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# HERPETOLOGICAL SOCIETY

# BULLETIN

No. 27
Spring 1989

## BRITISH HERPETOLOGICAL SOCIETY

*c/o Zoological Society of London*
*Regent's Park, London NW1 4RY*

*Correspondence, membership applications, subscription renewals and purchase orders for the British Journal of Herpetology should be sent to the above address.*

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

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

**Meetings**

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

**Subscriptions**

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

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The Bulletin is edited and produced by
**John Pickett and Simon Townson**

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

FRONT COVER
Adult male Panther Chameleon, *Chamaeleo pardalis*, in full breeding colours, when the colouration is usually a turquoise blue-green. See *Keeping and Breeding Oviparous Chameleons*, by Robert Bustard, p. 18.

## LONDON MEETINGS

### IMPORTANT NOTICE : CHANGE OF MEETING VENUE FROM JULY, 1989

**From July 4th until the end of the year, all meetings will be held in the Lecture Theatre of the Zoo Studies Centre, Zoological Society of London, Prince Albert Road (opposite Ormonde Terrace), London, N.W.1., starting at 7.00 pm, ending at 9.00 pm, unless otherwise indicated. This change of meeting venue is experimental only, not necessarily permanent, and will depend on its popularity with members.**

**The meeting of May 23rd* will be held in the Lecture Theatre of the Linnean Society of London, Burlington House, Piccadilly, London, W.1., at 7.00 pm, as normal.**

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| MAY 23rd* | Dr Christopher Raxworthy (Biology Department, Open University): Herpetofauna of the threatened rain forests of Madagascar – a unique habitat. |
| JULY 4th | *Amphibians and Reptiles worldwide : their care and breeding.* A discussion organised by the Captive Breeding Committee (Chairman: Mike Linley). Members are encouraged to bring live animals, amphibian voice recordings and 35mm colour slides for display and to illustrate discussions. |
| AUGUST 30th | Dr William Branch (Port Elizabeth Museum, South Africa): Herpetofauna of southern Africa. |
| SEPTEMBER 2nd | *Care and Breeding of amphibians and reptiles : an open meeting.* Contributions from members – live animals and photographic display. There will be facilities for the sale and exchange of members' private home-bred stock. **A special Saturday afternoon meeting from 2.00 to 5.30 pm.** |
| OCTOBER 10th | Dr David Corke (Department of Biology and Biochemistry, North East London Polytechnic): Lizards in paradise – conservation on St. Lucia (Windward I., Lesser Antilles), West Indies. |
| NOVEMBER 29th | Dr Clive Cummins (Monks Wood Experimental Station, Abbots Ripton): Effects of acid rain on amphibians. |

## FIRST WORLD CONGRESS OF HERPETOLOGY: BHS POSTER AND DISPLAY STAND

The BHS is a co-host of the First World Congress of Herpetology, to be held at the University of Kent over 11-19 September 1989. It is intended to produce a large poster illustrating the society's activities for the Congress, together with a display of BHS leaflets, journals and other paraphernalia. With a likely attendance of over 1000 herpetologists, the event will also provide an excellent opportunity to recruit new members.

Volunteers are required to man this display during the Congress. If you think you may be able to help out in this way, even for only a few hours, please contact one of the display co-ordinators, Richard Griffiths or Brian Banks (addresses at the back of the Bulletin).

## AUCTION FOR THE CONSERVATION OF ENDANGERED HERPETOFAUNA FIRST WORLD CONGRESS OF HERPETOLOGY

Proposed by the Fauna & Flora Preservation Society and as part of the social activities, the organisers of the First World Congress of Herpetology have agreed that an Auction will be held during the course of the congress, 11-19 September 1989. Books, paintings, carvings, amphibian and reptile films, videos and voice recordings, and herpetological curios, but not

live animals, will be auctioned-off to the highest bidders. The proceeds of the auction will go towards funding research and management for conservation of the world's endangered herpetofauna, since the Congress is committed to conservation with conservation of species as its main underlying theme. The conservation of reptiles and amphibians is a serious matter for they contain the greatest proportion of threatened species of any of the vertebrate groups.

