of pictures and those that were caught and handled were reluctant to bite. In one case the snake's head was gently raised with a stick as it lay basking with no reaction at all.

The colouring and markings showed two distinct forms.

1. Ground colour brown with completely black dorsal markings which varied in appearance

on the same specimen being a mixture of zig-zags and black transverse bars and lozenge-shaped markings either separate from each other or joined by a narrow vertebral line. This form does not agree with the illustrations in Arnold, Burton & Ovenden (1978) plate 39 3a and is closer to 3b except that the ground is brown rather than grey and the markings inconsistent in continuity and form. General impression: a snake with vivid clear cut colour and pattern.

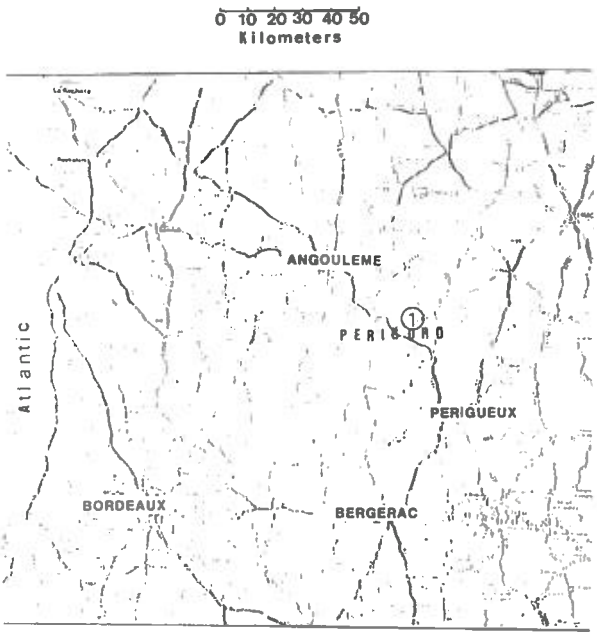
2. Ground grey-brown with the dorsal markings much narrower and dark-grey with some black edging in the form of off-set bars joined with a wavy vertebral line. General impression: a snake of diffuse colouring and markings.

DISCUSSION

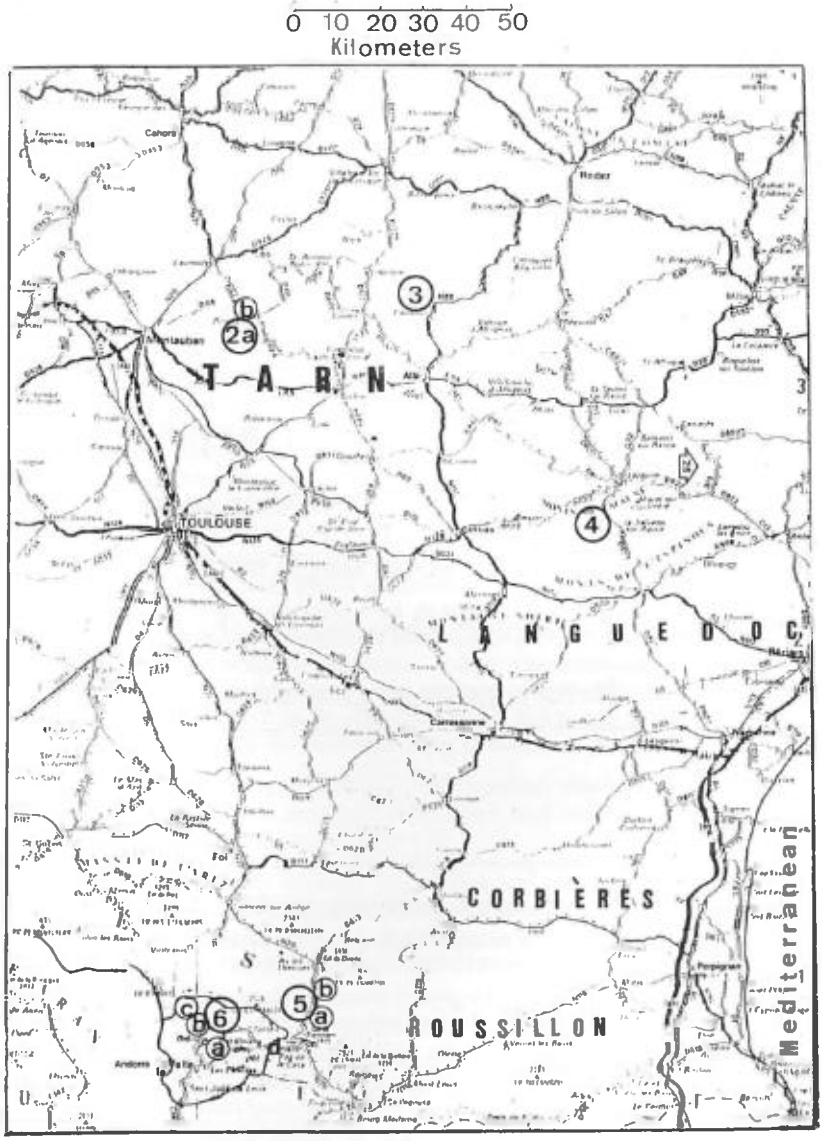
A total of 4 amphibian, 3 lizard and 2 snake species were found, not a great number but considerable abundance of some of these was observed. In addition *Alytes obstrecticans obstrecticans* was heard calling at Site 4 but could not be located and a very badly damaged juvenile *Natrix natrix* was found dead on a road near the same site. These have not been included in the species account because of the unsatisfactory nature of the finds. Certain species that were anticipated but not found include *Lacerta lepida, Lacerta agilis* and *Natrix maura.* The apparent absence of these lizards cannot be explained since the regions visited fall within their ranges. In the case of *N.maura* many places provided suitable habitats, both still and flowing bodies of water and lush vegetation in the surroundings but no trace of this snake was found. Snakes in the summertime are always more difficult to locate and other species that could be anticipated include *Coronella girondica* and *Elaphe longissima.* With regard to Site 1 this region north of the Dordogne probably had little unexpected to offer the herpetologist with regard to species content.

By contrast the Tarn region lies very much on a "grey" area – see Arnold, Burton & Ovenden (1978) who provide distribution maps. The low ground running from Montpellier through Caucassone to Toulouse could be expected to act as a corridor for the penetration of some Mediterranean species, possibly *Psammodromus algirus* and *P.hispanicus, Podarcis hispanica* and *Malpolon monspessulanus.* This does not appear to be the case and the area is of great interest as much for those species that are apparently absent as for those that can be found. Nevertheless I would venture to suggest that more careful searching of this region at a more propitious season would be worthwhile.

MAP 1 - SHOWING SITE 1



MAP 2 – SHOWING SITES 2 TO 6



MAPS

Because of the large area covered with the close proximity of some sites and the considerable distances between others it has not been possible to include all the localities on one map. The reader is therefore recommended to refer to any standard map of France in order to put the localities visited in perspective to the country as a whole. Map 1 includes Site 1 and Map 2 sites 2, 3, 4, 5 & 6.

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MEMBERS' ADVERTISEMENTS

* **For sale:** Captive bred *Phelsuma madagascariensis grandis* juveniles; contact: Charles Pain, 33 Ashfield Road, Aigworth, Liverpool L17 OBY. Tel: 051-727 6335.
* **For sale:** Adult pair of Californian Kingsnakes (banded). Captive bred baby Boa Constrictors, Hogs Island Boas and Emerald Tree Boas expectd soon. Simon Townson, Tel: 081-531 1378.
* **Wanted:** A **large** , Robust female *Phelsuma madagascariensis grandis* for breeding with a large, aggressive male I have. Please telephone Peber Daszak on 081-503 0463 and leave a message if no-one is available.

SPAWNING AND REARING THE PARSLEY FROG *(PELODYTES PUNCTATUS)* IN CAPTIVITY

SIMON HARTLEY

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INTRODUCTION

The Parsley Frog, *Pelodytes punctatus*, is native to western Europe, being widely distributed throughout France and Iberia and occurring also in western Belgium and extreme north-west Italy. It is closely related to the *Pelobatidae*, the Spadefoot and Horned Toads, but is now more often placed, together with the very similar Caucasian Parsley Frog, *Pelodytes caucasicus*, which occurs in the north-western Caucasus mountains, in a separate family, *Pelodytidae*.

It is small, reaching a maximum size of 1½-2" (4-5cm), possesses long hind limbs with unusually long toes, which are not webbed, a body covered with small, irregular warts, and a flattened head with prominent eyes, which have a vertical pupil. Colouration, even within one population, is extremely variable, ranging from the drab brown individuals usually illustrated in books, where the green dorsal spots which give the frog its name are often very small and sparce, through specimens with a variety of delicate brown patterns of different shades and red-orange dots along the sides, to others with broad patterns of bright, almost irridescent green on a dark or light background, and with additional dark green markings, the latter types being almost as strikingly coloured as European *Hyla*. Darker individuals often display a lighter X mark across the back, but whatever the dorsal colour, the underside is always a uniform, unmarked cream-white. The sexes are similar in general appearance, but males can be distinguished by their thicker front limbs, slightly broader heads and slimmer build, and also by the presence of nuptial pads on the forelimbs when in breeding condition.

Although Parsleys are extremely agile, and almost compulsive climbers, they are at the same time nocturnal and highly secretive, especially when adult, and while individuals can be heard calling during the day, it is always from cover.

The following is an account of my attempts at breeding and raising *P. punctatus* undertaken in 1988 and 1989. Since the latter produced much more information of interest and value to potential keepers of this species so far as spawning method is concerned than the former, observations made earlier this year will be considered in greater detail than those in the previous one.

As available literature covering Parsley reproduction was inadequate for my purposes, and no accounts of captive breeding could be found, my first efforts were wholly experimental. Tadpoles and froglets, about 1 month metamorphosed, obtained in May 1987 were sexually mature at between half and two-thirds full-grown, by September-October, the first characteristic low-pitched 'krr-ek' calls being heard in August. Partly because no suitable outdoor accommodation was available, partly that Parsleys are recorded as spawning after emerging from aestivation in southern Iberia (Salvador, 1985), the above, 4 males and 3 females, were kept inside at room temperature instead of being hibernated. However, general activity decreased in late November-December, so no attempt to induce breeding was made until the following spring.

