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INSTRUCTIONS TO AUTHORS

1. The BHS Bulletin publishes a range of features concerned with herpetology. Emphasis is placed on captive breeding and husbandry, conservation and field notes, general natural history, veterinary and behavioural aspects. These features include major articles and scientific papers (sometimes illustrated), short notes, letters and book reviews.

2. For preference, major papers should be submitted in duplicate, typed in double-spacing, with wide margins; the addition of a computer diskette would be an advantage. Letters and book reviews should also be typed. However where this is not possible, handwritten articles are acceptable.

3. Slides are the preferred form of illustration, although it is possible to use prints for reproduction purposes. Colour plates are expensive and all pictures should be entirely relevant to the text. It is also possible to reproduce line drawings (black ink), graphs and charts.

4. For style and layout, authors should consult a recent copy of the Bulletin.

5. Authors will be informed of the receipt of their work and will be given a time-scale within which it may be published. Acknowledgement of the receipt of a piece of work **does not** indicate acceptance for publication. Decisions on this will be made by the editors as soon as possible and the authors informed.

6. The editors reserve the right to shorten or amend material.

7. Twenty-five off-prints and one complimentary copy of the Bulletin are provided free to authors. Further copies may be available from the editors at cost. Slides, prints and other original material will be returned.

8. The copyright of all material published in the Bulletin is held by the Society. None may be reproduced without the permission of the editors.

9. The significance and importance of some articles may be such that the editors will offer the author a year's free subscription to the Society for their work.

10. The editors are keenly aware that members may find some of these instructions difficult to carry out. They are anxious to open the pages of the Bulletin to as wide a range of correspondents as possible. Therefore, if you have any concerns about the publication of a piece of work, or would like to help in preparing it, please discuss this with John Spence, at the address and telephone number below.

    The Bulletin is edited and produced by John Pickett and John Spence. Contributions and correspondence arising from the Bulletin should be sent to John Spence, 23 Chase Side Avenue, Enfield, Middx, EN2 6JN (0181-366 8127).

FRONT COVER
The Giant Fire Bellied Toad, *Bombina maxima*, in amplexus. See "A Preliminary Note on the Care and Breeding of *Bombina maxima* in Captivity", by Max Sparreboom and Paul Van Den Elzen, p.14.

BHS SCIENTIFIC MEETING

"The Scientific Study of the Ecology and Conservation of Great Crested Newts".

Saturday, 5th December, 1998
at Birkbeck College, Malet Street, London WC1E 7HX
(nearest underground station – Russell Square)
from 10.30 am – 5.00 pm

Speakers include:
Dr. Alex Kupfer (Germany)
Dr. Robert Jehle (Austria)
Dr. Richard Griffiths (U.K.)
Prof. Robert Oldham (U.K.)

Admission £5.00, including buffet lunch and refreshments

Supported by ENGLISH NATURE

For further details contact Dr. Clive Cummins, Institute of Terrestrial Ecology, Monks Wood, Abbots Ripton, Huntingdon PE17 2LS.

HERPETOFAUNA GROUPS OF BRITAIN & IRELAND

REGIONAL CONFERENCE

Sunday, 15th November, 1998
10.00 am – 16.45 pm

Highgate School Auditorium (Dyne House),
Southwood Lane, Highgate, London, N.6.

Further details and booking forms:–

London Amphibian & Reptile Trust,
67a, Ridgeway Avenue, East Barnet, Herts EN4 8TL
(Tel/Fax: 0181 440 6314)

THE NATTERJACK TOAD IN SCOTLAND

DR. H. ROBERT BUSTARD

The renowned Sir Joseph Banks, *the 18/19th Century botanist, who was President of the Royal Society for 41 years, stated that he was told by his Mother that* **"the toad is actually a harmless animal; and to whose manner of life man is certainly under some obligation as its food is chiefly those insects which devour our crops and annoy him in various ways."**

The inoffensive and beneficial habits of toads, due to the huge numbers of pest species they consume, is a significant plus for their conservation.

SUMMARY

The Scots Solway Natterjack populations are shown to be highly important in UK numerical terms. With *implementation* of existing protective legislation (absent from inland sites until now – resulting in the loss of all previously recorded inland sites) and scientific management, the population in this discrete area can equal the recent numerical estimates of numbers for ALL the English sites. Hence its future managed conservation is vital in UK Natterjack terms. Five, previously unrecorded, inland sites are described.

INTRODUCTION

This paper describes work which I carried out on the Natterjack (*Bufo calamita*) on the Scots Solway in Spring/early Summer 1998. The study is continuing but since the conservation implications of the findings and of work in progress are far-reaching it was decided to publish this account now. This work deals with what anyone could accomplish in their local area in *part of a single season* and forms section 2 of the present paper. It underlines the crucial importance for the Society of having people ***active*** in the field in their local area. These people will often require support, and indeed members have said to me that they needed access to information on topics that they did not know about. I would hope that a revamped and reactivated ***Conservation Committee (BHSCC)*** would provide this support nationally.

I was hampered by the Natterjack occurring on the opposite side of the country from where I live in East Perthshire, necessitating a car journey of some two and a half to three hours each way to reach the habitat, and the obvious need to stay away from home overnight when carrying out field work. Operating at this distance adds to the 'costs' of the work. If you are able to select a study site within normal commuting distance of your own home there are obviously great advantages.

There was interest in the former Nature Conservancy in the Natterjack in Scotland over a long timespan. I remember contacting the Warden at Caerlaverock about a visit prior to leaving for Australia in 1962. The then Warden, M.J. Boyd, wrote an internal document (1972) dealing with distribution and breeding. Although it dealt primarily with the area known as Caerlaverock National Nature Reserve it included the western one third of

Priestside in the area of known breeding sites. All the sites described were coastal. The known habitat of the Natterjack in Scotland extends from Southerness (Gillfoot Bay) in Kirkcudbright in the west, eastwards through Caerlaverock, Priestside with the Powfoot at its eastern end, to Royal Ordnance only a small distance further east.

The Species Action Programme (undated, but issued at the recorders' meeting on 29th April 1998) refers to the four Scots colonies listed above. With the exception of that at Royal Ordnance – a rare heathland site (one of only three remaining Natterjack heathland sites in Britain) – all are merse-related.

The SAP goes on to state:

"It is unlikely that there are any other populations remaining to be discovered in Scotland."

This does not agree with the findings of my limited work during 1998 in the course of which I discovered **five new colonies**. All of these were on inland, agricultural sites – the very type of site reported to have been destroyed in the publications referred to in section 4 – hence highly threatened.

The SAP states that the [then] four known colonies on the Scots Solway "are estimated to account for between 11 and 23% of the total UK population of 15,000 animals" (Banks *et al.* 1994). The population targets set out in the SAP are unrealistic – as must be the case in the absence of any population studies. For instance the **target** is 700 adults for the whole of Priestside, a linear length of 6km of merse. This year I started a population study on a 240m length of Powfoot Bay at the eastern end of this strip of merse. This strip alone, reported not to be the richest for Natterjacks in this part of Priestside, has a 1998 population estimate of 529 adults based on mark-recapture data from my individually recognisable population (Bustard, in prepn.). Of course this 6km length of merse is not uniform, but for illustrative purposes, if a similar population density was found to occur *on average*, or could be built up, along Priestside, then the **adult** natterjack population of Priestside would be 13,225 toads! This is a comparable figure to that of Banks *et al.* (1994) of 15,000 for the whole of the U.K. including Scotland, and is only slightly smaller than the U.K. estimate of 15,000-20,000 given by Beebee and Denton (1996). While no data exist to even guestimate the size of the Priestside population at the present time, I have no doubt, that with fairly minimal management, such a population if not present, is achievable. This figure does not take into account the populations that occur at Southerness, where the potential for recovery is enormous, Caerlaverock (a very important population) or Royal Ordnance, a site of potentially very great significance. Nor does it take into account the recently discovered inland breeding populations. Their significance – if they can be properly protected – is to extend the Natterjack in substantial numbers much further inland that the merse-related populations are likely to reach in the course of normal foraging activities, hence opening up large new habitat areas for colonisation. The *potential* for the solway meta-populations is enormous provided the legal protection afforded the species is actually implemented by the statutory authority.

Properly managed, therefore, the Scots Solway can sustain populations greatly in excess of Banks *et al's* (1994) and Beebee and Denton's (1996) total UK population estimates. Clearly, therefore, this is a site of *national* importance, the highlighting of which is the key conservation contribution of this paper.

MY INVOLVEMENT

John Buckley is due credit for my involvement in Natterjack Toads. He saw that Frank Bowles and I were invited to the Scottish Heritage Natterjack Toad Recorders' Meeting held at Dumfries on 29th April 1998. I said to him well in advance that if I was to play a useful role at the meeting I needed to see the situation in the field beforehand. John, it turned out, had planned a monitoring visit around the meeting so Frank and I were able to spend three days in his company during which we visited virtually all the known Scots Natterjack habitat with John as guide/instructor.

The SAP for the Natterjack was presented at the 29th April meeting. In the discussion of this and what needed to be done for Natterjack Toad conservation in Scotland, it became apparent that there was an urgent need for hard data and hence an important role for my professional skills as a population ecologist. I agreed, at the meeting, to become involved in census work if permits could be granted to enable me to start work more or less immediately to make full use of the 1998 breeding season then already underway. The SNH Area Officer, Chris Miles, played a key role here, and I was issued with a permit within days.

I chose as my study area a very fragile population, in the sense that its habitat was very restricted and highly threatened by human activities. This is at Powfoot (Queensberry Bay) on the merse between Annan and Cummertrees. We had visited that area with John Buckley both by day and in late evening after the northern darkness had fallen. As it happened the count we made on 28th April, the evening before the meeting, of 139 toads, including three pairs in amplexus, was the largest count I have made this season (Bustard 1998, a). This may reflect the way breeding has unfolded this year due to subsequent cold and/or dry periods, but on some evenings may have been a result of my inability, due to the time taken to record toads individually, to cover the whole breeding area in the time available. The toads do not emerge from cover until late dusk and then only spend some two hours at the breeding pools before returning to their homesites. I do not know if this short period is normal or reflected rapidly falling temperatures after nightfall.

I had hoped to be able to mark toads for subsequent recapture to enable population size to be estimated. I do not believe in toe clipping amphibians nor using plastic waist bands on anurans. Nor do I like the idea of inserting transponders which represent to toads the equivalent of inserting a sizeable battery pack into a human. Both these activities have a 'cost' in ecological terms. A cost which is unknown especially in relation to possible changes in behaviour over the shorter term when most recaptures need to be made during population size estimations. While I was investigating possible methods which I approved of, Bill Wales, BHS Chairman, suggested that I affix small markers with biological glue. So that they would be water resistant I decided to use 1mm circles punched out from waxed milk cartons.

The use of this technique on Natterjacks in my study area was not approved by SNH. This has resulted in my doing a trial run using the nearest toad then available – *Bufo pardalis*. The results of these trials will be published in due course. It also necessitated my developing a visual identification method that could be used to identify toads *individually* to enable the 1998 work programme to proceed. I discussed visual recognition features with Trevor Beebee who thought that throat patterns of females would allow individual recognition of small numbers – perhaps up to 25 females – but that the method would not work on males due to the dark reddish-brown colour of the throat in breeding males.

I started by looking at the dorsal yellow stripe and decided that by using that in combination with the throat markings it should be possible to identify **every** toad individually. This technique will be published elsewhere. It comprises a quick *diagnostic drawing* of BOTH the stripe and the throat pattern. Blanks, the original kindly provided by John Buckley, are run off in advance so that the stripe can be placed in relation to the eyes, parotids, etc and the throat markings in relation to the lower jaw. The key thing is that this method has worked 100% at Powfoot in 1998 on a marked population estimated at 529 adult toads.

The two techniques – affixing dots and drawing the stripe/throat – are not mutually exclusive. The dot technique involves minimum disturbance to the toad, compared to the other commonly used techniques mentioned above, as the biological glue dries instantly. The dot is short-lived – being lost at the next moult – but a large number of toads could be marked in an evening and the population resampled the next night. The toads do not need to be touched at recapture – one merely records the number of marked and unmarked toads and hence arrives at a population estimate for the number of male toads at that breeding pond *at that particular time.* A further advantage of this technique is that it can be quickly 'exported' to other toad workers in the area and requires no special skills. It is also most inexpensive.