With his many years' experience of auctions at the big joint annual meetings of two of the main herpetological societies in the USA, it is anticipated that Joe Collins (Museum of Natural History, University of Kansas, Lawrence) will be the main auctioneer. Proposers of interesting, fundable projects will probably present short summaries to provide breaks and a change of pace as the auction progresses.

It is intended that the highlights of the auction will be listed in a brochure to be circulated in Spring 1989. One is an original watercolour by David Dennis of the Gautemalan beaded lizard (recently discovered and shortly to be described).

The auction is planned to take place on the evening of Monday 18 September during the congress's al fresco (weather permitting) party and barbecue.

The organisation of the auction has fallen upon me, assisted by Mr Richard Howard, a member of FFPS Council.

This is an APPEAL TO ALL HERPETOLOGISTS and others interested in natural history TO DONATE ON BEHALF OF THE WORLD'S ENDANGERED HERPETOFAUNA any surplus items of herpetological interest listed above (amusing or otherwise) that they have in their possession for auctioning-off at the World Congress in 1989.

Please make contact with the congress Office at the address below to inform them of the items that you intend either to bring or to send in advance so that these are properly listed with the names of the donors:

Secretariat
First World congress of Herpetology
Ecology research group, Rutherford college
University of Kent, Canterbury CT2 7NY, UK
Tel. (0227) 764000 ext. 3500; telex 965 449

MICHAEL LAMBERT

## BIOMEDICAL SURVEY OF THE ALDABRAN GIANT TORTOISE POPULATION IN THE SEYCHELLE ISLANDS (INDIAN OCEAN)

JAIME SAMOUR
*Institute of Zoology, Zoological Society of London, Regent's Park, London NW1 4RY*

*An abstract of a talk given at a joint meeting of the BHS and British Chelonia Group on June 27th 1989 in the Lecture Theatre, Linnean Society of London*

Observations on the morbidity and mortality of captive giant tortoises (Samour, Hawkey, Pugsley & Ball, 1986) led to a field survey of healthy Aldabra giant tortoises (*Geochelone gigantea*) on the island of Curieuse (Republic of Seychelles) in the early 1986 (Samour, Spratt, Hart, Savage & Hawkey, 1987). The colony of tortoises, reintroduced to Curieuse in 1977 by the Royal Society and the Seychelles Government (Stoddart, Cowx, Peet & Wilson, 1982), is the only reasonably sized group in existence other than the self-maintaining breeding colony on Aldabra Atoll. It was established in order to:-

1. Safeguard the species should any natural disaster occur on Aldabra,
2. Act as a model for introduction elsewhere, and
3. Provide access to tortoises for the benefit of scientists and tourists, and for other educational purposes.

The main aim of the study was to obtain biomedical data from healthy free-living tortoises, and thus to provide baseline information for improving the management of the Aldabran giant tortoise in captivity. It was also intended to assess the progress of the colony. During the Zoological Society of London Expedition to the Republic of the Seychelles between 23 January and 14 February 1986, techniques adapted for field conditions were used to carry out work from a base camp established in a derelict building. Every effort was made to locate all tortoises present on the island and 144 post-hatchling animals were found. Each was weighed, measured, and examined for evidence of injury or disease. Body and environmental temperatures were recorded. At the same time, samples of blood, urine and faeces were obtained for haematological, biochemical and parasitological studies. The animals were found to be in good condition and without serious parasitic infestations.

The opportunity was also taken to conduct a population census of the tortoises on the island. This revealed the disappearance of at least 50 per cent of those adults originally introduced. The only young found were 17 hatchlings which, it is understood, have since disappeared, and one sub-adult animal. Breeding activity appeared to be normal and, on the basis of the original number of adult females, of the average clutch size, and of a conservative estimation of hatchling survival rate, there should have been about 400 tortoises aged less than six years. Evidence of theft and poaching was obtained and recommendations were made as to how these activities might be curtailed in the future. A plan to convert one of the existing buildings on the island into a Conservation Unit and to build a rearing unit, where hatchlings can be managed under protection, has been devised and has gained approval from the Royal Society and the Government of the Seychelles. Fund raising for this proposal is now in progress.