BREEDING ACCOMMODATION

The only indication of water depth preferred by spawning Parsley Frogs was that strands of eggs were apparently wrapped around vegetation in similar manner to Spadefoots, so it was decided to start with 10" (25 cm), which could be reduced if required. An aquarium 25" x 12" x 15" was prepared, filled with water to the above depth, to which clumps of *Elodea densa* were added, and a terrestrial area, covered with clumps of grass, moss and stones, was built up in the middle. The tank sides were raised a further 6" (15 cm) by a

temporary glass construction, and the top covered with a combination of curtain netting and plastic aquarium condensation sheets, to prevent escapes. As the frogs were evidently active by day during the spawning period, (Arnold & Burton, 1978), the tank was placed where it could receive strong sunlight from a south-west facing window, and since water temperatures remained in the mid to upper 50sF (c.12C) when the above was first set up, no artificial heating was used initially.

SPAWNING

The first attempt at amplexus, which in this species, as with *Pelobates* and *Bombina*, is inguinal, was observed in the second week of March. On closer examination, the females appeared gravid, and nuptial pads, in the form of dark brown patches extending the length of the front limbs to the arm pits as well as on the thumbs and forefingers, were now clearly visible on the males, so they were all transferred to the breeding tank on the 17th.

Within 24 hours the males began producing calls which were much louder, and repeated for much longer periods, than those previously described. They did this either resting amongst plants on the surface at the edge of the island, on the island itself, or even from the bottom of the aquarium, where the effects were somewhat 'muffled', but the sound still quite audible. Pairs were seen in amplexus over the next 4 days, sometimes for up to 48 hours, but nothing more happened, cooler temperatures and lack of sun coinciding with less calling, so a heater-thermostat was introduced, raising the water temperature to the mid-60sF (c.18C), and light spraying, simulating rain, was applied to the island in the late evenings. Frogs kept calling and going into amplexus as described, but producing no spawn, for the following 3 days, so the temperature was raised to 75/6F (23-24C) early on the 24th, with a view to turning the heater off at night to simulate a natural fall. Still nothing had happened by then, and as females in amplexus earlier had been released, I decided to give the terrestrial area a much heavier spraying last thing.

The next morning, the 25th, 3 clumps of eggs were found, partly wrapped around roots of grass growing into the water from the island. On examining the frogs, all eggs had clearly been deposited by one female, the smallest, which at only 1" (2.50 cm) was half the size of the others, and apparently the least gravid. Its very dark appearance indicated the spawn had been laid probably a few hours previously, and the temperature at the time of discovery was 68F (c.20C). The clusters, each approximately the same size, c.1½ " (3.50cm) long, were all close to the island, two being at a depth of 1-2" (2.50-5cm), the third at 6-7" (15-18 cm), where growth of roots and *Elodea* was thickest. Over the next 24 hours the spawn swelled to approx. 2" (5 cm) in diameter, and as removal would have proved difficult without causing damage, it was left 'in situ', where it could in any case be easily observed, and temperatures were maintained in the lower to mid 70sF.

Vigorous calling by the males, plus further spells of 24-48 hours in amplexus with the other females continued, but though the pattern of higher temperature and heavy evening spraying was maintained, no further eggs were produced. The last loud breeding calls were heard on 1st April; by the 6th all the frogs had left the water, and the males' nuptial pads were clearly disappearing, so they were removed to their former quarters and the island was dismantled, leaving the tank for rearing the tadpoles.

TADPOLE DEVELOPMENT

With temperatures as above, the eggs developed quickly, and with the exception of a small number of infertile ones in the centre of each cluster, began hatching in 48 hours. At this stage the tadpoles resembled many other newly-hatched anurans, dark brown with a lighter underside, short tail and small, feathery external gills, and developed in much the same way, remaining attached to the spawn jelly or surrounding vegetation until they became free-swimming in a further 48 hours. During this period, I removed one of the clusters for closer observation, finding that it contained 104 embryos, including 20-30 which failed to develop, indicating that the total of eggs produced was around 300.

Over the next 10 days, the tadpoles assumed a shape, size and colour very similar to those of *Bombina* at the same stage, and, feeding mostly on algae growing on the tank sides and

plants, plus good quality tropical fish flakes, they progressed very well over the next month, during which time 80-100 were moved to another tank to avoid overcrowding. However, by 28th April it was noticed that although feeding avidly, the majority, especially the smaller ones, were losing their normal rotund shape and becoming thinner, a process observable in both tanks. On 6th May hind leg buds were visible on the largest tadpole, but many of the others were now very thin, and seemed to be stagnating.

Having raised numerous tadpoles of *Rana, Bufo* and *Bombina* species in similar densities, straightforward overcrowding seemed unlikely to be the problem, so possible causes and solutions were sought from various herpetological contacts, though none had experience with Parsley tadpoles. Mike Linley suggested the cause might be minute organisms living in the tadpole gut, which, in a confined area, could be passed on to other tadpoles via the droppings, some of which would be eaten by the latter, whose digestive system would be effectively blocked by the multiplying organisms, with results similar to those I was currently witnessing. Trevor Beebee has since told me of just such an organism, which appears to be the key to competition between the tadpoles of Common and Natterjack Toads *(Bufo bufo* and *calamita).* His research suggests it could be a protozoan or yeast, but at the time of writing this article, the precise identity of the organism is still uncertain. Charles Snell told me of his experiences with tadpoles of Green Frogs *(Rana lessonae/esculenta/ridibunda* complex), when a small number of larger individuals kept in restricted space would regularly outgrow the rest, which appeared to stagnate. This adverse competition could be avoided, he suggested, by splitting the tadpoles up according to size and making more frequent water changes, the latter to prevent the build-up of whatever substance was causing the problem. This was duly tried, and while the smallest, approximately one third of the whole batch, which were by now clearly the weakest, failed to recover, the rest improved rapidly, the largest individuals reaching 2½" (6cm). However, though they were now maintained in much lower densities, I still found it necessary to keep those of comparable size together, as a few larger ones would, within 12-14 days, start pulling away while their tank-mates would start to fall back as before.

By 23rd May 3-4 tadpoles had fully-developed hind limbs, with their front ones beginning to come through; within the next 6 days this process was completed, other frog-like features had rapidly developed, and on 1st June they emerged as fully-metamorphosed froglets. The rest continued to come through over the following 6-7 weeks, though many, again possibly as a result of having their development retarded, failed to reach more than 2" (5 cm) as tadpoles, thus metamorphosing at much less than the 15mm attained by the largest individuals, and were evidently not strong enough to survive for long.

REARING THE FROGLETS

With the previous year's experience to go by, this proved fairly straightforward. The young Parsleys were housed in various converted aquarium tanks, furnished with a simple substrate of earth and leaves, to which were added clumps of moss, bark and assorted pieces of wood and stones. A water dish was not provided, but I found from unfortunate experience that, even when adult, these frogs easily dessicate if their accommodation becomes too dry, so it was necessary to keep conditions in the tanks damp by means of regular spraying. Fed on a wide variety of insects and other invertebrates collected from grass/hedge sweepings, supplemented by fruit flies *(Drosophila)* and occasionally small crickets *(Acheta domestica),* the froglets made good progress, some of those retained being half-grown by August; calling first heard on 11th of that month, and the largest 6-7 individuals had reached a size comparable with that of their parents at the same stage by the end of November.

1989

The 1988 experiences raised a number of questions, such as why only one of 3 apparently suitable females actually spawned, what really 'triggered' that particular success, and was it more a case of good fortune than providing the correct conditions. Alternatively, in view of the relatively short period of intense breeding activity, there was a possibility that the frogs may have been introduced to the breeding set-up too late, and perhaps the females were not in such prime spawning condition after all. The main task of the 1989 season, therefore, was to try to provide answers to some or all of these.

BREEDING ACCOMODATION

Later in the spring of 1988, Charles Snell obtained a successful spawning from Parsley Frogs (unrelated to mine) in conditions very different to those I had experimented with, i.e. in an outdoor vivarium, with eggs deposited in much shallower water. I thus decided to try a more natural setting for this year's attempt. Also, since another contact, Pat Thorp, had Parsleys (from the same batch as my original ones) produce spawn, which proved to be infertile, apparently 3 weeks before mine had been set up to breed, this in a heated conservatory, I decided to make an earlier start, which of course meant continuing indoors.

This time a vivarium 40" x 20" x 16" was used, with a half aquatic, half terrestrial arrangement in mind, to which end a glass divider 4" (10cm) high was fitted across the tank, sealed by silicone. The basic furniture was similar to that used in '88, except that small logs and more moss were placed in the water and connected with the main terrestrial area by slates overhanging from the latter. The slates, along with clumps of grass positioned so that strands would hang into the water as in the previous set-up, provided cover close to and overhanging the water, giving the frogs greater security and perhaps better 'calling posts' for the males. The water section was filled to a depth of 3½-4" (8-10 cm). *Elodea densa* was added as before, and the tank was this time covered by a strip of plastic greenhouse shade netting, which was fine enough to prevent not only the frogs but also their food, chiefly flies (*Lucilia* and *Calliphora* species) and crickets, from escaping. Since temperatures were unusually mild when this was set up at the beginning of February, and the tank was positioned where it could receive more direct sunlight than last year, it was again decided not to start with any extra heating.

SPAWNING

The frogs, this time consisting of last year's spawning female (now twice the size it was then) and one male, and the largest of the 1988 youngsters, were in excellent condition by early February, most of the males showing nuptial pads and the females clearly plump with eggs. Therefore, 3 of the total 4 females, the other being a small individual which had developed with only one front leg, to be used only if the rest provided unresponsive, and the 7 largest males, were moved to the breeding quarters on 13th of the above month.

Despite 2-3 attempts at amplexus observed within an hour of being introduced to their new surroundings, disappointingly little happened over the next 3 weeks. Typical non-breeding calls were made by males, usually in the evenings and in response to noise produced by television or radio, but frogs were observed in the water only first thing in the mornings, and none were seen in amplexus. On 25th a heater-thermostat was installed in the water section, bringing the temperature there up to the 1988 spawning level of 68-70F (20-22C), but still the only activity of note was prolonged calling by one of two males, slightly louder than before. However, on 3rd March, one such louder call was answered by a much lower-pitched one, later observations confirming this latter as a call made by a female, something not heard in 1988, though it was reported by Arnold & Burton (1978) and Salvador (1985).

Following the pattern of '88, turning the heater off at night to vary the temperature, and persistent heavy spraying was tried, but made no difference to the frogs' behaviour, so on 11th March the water level, which had previously been topped-up as it evaporated, was allowed to decrease over the next 3 days. At the end of this, fresh cold water was poured into the tank last thing at night, along with a heavy dose of spraying applied to the terrestrial section.