The drawing technique, on the other hand, is a **permanent** record and of an **individual toad**. These are big plus points. The disadvantage is that some skill in drawing and a good eye to be able to confidently and quickly record the diagnostic features are necessary, so the technique is not so readily exportable to other workers. Furthermore, since it is clearly impracticable to carry books of drawings into the field at night (especially on the treacherous Scottish *merse*), the toads have to be redrawn at each further sighting and the numerous drawings that accumulate subsequently compared in order to detect matches.

Individual recognition has many advantages, of course, in that it allows one to work on topics such as survival and movement of individual toads. So I am glad that I have tested the technique and found that it works effectively on the Natterjack.

In the course of the work at Powfoot described above, in 'spare time', I have talked extensively to local people and followed up reported breeding ponds. In the course of searching for one such pond two other important areas being used by breeding populations of Natterjacks have been discovered. Indeed, I have recorded a total of five new breeding populations. These have been reported regularly in the *Natter Jack.* A portion of the breeding pool of the first of these is shown in Plate 3. Since the whole field has been ploughed up, no terrestrial habitat remained for the toads, making them extremely vulnerable to predation. This photograph was taken on 13th May 1998, long after the breeding season had commenced. As I pointed out at the time (Bustard, 1998b), "Such treatment of a site is a recipe for population extinction – which is, of course, precisely why such sites are meant to be fully protected".

Frank and I listened to this population calling after dark on both the evenings of 12th and 13th May, and by the volume of sound on both evenings, It was clear that we were dealing with an important population. To quote from Bustard (1998b) "Ploughing the field had attracted large numbers of herring gulls, lesser black-backed gulls and crows, all voracious feeders and serious potential predators of the toads". These birds are all able to disembowel the toads thus avoiding problems with the toxic skin. This site still held water in late Summer.

Plate 1: The narrow habitat strip at Powfoot with traditional cottages behind the dune bank

Plate 2: Two small breeding pools (on opposite sides of the plate) on Powfoot merse

Plate 3: A very threatened inland breeding site on arable land near Cummetress showing ploughing into the pool and absence of any terrestrial habitat

Plate 4: Debris lifted to show natterjack in sealed chamber (Southerness). The toads close the entrance when 'at home'

The second site is a roughly circular, man-made, stock pond (Bustard 1998c) located in a field currently under grass at Cummertrees village at an elevation of 15m. I wrote, "Frank Bowles and I heard substantial Natterjack calling at this site after nightfall on two nights in mid-May. Furthermore, several local residents confirmed that they regularly heard the toads calling after they went to bed . . . . . this is clearly a well-established breeding pond well known to the local people but one that has never been recorded. This pond requires management. It is too deep, and is a permanent pond extensively used by Common Toads judging by the numbers of all age classes seen in the vicinity. However, successful Natterjack breeding appears to have occurred in 1997, as during a joint search with me, John Buckley discovered a 1997 toad in a sandy area adjacent to this pond in July 1998 (Bustard, in press, a). By the time this paper appears management of sites 1 and 2 will have been discussed in a tripartite meeting between *BHS* (represented by Frank and myself), SNH, and the tenant farmer.

The third new site and potentially the most exciting (Bustard, 1998d), is a large water-meadow covering about one-third of the depth of a sizeable field and approximately two-thirds of its breadth (this in mid-May 1998). Large numbers of toads were calling both from the main water area, and also from 'satellite' pools across the breadth of the field at the time we discovered the site in mid-May. Unfortunately, the next day we found a sluice mechanism to drain the field into an adjoining ditch. Despite this drainage, the site appears to have produced many metamorphs in 1997 (Bustard, 1998e; in press, b). If drainage can be stopped this water meadow could become a key breeding site in the local **meta-population**. Details of two further sites are given in Bustard (in press, c; in press, d).

These discoveries have perhaps been the aspect of this year's work which has most fired conservation interest, in that these five breeding areas are all away from the merse – up to distances of 1200m and elevations of 15m. The generally accepted view appears to have been that the toads were tied to the merse and the sand (bank) immediately behind the merse.

Discovery of these inland populations is of great conservation significance as the merse is in retreat at the present time due to massive erosion. Indeed its depth has been halved in less than half the lifetime of local farmers. The fact that breeding is also taking place away from the merse provides safeguards in the event that the remaining merse is progressively lost. It also provides key continuity of populations. The area in which I directed most searching effort over the 1998 breeding season was around Cummertrees. Inland breeding ponds are about 350m apart varying from about this distance to 1200m inland from the merse. Their distribution means that they all constitute at least potentially inter-breeding populations. Decimation of habitat in southern England has resulted in the fragmentation of many Natterjack populations and it is isolated mini-populations which are most liable to extinction. Hence this discovery of these contiguous breeding or meta-populations on arable land, when taken together with the known populations on the merse, is a very significant discovery in Natterjack conservation ecology *on a UK-wide basis.* It is not that inland breeding sites are a-typical (Bustard 1998f; Buckley 1998) but that most such sites have long gone and it had been assumed that they were confined to the dune/saltmarsh (merse) habitat.

Conservation action has to try to ensure that these contiguous populations including newly discovered inland populations on arable land are protected as it is the combination of these and merse sites that will provide the best long-term future for the Natterjack.

Actions that the *Society* can take in order to try to achieve this ideal goal are considered in section 5.

Plate 5: Detail of a merse breeding pool at Powfoot. The shallow pools are typically 10-15cm deep and usually measure only 2-3m x 1-2m

Plate 6: Eleven of eighteen 1997 juveniles located under one stone at Moss-side farm, an *excellent* site on Priestside merse

KEY SITES

Key sites include Caerlaverock, under excellent protection as a National Nature Reserve/Wetland & Wildfowl Trust Reserve; Southerness to the extreme west of the *recorded* distribution where the population needs every help it can get (see 5 below); the merse along Priestside to Powfoot; and the Royal Ordnance heathland site. This site last came on the market several years ago and had we known that SWT (Scottish Wildlife Trust) was not to purchase it we would have purchased this key site for all time.

The other sites are the five that I discovered this year in the Cummertrees area, described above. It is also most probable that further inland sites remain to be discovered. The 1998 searches concentrated in a single area. A new – *workable* – mechanism will have to be put in place to properly protect sites on agricultural land (see 5 below).

LOSS OF ALL PREVIOUSLY-KNOWN BREEDING SITES ON ARABLE LAND

When I started my work in May 1998 all recorded sites were on the coastal salt marsh (known locally as merse). All subsequent inland sites that came to my notice as I did a literature search were describing their loss. These are set out in summary form below. They make distressing reading in that all inland sites on arable land were lost. Bridson (1976) provides early information on the progressive loss of breeding sites on farmland close to Caerlaverock due to incompatible agricultural activities. The *BHSCC* Report, combined 1989 and 1990 (Anon, 1991) states:

"In the latter county (Dumfriesshire) two important saltmarsh breeding ponds were drained although negotiations are underway with the owners to provide replacement ponds. Another group of pools in a sandy field at Powillimont were completely destroyed when the owner *ploughed and reseeded the site* (my italics). Damage to another pool by a farmer was reported to the NCC in August 1990" [I have corrected mispellings],

It should be noted that all these pond losses occurred in this small area in the timespan of the *BHSCC* 1989 and 1990 report.

Vin Fleming, a senior Scottish Natural Heritage staff member, formerly stationed in SW Scotland, has taken a keen interest in Natterjacks and their conservation. It is greatly disturbing, therefore, that he wrote in our *Herpetological Journal* (Fleming *et al.*, (1996) of, *'continuing loss and attrition of breeding ponds'*
and
'Of greatest concern, perhaps, is that these losses have continued, and indeed accelerated, into the present decade, despite legal protection given to the Natterjacks, and elements of their habitat, since 1975.'

This paper, above all others, indicates that all is very far from well with Natterjack conservation as it has been practiced on the small Solway area where this toad still exists in Scotland. It is obvious that there has been long-term failure by the statutory authority charged with implementing the legal protection afforded to the Natterjack by Parliament.

In the SAP for the Natterjack Scottish Natural Heritage, writing about Southerness Natterjacks – the most threatened colony on the Scots Solway – stated:

"Numbers have continued to decline with the loss in 1989 of unprotected breeding pools at Powillimont."

It is very hard to understand how these key breeding pools at the extreme western part of the range could have been "unprotected". I have written "key" as the terrestrial habitat at Southerness (Gilfoot Bay) has virtually all been lost to a gigantic caravan city complete with all amenities on site. John Buckley has – as always – been most helpful in rediscovering with me the two Powillimont ponds. In our opinion these could easily be reinstated. Equally significant is that John showed me three other ponds at Southerness all of which could also be reinstated. Two are just outside the caravan site, and the third is in the 'village green' area, where the caravan site could have a unique breeding site and give themselves very positive conservation publicity. Southerness is a considerable distance from my centre of activities, and 'servicing' this from Perthshire I do not think it possible that I can do this site justice. Accordingly I have advertised in the *Scottish Herpetologist* (the *BHS* Scottish Group publication) for people interested in adopting this site. If such people do not come forward then this would be an excellent area for our sister organisation *Herpetological Conservation Trust (HCT)* to carry out complementary work to what I have been doing to the east. We badly need these five ponds reinstated and this whole small area managed on a regular basis for the toads. Priority should be given to the Powillimont ponds.

SNH have advised me that the Natterjack enjoys all legal protection necessary for its conservation. In view of this, the failure to use this legislation effectively is extremely disturbing. The loss of these five ponds at what is the most threatened Scots population is dreadful. This is a subject which I will be discussing with Vin Fleming and his staff in Edinburgh on behalf of the Society in early September.

WHAT THE *BHS* CAN DO

1) Highlight the problems.

2) Carry out population studies to show the significance of key threatened populations (e.g. Powfoot) and provide hard data on abundance.

3) Enter into management agreements with landowners.

4) Try to have key sites reinstated (this would often be easy with minor work due to the nature of Natterjack breeding sites).

5) Lease land to fully protect threatened inland sites.

6) Buy land – by the time you read this paper the *Society* will hold an option to purchase a farm in Dumfriesshire **which has the potential to double the total Scottish Natterjack population of 2250 adults set out in the SAP.**

All five of these activities are being strenuously pursued at present.

The *BHS* has suffered in Scotland, as elsewhere, by not being active over most of Britain. This is a situation that I am working to improve.

The failure of the *Conservation Committee* to live up to its *national* remit gives cause for concern. There is much more work to be done that ALL the existing conservation groupings can cope with. The situation described in this paper amply confirms this, and more importantly underlines the need for **local involvement on a continuing basis.** It is totally inadequate for even an outstanding field worker such as John Buckley to make occasional visits to such a site. *There has to be local people involved in a continuing dialogue to achieve and maintain conservation objectives.*

FUNDING FOR THIS WORK

The *BHS* has a land fund which is divided into two – money which may be spent to acquire reserves, and money invested, the income from which may be used for paying annual leases for land. Unfortunately, the land fund, once very active, appears to have lost impetus. When I raised the question of land purchase I was told that it was most unlikely that land would be available to purchase. In my short time working in SW Scotland I have found that land is fairly readily available. The need, therefore, is to raise the funds to acquire it. **There is no substitute for land ownership.**

The late Sir Peter Scott of Slimbridge Wildfowl Trust (and its other more recent derivatives) was extremely helpful to me when I was a youngster and he impressed on me then the importance in a country such as ours of **actual land ownership or achieving the same effect by very long leases**. One has to be persistent, patient and persuasive but if one is, a tremendous amount can be done for conservation. Substantial land ownership also raises one's profile enormously which is exactly what the *BHS* needs right now – nationwide.

If even a part of these plans are successfully brought to fruition – and I am hopeful, as I write in late August, that they ALL will be – then the NATTERJACK, from being a neglected member of the Scots fauna, can become a significant conservation icon and the implications of the work will have a large UK-wide effect. Opportunities for the ***BHS*** to benefit from this are as enormous as they are obvious.

ACKNOWLEDGEMENTS

The Scots Natterjacks owe a debt of gratitude to those who helped me in the field. John Buckley not only took both Frank and I round the then known sites but dealt with all my many subsequent queries and his dedication to their conservation is inspiring. We have spent two visits to the Scots Solway together. Frank Bowles has likewise made two visits with me helping me at Powfoot and he was with me when several of the new inland sites were discovered. It has also fallen to Frank, as Conservation Officer of the Scots Group, of *BHS* to carry out the follow-up to try to ensure their conservation. At this he is excellent – and most tenacious. Colin Glendinning, whom I recently recruited as a new *BHS* member, kindly helped me at Powfoot one week-end, and Gwen Soutar – whom I have yet to recruit to the *Society* – helped on two occasions both at Powfoot and on night-time road searches. The work could not have been undertaken without the support of Chris Miles, the SNH area officer for Dumfriesshire, who got a licence issued to me in days to enable me to immediately commence the population work at Powfoot. I thank them all.