## REFERENCES


Samour, J.H. Hawkey, C.M., Pugsley, S.L. & Ball, D. (1986). Clinical and pathological findings related to malnutrition and husbandry in captive giant tortoises *(Geochelone* species). *The Veterinary Record* **118,** 299-302.

Samour, J.H., Spratt, D.M.J., Hart, M.G., Savage, B. & Hawkey, C.M. (1987). A survey of the Aldabra giant tortoise population on Curieuse Island, Seychelles. *Biological Conservation* **41,** 147-158.

Stoddart, D.R., Cowx, D., Peet, C. & Wilson, J.R. (1982). Tortoises and tourists in the Western Indian Ocean: the Curieuse experiment. *Biological Conservation* **24,** 67-80.


**Ed. Note.** This account is based on that given in the Scientific Report 1984-1987 of the Zoological Society of London: *research at the Institute of Zoology on conservation, animal health and reproduction.*

# REPORT ON THE 3rd EUROPEAN CHELONIAN SYMPOSIUM, 3-8 JULY 1988, MARSEILLE (FRANCE)

The 3rd European Chelonian Symposium was held in the Natural History Museum of Marseille, 3-8 July 1988 as part of the annual meeting (3-9 July 1988) of the Société Herpétologique de France (SHF). At the request of the past and present Presidents of SHF (Jean Lescure and Robert Guyétant, respectively), the symposium was organised by the Director of the Museum, Mme Michele Duron-Dufrenne, who has specialised in chelonian osteology. The symposium took place in the august and dignified surroundings of the 18th century Palais Longchamp, which houses the Museum in Marseille, and arrangements were charmingly conducted by Michele Duron and her assistants.

Two previous symposia had been held; one in 1980 (16 May) and the other in 1981 (3 and 4 October). The First was organised by Jean-Paul Risch (then of the Laboratoire des Reptiles et Amphibiens, Muséum d'Histoire Naturelle, Paris) as part of the annual meeting of SHF (15 and 16 May) at the University of Nancy; the Second was organised by Michael Lambert (through the aegis of the British Herpetological Society and in conjunction with an International Herpetological Congress, 3-8 October) as a follow-on from the Inaugural Meeting of the IUCN Species Survival Commission Tortoise Group (1 and 2 October) at the University of Oxford. The proceedings of the 1st Symposium were published in the *Bulletin de la Société Herpétologique*

*de France* No. 19, 1981, and the proceedings of the 2nd Symposium were published as A in *Amphibia-Reptilia* 5 (i): 1-80 (1984), the publication of Societas Europaea Herpetologica, and as B in *Testudo* 2 (2): 1-32 (1983), the journal of the British Chelonia Group. A report on the 2nd Symposium by M.R.K. Lambert was published in *BHS Bulletin* No. 4: 10-12 (1981).

As "III. Symposium Cheloniologicum Europaeum", the meeting in Marseille covered land tortoises and freshwater and marine turtles under four main topics:

- evolution of chelonians
- systematics and biogeography
- ecophysiology
- reproduction and growth

The communications presented are to form the basis of articles and notes to be published in *Mesogée, Bulletin due Muséum d'Histoire Naturelle de Marseille* **48**, 1989.

One hundred participants were listed in the meeting programme, mostly originating from France, but included others from Belgium (6), Spain (3), Switzerland (3), FR Germany (2), Greece (2), Monaco (2), UK (2) and Italy (1). All but two of the communications were in French. The titles listed below in square brackets have been translated into English.

**POSTERS:**

**Land tortoises**

GIMENEZ-CASALDUERO, A. (Murcial): [Populations of *Testudo graeca* L. to the south-east of the Iberian Peninsula: present situation and prospects].