Loud, typical breeding calls were heard early on the morning of the 12th, and upon checking the vivarium at c.7.30, 2 clusters of spawn, one as large as those laid last season around a grass stem, one very small around a leaf of grass, had been deposited. One pair of frogs were also in the water, apparently showing little interest in each other, but it was on this occasion that the female, which by its relatively thin appearance had clearly produced the eggs, was heard answering the male's intermittent vocalisations. The temperature of the water was around 68F (c.19C), and since the weather was overcast, there was no strong sunlight.

Periodic calling by the above pair went on until they were back in amplexus 2 hours later, and I was now able to witness the actual spawning process, descriptions of which appear to be totally absent from relevant literature. Fortunately, the frogs chose to perform close

to the front of the vivarium, which made for perfect viewing. First the female grasped a strand of grass hanging 2-3" (5-8 cm) into the water, from which the pair hung in a vertical position with the female's hind toes just about touching the bottom of the tank, thus pulling the grass a further 2" (5 cm) under the water. After about 10 minutes, the female began pulling itself up the strand 1-2" and a tightly packed string of spawn was quickly ejected while the female made sideways movements which wrapped the eggs around the grass, the male presumably fertilising them as they were produced, in the usual anuran manner. All this was completed, considering it was not just a case of dropping eggs onto the vegetation etc., with surprising speed, in less than 5 minutes, whereupon the male released the female, swam to the opposite side of the water section and resumed calling. The same process was enacted again about 15 minutes later, this time with a much smaller cluster of spawn produced, after which the female had clearly deposited all remaining eggs, and promptly left the water.

The above male continued calling throughout the day and well into the evening, but none of the other females responded, and apart from spells of loud calling, mostly at night, nothing more happened over the next 2 weeks; frogs were seen in the water only briefly in the early mornings or late at night, none in amplexus. Heavy doses of fresh water every 3-4 days, plus equally heavy spraying, had no more effect than the latter had done after the 1988 spawning.

During this period, another contact to whom I had supplied Parsley froglets, Colin Melsom, reported a spawning in a set-up very similar to the above, and noted how quickly his frogs had attempted to go into amplexus whilst being moved into the breeding quarters, as had also been the case with mine. In addition, most of the males seen in the water over the past 2 weeks had actually attempted amplexus on the rare occasions one of the females passed close to them, but never pursued them very far, so I began to wonder whether forcing the gravid females into close contact with males might produce better results. As an experiment, a pair were placed in a small container, and within moments they were in amplexus.

Following this idea, on 24th March I decided to try the remaining 2 gravid females in a much smaller, almost totally aquatic set-up, from which they could not easily escape the attentions of the males. Thus, a tank 14" x 8" x 8" was prepared, with a small island built up with tile and rocks in the centre, from which large clumps of grass hung into water to a depth of 5-5½" (12-15cm). The tank was placed in a back room with no direct sunlight, and 2 pairs of frogs were installed. Within a few hours one male was calling, by evening one pair had gone into amplexus, and ½" (2.2cm) of fresh water was added last thing. Calling was heard after dark.

The same pair were still in amplexus the next day, and by mid-morning the other pair had done likewise. As an experiment, a one third change of warm water, pushing the temperature up to 85-90F (30-33C), was tried as an extra stimulus, last thing on 25th. The following morning at about 8.30, spawn was found, attached to the grass as before and very fresh looking, laid perhaps 2-3 hours earlier. This time it consisted of 2 large clusters, around 2"-2½" long, one about half that size, and a very small one of no more than 6-7 eggs. The temperature was then 58F (14C), and the other pair were still in amplexus.

With temperatures in the original vivarium now reaching 70F (22C) in the afternoons and staying at around 60F (15C) at night, it was decided as a further experiment to move the small tank to a position in front of the former, so as to receive maximum sunlight from the window. This was done on 27th, and once again a half change of warm water was tried that night. The remaining pair were in amplexus then, but had separated by the following afternoon, and were only persuaded back together again by means of a half change of cold water last thing at night. Still nothing had happened the following morning, and despite changing half or three quarters of the water for the next three evenings, varying the water depth between 3-5½" (7.5-15cm), and altering the positions of the rocks and grass clumps, the frogs simply went in and out of amplexus periodically for the rest of the week. On 1st April the water level was raised to its original 5½", and no further alterations were made, the pair being in amplexus last thing.

On the morning of the 2nd, nothing had changed, and little attention was paid to the frogs. However, completely without warning, spawning occurred in mid-morning, at a water temperature of 56F (c.13C), the fact that it had taken place being heralded by characteristic

loud calling by the male after it was all over. This proved to be the largest of the three spawnings, consisting of 6 clusters, 2 large, c.3" (7.5cm), 3 medium, c.1-1½" (2-3.5cm), and one small, and as was the case with all others, the eggs were attached to grass leaves.

Most of the males remained in breeding condition for 2 weeks following the last success, but there was no reason to try the 'reserve' female, if only because there were already more than enough tadpoles to handle.

TADPOLE DEVELOPMENT

As with that in 1988, each of the '89 spawnings had a high fertility rate. Those eggs kept artificially heated developed very quickly as before, those at room temperatures 3-4 days longer. Including the 30-40 infertile eggs in each batch, the first spawning totalled betfween 450 and 500, thc second, produced by the female which bred in '88, 420-30, and the final one 820-30. Though all were substantially bigger than the '8§ spawning, even the last was still well short of the 1,000-1,600 reported by various authors Angel, 1946, Fretey, 1975, (Van Den Elzen, 1976, Arnold & Burton, 1978, Lanka & Vit, 1985 and Salvador, 1985), but none of the females, even the one from '88, was then fully-grown. At the time of writing they are all noticably larger, and can be expected to produce significantly more eggs next season.

Needless to say, without allowing the Parsley tadpoles to monopolise my available facilities, attempting to raise over 1500 of them was neither possible nor desirable, so large numbers were distributed among various herpetological contacts, and any further surplus fed to newts. With lower densities maintained in a selection of aquaria, the problem created by competition in '88 never arose, most tadpoles this time developing extremely well. Those retained from the first batch, which had been kept at 68-70F, first showed hind leg buds on the 16th April, front legs on the 26th, and the first two froglets metamorphosed on the 28th – 46 days from hatching.

Perhaps the most interesting observation concerning the 1989 tadpoles, and one which occurred almost by accident, was that keeping them under different conditions and providing a different diet appeared to have an effect upon the colouration of both tadpoles and froglets. Those reared in the same way as last year, i.e. in tanks indoors, and fed largely on fish flakes, assumed a deep reddish-brown body colour, with no discernable markings until about 2 weeks from metamorphosis. However, others, mainly from the third batch, maintained in a temporary PVC lined pond which was dug in one of my outdoor enclosures to help spread the numbers even further, by contrast developed a lighter, more mottled green-brown appearance. These were still provided with flake food, but also fed on the very considerable growth of algae prompted by the strong sunlight the pond received. I originally put the above down to the fact that the pond liner had a light brown colour, but later it became increasingly clear that not only did the tadpoles here rarely resemble the ones developing elsewhere, but there were also far greater numbers of froglets with bright green markings emerging from this pond than anywhere else. Unfortunately, with so many other breeding amphibians dividing my attention at this time, the significance of the above only occurred to me when, along with those reared indoors, many of the tadpoles and froglets from the pond had gone to contacts as described or been released into outdoor enclosures, so it was too late to make reliable comparisons by monitoring closely the development of large numbers in each area, although among those that were left the differences were quite noticeable. Later in the summer, a similar exprience occurred when Yellow-Bellied Toad *(Bombina variegata kolombatovici)* tadpoles were reared in an aquarium situated in a position receiving strong enough sunlight to produce algal growth similar to that in the Parsleys' pond. These developed a green appearance never previously seen in the many hundreds of Yellow-Belly tadpoles handled in recent years, the metamorphosed toadlets retaining green dorsal colouration, of which the parents showed no trace. There may also have been genetic factors involved here, but this further convinced me that the high degree of algae in the diet of Parsley tadpoles in the pond had affected the latter as previouly described. Certainly this is a theory I look forward to testing next spring.

Apart from the colouration element discussed above, 1989 produced no information on raising the froglets worth adding to the relevant 1988 section, so there is no need to describe this aspect again.

CONCLUSIONS

As a result of the preceding survey, a set of conditions required in order to reproduce Parsley Frogs successfully using indoor vivaria can now be summarized, with the addition of a few suggestions (some possibly rather speculative!) as to how my experiences may relate to their behaviour in the natural state. However, this is in no way intended to be definitive, merely what has worked for me, and information on any alternative methods offered by readers of this article would be welcomed.

(1) The evidence of the 1989 season in particular strongly suggests that sudden changes in the frogs' environment will trigger spawning. In contrast to the males, females always seemed much more reluctant to enter the water, which suggests that perhaps in their natural habitat sudden heavy rainfall stimulates them into activity near the breeding sites, where they then come into close contact with males. Thus, a small aquarium-vivarium set-up, i.e. one which keeps the sexes in continual contact, and with frequent water level changes etc. as described, is most likely to produce the required results.

(2) A water depth of no more than 3-5" (7.5-12cm) is necessary, as none of the spawn clusters were deposited at more than 6" below the surface. It is highly probable that the frogs prefer spawning in shallow water near the edge of ponds, ditches etc. because of (a) the greater abundance of suitable overhanging vegetation, and (b) in view of what was observed during the first spawning of '89, the actual spawning method seems better adapted to shallow, thickly vegetated surroundings. This also suggests one possible reason why the two larger females failed to breed in '88 was that the much greater water depth, combined with much thinner density of grass etc., meant they lacked the extra support the above conditions would have provided, and so were unable to balance properly in order to deposit the eggs. Although I had no way of knowing which male was involved in the '88 spawning, it may well have been one of the smaller individuals, as the pair would then probably have been light enough to gain sufficient support from the grass hanging from the island.

(3) As regards temperature and light, spawning conditions were extremely variable, so success can be expected at anything between the mid-50s and upper-70sF (12-25C). Though it is quite probable that increasing day-length helps bring the frogs into breeding condition, and they are certainly less nocturnal when spawning, on the evidence above strong sunlight is not essential.

(4) Tadpoles may be reared in much the same manner as those of most other anurans, and no problems should occur so long as overcrowding is avoided. Suitably accomodated and fed as described, the young frogs can be ready to breed in as little as 7-8 months.