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EDITORIAL NOTE

In the early 1980's, the Giant Fire Bellied Toad, *Bombina maxima* of Western China, was imported alive into Britain, Europe and North America, for the first time. At that time its natural history, behaviour and captive care were little known. While it was successfully kept and bred for a short time by a few individuals, it never became firmly established in captivity, at least not in Britain or North America. Also, the imported animals were mostly short-lived, succumbing rapidly to unknown infections.

This year, 1998, it has again been commercially exported from China in some numbers. This time, fortunately, the animals appear to have been healthy and have not suffered from disease or unusual levels of mortality. Many people will have had the opportunity to acquire the species. In view of the scant information available, we consider it appropriate and helpful to reprint the following paper, originally published in the British Journal of Herpetology in 1982, by Max Sparreboom and Paul van den Elzen, and revised recently by Max Sparreboom. We hope in the near future to publish further articles with new information on the natural history, care and breeding in captivity of the species.

This is a partial reprint of a paper published in the British Journal of Herpetology, 1982, Vol. 6, pp. 269-272. Changes to the original text were made by the first author; the recent address of the second author is unknown.

A PRELIMINARY NOTE ON THE CARE AND BREEDING OF *BOMBINA MAXIMA* (BOULENGER, 1905) IN CAPTIVITY

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SUMMARY

Notes are given on the behaviour of *Bombina maxima* as observed in captivity. The males, and to a lesser extent also the females, display a behaviour pattern which has been provisionally described as territorial. Clasping, making sideways jerking movements and the emitting of the excitement-call, are here explained as serving to maintain or to establish a certain distance between individuals. The toads have been bred in captivity. The development of tadpoles is described and compared to that of the other known species of *Bombina*.

INTRODUCTION

Very few specimens of *Bombina maxima* (Boulenger, 1905) had been seen alive in Europe until fairly recently, and even major museums failed to have it in their collections. The species was collected for museums in Britain, Germany, Austria and the U.S.A. during the early part of this century (Boulenger, 1905; Mell, 1922; Werner, 1924; Schmidt, 1927; Pope, 1931). Stadtmüller (1931) reports on a specimen examined by him which he bought from a dealer and which originated from Yunnan. Reports that the species has been kept and bred in Hungary cannot be corroborated for lack of further information. Liu (1936, 1945, 1950) was the first to deal with the species in detail and describes its life history.

During the latter part of 1980 hundreds of *B. maxima* suddenly turned up on the European market. They were shipped via Hong Kong to two major herptile dealers, Van Mourik (Netherlands) and Hoch (Germany). After a short boom the number of specimens kept alive in captivity dwindled rapidly for various reasons, but mainly because of an epidemic caused by a bacterial infection (Diesener, 1981). It is now once more rare in amateur terraria.

The collecting locality of the specimens is unknown. Marked differences occur in dorsal and ventral colouration patterns (Kühnel & Epperlein, 1981).

The aim of this paper is to present information on the care and breeding of the species under captive conditions. All observations are made on captive specimens.

CARE

Eighteen specimens were kept in glass aquaria. Most bell-toads measure c. 60 mm but some attain at least 75 mm. Six specimens were housed in a 60 x 30 x 30 cm tank, furnished with a ground soil of coarse sand, with stones and pieces of corkbark placed on it. The water level was 7 cm. The toads could find hiding places both under and above the water surface. Twelve specimens were housed in two full-glass aquaria of 60 x 40 x 40 cm, furnished with 10 cm high density foam, stones and pieces of masonite sheeting to afford hiding. In both instances the toads were bred.

In order first to increase the animals' condition, the water temperature was raised until it reached approximately 20°C, and the toads were fed several times weekly on naked mice and big earthworms. In the beginning of February 1981 the temperature was lowered again. The aquarium was standing in an unheated room, where temperatures could sink to about 7°C in winter. Food was still accepted at temperatures of 10°C. In spring the males developed large black nuptial pads on the first three fingers and the forearms, but hardly on the chest.

One of the observation tanks will be dealt with here. Although the aquarium was too small for the six toads, they were left in it for the time being. At that time other keepers of *B. maxima* lost many specimens due to sudden diseases. Our own toads were apparently healthy, so it was decided to maintain the *status quo* for some time. The average temperature of the water rose according to the season; during summer, temperatures sometimes exceeded 25°C. Food was now offered once a week. There was however little mating activity and the mating call was not heard.

Plate 1: *Bombina maxima,* adult female

Plate 2: *Bombina maxima,* adult male, underside, showing typical body form and colour pattern

Plate 3: *Bombina maxima,* adult female, underside, showing typical body form and colour pattern

Plate 4: *Bombina maxima,* juvenile

In August 1981 the toads were moved to a larger aquarium of 100 x 55 x 50 cm, furnished with big stones, sand on the bottom, a water level of 8 cm and some floating waterplants (*Fontinalis, Elodea, Ceratophyllum, Hydrocotyle*). During the day the tank was illuminated by a 25 W neon light. The water part was not filtered or aerated. In this aquarium most observations on the toads' behaviour were done. Although the thickness and the black colour of the males' nuptial pads clearly decreased in July and August, calling and amplexus were still observed. The toads appeared to be much more active now than earlier in the season in the small aquarium and from now the six toads were observed in the larger aquarium.

Although the toads were often visible and active at daytime, especially when they were fed, they led a mainly nocturnal life. At night they moved about most and could also be seen sitting on land. During the day they sat in the water, hiding under it but also squatting at the water's edge.

Like the other *Bombina* species, these toads actively jump or swim towards prey. Then the tongue is protruded first, but if the prey cannot be caught in that way it is snapped up. Even big prey like naked mice and the biggest worms are eaten. Prey can also be captured under water. *B. maxima* appears to be very voracious but less impetuous in swallowing prey and fighting for it, than the other species of *Bombina.* A few days after feeding the faeces are found in the water; they are of elongate shape and approximately 1.5 cm long.

REPRODUCTIVE BEHAVIOUR

Any sudden movement in the aquarium by objects approximately the size of a toad immediately provokes two kinds of behaviour. If, for instance, food is offered and one or more toads start moving towards the prey, this frequently induces the males to clasp. If the clasped animal is a male, it usually frees itself with some rapid movements, at the same time uttering the release-call. If the clasped animal is a non-receptive female, she also gives a release-call (at present not distinguished from the male's release-call). She keeps her hindlegs stretched or flabby, flattens her body and keeps the eye membrane closed over the eye. By slow crawling movements of the forelegs she tries to slither away out of the male's grip. These movements look like those on a slow-motion picture. This phenomenon has also been described in *B. variegata* and named "Chamäleonreaktion" by Birkenmeier (1954; see also Savage, 1932). By making too sudden movements the female would possibly stimulate the male to strengthen its grip. While escaping from a male, the female of *B. orientalis* often hammers on the clasping male's forelegs with her forelegs. This behaviour has not been observed in *B. maxima.* The male attempts to prevent the female from climbing ashore and thereby from breaking away from his grip by making rowing movements with his hindlegs and so staying in open water. Other males, attracted to these movements, are knocked off by the amplecting male by fierce thrusts of the hindlegs.

During the amplexus the clasping male makes some remarkable movements. It moves its body to the left, to the right or alternating left and right, with short jerks, quickly succeeding each other. First, these movements appeared to be only connected with the strengthening of the grip but that was not necessarily always the case. The actual grip is often very loose, the male hardly touching the female's back with thorax and throat. The movements were, furthermore, also made without clasping. This behaviour is often provoked when two or more animals come in each other's proximity. In such a case, the

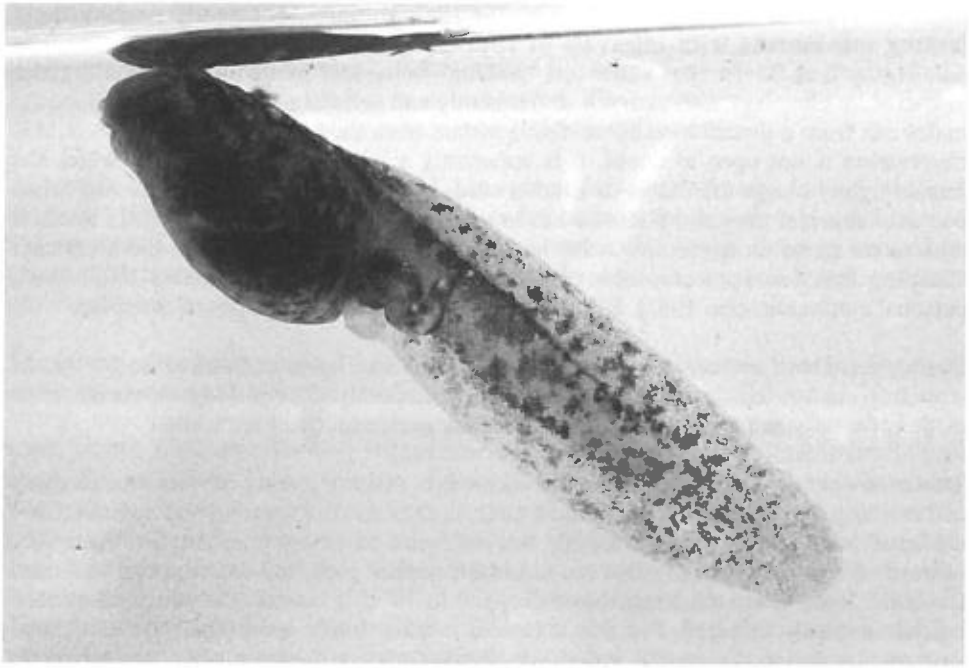

Plate 5: *Bombina maxima,* tadpole

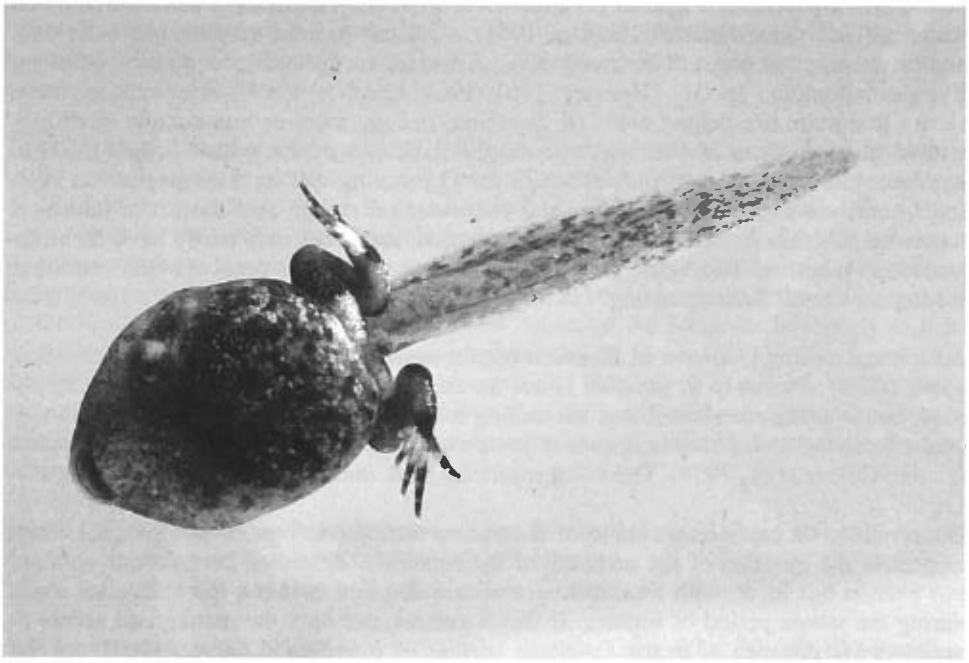

Plate 6: *Bombina maxima,* tadpole

toads sit opposite or next to each other for some minutes, constantly making these jerking movements with intervals of approximately one or a few seconds. It is noteworthy that the females show this "jerking" behaviour too. Moreover, the females also execute claspings, although not so frequently and persistently as the males. Since the males can from a distance easily be distinguished from the females by the observer, this observation is not open to doubt. It is apparently a wilful amplexus during which the female tightly clasps the flanks of another toad. It is often elicited during feeding when one animal seizes prey and a female has to wait till another prey item comes in reach. It thus seems to be an aggressive behaviour and could indicate ranking in the hierarchy. Clasping females were also observed by another keeper of *B. maxima* (Houwaart, personal communication 1981). It is not yet known in the other species of *Bombina.*

During periods of intense activity the toads often swim up to each other and a sort of wrestling ensues during which the toads clasp randomly. The jerking movements are made constantly and both the release-call and the excitement-call are emitted.