RAZARIHELISOA, M. (Paris): [Tortoises of Madagascar].

**Marine turtles**

DURON-SUFRENNE, M.: [Keeping track of the luth turtle in the Atlantic by the Argos system].

MAIGRET, J.: [CIESM sea turtles working group].

KREMEZI-MARGARITOULI. A. (Kifissia): Research and conservation projects on marine turtles in Greece.

**PAPERS:**

**Wednesday, 6 July**

First morning session – Chair: R. GUYETANT (Besançon):

BOUR, R. (Paris), DURON-DUFRENNE, M. (Marseille): [Cephalic osteology compared in chelonians].

LAMBERT, M. (London): [The bioclimatic ranges of Mediterranean *Testudo* L. preclude the species' survival in N Europe].

STUBBS, D. (London): [Census and repopulation of the Maures tortoises].

BLANC, C., SQUALLI HOUSSAINI, H., BLANC, F. (Montpellier): [Genetic diversity of the tortoise population of the Massif des Maures].

Second morning session – Chair: J. LESCURE (Paris):

CHEYLAND, M., JOUBERT, L. (Montpellier): [Results of the two years of research on Hermann's tortoise in Corsica].

BOULAIN, J.L. (Le Minihic-sur-Rance): [Growth in captivity of *Testudo graeca*].

VIVIENE-ROELS, B. (Strasburg):: [Environmental factors and seasonal cycles for reproduction in *Testudo hermanni Gm.:* role of the pineal gland].

GMIRA, S. (Paris): [The land tortoises of Morocco].

First afternoon session – Chair: M. LAMBERT.

CASTANET, J. (Paris): [Age estimation in tortoises].

SERVAN, J. (Le Plessis-Belleville): [The European pond tortoise, *Emys orbicularis,* in the marshes of Brenne (France)].

PIEAU, C. (Paris): [Mechanisms involved in the inversion of the sexual phenotype under the influence of temperature in tortoises].

CHEYLAN, M., AGRET, S. (Montpellier): [Criteria of age, growth and demographic structure in the pond tortoise, *Emys orbicularis.* Study of a population in the Massif des Maures, south-east France].

Second afternoon session – Chair: C. PIEAU.

BELS, V. (Liége): [Comparative ethology in chelonians, research and prospects].

NAULLEAU, G. (Beauvoir-sur-Niort): [Activities and movements of the tortoise *Kinixys erosa* in Gabonese equatorial forest].

PAULER, I and W. (Wachenheim): [On reproduction of *Malachochersus tornieri* (Sienbenrock 1903) in the terrarium].

LEMIRE, M. (Paris): [Primary visual pathways in chelonians: analysis by radio-autographic marking in the luth turtle, *Dermochelys coriacea*].

Evening:
**FILM:**
Organised by the SHF and the Association des Amis du Muséum de Marseille, four films on reptiles included one "L'Ile aux tortues".

**Thursday, 7 July**
First morning session – Chair: M. DURON-DUFRENNE

LESCURE, J. (Paris): [The luth turtle, the strangest of reptiles].

RENOUS, S. (Paris): [Terrestrial locomotion of the luth turtle, *Dermochelys coriaceal.*

BELS, V.: [Keeping luth turtles in captivity from 1984 to 1988: present results].

Second morning session – Chair: J. MAIGRET (Monaco).

RENOUS, S.: **3** [Embryonic development of the luth turtle, *Dermochelys coricea].*

MARGARITOULIS, D. (Athens): Nesting of the loggerhead sea turtle *Caretta caretta* on the shores of Kiparissia Bay, Greece.

DELAUGERRE, M. (Paris): [Sea turtles in Corsica].

LE GALL, J.Y. (Paris): [Biology and assessment of populations of the green turtle *Chelonia mydas* on Tromelin and Europa Atolls (Indian Ocean)].

First afternoon session – Chair: D. MARGARITOULIS.

GAGLIANO, T. (Toulouse): [Reproduction in captivity of the "Florida" turtle *Chrysemys scripta elegans*].