However reliable the foregoing prove to be in the future, I have no doubt that the Parsley Frog, with its small size, simple requirements and fascinating colour variations, is to be recommended as a highly interesting and rewarding subject for the amphibian enthusiast.

ACKNOWLEDGEMENTS

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TOAD AGGREGATIONS UNDER STREET LAMPS

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The summer this year (1989) has seen a prolonged dry spell. The breaking of this weather was the cue for large migrations of newly metamorphosed toads *(Bufo bufo)* away from their larval ponds. One such migration was observed at Walton Lake, in one of the linear parks in Milton Keynes. This breeding site is a large, but shallow (less than 30 cm in most places) balancing pond, bordered on its southern side by a 'redway' (public footpath/cycleway). On rainy or humid nights (7-7-89, 9-7-89 and 10-7-89) large numbers of toads were seen on the path between dusk and midnight. It was noticed that many toads seemed to have congregated under street lamps. To ascertain whether or not this was the case and not just a phenomenon caused by the fact that toads were more visible along the lighted sections of the path, numbers of toads were systematically counted on 9-7-89. Twelve sites were sampled, six directly under street lamps and six at points midway between street lamps, alternating lighted and dark sites as I moved along a 330 m length of path. At each sampling point three sweeps were made across the path, capturing all toads possible by hand and with the aid of torchlight (although this was superfluous in the lighted areas). The path is 3 m wide and each sweep of the path covered a length of path of approximately 1.2 m, so the area of path sampled at each point was approximately 10.8 m^2. Numbers of toads captured and densities of toads at each sampling point are given in the table. These figures are undoubtedly lower values than the actual toad densities, since some toads evaded capture by moving off the path where they were hidden in grass.

Table. Numbers of toads captured at each sampling point. Figures in brackets are densities of toads per m^2.

Light	14 (1.3)	51 (4.7)	38 (3.5)	43 (4.0)	19 (1.8)	27 (2.5)
Dark	4 (0.4)	3 (0.03)	7 (0.6)	0 (0)	5 (0.5)	4 (0.4)

The distribution of these toads is clearly clumped, with large numbers gathering under the street lamps (mean densities of toads under street lamps and in unlit areas are 3.0 per m^2 and 0.4 per m^2 respectively). The toads captured were predominantly those that had recently metamorphosed. Only two adults and three immatures were captured and so it is not clear whether toads of all ages had gathered under the street lamps, or whether it is just the recently transformed toadlets that did so. The most obvious explanation for this behaviour may be that they are responding to high densities of prey items. Flying insects could be seen flying around the lamps and presumably some eventually move or fall to the ground where the toads are able to capture them. Smith (1973) reports *Bufo bufo* waiting for prey at bee-hives and trees baited with sugar, by entomologists, to attract moths, whilst Green Toads *(Bufo viridis)* are reported to forage under street lamps (Arnold, Burton and Ovenden 1978, Ballasina 1984). Distribution of predators according to prey density has been recorded among non-amphibian species eg. sticklebacks, cichlids and mallards (see Parker and Sutherland 1986 for review). Various methods may be employed by predators to assess prey density, for example they might be attracted to areas where large numbers of prey items are visible or they may actually assess their own rate of prey capture. Most of the insects that were attracted to the light were flying around the lamp itself – beyond the range that toads normally respond to prey items. Only two toads, a juvenile and an adult, were seen to capture prey items within one hour of observation. Since the density of toads under the lights is very high, average prey capture rate must be quite low, which makes high rates of individual prey intake seem an unlikely cause for those toadlet aggregations. Since they had only recently left the larval environment it would also seem unlikely that they had learned to associate lighted areas with high prey densities. So why do they aggregate under street lamps? There are certainly good reasons not to do so, since the street lamps light a path, there is a high risk of being squashed

by cyclists and pedestrians. The number of squashed toadlets seemed similar to the number of survivors, even on this infrequently used path. Other potential predators are carabid beetles. Two species *(Carabus violaceous* and an unidentified *Fernia* species) were also seen foraging in the lighted areas of the path. However none was seen to attack toadlets, despite the fact that one of both species were seen attacking earthworms, larger prey items than the toadlets, and both species were seen eating recently squashed toadlets.

As an alternative hypothesis, the aggregations of toadlets may not actually be a response to high prey levels, but may be related to the levels of luminance generated by the lamps. Toads are capable of using vision to detect prey at very low levels of illumination (as low as 10 ulux, which is as dark as a 'dark wood at midnight' [Larsen and Pedersen 1982]). However, if the eyes of toads function better under conditions of semi-brightness rather than darkness of night then they may find it easier to forage under lighted street lamps rather than in unlit areas. Jaeger and Hailman (1973) experimentally tested the light intensity preferences of anurans in the laboratory. The majority of bufonids that they tested showed a photopositive response, but as the authors point out, the range of stimulus illuminances provided was lower than that of daylight. They speculate that each species will have an 'optimum ambient illuminance', and so their 'photopositively' responding species may well have been those with crepuscular activity rhythms, and given a full range of stimulus illuminances would select a level corresponding to twilight. This conclusion could also explain why the toadlets in this instance moved towards lighted areas of path, since the street lamps may provide levels of light close to the optimum ambient illuminance.

To summarize, recently transformed Common Toads aggregated in large numbers under street lamps. These lighted areas of footpath did not seem to provide individual toadlets with high prey capture rates, and presented the toadlets with a high risk of being squashed by pedestrians/ cyclists.

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AN OCCURRENCE OF NEOTENOUS SMOOTH NEWTS *(TRITURUS VULGARIS)* IN CAMBRIDGESHIRE

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THE SITE

A pond outside the village of Warboys, in Cambridgeshire, contains a small colony of two newt species. *Triturus vulgaris* and *T. cristatus.* The predominant species is *T. vulgaris,* of which about 20 individuals can be seen if the pond is examined at night in the breeding season. About five individuals of *T. cristatus* can usually be seen.

The pond is a shallow depression in pasture used for grazing horses in the summer, maximum depth estimated at two metres. It is about ten metres long and six metres wide. Much of its surface is covered by a thick growth of Canadian pondweed, with only small areas around the edge uncovered. These areas have a mud bottom.

Newts are seen around the edges of the pond, on the surface of the mud. If disturbed they will move into the weed or bury themselves in the mud.

There is much food for newts in the pond; there are many small invertebrates, in particular water boatmen and various water beetles are very common.

NEOTENOUS NEWTS

In autumn and early spring, large numbers of Smooth Newt larvae can be seen, fully developed, which presumably hibernate and metamorphose in the spring. I have never witnessed this in Crested Newts in Warboys.

Distinct from this are neotenous Smooth Newts, which I observed for the first time in 1989. These do not make up a substantial part of the population; the most seen have been three in one night. They have been seen on six occasions in the spring of 1989, out of about 25 occasions when newts were seen in this pond.

Those neotenous newts seen resemble female Smooth Newts in appearance and size, with no sign of albinism as reported by Smith (1951). They are distinct only in having feathery gills and a wider head, as in larvae. One of these newts was taken to keep in captivity, and a day later laid fertile eggs. A very small quantity of eggs was laid (about 25) which would suggest that egg-laying had already started before capture. These developed into larvae in about two weeks when kept in a warm room. On hatching, these larvae were released into the pond from which they came. Smith stated that neotenous newts 'do not rise to the surface of the water for air', but this specimen did so. This might suggest that the gills were receding, but no sign of their loss could be seen after three weeks in captivity, when the newt was released again.

It has been suggested, by Smith, that neoteny has been favoured in ponds with steep sides from which newts cannot escape. That is not the case in the pond in Warboys, which is just a depression in a grassy area, from which I cannot foresee newts having any trouble escaping.

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NEW RECORD SIZE FOR NORTH AFRICAN *TESTUDO*

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INTRODUCTION

The previously largest recorded dimensions for a tortoise originating in North Africa are those given by Flower (1945) and the further notes concerning the same tortoise by Lambert (1982). The maximum weight attained by this tortoise was 4.366 kg. Boulenger (1902) earlier recorded a specimen of *Testudo (graeca) ibera* PALLAS 1814 from Romania weighing 3.629 kg. The largest recorded size for *T. hermanni boettgeri* MOJSISOVICS 1889 is by comparison 264mm and 3.420 kg (Highfield, 1988). All of these measurements are exceeded by the tortoise reported here.

DESCRIPTION

The dimensions of the specimen, which is a female, are as follows:

Straight line carapace length = 292mm
Length of carapace over curve = 355mm
Maximum carapace height = 126mm
Maximum width at posterior marginals = 215mm
Median transverse carapace width = 209mm
Weight = 4.550 kg.

The carapace is broad, flattish and elongate with markedly flared and serrated posterior marginals. The frontal vertebral scute is round, not square. There are two large white inturned conical spurs on each thigh measuring some 10mm long. The carapace has a golden-yellow ground colour with radiating brown-black markings. There is a complete absence of anterior borders or central dots on the vertebral scutes and an absence of anterior borders to the costal scutes. The plastron has an irregular series of radiating black markings.

This description is inconsistent with the holotype of *Testudo graeca* LINNAEUS 1758 but entirely consistent with the type of *Testudo whitei* BENNETT 1836 (Highfield & Martin, 1989). This latter species invariably reaches a much greater adult size than that ever attained by specimens conforming to the holotype of *Testudo graeca* L. 1758. A side by side comparative view of the two species is provided by plate 1 where the difference of morphology and carapace markings between the two species are immediately obvious.

We are fortunate that for both animals depicted we have a considerable amount of historical data. Full details of growth over the period covered by annual weight and length records will be published later. The large *T. whitei* was obtained by its previous owner 18 years ago when it measured approximately 160mm (no weight recorded). The *T. graeca* was purchased by another owner in 1972 when it weighed 300g. Over the subsequent 17 years the *T. graeca* increased in weight to its present maximum of 535g. The straight-line carapace length of this specimen is now 133mm, transverse median width 96mm, maximum width of posterior marginals 96mm and carapace height is 73mm.

Another Algerian *T. whitei* was purchased by the same owner in 1968 when it measured only 120mm and had an estimated weight of 275g. Its dimensions as at September 1989 were: straight line carapace length 238mm, transverse median width 162mm, maximum width of posterior marginals 162mm and carapace height 116mm. Weight was recorded at 2.580 kg.