This behavioural repertoire: jumping on each other, making jerking movements, clasping and emitting the release- and excitement-calls, is displayed all summer and autumn. Only the "real" mating call, the 'Unkenruf', was not heard any more after August. From July onwards the males gradually lost the big black nuptial pads, but retained the thickened forearms. Even when the temperature dropped to 10°C in winter, the above-mentioned behaviour hardly changed. For this reason, it is most likely not exclusively associated with mating during the mating period but also has a social function which, moreover, is maintained after the reproductive period and could be territorial.

Some sort of territorial behaviour is known in different anuran families (Heusser, 1969) and in a number of species it is assumed that they "carry" their territory with them, *i.e.* they do not occupy a territory in the sense of a small marked-off area of which the boundaries are defended against potential rivals, but they maintain a certain individual distance ("Individualdistanz", Heusser, 1961), a critical distance between one individual and the others, that may not be transgressed. This has, for instance, been observed in the European *Bombina* species (Heusser, 1961, 1969; Lörcher, 1969). Investigations have shown that male fire-bellied toads *(B. bombina)* occupy more or less circular territories with a radial distance of 1-1.5 m, whereas the territories of the yellow-bellied toad *(B. variegata)* have a radius of only 0.5-0.75 m. The mating call in both species has been interpreted as serving to maintain the individual distance and therefore having a territorial function (Lörcher, 1969). In our opinion, amplexus may partly have the same territorial function. The behaviour of *B. variegata* which has received the somewhat inadequate name "Scheinpaarung" (sham-mating, Birkenmeier, 1954) could point to this.

Antiphonal calling is known in *Bombina* but the males do not necessarily form choruses when calling. Probably *B. maxima* is not an exclusive chorister either. The possibility may, however, be mentioned that the calling may serve to synchronize mating activity and to keep the males clustered, as it is known of certain typical chorus-forming species (cf. van Gelder *et al.,* 1978). The vocal repertoire of *B. maxima* has not been described.

Observations on captive specimens of *B. maxima* during one year cannot give a definite answer to the question of the meaning of the behaviour described here. In our opinion, however, it has to do with establishing a certain distance between the individual toads during the whole period of activity. If this is correct, not only the mating call serves to maintain the distance as in the European species of *Bombina* (Lörcher, 1969), but the clasping behaviour, the jerking movements and the excitement-call do so as well.

BREEDING

While the toads were still housed in the smaller aquarium, spawn was produced on 20 June 1981. The spawning itself was not observed. The eggs were deposited in small clusters among the vegetation (*Fontinalis*) and loose on the bottom.

According to Liu (1950), the eggs are laid in masses, which mostly sink to the bottom of the pools. If there is any vegetation floating on the surface, the egg-mass is attached to it and suspended from it. It has also been recorded (Anon, 1977) that the eggs are laid in small clusters that can also be deposited in marshy areas in stagnant water, between grasses and reeds.

The larvae were hatching on 25 June. There were about 40 hatching larvae. The eggs could not be counted. Half the number of larvae were kept in an aquarium of 70 x 40 x 40 cm, which had previously accommodated newts. The aquarium was furnished with sand, stones and some floating waterplants, moreover it contained much debris and algae. The rest of the larvae was put in a small aquarium (30 x 20 x 20 cm) containing waterplants. Anuran larvae, when kept in larger tanks, generally grow bigger than in smaller containers, but this was not the case here. In both aquaria the tadpoles grew alike and completed metamorphosis at the same time, having reached about equal size. Rearing the tadpoles presented no difficulties. Water temperature varied from 17-23°C. They were fed on bruised lettuce, algae, Tetramin and now and then a tablet of beer yeast. Development until the completion of metamorphosis took 5-6 weeks and proceeded as follows:

25 June: hatching. 28 June: larvae hanging at glass and plants. 6 July: ± 20 mm, grazing algae and lettuce leaves. 16 July: ± 35 mm, beginning of hindlegs. 29 July: first forelegs broke through. Dorsum became rough and warty and showed vague light spots on shoulder region. 3 August: biggest tadpole 42 mm. 5 August: first metamorphosis, all the other tadpoles underwent metamorphosis during the following week. Young toads measured 14 mm. They were fed on *Tubifex, Chironomus* larvae and *Drosophila.* A few months later, dew worms and flies were taken.

Twenty-three of the tadpoles grew up well and 22 reached metamorphosis. The young toads resembled their parents in colour and appearance. Some had light green spots, distributed irregularly over the back and hindlegs. The green colour was somewhat lighter than in the adults. One juvenile had a completely green back. Unlike the other *Bombina* species, the yellow coloured vent becomes apparent before metamorphosis. Before the forelegs break through, two light spots can be distinguished: the yellow palms of the hands. On the hindlegs too, the yellow colour of the footsoles is already visible when the legs are still very small. The development of the larvae was found to agree with the account of Liu (1950). It can finally be noted that tadpoles of *B. maxima* do not grow as big as those of other *Bombina* species and accordingly reach metamorphosis at a smaller size. The following maxima have been measured of larvae bred and reared in captivity:

B. maxima	larva 42 mm	juv. 14 mm
B. variegata	larva 50 mm	juv. 19 mm
B. orientalis	larva 47 mm	juv. 17 mm

The young toads were reared in small plastic aquaria (30 x 20 x 20 cm) filled with a shallow layer of water and a piece of cork bark serving as hiding place and terrestrial part. In this way the animals could easily pick up food from the water. Almost one year

old, the young toads now measure ± 4 cm and grow well on a diet consisting mainly of earthworms.

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HOW MANY CLUMPS OF FROG SPAWN ARE LAID ANNUALLY AT ANLABY COMMON?

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INTRODUCTION

Heavy rainfall in the Autumn of 1997 and Spring of 1998, has meant that local ponds have contained more water than they have for several years in this area. Many temporary ponds have held water longer this year than they have for a number of previous years. There is every indication that large cohorts of metamorphosed frogs, toads and newts will join terrestrial populations in the late Summer and Autumn.

It may be interesting to speculate whether the high rainfall and subsequent deep ponds this year have stimulated more than usual numbers of adults to return to ponds to breed. At the time of writing, a toad pond I regularly visit contains more *Bufo bufo* tadpoles than I have ever seen in the pond. A local Great Crested Newt *Triturus cristatus* pond, when searched by torch light, contained more newts than usually found at the same time of year. On Anlaby Common, in April of this year, there were approximately 14.5 m^2 Common Frog *Rana temporaria* spawn in a single raft, whereas over the past few years there has been a steady decline.

ANLABY COMMON

Anlaby Common is a large area of land on the outskirts of Hull. It is approximately 1 km by 0.5 km and consists of rough grassland, with some hedging bisecting across it and on its boundaries. To the east, it is enclosed by back gardens of several streets of houses. To the north, east and south are roads. Part of Anlaby Common has a topography of a remnant ridge and furrow system. Within a number of furrows and in several large depressions, there is usually standing water in the early Spring.

Although I have not visited the Common every year, most of the years' breeding frogs usually spawn in the same body of water. Spawn clumps can be found in some of the flooded furrows, but usually not many. The main breeding site is about 30 metres from the eastern boundary of back gardens. It is a wide depression that floods in early Spring and in late Summer it has usually dried out to resemble the grassland surrounding it. The actual depth of water varies from year to year. It has been at its deepest this year, being 80 cm in depth, whereas last year, there was hardly enough water to spawn in. In fact, by early May, the whole site was dry and all the spawn would have perished. A lot of it was rescued by a local naturalist, who placed it into a number of ponds on his land.

My early estimates on the number of clumps of spawn started in 1986, when on 4th April of that year I wrote in my field notebook that a large amount of spawn had been laid, "in excess of 500 clumps over 3 separate water bodies". In 1987, there was much concern that Anlaby Common was going to be sold as building land. As part of the 'green belt', local residents were quite anxious to keep it as it was. As part of 'the campaign' it was

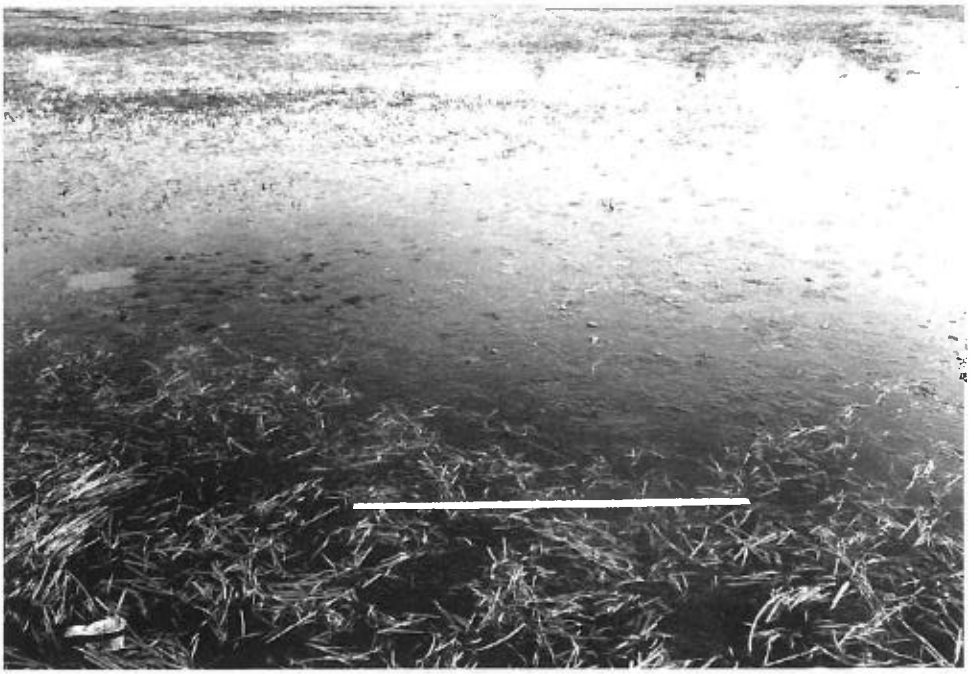

Plate 1: The 1998 raft of Common Frog *Rana temporaria* spawn at Anlaby Common (a metre rule is floating in the fore ground)

suggested that it might be useful to show that the land did support a very large population of frogs. It was decided that one way of showing this was to actually count the number of clumps of frog spawn that had been laid that year. An interested local resident, a 'Watch Group' member, a representative from the NCC and myself, arrived on site in early April of that year. We devised the rough and ready method of counting the number of spawn clumps in a 'typical' square metre and then multiplying this by the total area of the spawn raft. We had measured an approximate total area of spawn as being 44 m^2 for the main spawning site. Overall, we estimated that 2640 clumps [60 x 44] of frog spawn had been laid at Anlaby Common that year.

The threat came and went and Anlaby Common is still there. I have continued my visits over the years and have observed a decline in the area of frog spawn laid each year. There has always been pressure on the site and although a local group of volunteers do help frogs across one stretch of road, a number do get run over on their migration to the breeding site every year. A variable amount of spawn and frogs do get collected every year, for there are always people with buckets making their way backwards and forwards across the common during March and April.

THE TASK

In 1996 I decided that I wanted to monitor the site more carefully and needed a more accurate method of estimating the total number of clumps of frog spawn laid at Anlaby Common. Within a raft of spawn the number of clumps per square metre is bound to vary slightly, depending on the depth of water, maturity of the spawn, vegetation within

the pond etc. I felt it may still be worthwhile to find out, all be it 'roughly', how many clumps to expect. I decided that my starting point should be a single clump of spawn. Within a raft of spawn I wanted to try to produce a model for the surface area occupied at the air-water interface for a single clump. During my visit to Anlaby Common in 1996, I measured the total area of the spawn raft and took the dimensions of several single clumps of spawn.