FERTARD, B. (Le Cannet): [Surgical cure of egg retention in a chelonian *(Pseudemys scripta elegans)*].

FRISENDA, S., BALLASINA, D. (Italy and Belgium): [The situation for land and fresh-water chelonians in Italy].

CLARO, F. (Paris): [Introduction of the book: "Fresh-water turtles and land tortoises": breeding and care. (F. Claro and P., Bourdeau)].

FRETEY, J., SCHAAF, D. (Cayenne, French Guiana): [Placing of eggs of the luth turtle, *Dermochelys coriacea,* on the beaches of French Guiana in relation to various physical criteria]. Read by J. LESCURE.

Second afternoon session – Chair: R. GUYETANT

LESCURE, J.: Summing up of the symposium.

**Resolution:** The new Toulon-Le Luc motorway threatens a major site for *Testudo hermanni* in the Massif des Maures. The Symposium supported SOPTOM (Station d'Observation et de Protection des Tortues des Maures) and SHF in their efforts to gain an environmental concession on the building of this motorway – a minor realignment is one of the options for consideration.

**EXCURSION:**
**Friday, 8 July**
Visit to the "Village des Tortues" of SOPTOM, near Gonfaron, Département dc Var.

Departing at 8.50 in the morning from the Place victor Hugo outside Cité Universitaire Gaston Berger, the hall of residence (not far from the SNCF St-Charles) where most of the participants stayed, the two coaches made their way through the crowded streets of Marseille to the Aubagne-Toulon Autoroute (Carte Michelin 1/200,000 no. 84). Come early July in the Mediterranean, the air was warm and the sunshine brilliant. The motorway made its way amongst dry, pine-wooded Provençal hillsides of grey limestone, over a col offering a fine view of the small port of Cassis in the south-west, and then, upon entering the Département de Var, through an area sometimes suffering from severe fires fanned by the Mistral wind, but with vineyards that produce a fine rosé wine stretching to either side, and scattered farm houses surrounded by tall cypress trees. We passed Ollioules (with the biggest flower market in France) before entering the bustling port town of Toulon. We continued past hillsides of olive trees with occasional characteristic church towers set above villages until reaching Gonfaron. A right fork onto the D 233 eventually led us in the late morning to the D 33, and a signposted turn onto the D 75, just 1 km short of the small village of Les Mayons in the middle of the Massif des Maures, brought us to the Village des Tortues.

Our emergence from the coaches was greeted by the piercing shrieks of cicadas and the aromatic scent of crushed herbs. The tortoise village was nicely situated on a gently sloping hillside with much needed shade from the bright sunshine provided by an open forest of cork oak *(Quercus suber).*

The village had been officially opened on 28 May 1988 by the Mayor of Gonfaron (for further details, see *La tortue,* the journal of SOPTOM no. 8: 1-4, June 1988; *30 Millions d' amis – la vie des bêtes* no. 16: 78-81, June 1988 and *Herpetofauna News* no. 12: 2, November 1988). The ceremony was attended among others by Gerald Durrell, who had driven the relatively short distance from his house near Niîmes. Others had come from further afield such as Donato Ballasina from Belgium, who has proposed that a similar village should be opened in Tuscany near Grosseto, Italy, and from England, Dr Ian Swingland, Co-Chairman of the IUCN Species Survival Commission Tortoise and Freshwater Turtle Group, and David Stubbs, Co-Founder of SOPTOM. Dr Ana Andreu, a researcher at the Estacion Biologica de Doñana near Seville, had come from Spain and Thijs Kramer, founder of a nature reserve for tortoises at Son Cifré de Baix on the island of Mallorca, from the Netherlands. The Fauna & Flora Preservation Society's Staff Herpetologist, Tom Langton, also lent his support, while Bernard Devaux who lived locally, another Co-Founder of SOPTOM and inspiret of the tortoise village concept, directed the proceedings and acted as Master of Ceremonies. With the cutting of a tricolor ribbon by the Mayor of Gonfaron and the letting off of a flight of multicoloured balloons, the village was declared open.