A typical adult male specimen of *T. graeca* L. 1758 measures 145mm and weights approximately 675g (Highfield & Martin, 1989) These figures closely match those recorded in Morocco by Lambert (1982) who also notes that the largest specimens of *T. graeca* L. encountered in the wild measured 151mm for males and 198mm for females. The largest male *T. graeca*

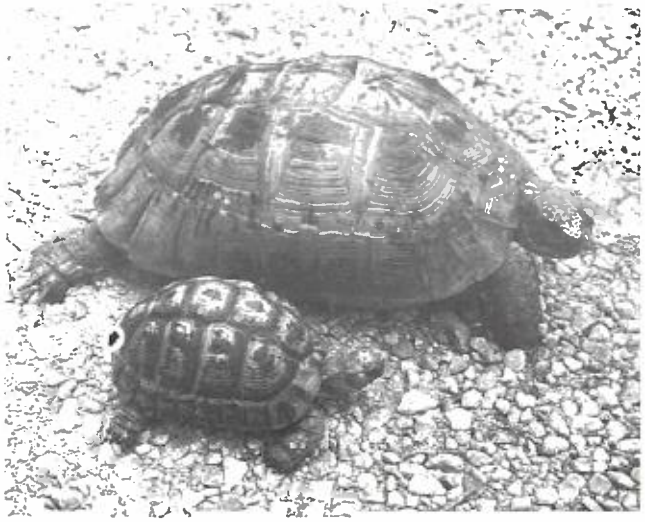

PLATE 1.

Testudo whitei BENNETT 1836, 292mm
Testudo graeca L. 1758, 133mm

Both specimens are adults, the *T. graeca* being somewhat older than the *T. whitei.*

L. ever seen by the present author measured 188mm. This animal had been in continuous captivity for 68 years and probably represents the maximum attainable by the species. These figures should be compared to a typical 215mm and 1.750 kg for male *T. whitei* and a typical 270mm and 2. 875 kg for a female of the species. This difference in size is even perceptible in hatchlings of the two species, *T. graeca* hatchlings rarely measuring more than 27mm long and typically weighing 8g compared to *T. whitei* which typically measure 33mm long and weight 12-14g.

The age of our very large specimen is estimated at less than 35 years.

There are clear signs that growth is still continuing quite rapidly. Fortunately, this specimen has not been subjected to an unnatural or damaging diet (Highfield, 1989) and has no dietary induced skeletal abnormalities. There is some damage to the left-hand side of the carapace consistent with the animal having survived exposure to a fire in the wild as a juvenile. Development would appear to be perfectly normal, which raises the question of what the true maximum potential adult dimensions of this species may actually be. Certainly *T. whitei* are generally the largest known members of the genus *Testudo,* often exceeding even *T. marginata* in body mass (with which they were often confused in many 19th century accounts). They are certainly the largest of north African land tortoises, invariably surpassing the Linnaean *T. graeca* in length, width and weight by a factor of several fold.

The conclusions of Flower (1945) who maintained the north African tortoises can continue growing for 40 years and that "the largest known individuals...may not be more than 35 years old" are entirely supported by our present findings.

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A LATE PLEISTOCENE INTERGLACIAL HERPETOFAUNA NEAR SHROPHAM, NORFOLK

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INTRODUCTION

This report details a fossil herpetofauna from a recently discovered locality near Shropham, Norfolk. The site was found by J.D. Clayden in 1983, and he has been collecting there since that date. The stratigraphic relationships of the sediments and the vertebrate taxa indicate an Ipswichian interglacial age for the fossiliferous stratum reported here. Although the herpetofauna is small, two frogs, a pond tortoise, and possibly a snake are continental forms that do not occur naturally in Britain today.

THE SHROPHAM LATE PLEISTOCENE INTERGLACIAL SITE

The fossiliferous beds occur in the Minn's Aggregates Company Pit near Shropham, Norfolk (TM 005938). The stratigraphy is from bottom to top (1) an undertermined thickness of Cretaceous chalk; (2) a chalky, pebbly gravel 1m thick; (3) a fossiliferous detritus mud containing the herpetofauna discussed here (as well as other fossils) in a layer ranging from about 1 to 5 m thick; and (4) Devensian gravels and muds at the top of the site, containing some large vertebrate bones, and forming a layer about 8 m thick.

The Devensian gravels and muds have yielded fossil bear, wolf, lion, woolly rhino, bison, red deer, reindeer, and mammoth. The detritus mud below the Devensian deposits not only yielded the herpetofauna reported below, but also produced water chestnut fruits and chewed hazel nuts, a rich molluscan and beetle fauna, bird bones and bird egg fragments, as well as the following mamalian species: *Arvicola cantiana, Clethrionomys glareolus, Microtus arvalis/agrestis, Microtus oeconomus, Castor fibre, Sorex minutus, Neomys sp., Bison sp.,* and *Hippopotamus amphibius.* These mammalian remains are consistent with those in other Ipswichian faunas in Britain.

The Shropham interglacial fossils were collected from two sites within the detritus mud stratum. These sites were designated "NP" and "JC". NP was worked from 1983 through 1989, JC was opened and worked in 1989 only. Specimen numbers in the present paper are those of the J. D. Clayden Collection, Sunnyholme, East Runton/Cromer, Norfolk NR27 9PG. These numbers reflect whether the specimens were collected from the NP or the JC sites.

Fossiliferous matrix was screen-washed in a 500 micron sieve, and was dried and sorted through for fossils at the facility at the J. D. Clayden Collection. Collecting at the site will continue to be directed and coordinated by J. D. Clayden who will arrange for the additional fossil specimens to be studied by experts in each group.

SYSTEMATIC PALAEONTOLOGY

This section details the fossil amphibians and reptiles of the detritus mud stratum of the Shropham site.

Class Amphibia
Order Caudata
Family Salamandridae
Triturus vulgaris (Linnaeus)

Material – Trunk vertebra JCSHR (NP 89-60).

Remarks – The trunk vertebrae of *T. vulgaris* have much higher neural spines than those of *T. cristatus* and *T. marmoratus*. The trunk vertebrae of *T. vulgaris* may be distinguished from those of *T. helveticus* in that the postzygapophyseal notch is narrower and more deeply indented in the former species. *T. vulgaris* occurs in the area today (Frazer, 1983).

Order Anura
Family Bufonidae
Bufo bufo (Linnaeus)

Material – A left and right ilium (NP 89-61-62).

Remarks – *Bufo bufo* has a lower dorsal prominence and lacks the distinct ridge (*"calamita"* ridge) on the anteroventral portion of the ilial shaft that occurs in *B. calamita*. *B. bufo* occurs in the area today (Frazer, 1983).

Family Ranidae
Rana arvalis Nilsson

Material – One left and three right ilia JCSHR (NP 89A-39-32), and one left ilium (NP 89B-54).

Remarks – Holman (1987a) gave characters that distinguish the ilia of *R. arvalis* from other European *Rana*. This species does not occur naturally in Britain today, but has been reported from the Cromerian (Holman, 1987b; Holman et al., 1988; Holman, 1989), Ipswichian (Holman, 1987a), and possibly the Hoxnian (Holman and Clayden, 1988) interglacial sites.

Rana temporaria Linnaeus

Material – Right ilium JCSHR (NP 89-27).

Remarks – The ilia of *R. temporaria* may be distinguished from those of other species of European *Rana* on the basis of its poorly developed ilial blade (Holman, 1985). This species occurs in the area today (Frazer, 1983).

Rana ("water frog" species)

Material – One left and one right ilium JCSHR (NP 89-33-34).

Remarks – These ilia have the steep slop of the tuber superior into the pars ascendens ilii as in "water frog" species such as *R. lessonae*, *R. ridibunda*, and the hybrid form *R. "esculenta"*. We are unable to assign these somewhat fragmentary ilia to any one of these species. *Rana "esculenta"* or *ridibunda* was reported from the Cromerian interglacial stage of Britain (Holman, et al., 1988).

Rana sp. indet.

Material – Two left and four right ilia JCSHR (NP 89A-35-40), and four left and one right ilia (NP 89B-55-59).

Remarks – These ilia are much too fragmentary to identify either to species group or to species.

Class Reptilia
Order Testudines
Family Emydidae
Emys orbicularis (Linnaeus)

Material – Two neurals: JCSHR (NP 89-9-10). Sixteen costals: second left (NP 88-4, Fig. 1), third right (NP 89-1), fourth left (NP 89-2), sixth left (NP 89-6), costal fragment (NP 88-8), incomplete costal pieces (NP 89-12-21). Five peripherals: second right (NP 88-2), fifth right (NP 88-3), sixth right (NP 89-8), tenth left (NP 88-5), eleventh left (NP 89-4). Two hyoplastra: left (NP 89-7), incomplete piece (NP 89B-9). Plastral fragment (NP 89-28). Two shell fragments (NP 88-6-7).

Remarks – These bones are identical to those in modern skeletons of *Emys orbicularis* and they are assigned to this species with confidence. The European pond tortoise has been identified from Cromerian, Hoxnian, Ipswichian, and Flandrian temperate stages (Stuart, 1979, 1982),

and is especially characteristic of Ipswichian deposits. Mean July temperatures greater than 18 degrees C appear to be needed for the modern species to reproduce successfully; thus Stuart (1979) suggested that temperatures in England were at least 2 degrees C warmer than now when *E. orbicularis* inhabited England in ancient times.

Order Squamata
Family Lacertidae
Lacerta cf. *Lacerta vivipara* Linnaeus

Material – One vertebra JCSHR (JC 89-1), and five vertebrae (NP 89-22-26).

Remarks – These vertebrae are very morphologically distinct from those of *Anguis fragilis* (Holman et al., 1988) and appear to be identical to those of adult *L. vivipara* in size and characters. The fossils are tentatively assigned to *L. vivipara* because skeletons of *L. agilis* were not available for study. *L. vivipara* occurs in the area today (Frazer, 1983).

Family Colubridae
Natrix natrix (Linnaeus)

Material – One vertebra JCSHR (NP 88-1, Fig. 2), and seven vertebrae (JC 89 2-8).

Remarks – These vertebrae have their hypapophyses obtuse or rounded distally and have robust parapophyseal processes as in *N. natrix* (Szyndlar, 1984). This species occurs in the area today (Frazer, 1983).

Natrix cf. *Natrix maura* or *tessellata*

Material – Seven vertebrae JCSHR (JC 89 9-15).

Remarks – These vertebrae have their hypapothyses pointed distally and delicate, slender parapophyseal processes as described for *N. maura* and *tessellata* by Szyndlar (1984). We will tentatively assign the above fossils to this group, but J.A. Holman has noticed that this vertebral condition is very closely approached by some specimens of *N. natrix*. Additional skeletal material of species of *Natrix* is needed to ascertain the value of the hypapophyseal and parapophyseal characters. Both *N. maura* and *tessellata* do not occur in Britain today, but are found on the European continent.