My observations seemed to suggest that a single clump of spawn is oval in shape with average dimensions of approximately 100 mm by 150 mm. Modelling the shape of spawn and using these dimensions, together with mathematical formulae, I arrived at an area of 128.6 cm^2. Therefore, for 1 m^2 of spawn there would be an estimated 77.8 clumps of spawn. So for 1996 approximately 12 m^2 of spawn had been laid giving an estimate of 933 clumps.

I had wondered whether anyone had investigated ways of estimating the number of clumps of spawn in rafts. At this point in time, I contacted Richard Griffiths, who referred me to his co-authored article in a BHS Bulletin (1994). Interpolating their plotted data 1 m^2 would yield 76 clumps of spawn. Remarkably this was very near to the figure shown above and using it for 1996, 912 clumps of spawn had been laid.

In 1998, I visited Anlaby Common several times and when the frogs seemed to have completed spawning I measured the roughly square egg mass at 4 m by 3.6 m, a total area of 14.4 m^2 [see Plate 1]. Using the first estimate of 77.8 clumps m^{-2} gives a total of 1120.3 and using 76 clumps m^{-2} gives a total of 1094.4 clumps.

CONCLUSION

I will continue to monitor Anlaby Common and whilst it may be useful to measure the total area of frog spawn, it is also helpful to express the year's production as an actual number of clumps. Such a number can be no more than a reasonable estimate. As evident from the data above, Anlaby Common does support a very large population of frogs and needs to continue to do so, especially within a wider area that supports such a paucity of amphibian and reptile species. Using the more accurate data above it does appear that there is the strong possibility of a decline occurring in the amount of spawn. It would now seem that in 1996 44 m^2 would have represented 3423.2 or 3344.0 clumps of spawn.

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HERPETOFAUNA OBSERVATIONS IN PALAS VALLEY, NORTH-WEST FRONTIER PROVINCE, PAKISTAN

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INTRODUCTION

In the Spring of 1994 from 15 May to 23 June, under the auspices of Bird Life International and the Himalayan Jungle Project (HJP), a team of four British ornithologists working with Pakistani counterparts from HJP and the Department of Forestry (Wildlife), visited Palas, North-West Frontier Province (NWFP) in northern Pakistan. The primary objective was to undertake surveys of the Western Tragopan *Tragopan melanocephalus*, a threatened montane pheasant endemic to the western Himalayas. I was subsequently involved with a further Western Tragopan survey in the winter of 1995-1996. During these surveys Naeem Ashraf (then HJP) and myself were able to make some observations of amphibians and reptiles. No herpetofauna studies had previously been undertaken in Palas, and this region of the extreme west Himalayas is relatively poorly known to herpetologists.

The Himalayan Jungle Project and Palas Valley

Commercial timber extraction and local pressure on forest resources has resulted in large scale deforestation in northern Pakistan. Palas supports one of the largest areas of remaining Himalayan temperate and subalpine forests in Pakistan. The Himalayan Jungle Project, established in 1991, aims to conserve the remaining forest and other important wildlife habitats within Palas. Its approach is to enable local people to tackle the linked causes of poverty and incipient natural resource degradation through establishment of sustainable integrated natural resource management. Very simply the project promotes conservation of the forest and associated wildlife whilst undertaking ventures such as bridge building, introducing new and higher yielding crops appropriate to the low-intensity agriculture practised in the area, constructing water mills to grind locally produced maize, *Zea mays*, and other initiatives to benefit the local people.

An important component of the project is to elaborate base-line data on the biodiversity of Palas, in particular on the status and distribution of the threatened Western Tragopan and other species endemic to the western Himalayas.

Location

Palas is situated within District Kohistan, NWFP, in northern Pakistan. Palas lies immediately to the east of the River Indus and covers an area of 1413 km2.

It is located between 34°52'E to 35°16'E and 72°52'N to 73°35'N (see Map 1).

The valley entrance is close to the small town of Pattan 35°12'N 73°02'E. Pattan is located alongside the Karakoram highway on the west bank of the Indus.

Topography

The topography is characterised by deep, steep-sided valleys and precipitous slopes with many rocky crags and outcrops, and patches of boulder scree. The main valley known as Bar Palas is about 45 km long, running in an approximately south-east to north-west direction. In altitude it varies from 1000m at Karat (the Palas valley road-head) to 4500m over Ledi Pass at the south-eastern end. The surrounding snow-covered mountain peaks reach over 5000m, the highest being Bahader Ser at 5151m.

Habitat

Through the main valley of Bar Palas flows the turbulent Mushaga River and along the numerous smaller adjoining side valleys there are numerous fast flowing, boulder strewn streams. In a few areas along these water courses there are slow flowing stretches and pools that provide breeding sites for anurans.

Palas supports large areas of Himalayan temperate and subalpine forest, herb-rich high alpine pastures and also cultivated terraced slopes in the vicinity of villages.

At the valley entrance at 1000m, evergreen *Quercus baloot* (a species similar to Holly Oak, *Quercus ilex*) woodland dominates boulder strewn slopes up to about 1900m. It occurs mostly in a somewhat degraded state due to lopping of trees to provide fodder for livestock and heavy grazing of the understorey, mainly by domestic goats. Wild Olive *Olea* sp. is an important constituent species at these lower altitudes.

Above 2000m the *Q. baloot* woodland gives way to West Himalayan temperate forest comprising a mix of coniferous and deciduous tree species. The dominant conifers on the drier ridges are Himalayan Cedar *Cedrus deodara,* Himalayan Blue Pine *Pinus wallichiana*, West Himalayan Silver Fir *Abies pindrow* and *Picea smithiana*, often mixed with *Q. baloot.* A variety of deciduous broadleaf species which predominate in damper gullies and ravines include Maples *Acer spp., Parrotiopsis jacquemontiana,* Walnut *Juglans regia* etc. A small population of the endangered West Himalayan Elm *Ulmus wallichiana* also occurs in this vegetation zone.

In less heavily grazed areas a shrub layer persists composed of woody plants including *Berberis* spp, *Cotoneaster* spp, *Indigofera* spp, *Lonicera* spp, *Rosa webbiana* and *Viburnum* spp.

Above 3000m, patchy subalpine Himalayan Birch *Betula utilis* woodlands are found, grading into alpine scrub and pasture above 3300m. Higher still are rocky mountain ridges and peaks, with large areas of permanent snow and ice.

Persecution of Herpetofauna

In Palas, as is the case almost worldwide, snakes are viewed with general fear and loathing by humans. Locals usually attempt to kill snakes on sight by beating them with a stick or stoning them with rocks. They do not attempt to distinguish between harmless and venomous species. Locally, around villages for instance, this may have a negative effect on snake populations but the indiscriminate killing probably has little effect in the valley as a whole.

Surprisingly perhaps, lizards, especially the conspicuous Agamas, are also feared. they are frequently the targets for stone-throwing children and teenagers. Despite questioning locals it could not be ascertained why they feared Agamas but this fear is obviously deep-seated in their folklore. They are quoted in poems/verse and apparently represent the 'ugly man'. Translation difficulties prevented any clarification of this! The head-bobbing display commonly exhibited by Agamas is interpreted by some Moslems as being an insult to Allah which appears to account for persecution of agamids in some regions.

Toads (and possibly frogs too) are also feared. A Green Toad *Bufo viridis* shown to two local porters was viewed with obvious fear. They refused to pick-up or even touch it and backed away when it was held towards them. However, unlike snakes and Agamas, no direct persecution of toads or frogs was observed. This fear of anurans too, is presumably passed on through local folklore.

HERPETOFAUNA OBSERVATIONS

Survey Methods

No particular survey methods were employed. Encounters with reptiles were usually made when walking between Tragopan survey sites during daylight hours. When time allowed a special effort was made to search likely looking areas for amphibians and reptiles. An attempt was made to describe the habitat at observation localities but frequently insufficient time was available to make more than brief notes as observations were often made when on the move between Tragopan survey sites.

On a few occasions, especially after rain, spot-lighting at night (usually in the early hours of the evening when it was still relatively warm) was undertaken to look for nocturnal species.

Species Accounts

Three species of amphibian and five species of reptile were encountered in Palas. The most interesting observation was of a frog of the genus *Paa*, possibly a species new to science. A summary of these observations is given below.

AMPHIBIA

FAMILY BUFONIDAE

Bufo stomaticus (Lutker) – Indus Toad

1- 11-12.6.94. Karat, Bar Palas road head. 1000m.

Female spot-lighted soon after dark at 20.00hrs and male spot-lighted at 03.00hrs.

Bufo viridis Laurenti – Green Toad

1- 17.6.94. Pichbela, Bar Palas. 2200m.

30 plus adults and sub-adults spot-lighted at dusk. Most were amongst boulder piles (providing daytime refuges) or moving quickly with short rapid hops across bare, alluvial sandy soil. Three to four calling sporadically from standing water and several thousand large tadpoles, some with limbs and approx. fifty recently metamorphosed toadlets were observed in and around shallow pools.

2- 18.6.94. Dumbela, Bar Palas. 2200m.

12 adults and one sub-adult spot-lighted soon after dark at 20.00hrs. Mostly seen on alluvial sand close to boulder piles with scant herbeceous vegetation, but one was observed foraging amongst grass at the end of a small terraced field and three were in a small pond (2m x 3m x 0.4m deep) containing some emergent *Juncus*.

3- 14.6.94 Shaman and Chakal. 2000m.

Approximately 500 tadpoles in a small pond (1m x 3m x 0.3m deep) with a bare mud bottom, green algae coating a few submerged rocks and marginal vegetation of *Veronica beccabunga, Carex* sp and grasses.

4- 20.6.94. Pichbela and Pulbela. 2200-2250m.

A few tadpoles observed in shallow pools and small slow-flowing streams.

FAMILY RANIDAE

***Paa* sp.** Three frogs and several tadpoles of this genus were seen at two localities (see below). I am indebted to Prof A. Dubois for his identification and comments with regards to this frog. He considers it clearly to be new to the region, resembling *Paa blanfordii* (from eastern Nepal, Darjeeling and Burma). It could be an atypical *P. polunini* (known from western Nepal) but it is possibly a new, undescribed species. It is hoped that some specimens of adults and tadpoles can be obtained to ascertain its identity.

1- 20.5.94. Pichmoru and Karo Ser, Bar Palas. 2000m.

One adult and two immatures spot-lighted shortly after dark at 20.00 hrs. The adult was in a small pool (3m x 2m x 0.3m deep) situated underneath a rock overhang. The pool contained clear water with a gravel and silt substrate with a little accumulated plant debris on the bottom. Marginal vegetation consisted of a few small ferns and grasses. The pool was heavily shaded by an overhanging rock face. The two immatures were in a wooden water trough (a hollowed out conifer trunk) adjoining the pool via a short wooden water chute. The surrounding habitat consisted of open *Q. baloot* woodland on a south-facing boulder strewn slope.

2- 26.12.95, Karo Ser, Bar Palas, 2050m.

Six to seven large tadpoles of the above species were observed in a small pool just above Karo Ser village. These were nocturnal, emerging after dark from day-time refuges under submerged rocks. They were between 60 to 65 mm in total length.

Water body description:
Dimensions: Approx. 70 cm x 200 cm x 12 cm deep.
Flow: Slow, up welling from a spring. Outflow over granitic boulders at opposite end of pool to inflow.
Shading: Approx. 25% shaded by overhanging rocks.
Water Clarity: Clear.
Substrate: Irregular shaped small granitic rocks <10 cm diameter and gravel, with fine accumulation of silt covering 70% of bottom. Occasional goat droppings in water and very sparse fragments of macrophytic plant remains.
Aquatic vegetation: None, except for slight epipelitic fern possibly *Dryopteris sp*, an *Epilobium sp, Cerastium sp, Veronica sp* and a grass.

REPTILIA
FAMILY: AGAMIDAE
Laudakia tuberculatus (Hardwicke and Grey) – Kashmir Rock Agama
In May and June 1994 *L. tuberculatus* was observed to be a common conspicuous species occurring throughout most of Bar Palas from the roadhead at Karat at 1000m up to 3000m. Many adults, predominantly males (identifiable by their blue marbled throats), lesser numbers of immatures and a few very small individuals (presumably 1994 hatchlings) were noted. This agama was encountered in open, rocky and boulder strewn areas and occasionally man-made drystone walls. When disturbed they retreated under rocks or into rock crevices. At one locality several were observed foraging in alpine pasture but only in the immediate vicinity of rock piles in which they took refuge when alarmed.