During the visit of the participants at the 3rd European Chelonian Symposium, Bernard Devaux gave an introductory presentation and described (in French) the habitat management that had been carried out in egg laying zones. This had involved the removal of bushes and a means to protect nests from predation. Our visit started at the FFPS-sponsored nursery where one could see through windows into the world of juvenile tortoises in their natural habitat, but protected on all sides from predators. We passed next to the hatchery enclosure, where the season's egg-laying had started, and then on to the habitat panel, explaining how the natural environment for tortoises has changed little over the years, before coming round to the terrapin pool, which like some of the tortoise enclosures was stocked with animals donated

by erstwhile owners. Across a path, there was an enclosure for mixed spur-thighed and eastern race Hermann's tortoises, also donated. These were animals for exhibition and display purposes only, not for release, for they were of unknown origin from around the Mediterranean (Morocco, Algeria, tunisia, Turkey and elsewhere). The next enclosure was perhaps the most important – the breeding pen, which contained over 100 animals from the Maures that had been donated by local owners and which would be released into the wild at the end of the summer. Even at such a density, the animals were well hidden from the strong sunshine and difficult to see in the natural habitat-setting provided. Further down the slope, there was the juvenile enclosure for 4-5 year olds, which have natural food and the spaces and time to become used to natural conditions before being released into the wild. Finally, there were the quarantine pens in which sick or injured animals are cared for; one male tortoise with a severely fractured carapace held together by a heavy mould of polyester resin in no way had his ability to mate impaired!

Later improvements are to include a lecture theatre/meeting room, clinic, a "diorama" and further enclosures so that the Tortoise village can become something more than a repopulation and visitor centre and will provide a meeting place for further ideas and interests in conservation. In the reception area, there were lots of gadgets for sale – T-shirts, key rings, jewellery, money boxes, books and suffed toys, all providing revenue for the continued operation of the village in its aim to rear and protect tortoises of the Maures, and to promote tortoise conservation through education, information and interest.

The tour was ended by an al fresco picnic in the cork oak forest. With characteristic gallic flair, long trestle tables with benches and chairs to either side, and covered by gleaming white table cloths, were set up amongst the trees. Partially shaded from the warm sunshine, places had been laid and opened bottles of local red, rosé and white wine on each table greeted symposium participants and awaited consumption! Bernard Devaux's culinary talent came to the for and a leisurely and memorably enjoyable meal was produced to the accompaniment of animated conversation.

For those interested in joining SOPTOM (c/o Village des Tortues, B.P. 24, 83590 Gonfaron, France), which is always seeking new members for its work to be supported (subscription £8.00, please contact the UK Secretary, David Stubbs (16 Bailey Road, Westcott, Dorking, Surrey RH4 3QS; tel. Dorking (0306) 888933).

## CONCLUSIONS:

The meeting was most enjoyable and a great success. Michele Duron and her assistants at the Natural History Museum of Marseille are to be heartily congratulated in bringing together such a substantial number of herpetologists with an interest in chelonians. The papers presented were varied and informative, and invariably of great interest. It was a pity that the meeting was not attended by a larger number of tortoise specialists from outside France and this was perhaps due to the overwhelming majority of papers being presented in French. This, however, was completely understandable since the symposium formed a part of the annual meeting of the Société Herpétologique de France. There are furthermore several French herpetologists of international distinction who as members routinely attend the French herpetological society's yearly meetings in different venues in France and it would be unreasonable to expect communications in any other language, especially when nationals of other countries were made to feel so welcome. Perhaps the future will see the 4th European Chelonian Symposium being organised somewhere other than in France or England, for there are several other countries in Europe where chelonian specialists are based!

ML was able to visit Marseille on his return from an official visit to Rome and would like to thank the Société Herpétologique de France (President: Dr Robert Guyétant; Past-President: Dr Jean Lescure) for covering his accomodation costs in the Cité Universitaire Gaston Berger for the duration of the meeting.