Natrix sp. indet

Material – Twelve vertebrae JCSHR (NP 89 42-53), and 52 vertebrae (JC 89 16-67).

Remarks – We are unable to assign these specimens to species. Some of the vertebrae are missing diagnostic parts, and others come from inappropriate portions of the vertebral column.

COMMENT

This is only the second reported British herpetofauna from sediments assigned to the Ipswichian interglacial stage. The other fossil herpetofauna is from the Swanton Morley site, also in Norfolk (Holman, 1987a). Both of these faunas are rather small (Table 1), but both have species that do not occur naturally in Britain today, but that occur in continental Europe. These species suggest a more continental climate in Britain during Ipswichian times. In fact, Stuart (1979) suggested that the presence of *E. orbicularis* indicates that the temperatures in England were at least 2 degrees C warmer when that species occurred there.

The detritus mud sediments that yielded the fossils suggest a low energy aquatic situation such as the quiet backwaters of a meandering stream. The fossil herpetofauna from Shropham (Table 1) is consistent with this interpretation.

Additional Ipswichian herpetofaunas are being studied at present, and it will be interesting to see if a "typical" British Ipswichian herpetofauna picture emerges with the addition of new information.

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We are very grateful to the people of the Minn's Aggregates Company for allowing us to

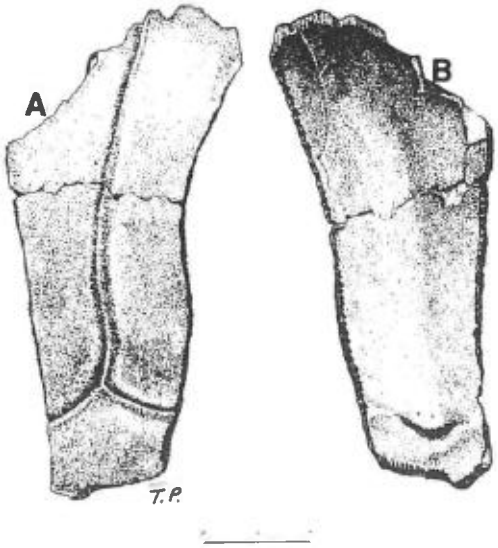

Figure 1. Second left costal bone of *Emys orbicularis* JCSHR (NP 88-4) from the Shropham, Norfolk, interglacial site. A, dorsal; B, ventral. The scale line equals 10 mm and applies to both figures.

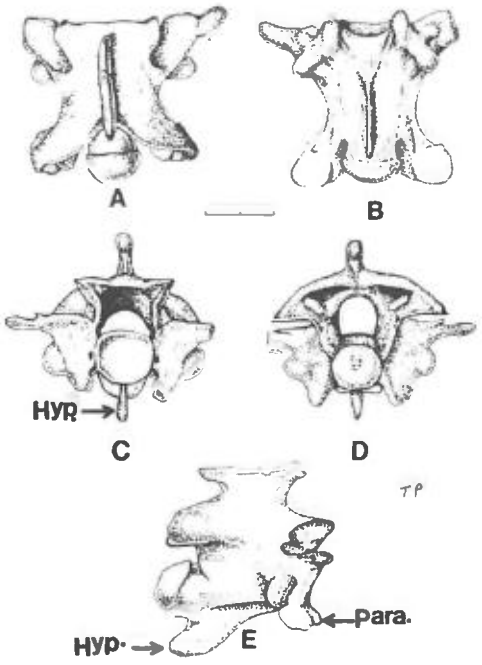

Figure 2. Vertebra of *Natrix natrix* JCSHR (NP 88-1) from the Shropham, Norfolk, interglacial site. A, dorsal; B, ventral; C, anterior; D, posterior; E, lateral. (Hyp.) refers to the hypapophyses on the vertebral drawings; (Para.) refers to the parapophyseal processes on the vertebral drawings. The scale equals 2 mm and refers to all figures.

collect the fossils at the Shropham Pit, and for removing overburden for us several times. Teresa Petersen made the figures. The United States National Science Foundation supported my work in Britain with Grant NSF BSR 851-5565.

TABLE 1: Herpetological species identified from the Swanton Morley and Shropham Ipswichian sites. (E) refers to forms that do not naturally occur in Britain today, but that inhabit continental Europe.

Species	Swanton Morley	Shropham
Triturus vulgaris	0	+
Bufo bufo	+	+
Rana arvalis (E)	+	+
Rana temporaria	+	+
Rana ("water frog" species) (E)	0	+
Emys orbicularis (E)	+	+
Lacerta cf. *vivipara*	0	+
Natrix natrix	+	+
Natrix cf. *maura* or *tessellata* (E)	0	+

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THE REPTILES AND AMPHIBIANS OF POLAND

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INTRODUCTION

Poland seems to have been somewhat negleted in many of the books published in English concerning the European herpetofauna. Specific references to the country are few and distribution maps for species often at the edges of their ranges are often vague. This is in spite of the fact that for some years Poland has been one of the more accessible of the Eastern European countries and one in which the availability of current vernacular literature reflects public interest in reptiles and amphibians. (Polish people do not, I find, think you crazy when you tell them you have come to their country to look for newts!) In this short article I intend to give an introduction to Polish herpetology, drawing where possible on my own experience from visits to the country as well as on relevant publications. An annotated check-list of the native species is given, using the format: Latin name/English name/Polish name.

THE COUNTRY

Poland is a country which is almost a third as large again as the United Kingdom but which has little more than half the population. In the south and west, undustrialized areas such as Silesia border similar areas of Czechoslovakia and Germany, creating a pollution problem that threatens to make some districts uninhabitable. On the other hand, low-technology agriculture and a claim to more wilderness than any other country in Europe mean that Poland has very much an unspoilt feel to it. The south of the country is mountainous (the Carpathians run from Poland, south through the Ukraine and Czechoslovakia, to Romania), with the North European Plain comprising the rest of the area northwards to the Baltic Sea. In the west and elsewhere are further ranges of hills and mountains, and to the east are extensive marshes. In the north, sand-dunes back on to more marshes and lakes and, even at the height of summer, parts of the sea are fresh enough to support freshwater fish. Much of the north-east is very low-lying, even below sea-level in places, with a vast number of lakes resulting from past glacial activity. In the south-east, where a small part of Poland is squeezed between Czechoslovakia and the Soviet Union, the mountains seem more like large hills, with tree cover to the summits in many cases. Forest of all types is characteristic of Poland. Rivers such as the Oder and the Vistula run roughly south to north, with their tributaries the Warthe and the Bug running east to west to join them. The Central European climate means that long, hot summers and very cold winters are to be expected.

SPECIES LIST

Amphibia/Amphibians/Pazy

URODELA/NEWTS AND SALAMANDERS/PAZY OGONIASTE

***Triturus cristatus*/Crested Newt/Trszka grzebieniasta**

Found throughout Poland with the exception of some mountainous areas but considered to be decreasing as elsewhere in Europe.

***Triturus vulgaris*/Smooth Newt/Traszka zwyczajna**

The common newt of Poland, subspecies *vulgaris* being found in most parts of the country.

***Triturus alpestris*/Alpine Newt/raszka górska**

Found in the south and south-west only but not restricted to the mountains. I have found well-grown tadpoles in a small concrete reservoir at Zakopane, a mountain/ski resort in the south. Subspecies ***alpestris*** is the only one present.

***Triturus montandoni*/Carpathian Newt/Traszka karpacka**

Mountains of the extreme south. In the south-east I have found this newt in great abundance, occupying every kind of fish-free water from woodland ponds to temporary

puddles and the running water of small roadside ditches. In these places it was the only newt species but, in the relatively few places where it can be found alongside the Smooth Newt, hybrids can make up 60% of the population. Even in breeding condition, this species is characterized by a rough-feeling skin. An albino larva has grown to a size beyond that at which metamorphosis would normaly take place and has over-wintered in this condition. (I am not aware of this phenomenon having previously been recorded for this species).

***Salamandrà salamandra*/Fire Salamander/Salamandra plamista**

Very largely restricted to the mountains of the south and south-west. While searching for the previous species, I was told by locals that salamanders would be much easier to find, especially if it rained. In the absence of rain, I saw no adults, but larvae were not difficult to spot in pools beneath tiny waterfalls. I would suggest that Polish salamanders are mainly of the subspecies ***salamandra*** in the south, with ***terrestris*** found west of the Oder.

ANURA/FROGS AND TOADS/PAZY BEZOGONOWE

***Bombina bombina*/Fire-bellied Toad/Kumak nizinny**

Found throughout the lowlands but largely absent from the mountainous south. Where its range overlaps that of the following species, hybrids are well-known.

***Bombina variegata*/Yellow-bellied Toad/Kumak górski**

Subspecies ***variegata*** is restricted to the south where I have found it alongside the Carpathian newt in all but the most shaded of waters. In places it is extremely abundant and its tadpoles blacken the water of puddles which are often destined to dry out.

***Pelobates fuscus*/Spade-foot Toad/Grzebiuszka ziemńa**

Subspecies ***fuscus*** is found everywhere with the exception of some of the mountainous regions of the south.

***Bufo bufo*/Common Toad/Ropucha szara**

Found throughout the country. In the south-east I have seen pairs breeding in May and June in large, fast-flowing mountain streams, surrounded by shoals of minnows, as well as in tiny, running ditches. Also plentiful in marshes behind the dunes in the north. Subspecies ***bufo.***

***Bufo viridis*/Green Toad/Ropucha zielona**

Subspecies ***viridis*** is found in all parts.

***Bufo calamita*/Natterjack Toad/Ropucha paskówka**

The distribution is less certain than for the previous species, but it seems likely that there are colonies in most parts of the country, with the exception of the far south.

***Hyla arborea*/Common Tree Frog/Rzekotka drzewna**

Well-known and more or less ubiquitous, a colony I encountered in the west is based on a pond in the middle of a building-site and is certain to be destroyed.

***Rana "esculenta"*/Edible Frog/Zaba wodna**

***Rana ridibunda*/Marsh Frog/Zaba śmieszka**

***Rana lesonae*/Pool Frog/Zaba jeziorkowa**

Green frogs are to be found in any extensive body of water, whether at the edges of lakes or in networks of drainage ditches, and even in town park ponds. I have also found them in quite small, swift lowland streams with fish such as Gudgeon. The Marsh Frog (subspecies ***ridibunda***) is less likely than the others to be found in the southern mountains.