On 10.2.96 in Kuz Palas at 1500m, a *Laudakia sp* presumably *L. tuberculatus* recently emerged from hibernation, was seen being carried in the claws of a Large-billed Crow *Corvus macrorhynchos.*

FAMILY: SCINCIDAE
Eumeces taeniolatus (Blyth) – Yellow-bellied Mole Skink
1- 16.5.94. Gorkhar, Bar Palas. 1900m.
One retreating into crevice in boulder pile.
2- 29.5.94. between Shambela and Shared. 1750m.
One adult observed taking refuge under boulder on ESE facing slope. Surrounding boulder scree with very sparse vegetation cover (<5%) of grasses, *Geranium* sp, *Rabdosia rugosa* scrub and a few *Quercus baloot* trees.

Liolopsima himalayanum (Günther) – Himalayan Ground Skink
1- 23.5.94. Breathbeck, Bar Palas. 2550m.
At least ten including one feeding on a hunting spider (probably Family Lycosidae).
Inhabitating south-facing boulder scree slope with *Ephedera gerardiana* scrub (up to about 50cm in height).
2- 25.5.94. Sartoe, Bar Palas. 2400m.
One observed by summer inhabitated shepherd hut adjacent to terraced fields on south-facing slope.
3- 26.5.94. Dahr, Bar Palas. 2750m.
Several observed in old overgrown drystone wall.
4- 16.6.94. Chakala. 2450m.
One observed on south-facing consolidated boulder scree slope with approx. 50% herbaceous vegetation cover of *Rumex* sp. *Euphorbia wallichii, Fragaria nubicola* and grasses.

5- 16.6.94. Wulbela, Bar Palas. 2300m.
One observed.
6- 18.6.94. Dumbela, Bar Palas. 2300m.
Two on south-facing mainly grass covered slope with other herbaceous vegetation including; *Fragaria nubicola, Artemesia* sp, and *Ranunculus* sp. Woody vegetation including; *Rosa* sp, *Viburnum* sp and small scattered *Juglans regia* trees.
7- 18.6.94. Gdar, Bar Palas. 3500m.
Several on south-facing rocky scree slopes with some grass/herbaceous vegetation cover.
8- 22.6.94. Ledi Pastures, Bar Palas. 3300m.
Five observed on well vegetated south-facing slope. The dominant plant was *Berginia* sp, the underlying, dry leaves of which the skinks took refuge when disturbed.

FAMILY: COLUBRIDAE
Coluber ravergieri Ménétriés – Mountain Racer
1- 23.5.94. Breathbeck, Bar Palas. 2600m.
One on boulder scree on north-west facing slope with areas of exposed soil and patches of melting snow. Herbaceous vegetation in the vicinity included; *Corydalis sutifolia* (dominant), *Ranunculus* sp, *Fragaria nubicola* and *Nepeta* sp. Woody species included; *Viburnum cottonifolium* (dominant), *Sambucus wightiana, Cotoneaster* sp and *Ribes* sp.

2- 17.6.94. Pichbela, Bar Palas. 2200m.
One taking refuge under large boulder on steep, grassy south-facing slope with some patches of scree and boulder piles.

FAMILY: VIPERIDAE
Agkistrodon himalayanus (Günther) – Himalayan Pit Viper
1- 23.5.94. Breathbeck, Bar Palas. 2550m.
One observed basking at 10.00hrs, taking refuge under large stone slab when disturbed. Situated on a south-facing slope of boulder scree with *Ephedra gerardiana* scrub.
2- 23.5.94. Breathbeck, Bar Palas. 2650m.
Four observed on south-facing boulder scree slope.
3- 24.5.94. Breathbeck, Bar Palas. 2400 and 2500m.
Two on south-facing scree slope with some short herbaceous vegetation.
4- 24.5.94. Sartoe, Bar Palas. 2400m.
One observed during period of light rain in *Picea smithiiana* dominated woodland with *Cedrus deodara, Pinus wallichiana* and *Acer* sp. Extremely well camouflaged against leaf/twig litter. Sparse ground flora in the woodland consisted of *Viola* sp, *Galium* sp, *Fragaria nubicola, Polygonum* sp and ferns.
5- 26-27.5.94. Dahr (above Kundal), Bar Palas. 2750m.
One immature on south-facing grass bank adjoining boulder scree slope on 26 and two on 27 May above Dahr village.
6- 13.6.94. Above Shukiser, Bar Palas. 2500m.
Two on consolidated boulder scree with patches of *Viburnum cottonifolium* scrub.

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Many thanks to Richard Grimmett and Joanna Barnes (BirdLife International) for preliminary planning and organisation prior to departure. Thanks to Barry Clarke (BMNH) for endeavouring to help with the identification of the mystery frog which was later confirmed by Prof. Alan Dubois (Muséum National D'Histoire Naturelle), as belonging to the genus *Paa* and possibly a species new to science.

In Pakistan I would like to thank the following: Guy Duke, the then HJP Director, and all the HJP staff especially Naeem Ashraf Raja (an enthusiastic herpetologist who was of great assistance in the field in 1994 and who unfortunately had to depart prematurely in the winter 1996-97 due to illness). Abdul Ghafoor who accompanied us during both surveys. Razwal Kohistani who oversaw liaison in Palas, Muhammad Arshad for organisation in Islamabad and Muhammad Ramzan our driver; Mumtaz Malik, Conservator (Wildlife Division) NWFP for arranging counterparts and clearances; all the Forestry Department staff who accompanied us, especially Mohammad Buzurg for his help during the winter survey and whose efforts enabled it to run smoothly after the early departure of Naeem Ashraf Raja; our two shikaris Autangzeb and Paloo and all our Palasi porters.

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THE FROGLIFE COMMON SPECIES PROJECT

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BHS members will have heard that the Society supports a conservation initiative called the Common Species Project (CSP), operated by Froglife at their offices in Suffolk. This article aims to give an overview of what the project entails. The term "common species" encompasses the nine widespread native herps, i.e. the Common Frog, Common Toad, Smooth, Palmate and Great Crested Newts, Slow-worm, Common Lizard, Grass Snake and Adder. In other words, the three-quarters of our non-marine herpetofauna species that are fairly widely distributed and not as restricted in range as the Sand Lizard, Smooth Snake and Natterjack Toad, but in some cases equally threatened and declining. The conservation of the rarer species are dealt with largely by a combination of the statutory agencies, the Herpetological Conservation Trust and the BHS Conservation Committee.

But is there a need to conserve widespread species? In fact when you start to examine the health of any of these species at the local level in certain areas, you will find that they are in difficulty. Overall, there is little evidence for a nett increase in any of the species, and many are finding it hard even to remain stable at the county level. Adders, Grass Snakes and Great Crested Newts in particular are in decline across much or all of their range, and loss of lizard habitat is also a major problem.

The main reasons for these declines are the loss, modification and fragmentation of habitats. Grasslands and heathland sites are still being snapped up by developers to build new housing estates, factories or industrial units. Flooded quarries, chalk pits and sand pits – so important for Great Crested Newts and several other species – are often subject to resumption of mineral extraction and landfilling. Ponds in traditional agricultural settings are being neglected or infilled, perhaps not at the rate which prevailed a couple of decades back when farmers were actually paid to fill in ponds, but what relatively few remain are still often under threat. Road schemes carve up habitats and restrict access to key habitat patches, and then lead to massive mortality. Even nature reserves which are dedicated to preserving natural habitats can be mismanaged – for example by overgrazing, or cutting at the wrong time of year. Snakes are still being persecuted, despite legal protection for several years.

Ok, so that's the bad news. Now for some glad tidings. Some of these problems can be countered given the right effort and expertise in the right places. There are several "weak points" which obviously need addressing. Protecting sites through the planning process is one of the obvious places to start, but to do this we need to know which sites to protect, and in some areas information on distribution is woefully lacking. Further field survey needs to be undertaken. To do this we need keen field herpetologists with good training or a background in survey skills. Information on site protection and habitat management needs to be able to help with identifying site threats and proposing important sites for designation. The demand for conservation information for the general public has to be catered for.

These activities are where the Common Species Project steps in to help. A Common Species Unit (CSU) was established by Froglife in 1989 from the herpetofauna

programme run by the Fauna and Fauna Preservation Society (now Fauna and Flora International). The CSU initially set up one post (the Common Species Co-ordinator or CSC) in 1944, and in 1996 expanded to two posts (the CSC plus an Information Assistant [IA]), with an extended remit. The CSP – which occupies most of the CSC's time and half the workload of the IA – is designed to co-ordinate conservation actions briefly summarised in the preceding paragraph. The target areas which the CSP works on are as follows:

1. **Great Crested Newts Species Action Plan (GCN SAP).** The UK Biodiversity Action Plan is part of the Government's response to the Earth Summit held in Rio in 1992. The Plan contains a list of conservation packages for a number of threatened species, including the Great Crested Newt. BHS and HCT are "Lead Partners" for this species jointly with Froglife. As the great crested newt is declining nationally yet is still fairly widespread, the task of delivering conservation targets is particularly tricky (especially compared to some of the plant species in the BAP which are found only on a handful of small sites; Crested Newts are thought to occur in around 18,000 ponds!). Consequently, the CSP acts as a main conduit through which the activities listed in the Action Plan will be monitored. A meeting was organised by the CSP to discuss this, and to help develop a draft work programme, in February 1998 at the National Museum of Wales, Cardiff. This work will be co-ordinated by a wider group of organisations through a steering group. Other specific actions being undertaken by the CSP for the Crested Newt include the production of a conservation handbook, to allow site owners, reserve wardens, volunteers and others to manage and monitor Crested Newt populations more effectively. This should be ready in Spring 1999. A grant scheme to fund small projects furthering Great Crested Newt conservation has been initiated, with funding from HCT, and Spring 1998 saw the first round of projects get underway. One thing the humble Great Crested Newt still lacks is a so-called "Champion" – a provider of major resources to fund conservation. One or two other species (including, predictably, some of the "cuter" ones) in the UK Biodiversity Action Plan have secured such a gift horse, usually large commercial companies or utilities. We live in hope for Crested Newts. It would be great to be able to fund a nationwide team of surveyors to help track down colonies and prevent their destruction.

2. **Local group and volunteer support.** A lot of the conservation work discussed above can only realistically be undertaken by volunteers. The network of local groups dealing with herp conservation, Herpetofauna Groups of Britain and Ireland (HGBI), was set up in 1990 and has rapidly grown with the help of the CSP. The HGBI national panel meets annually and acts as a forum for the exchange of views and for campaigning on behalf of herps. At present there are around 20 local Amphibian and Reptile Groups (ARGs) – normally covering a county or equivalent each. We have found that such groups are one of the best ways of delivering conservation "on the ground". These groups develop policies and determine national priorities through HGBI, using information on local status and important issues that are reported to the national panel. New groups are being set up year by year, and part of the CSP is to help emerging groups by suggesting policies, providing contacts and written materials, etc. Training events are held for local groups so that volunteers can get up to speed with identification and survey techniques. Regional HGBI meetings have been happening in a few regions now for several years and are advertised in *The Natterjack*.

3. **Production of literature.** The CSP is heavily involved in writing and distributing key publications, such as its advice sheet series for ARGs and others to use. This set of leaflets covers topics which are the most common source of queries from the public and conservation groups, such as snakes in gardens and correct habitat management, the

"Toads on Roads" scheme, the problems of exotic species, and how to defend sites from development threats through the planning process. Through HGBI, more detailed advice has also been produced on mitigation schemes and other work in the pipeline includes a report on the problems of exotic plants in amphibian ponds. The newsletter of HGBI, *Herp-line*, is now produced twice per year and distributed to over 800 contacts across the UK (and a few overseas too), as well as to BHS members. *Herp-line* contains information on important conservation developments and key issues for volunteers. The *Herpetofuana Worker's Guide* is now in its third edition with the publication of the 1998 version, and includes a wide range of contacts and lists resources for anyone interested in UK herp conservation. The *Frogalogue* lists all publications available from Froglife. Both documents are available free of charge.

4. **Advisory service.** There is a huge volume of requests for information from a variety of organisations and the public which needs to be dealt with carefully. Some people simply need to be told how to tell snakes from Slow-worms, while other more involved requests might entail site visits to assess the degree of threat from a new housing development or pollution source. At Froglife we handle requests by providing advice over the phone, sending out relevant literature, and by referring callers to ARB members or other local experts where necessary. All enquiries are logged onto a computer so that we can keep track of them, pass on details to local groups and reflect on how well we are coping. We are happy to answer conservation enquiries referred to us from other organisations.