***Rana temporaria*/Common Frog/Zaba trawna**

Found everywhere, this seems to me to be the most common ranid in the mountains. Subspecies ***temporaria.***

***Rana arvalis*/Moor Frog/Zaba moczarova**

Possibly the most common Brown frog over most of Poland, subspecies ***arvalis*** is probably only absent from the extreme south (where subspecies ***wolterstorffi*** may occur). It appears to be very common in small and isolated waters in the west. The specimens in the building-site pond mentioned above all had a distinct dorsal stripe.

***Rana dalmatina*/Agile Frog/Zaba dalmatyńska**

Only likely to occur in the extreme south-east. A colony may previously have existed on the Oder. Something of a mystery has surrounded this frog, as past identification

of Polish specimens has often been in doubt and all individuals have been females. My first impression of frogs at the best-known site has been that they are indeed Agile Frogs, but subsequent closer inspection of characteristics such as relative leg-length has proved inconclusive.

Reptilia/Reptiles/Gady

TESTUDINES/TURTLES AND TORTOISES/ZÓLWIE

***Emys orbicularis*/European Pond Tortoise/Zolw blotny**
A number of colonies are widely scattered in lowland areas.

SQUAMATA/LIZARDS AND SNAKES/JASZCZURKI I WEZE

***Anguis fragilis*/Slow-Worm/Padalec zwyczajny**
Subspecies ***fragilis*** is found in all parts.

***Lacerta agilis*/Sand Lizard/Jaszczurka zwinka**
Subspecies ***agilis*** is found everywhere.

***Lacerta viridis*/Green Lizard/Jaszczurka zielona**
Subspecies ***viridis*** **is found only at one spot in the south.**

***Lacerta vivipara*/Common Lizard/Jaszczurka zyworodna**
Found in all parts. I have most frequently encountered it as dark-coloured specimens in the mountains.

***Natrix natrix*/Grass Snake/Zaskroniec zwyczajny**
Subspecies ***natrix*** is found in all parts of the country. I have seen it in water meadows where Moor Frogs are abundant.

***Coronella austriaca*/Smooth Snake/Gniewosz plamisty**
Subspecies ***austriaca*** is found mainly in the south, with relatively few sites being reported for the central and northern areas.

***Elaphe longissima*/Aesculapian Snake/Waz Eskulapa**
Subspecies ***longissima*** is restricted to the extreme south-east, where it is found in the vicinity of ruined dwellings. Illegal collection by visitors from the West, mostly Germans, is said to have depleted its numbers.

***Vipera berus*/Adder/Zmija zygzakowata**
Subspecies ***berus*** is found in all parts of the country. I have found specimens occupying rock crevices in alpine pasture.

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THE LIZARDS OF INDIA: AN OVERVIEW

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Some 150 species referable to 8 families, namely Gekkonidae, Agamidae, Chamaeleonidae, Scincidae, Dibamidae, Lacertidae, Anguidae, and Varanidae comprise the saurian fauna of India.

GECKOS (Family Gekkonidae): Geckos are small, gentle lizards characterised by a soft dull skin and large unblinking eyes. They are the most abundant and familiar lizards in the tropics as the 'Nocturnal prowlers' in every house. Some have clinging pads on the underside of their toes which enable them to climb smooth surfaces. Geckos are found in the houses, on the ground, in the forests and on the tree-tops. They are the only reptiles to have a true voice, matching the calling notes of frogs and birds. Even their popular name 'gecko' is derived from the clicking sounds such as 'yecko' and 'gecko' produced by these house lizards by pressing the tongue against the roof of the mouth. They mostly feed on insects. All geckos are egg layers but not more than two eggs are laid by the female under the hollow of a tree, or under the ceiling or stones in the ground. The eggs of geckos are hard and brittle instead of being leathery like those of most lizards.

Some 51 species of geckos contained in 14 genera, namely *Eublepharis, Stenodactylus, Cyrtodactylus, Cnemaspis, Calodactylodes, Dravidogecko, Hemidactylus, Cosymbotus, Hemiphyllodactylus, Gekko, Ptychozoon, Phelsuma, Teratolepis,* and *Lophopholis* are known. The Fat-tailed gecko, *Eublepharis macularius,* is an inhabitant of the arid areas of northwest India. It is strictly nocturnal in its habits and is a voracious feeder. Several geckos are restricted to the hills and the forests. Of these, the commonest are the geckos of the genus *Cnemaspis* of South India. The Andaman Green Gecko, *Phelsuma andamanense,* found in and around Port Blair often enters the houses. Another interesting forest gecko is the so called 'Flying Gecko', *Ptychozoon kuhli,* which can parachute small distances by means of the membranous expansions on the sides of the animal's head, body, limbs and tail. This interesting gecko is confined to the Nicobar Islands. The Great House Gecko, *Gekko gecko,* which derives its common name, Tokay, because of its cry 'Touk-tay', is a giant among the geckos as it attains a length over 25cm. It is not a gentle creature, unlike the other geckos, as it occasionally gulps down a small rat or bird in its nocturnal rambles. When annoyed, this red or orange spotted house lizard raises its body and growls, holding its jaws wide open in defence. The Rock-geckos of the genus *Cyrtodactylus* found in the hills have clawed toes and laterally compressed bodies. Some ten species of the genus *Cnemaspis* are restricted to the hilly regions of South India. They are characterised by a granular or tuberculated body, a cylindrical tail, and a round pupil. The widespread and large genus *Hemidactylus* is represented by as many as thirteen species in India. Of these, the commonest forms are the Spotted House Gecko, *Hemidactylus brooki,* the Yellow-bellied House Gecko, *Hemidactylus flaviviridis,* and the Bark Gecko, *H. leschenaulti.*

GARDEN LIZARDS (Family Agamidae): The agamids are a large group of ground, rock, and tree-dwelling lizards although they are commonly referred to as the garden lizards. They are characterised by well-developed movable eyelids, pentadactyle limbs and a slender long tail. The terrestrial species have a flat body while the tree dwellers are slender. The skin is dull, rough or spinose and the tongue is broad and flat. A majority of the agamids are insectivorous and some are entirely herbivorous. The females lay eggs. Some forty species belonging to fourteen genera namely, *Draco, Sitana, Otocryptis, Ptycotolaemus, Goniocephalus, Mictopholis, Oriocalotes, Japalura, Salea, Calotes, Psammophilus, Agama, Phrynocephalus,* and *Uromastix* occur in India. The genus *Calotes* comprises the true garden lizards which are recognised by their compressed bodies, dorsal crests and a throat fan. The commonest Indian Garden Lizard, *Calotes versicolor,* is found among the bushes and shrubs near human dwellings. This harmless lizard is misappropriately labelled 'Blood Sucker' for an altogether harmless

trait. When it is excited or at the time of courting a female, its usually brownish body turns yellow while the throat, sides of the body, head, and neck turn scarlet in colour. The lizards of the *Calotes* complex are recognised by the crests on the neck and the dorsum, a gular sac in the males and an extremely long, slender tail. Though they are able to station themselves on the tree-tops even at a height of 8m, they are quite at ease on the ground. They feed mostly on insects, larvae and spiders. The female lays about a dozen eggs which hatch after two months. The Sita's Lizard, *Sitana ponticeriana,* has five toes on the hand and four on foot and is devoid of a dorsal crest. The male of *Sitana* has a throat-fan which is unfolded or contracted repeatedly when the animal is excited. It is a fast runner and adopts a bi-pedal mode of locomotion.

The Black and Orange Rock Lizard, *Psammophilus dorsalis* of the South Indian hills is often found an rocks matching its colour. It is a very agile creature disappearing at the first approach. The male is gorgeously coloured during the breeding season. Another beautiful agamid is the Himalayan Rock Lizard. *Agama tuberculata,* common in and around Simla, Garhwal, and Kumaon. The male displays a spectacular 'breeding dress' when its throat and belly turn bright blue. The genus *Draco* comprising the so called 'Flying Dragons' is represented in India by two species, namely, *Draco dussumieri* of South India and *D. novrilli* of Assam. These slender lizards have earned the dubious distinction of being the flying lizards because they are capable of gliding by means of "wings" or "patagia" which are folds of scaly membranes supported by six pairs of laterally movable and greatly prolonged ribs of the breast. The flying dracos measuring 24 cm can undertake sorties of more than 9-10 m in the forest in search of their staple diet-insects. The patagia of these tree lizards are beautifully patterned, on the basis of which their sex can be determined. The female lays two to five eggs at a time and buries them in the ground.

A curious looking agamid called the Spiny-tailed Lizard, *Uromastix hardwickii,* is found in the desert tracts of U.P., Rajasthan, and Punjab. It avoids the sun during the hottest part

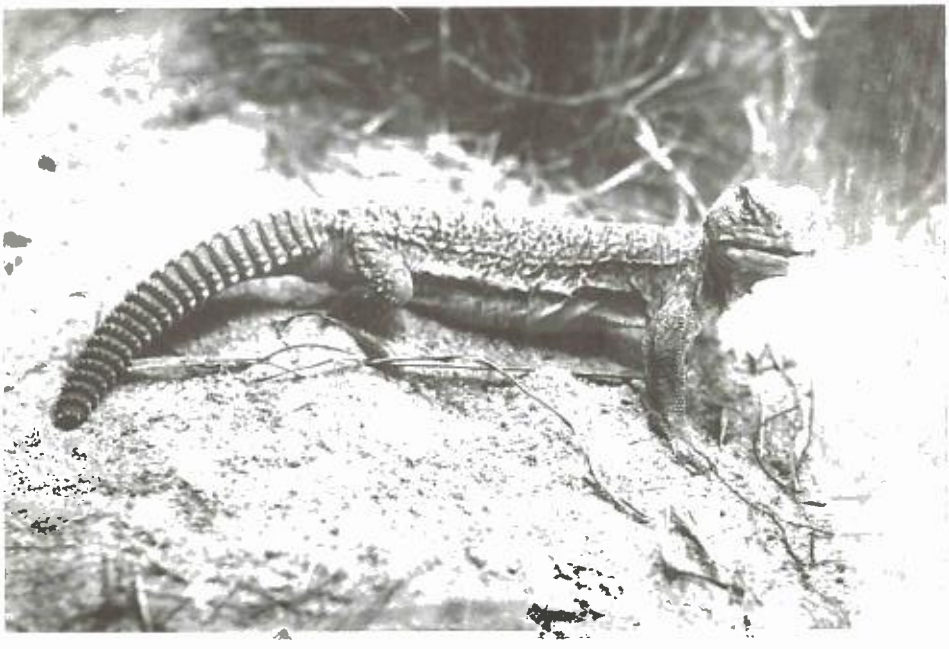

Plate 1. *Uromastix hardwickii*

of the day by retiring into a burrow. It enters its dwelling hole head-first, and the spiny tail blocks the entrance in a most efficient manner. It feeds chiefly on flowers, blades of grass, and fruits and occasionally on insects. This lizard is gentle in disposition and is easily tamed in captivity.

CHAMELEONS (Family Chamaeleonidae): The Indian Chameleon, *Chamaeleon zeylanicus,* found mainly in the scrub and wooded districts, is recognised by its compressed body, watchspring-like tail, helmet-like knob on the head and the round bulging eyes which together give the lizard a grotesque shape among the entire clan of lizards. A chameleon can change its colour from green and brown to different shades of yellow, white and black in the space a few minutes. It is surmised that the colours of a chameleon are dependent largely upon a psycho-physiological stimulus and in moments of intense excitement sweep in a flush over the creature's body.

With all its unique features, a chameleon is a slow moving creature. When picked up, it hisses and can inflict painful bites. During courtship males fight among themselves. The female lays 10-30 eggs and deposits the eggs in loose earth below the surface. The period of incubation lasts from four to ten months.

SKINKS (Family Scincidae): Skinks are a group of heavily built lizards. The majority of them are ground dwellers while the rest are burrowers. They are recognised by their overlapping and smooth and shiny scales with symmetrical shields on the head, a broad flat tongue and movable eyelids. Some have blunt heads which is an adaptation for their subterranean life. The tail may be short or long but snap off to distract the enemy. The trend towards reduction of limbs and elongation of the body is so much pronounced in the skinks that they are often mistaken for snakes. However, the characteristic fusion of their lower jaw and the movable eyelids establishes their identity as lizards. The tongue of a skink is thick and fleshy like that of a frog or a toad. It is used both for eating and drinking. Skinks burrow in the sand without much effort.

A unique feature of some skinks is that their lower eyelids have transparent discs or 'windows' so that their vision is not obscured when the eyes are closed. Further, this disc protects their eyes against foreign particles. Skinks are primarily insectivorous while a few feed upon vegetable matter as they grow in size. They lack the ability to change colour but the males acquire red or orange hues during the breeding season. While a few skinks bring forth their young alive, the majority lay eggs. Some forty four species of these widespread lizards distributed among twelve genera, namely *Dasia, Sphenomorphus, Chalcides, Scincella, Riopa, Ablepharus, Ristella, Mabuya, Eumeces, Ophimorus, Barkudia,* and *Sesophis* are found in India. The genus *Ablepharus* is represented by a single species, *A. grayanus,* which occurs in north-western India. The eyelids of this degenerate species are fused to form a transparent disc. Its limbs are very feeble. The genus *Barkudia* includes the unique limbless skink, *B. insularis,* found on the Barkuda Island of Chilka, Lake Orissa, and in the sandy shores off the Andhra University, Waltair. It is much elongated in shape and burrows with unbelievable speed in the loose earth. Striped skinks of the genus *Mabuya* are common throughout India. These small to medium sized lizards can move with remarkable speed when pursued. Each species is characterised by a definite pattern of stripes or lines on the back and spots on the flanks. Some twelve species are described from several parts of India. Of these, the Common Skink, *Mabuya carinata,* and the Striped Grass Skink, *Mabuya dissimilis* are well known. The Yellow-bellied Mole Skink of Kashmir, *Eumeces taeniolatus,* is a secretive lizard as it remains hidden in the burrows or under the rocks for most of the day. The Indian Sandswimmer, *Ophiomorus tridactylus,* a denizen of the desert, literally 'swims' its way under the surface of the sand and hence its Punjabi name 'Ret-mahi' which means a sand fish. It can burrow up to a depth of 30 cm under the sand from which it issues forth only after the sun rises. This lizard is captured in large numbers by the hakims for its visceral fat which is supposed to act as an aphrodisiac. The burrowing cat skinks of the genus *Ristells* are restricted to the hilly tracts of southern India. They have clawed digits and their lower eyelids are scaly. Their breeding habits are unknown. The genus *Riopa* includes the garden skins which are small but robust in form. The young of these ground dwelling lizards have definite colour pattern. The Himalayan skink, *Scincella himalayanum,* avoids the light and lives in rather damp situations. It is found in abundance near the banks of the lake at Naini Tal and in the gardens of Simla. It brings forth its young alive.

WORM LIZARDS (Family Dibamidae): The glassy-scaled Indian Worm Lizard, *Dibamus novae-guineae,* found in the Nicobars, is a degenerate type of skink. In tune with its subterranean existence, it is blind and devoid of the fore-limbs which are modified into scaly flaps in the

male. The head is olunt and conical with a large cup-like shield on the snout. The tail is short and cannot be detached. It grows to legnth of 225 mm and resembles a slender worm. The origin of this lowly reptile is a mystery and very little is on record about its biology.

LACERTIDS (Family Lacertidae): Lacertids are an abundant group of lizards considered as typical forms because of their slender bodies, well developed legs and long pointed tails. One does not come across either the specialised or degenerate species among them. They are found in sandy, grassy and rocky areas. The fragile tail is easily shed and the broken part is regrown. The majority of the lacertids are insectivorous while a few are cannibalistic. All of them are egg-layers. Some nine species contained in five genera namely, *Acanthodactylus, Cabrita, Eremias, Ophisops,* and *Takydromus* occur in India. The Indian Fringe-toed Lizard, *Acanthodactylus cantoris cantoris,* has scales on its digits that project along the sides to form a comb-like fringe which facilitates the animal's movements in the sand. This lacertid, found in the sandy tracts of northern India, is brightly marked while young. It lives in the burrows under bushes and emerges in the bright sun. It is a very agile lizard, disappearing quickly into the bushes on the slightest alarm. The genus *Cabrita* is represented by two small sized lizards, *C. leschenaulti* and *C. jerdoni,* found in the forests of southwest India. The genus of snake-eyed lizards, *Ophisops* is represented by *O. jerdoni* and *O. beddomei,* found in northern and south India respectively. These moderately sized lacertids and the above mentioned species of *Cabrita* have transparent discs in the centre of the lower eyelids. The Long-tailed Lacertid, *Takydromus sexlineatus khasiensis,* is found in the Khasi Hills, Meghalaya. It grows to a length of 6 cm and its tail, measuring 3.5 cm, supports the weight of the animal in its leaps from stem to stem in the grassy areas.

GLASS-SNAKE LIZARD (Family Anguidae): The Burmese Glass Snake, *Ophisaurus gracilis,* is the sole representative of the family Anguidae in India. It is found in and around Darjeeling and the Khasi Hills, Meghalaya, often at higher elevations from 820 to 1500 m. It also is recorded from Simla and is said to be common in and around Shillong. The glass-snake, so called because of its brittle tail and the absence of limbs, glides like a serpent by lateral undulations. It probes its way employing its blackish tongue in a truly snake-like fashion. However, it can be recognised as a lizard because of its movable eyelids and the ear opening which are absent in the snakes. The body is coated with ring-like overlapping scales. It is a terrestrial species, hiding under logs and stones for most of the day. It is sluggish in disposition and becomes active only at night when it issues forth in search of its food consisting mostly of insects. It is quite harmles and does not bite when handled. When first caught, it feigns death. The female lays from 4 to 6 eggs. Probably it is the longest lived of all lizards as its life span is about 60 years.

MONITOR LIZARDS (Family Varanidae): The very appearance of a monitor lizard or varanid with its elongated head, an unusually long neck and tail, and a completely snake-like tongue is striking. Monitors, which are among the lizards close to the snakes, having been derived from a common ancestral stock, have naturally more serpentine features and that is why the young of these lizards in north India are called *biscobras.* Monitors are the world's heaviest and largest lizards. Despite their massive bodies monitors are good climbers, runners and swimmers. The long forked tongue is employed as a sensory organ and it can be withdrawn into a protective sheath as in the snakes. The monitors are not vocal but they can hiss loudly when cornered. Some of the largest individuals, reaching a length of 3m, are as powerful as crocodiles. In the face of a threat a monitor's first concern is to seek escape. Some head for water, others run to a safe retreat or some climb up trees. But if their passage is blocked, a monitor inflates its body, hisses loudly, and lashes its formidable tail vigorously, and puts its sharp claws on show. The food of monitors is varied as it includes crabs, molluscs, small rats, squirrels and carrion. They are particularly fond of hen's eggs, in search of which they often raid chicken houses. Monitors do not normally chew or crush their food as other lizards do, but swallow their prey as a whole or in large chunks. The female lays about 15-30 eggs and deposits them in termite mounds or such other secluded spots.

Of the four kinds occurring in India, *Varanus bengalensis* is the commonest form. It is found in the forested areas and on the outskirts of villages. It escapes notice because of its brownish hue which harmonises well with its surroundings. It is found frequently during and after the

Plate 2. *Varanus bengalensis*

monsoon. The Yellow Monitor, *Varanus flavescens,* is found in Bihar, U.P., Punjab, Bengal, and Orissa. It is dark brown in colour and the body is marked with yellow spots or bars. The Water Monitor, *Varanus salvator,* occurring in the coastal mangrove regions of Orissa, Sunderbans, and Andaman and Nicobar Islands, is the second largest lizard in the world, reaching a length of 2.5 m. It is blackish or dark brown above, with yellow spots. The Desert Monitor, *Varanus griseus,* is found in the arid zone of central and northwest India.

ECONOMIC IMPORTANCE

The presence of geckos in human habitations is to our advantage as these small lizards are efficient destroyers of harmful insects. The monitor lizards serve not only as useful scavengers but also as destroyers of the coconut pests like crabs, beetles and snails. Further, these lizards feed upon destructive rodents. The eggs of monitors are a great delicacy and the animals themselves provide a full meal. The Spiny-tailed Lizard is captured in large numbers by the desert people for its flesh. The spiny-tail is considered a great delicacy, and the meat is said to be excellent, like chicken. Preparations made from the fat of this and other desert dwelling lizards are said to be effective as aphrodisiacs. Oil extracted from the visceral fat of the monitors is used for treatment of eye problems of the aged.

The leather of monitors has been much sought after because of its reputedly high wearing quality, infinite variety of pattern and texture. Moreover, they can be finished off in any colour.

All the four monitor lizards of India and other kinds like the chameleon and spiny tails are now protected under the Wildlife Act of India.

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