5. **The Herpetofauna Worker's Meeting.** Since 1995, the annual meeting of the HGBI national panel has been held alongside the lectures and workshops concerning herpetofauna conservation. Froglife has organised this annual gathering of herp conservation workers, and the CSP assists with the administration. The meeting takes place over two days in early February. Anyone who has attended these meetings will (hopefully) have found them to be of practical use in their conservation activities. As well as the main presentations, a guest lecture and a social element is included, with a quiz and much time spent in the bar to exchange stories and tips. The meeting rotates between England, Scotland and Wales (1998's was in Cardiff and 1999's will be at a venue to be decided in Scotland).

Of course, all of these activities need a high degree of management and are strengthened by participation from a wide range of bodies. A CSP Steering Group provides direction to the project, and comprises representatives from English Nature, Scottish Natural Heritage, the Countryside Council for Wales, Froglife, the BHS, The Herpetological Conservation Trust, HGBI, the Joint Nature Conservation Committee and The Wildlife Trusts. This Committee sits twice per year. Funding for the CSP comes from a variety of sources, including grant-aid from the statutory agencies, donations, charitable trust grants, and in 1997 BHS also generously gave a donation. BHS's aim to promote conservation of amphibians and reptiles in Britain – by helping with a national project – will help to ensure a better future for them. If you want to do more to help, you could consider assisting your local Amphibian and Reptile Group with site surveys and practical habitat management. A questionnaire survey (with reply envelope) was circulated with the last issue of *Herp-line* and we would like all members to return this as soon as possible. Try to attend the annual Herpetofauna Worker's Meeting or regional HGBI meetings. Any records you have gathered of herp sightings should be copied to your nearest herp recorder (see the *Herptofauna Worker's Guide* for details) as well as to the BHS Conservation Committee database. Other ways you can get involved are outlined in the *Guide*, which is available free from Froglife.

VETERINARY INVESTIGATION INTO RADIOGRAPHIC SEXING AND BLOOD PARAMETERS OF GILA MONSTERS *(HELODERMA SUSPECTUM)*

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Heloderma suspectum (Gila Monster) are one of only two venomous species of lizard, the other being *Heloderma horridum* (beaded lizard). There are two sub species of Gila Monsters, *Heloderma suspectum suspectum* and *Heloderma suspectum cinctum*. They are found ranging between northern Mexico and south-western USA. Unlike species of venomous snake each of the teeth carries a small groove aiding the animal to administer the venom. This is secreted from adapted salivary glands in the lower jaw into the mouth and administered to the prey through the animal's bite. The venom though not fatal can cause pain, swelling, drop in blood pressure, vomiting, weakness and perspiration. They warn potential predators of the dangers they present by their vivid black and orange markings. Despite their striking coloration, they are secretive and rarely seen, spending much of the time in their burrows. These are either dug by themselves or more often acquired from some hapless small mammal. Though outwardly they appear sluggish in nature when roused they can whip around very quickly and should therefore be handled with extreme caution. Gila Monsters have a preferred body temperature of between 28°C and 30°C. In the wild they survive the much colder winter months by hibernation. Eggs are their preferred food but they will take small mammals, birds and reptiles.

To know when an animal is sick a clinician must first know what is normal. This seems obvious but what is normal for one species may be very abnormal for a different species. This has been proved in mammals and when confronted with about 3,000 species of reptiles it is daunting to think that comparatively little is known about most of these species. Most of the readily available books addressing reptile medicine do just that; group all these species under the one title "Reptiles" elaborating occasionally on specific conditions of commonly kept species. This is not a criticism of these texts but more of the amount of research being conducted to increase our knowledge. It is therefore important to gain as much information about individual species as possible. A year and a half ago myself and Mr. Divers were given the opportunity to take a sample of blood from 8 adult Gila Monsters as part of a health screen. With the financial support of the British Herpetological Society Captive Breeding Committee, the blood was analysed by Grange Laboratories to measure haematological (the red and white cells in the blood) and biochemical (a range of tests that looks at organ function and damage) parameters. Blood tests are a vital aid to veterinary surgeons pursuing a diagnosis, but in order to be able to interpret the results it is vital that the normal species-specific blood ranges are known. As Gila Monsters are now rare in the wild and rarely seen (added to CITES appendix II in 1975) there is little published information on their blood values. While the

study group is too small to give definitive ranges, the paper does aim to give an idea of what normal blood parameters of this species are likely to be. Surprisingly some of the parameters had very different normal levels to those found in other species of lizards.

The second part of the study was to investigate the possibility of sexing monomorphic lizards by pelvis radiography. A system of gender determination using pelvic radiography had been previously advocated. However, our investigations failed to demonstrate any significant differences between males and females and therefore alternative methods of sexing including probing, hemipenal eversion, ultrasonography and endoscopy may be more accurate.

It is hoped that the blood parameter information will prove useful to all veterinarians involved with these fascinating animals and to this end publication in the veterinary press is envisaged. The authors would like to express their gratitude to the BHS Captive Breeding Committee for their continued support of captive management, propagation and maintenance of health of reptiles, because without their help such basic and relatively inexpensive information could not be obtained.

A NEW FUNGAL DISEASE ASSOCIATED WITH AMPHIBIAN POPULATION DECLINES: RECENT RESEARCH PUT INTO PERSPECTIVE

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There have been intense scientific, public and political interest in amphibian population declines. Despite some controversy (Pechmann & Wilbur, 1994; Blaustein, 1994), there is solid evidence that recent, marked declines have occurred in Australia (Richards, McDonald & Alford, 1993), North America (Wake, 1991; Drost & Fellers, 1996) and Central America (Pounds & Crump 1994; Lips, 1998). The situation in the UK is less clear – however populations of some species have clearly declined (Beebee *et al.*, 1990; Cunningham, 1993). Whilst some of the global declines have been linked to habitat loss, the causes of many remain a mystery. Hypotheses include adverse weather, increased UV irradiation, introduction of or colonisation by predators, acid rain, pollution and disease; however, many of these remain unproven. Some researchers have proposed a single global cause (see Wake, 1991), but this has not been demonstrated and current scientific opinion is that multiple casual factors are responsible (Halliday, 1998).

Perhaps the most alarming population crashes have occurred in the pristine, tropical rainforests of Australia and Central America. Here, amphibian populations have been falling rapidly (some say "catastrophically"), in remote, protected regions which were thought exempt from human influence (eg. agriculture, deforestation, pollution). These declines have been dramatic, often resulting in complete loss of amphibians from large swathes of habitat (Lips, 1998; Richards *et al.*, 1993; Mahony, 1996). Associated with these declines are the rapid disappearance and presumed extinction (see Bulletin Nos. 44, 46 & 55) of the Golden Toad of Costa Rica (rumours are currently circulating that this species has been rediscovered) and the almost certain extinction of 2 species of Gastric Brooding Frog in Australia. It is thought that as many as seven amphibian species endemic to Eastern Queensland have become extinct during the last decade (Laurance, 1996). Although disease has been suspected as a cause of the Australian die-offs (Laurance, McDonald & Speare, 1996; Laurance, McDonald & Speare, 1997), difficulties in obtaining fresh carcasses from these remote, tropical regions (where bodies are rapidly scavenged or decay) mean that only a few bodies have become available for post mortem examination. Despite these problems, an Australian Government-funded team lead by Drs Rick Speare (James Cook University, Queensland), Lee Berger and Alex Hyatt (CSIRO, Melbourne) collaborating with UK and US scientists, recently reported a major breakthrough in investigating the causes of these declines.

Their research implicates a new fungal disease ("chytridiomycosis") as the cause of death of amphibians from Australia and Costa Rica (Berger *et al.*, 1998). The real significance of this work is that the *same* fungal pathogen appears to have caused mass mortalities on two continents in areas where significant, documented declines have occurred. This "pandemic" has for the first time provided a casual link between two large, widely separated population declines in pristine rain forest habitats (Halliday,

1998; Kaiser, 1998; Daszak & Cunningham, 1998). Importantly, these are areas where UV irradiation has not increased significantly, thus discounting the most widely accepted alternative causes of declines. The causative agent of the disease is a new species and genus of chytrid – a primitive class of fungi which normally inhabit ponds, lakes or moist soil and don't produce the branching hyphae characteristic of higher fungi. Chytrids are small (development is intracellular and "spores" are usually less than 30 microns or about the size of 2-3 red blood cells), ubiquitous and normally live on substrates such as cellulose-based detritus, chitin and keratin, where they degrade these complex molecules. They are known parasites of diatoms, other fungi and insects. However this is the first reported case of a chytrid parasitising a vertebrate.

The chytrid infecting amphibians invades only the superficial keratinised cell layer of the epidermis, where it presumably degrades the keratin in the cell. This layer thickens to four or five times its normal thickness and becomes filled with the developing parasites. It is thought that the cause of death is either directly due to the formation of this thick waterproof barrier blocking supplementary respiration and/or osmoregulation through the skin or may be due to fungal toxins released during infection. An experimental infection of captive-bred adult frogs has demonstrated that the disease is highly pathogenic, with infected animals succumbing after 10-18 days. It appears that tadpoles, which lack keratin in the skin, become infected only in their keratinised mouthparts and don't succumb to the lethal effects of the disease. This probably doesn't significantly lower the death rate in the wild, since tadpoles with infected mouthparts would metamorphose into an environment where the pathogen is already present and able to infect their now-keratinised epidermis, possibly leading to death.

Research has only just begun on this new disease, but using the epidemiological, pathological and experimental evidence available, preliminary answers can be given to some of the most basic questions:

How does the organism pass between individuals and populations?

Chytrid fungi produce motile single-celled stages (zoospores) which swim through the aqueous environment. Zoospores occur in the amphibian chytrid and this organism probably moves between individuals in the water of streams and/or when animals make contact with each other. This might explain why the most severely affected amphibian populations are riparian (river-dwelling) species.

Where did the disease originate?

The epidemic was first noted in Australia in 1993 and found in Costa Rica in 1997. From a study of archival tissues at the National Zoo, Washington, USA (Pessier *et al.*, in press), we know that the disease was present in captive collections from at least 1988. Indeed, it may have been seen by earlier pathologists, but not correctly identified (gross lesions are not always apparent). So far it isn't possible to say for definite whether the disease was always present in the tropical rain forests of Australia and Central America. However, this seems unlikely, since the pattern of the die offs (multiple species affected, high mortality rates, "wave-like" spread etc.) suggest that the disease has recently been introduced to these pristine areas (Berger, Speare & Hyatt, 1998). Work is currently underway to test this hypothesis.

Could this disease be involved in mortality of UK amphibians?

Extensive, recent research on Common Frog (*Rana temporaria*) mortality incidents by Andrew Cunningham at the Institute of Zoology, Regent's Park suggests that chytridiomycosis is not a factor in these deaths. This work has involved investigation of well over 200 sites of frog mortality in the UK, and no evidence of this disease has so far been uncovered. Andrew Cunningham's work has demonstrated two distinct virus-associated disease syndromes associated with cases of mass mortality in Common Frogs (Cunningham *et al.*, 1993; 1996).

Are captive collections of tropical amphibians at risk from this new disease?

The list of wild amphibians found to be infected with chytridiomycosis includes some kept commonly as pets in the UK: the White's Tree Frog, *Litoria caerulea*, The Cane Toad, *Bufo marinus*, and members of the brightly-coloured genus *Atelopus*, the Harlequin Frogs of Central America. In a paper to be published in January 1999, Drs. Allan Pessier and Don Nichols of the National Zoo, Washington, USA report an outbreak of chytridiomycosis in longterm captive Dart Frogs (*Dendrobates* spp), White's Tree Frogs and the Ornate Horned Frog (*Ceratophrys ornata*). It may be that recently imported amphibians could bring the pathogen into collections, but the extent of it's occurrence in captivity (and the wild) are not very well known.

What should be done if dead amphibians are found in the UK?

Incidents of large numbers of wild amphibians found dead in the UK should be reported to the Frog Mortality Project. This group was set up to investigate the occurrence and causes of frog mortality in the UK and can be contacted at: FMP, Triton House, Bramfield, Halesworth, Suffolk IP19 9AE, Tel: 01986-784-518.

Unfortunately, no groups are able to investigate dead or dying captive amphibians and these cases should be taken to an interested vet for pathological examination.

For further information on amphibian population declines and for making donations to assist research investigating their causes, contact the Declining Amphibian Populations Task Force (DAPTF). The DAPTF is a network of experts set up in 1990 by the IUCN to investigate relationships between amphibian declines, chemical contaminants, climate change and disease. The address to contact the taskforce or make donations is: Tim Halliday, DAPTF International Director, Biology Department, The Open University, Walton Hall, Milton Keynes, MK7 6AA, UK.

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SEXUAL DICHROMATISM OF *AGAMA BOULENGERI* OBSERVED IN SOUTHERN MAURITANIA

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During a mission to southern Mauritania (Lambert, 1996) in the late rainy season (9-21 September 1996), *Agama boulengeri* Lataste, 1886 was observed to be abundant in rocky habitats. Both sexes were recorded at Aïn El Ghaire (17°11.70'N, 12°14.92'W), Assaba (19.ix.1996); near Louths (17°14.40'N, 12°6.04'W), Assaba (20 and 21.ix.1996) on the Tagant Plateau in three sites at 16-25 per man-hour of searching, and at Achram (17°21.01'N, 12°23.98'W), Brakna (21.ix.1996).

Males characteristically bear a mid-dorsal crest from the nape of the neck to the end of the tail (Joger, 1979). This, and their larger size, differentiates them from females.

The most striking difference between the sexes, however, was in the nuptial coloration of the females. The males were drab, with near uniform purple-grey coloured scales dorsally. The females had a brilliant yellow mid-dorsal band with three approximately bar-shaped transverse bands on a bright orange background. The bands increased in size from behind the neck to end in a patch towards the rear of the back. Their heads were bright blue-green or turquoise. The dichromatism was so striking that one could be excused for mistaking the sexes for different species, especially since in the females, only the neck supported a crest, which was reduced or nil on the back and tail.

The family Agamidae, comprising 300 species in 53 genera, is distributed throughout Africa to Australia, including the Middle East, and Central and south-east Asia in between. The genus Agama is primarily Palaearctic, but has representatives throughout Africa. Colour polymorphism and sexual dichromatism are the norm in most species (Branch, 1988). In *Agama impalearis*, there is both colour polymorphism and sexual dichromatism within its North African range. Males in SW Morocco have a vivid deep rust-red head, with upper sides of metallic greenish-blue and blue, and violet flanks, while the females have a blue head, and red transverse bars on a yellow background (Schleich et al., 1996). *Agama impalearis* extends southwards to Mauritania, but gives way to *A. boulengeri* in the south of the country.

To date, *Agama boulengeri* in Mauritania has only previously been recorded in the Adrar range (Dekeyser & Villiers, 1956; Ineich, 1996). It has also been recorded in Mali at Médine (type locality), Galougo and the Chutes de Félou (Joger, 1979), where it is very localised, and aggregates (Joger & Lambert, 1996). Observations on *A. boulengeri* made here were at localities between those of earlier records, and therefore represent an in-filling of the previous known range.

Full nuptial colouring in female *A. boulengeri* has not previously been described.

Plate 1*: Agama boulengeri* (Aïn El Ghaire, Assaba, Mauritania; 19.ix.1996), hand held for scale, a male with uniform purple-grey colouration, and dorsal crest on neck and along length of the tail (a species character).

Plate 2: *Agama boulengeri* (Aïn El Ghaire, Assaba, Mauritania; 19.ix.1996), hand held for scale, a female in nuptial colouring, dorsal crest on neck (a species character)

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CONSERVATION ACTIVITIES OF THE BRITISH HERPETOLOGICAL SOCIETY

REPORT OF A CONSERVATION MEETING HELD AT THE UNIVERSITY OF SUSSEX ON JUNE 28 1998

A meeting, organised by the Conservation Committee but open to all BHS members, was held at Sussex on Sunday June 28th. What follows is an informal account of events on that day.

Morning Session

Between 11.30 am and 1 pm, Conservation Committee members gave short (5-10 minute) presentations of their work since June 1997. Trevor Beebee (Chairman) introduced the session, indicating that it had a dual purpose: to inform Committee members of each others' activities prior to the business meeting later in the day, and to inform the BHS membership at large with a view to recruiting new helpers. In the latter context it was disappointing that only 3 BHS members not already associated with the Conservation Committee were in attendance.

Brian Banks gave an update on the Land Fund, indicating that there was currently in excess of £40,000 in the kitty and that there had been some income during the 1997-8 period. Dave Bird described management work on heathland sites in Dorset, including BHS Reserves. He emphasised that these sites supported a wealth of important species, including rare fungi and invertebrates, as well as the reptiles of most direct interest to BHS members. John Buckley summarised the situation with respect to information leaflets currently produced by BHS, and outlined the development by Tony Gent and himself of a general strategy for deciding on future publications. Leaflets for the identification of the British herpetofauna, and on management techniques for common amphibians and reptiles, were considered to be the top priorities at present. However, Beth Haslewood pointed out that recent sales of BHS leaflets had been very low and that a serious effort was required to promote them more effectively. Jan Clemons then explained that development of a BHS database for the rare species had proved unworkable because insufficient records had been received. Instead, Nigel and Jan were now concentrating on local recording schemes. As an example she showed a recent booklet they have produced which outlines the distribution of herpetofauna in Warwickshire.

Tony Gent gave an overview of relationships between the BHS Conservation Committee and the statutory conservation agencies, especially English Nature. He emphasised the need for both organisations to adopt realistic expectations of each other, and for the Conservation Committee to clarify its future role. Jonathan Webster described the development of the Herpetological Conservation Trust (HCT), and finished with some ideas about how HCT and the BHS conservation Committee could work together productively in future. Jan Clemons then returned to the podium to describe negotiations with *Froglife* concerning conditions for BHS's financial support (previously agreed to be £2,000 for the current financial year) of the Common Species Officer post based at that organisation.

Monica Green provided a statement of the Conservation Committee's current financial assets, which were in excess of £3,500. £1,000 of this is committed towards supporting the Common Species Officer post, and other expenditure during 1997-8 has included a small sum (less than £400) towards legal costs concerned with land lease/purchase. Another small sum (about £100) will be needed to pay for the present meeting arrangements. Finally the Chairman wound up the morning session with a brief outline of casework during 1997-8. This mostly involved defence of SSSIs such as the much-publicised one at Offham Marshes, lobbying for Special Areas of Conservation [SACs] for Great Crested Newt and Weald heathland sites, and lobbying against government funding cuts recently imposed on English Nature.

It was clear from the morning session that although Conservation Committee members had been active through the previous year, much uncertainty remained about how the BHS's role in conservation should develop in future. This is a central issue which needs further and urgent debate.

Afternoon (business) session

Apologies for absence from the business meeting were received from Anne & Marcus Langford, Howard Inns & Tom Langton; and also from Bob Bustard and Frank Bowles, both unfortunately involved in a minor road accident on their way to the meeting.

Present around the table as Committee or Support Group members were Brian Banks, Trevor Beebee, Dave Bird, John Buckley, Jan Clemons, Keith Corbett, Chris Davies, Tony Gent, Monica Green, Richard Griffiths, Beth Haslewood, Nick Moulton, Martin Noble, Kevin Sherrard, Mary Swan, David Taylor and Jonathan Webster.

Working with Froglife. A few issues had arisen from discussions with Froglife that required clarification.

The first of these concerned the Land Fund, which BHS wishes *Froglife* to promote. It was agreed that money from the Land Fund could only be spent on land lease/purchase for the three rare species (Natterjacks, Sand Lizards and Smooth Snakes), and as grant aid for pond construction/restoration for Great Crested Newts. Up to £15,000, over 3 years, was available for the latter but less than £500 had actually been spent on it during the first year (1997-8). It was agreed that two leaflets needed to be produced: the first (top priority) was essentially an application form for Crested Newt grants which, together with increased publicity, should increase take-up of the available funds. The second was a revised appeal leaflet, similar to the one produced by Brian Banks a few years ago but with minor modifications. A subcommittee to progress these leaflets was established, comprising Brian Banks, Dave Bird, John Buckley, Jan Clemons and Tony Gent.

The second issue concerned leaflet production, and the need to avoid redundancy by working closely with *Froglife* (which also publishes information leaflets). Both BHS and *Froglife* have produced leaflets on garden ponds, for example, and these do not concur on all the issues involved. There was concern that a fully democratic procedure for agreeing the text of information leaflets needs to be implemented. It was agreed that there should be further discussion with *Froglife,* partly to determine whether demarcation lines could be drawn up (e.g. with *Froglife* concentrating on advice to professional planners etc) but also to establish new procedures for ensuring a democratic consensus in all future leaflets.

Finally there was discussion about *Froglife's* refusal to circulate BHS application forms as part of the deal from which it will receive £2,000 from BHS in support of the

Common Species Officer post during the current financial year. It was agreed by a majority vote of the Committee (5 in favour, 2 against, 1 abstention – and with Chairman not voting) that this was unsatisfactory, and that while the funding promise for the present year should be met, BHS Council would be advised not to provide support for the following year (1999-2000) unless *Froglife* agreed to the above condition.

BHS and Great Crested Newts. Mary Swan reported the frustrations of the BHS representative (Clive Cummins) on the liaison committee overseeing events at the Orton Brick Pits site at Peterborough. Meetings of this committee have been characterised by inadequate or late provision of data, and most recently by abandonment of any proper agenda structure. It was agreed that this was quite unsatisfactory as a procedure for monitoring what amounts to experimental conservation work with the world's largest known Crested Newt population. It was therefore also agreed that the Conservation Committee chairman would write to the chairman of the liaison committee expressing profound disquiet and requesting a substantial improvement in the liaison committee procedures.

Committee membership for 1998-9. All existing members except the 1997-8 Chairman, who retired at this meeting, will remain in place during the coming year. Trevor Beebee read out a fax from the BHS President, Bob Bustard, exhorting the committee to greater things in future. It was agreed (with his approval) that Dr Bustard be proposed at the next BHS Council meeting as an interim Chairman of the Conservation Committee. It was also agreed that Frank Bowles be admitted to the Conservation Committee as the Scottish Conservation Officer.

BHS Annual Show. This will be held on November 29th 1998 in Leicester. It was agreed that the Conservation Committee should contribute a demonstration of its work, and that this will be organised by John Buckley and Tony Gent.

Financial support of BHS Committees. There was general agreement that the proposal from Council that committees should be funded in response to specific claims, rather than automatically be allocated a lump sum each year, was desirable and should be supported.

Land purchase in Scotland. BHS President Bob Bustard has identified a farm on Priestside which includes good Natterjack habitat and which might be available for purchase if sufficient money can be raised. It was agreed that the site was well worth obtaining, and that Conservation Committee funds up to £200-£300 be made available to obtain a formal evaluation. Further decisions about who should buy it (the Committee was split between BHS and HCT) should be deferred, and only be made after examining more detailed information about the farm.

Miscellaneous

Jan Clemons needs to find a home for the BHS Gateway Computer, which is no longer required for database work. This will be referred to BHS Council.

The prospect of using Land Fund money for the purchase of a further section of Gong Hill (a heathland site in Surrey) was raised. It was agreed that the sum required (more than £20,000) was too great at present, but that this site could be used as a focus to raise more money for the land fund. The possibility of purchase could then be reconsidered at a later date.

It was agreed that spring field trips for BHS members, organised in previous years but not in 1998, were useful and that they should be reinstated in 1999.

Future development of the Conservation Committee

This had been an important undercurrent throughout the day. Tony Gent offered to produce a draft discussion document on this subject, to be circulated to all Conservation Committee and Support Group members.

Trevor Beebee June 1998

MAMMALIAN PREDATOR OF *NATRIX*

Recently, 25.8.98, a Reserve Warden of the local Wildlife Trust sent to me, for identification, the contents of an Otter, *Lutra lutra*, spraint which were of reptilian origin.

It was identified as a section of the subcaudal scales of a very young, recently hatched, *Natrix natrix*.

Whilst Grass Snakes were not uncommon prey of Otters some fifty years ago, they are, apparently, less frequently recorded as such nowadays, possibly due to the fall in *Natrix* numbers, for now more attention is paid to the biology of *Lutra*.

KENNETH BLACKWELL

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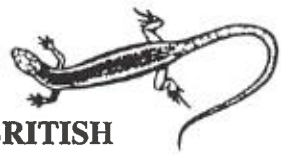

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