Michael Lambert
(Chairman)

David Stubbs
(European Observer)

**Ed. note.** A short report on the Symposium by B. Devaux (in French) has already appeared in *La Tortue* no. 9: 4-6, October 1988.

# CONSERVATION MATTERS

MAGGIE BEEBEE

*BHS Conservation Committee*

**The HCT**

The Herpetological Conservation Trust came into existence early in 1989 as a new registered charity. The charity has eight trustees, including three members of the Conservation Committee. These are the Chairman, Bill Whittaker, Trevor Beebee and Jon Webster. The HCT is chaired by Ian Swingland.

The aim of the Trust is to secure funds for herpetological conservation and other trustees of the HCT include Vincent Weir (Vincent Wildlife Trust) and Chris Tydemen (World Wide Fund for Nature). The Trust will work closely with the BHS Conservation Committee and give financial support to its' work.

From February 1989 Keith Corbett will be the first HCT Conservation Officer, working to BHS Conservation Committee policies. It is hoped that there will be funding for other posts, possibly another "UK rare species" officer to support Keith, and one "UK common species" officer, within the next few years. Also finance will be available to support BHS management work, especially work on heathlands.

The plan for 1989/90 is an initial package of £45,000, of which one third will come from each of Vincent Wildlife Trust, World Wide Fund for Nature and the Nature Conservancy Council. This will include the conservation officer's salary, various running and miscellaneous expenses, and £15,000 for management work.

The HCT has been set up to channel funds which are available for herpetological conservation, not to go into competition with BHS. The work funded and undertaken by HCT/BHS will be in accordance with BHS policies and usually undertaken by the BHS Conservation Committee.

**Glad to be Green?**

The Government has recently started to claim that it cares about the environment and this has come as a surprise to many conservationists. This financial year, 1989/98 the NCC budget in full is being reduced by 5% and the amount that can be given to voluntary bodies like BHS will be reduced by 30%.

A recent issue of "Earth Matters", the publication from Friends of the Earth, gave the following quote from comments made by Mrs. Thatcher during the Falklands campaign. "When you've spent half your political life dealing with humdrum issues like the environment..... it's exciting to have a real crisis on your hands". Mrs. Thatcher may have changed her mind about the environment, but it doesn't seem likely on current evidence.

If you are concerned about the lack of funds for conservation, please write to your MP.

*British Herpetological Society Bulletin, No. 27, 1989.*

# ADDITIONAL HERPETOLOGICAL RECORDS FROM THE MIDDLE PLEISTOCENE (CROMERIAN INTERGLACIAL) FRESHWATER BED, WEST RUNTON, NORFOLK

J. ALAN HOLMAN

*Michigan State University Museum, East Lansing, Michigan 48824-1045, U.S.A.*

## INTRODUCTION

Holman, Clayden and Stuart (1988) detailed fossil amphibians and reptiles collected up to 1986 from the well-known Middle Pleistocene (Cromerian Interglacial) Freshwater Bed at West Runton, Norfolk. Since that time John D. Clayden and Bernie Landau have collected much additional material from the site, including important herpetological remains. Although no previously unrecorded species were discovered, an unusual osteological morph of *Bufo bufo* occurs amongst the new material. Moreover, a minimum number of individuals of each species in the total herpetofauna may now be presented as a reflection of the composition of this ancient assemblage (Table 1).

## THE WEST RUNTON FRESHWATER BED

The West Runton Freshwater Bed has yielded the richest vertebrate fauna of any non-cave site in Britain (Newton, 1982a, b; Hinton, 1926; Stuart, 1975, 1982). The fossil exposure lies at the base of the cliff east of the West Runton Gap (Woman Hythe), occupies a channel about 300 metres long, and has a maximum thickness of about two metres. The bed contains sand, silt and organic muds that are rich in molluscan shells, wood and other plant detritus as well as vertebrate fossils. This Freshwater Bed and its overlying marine sediments represent an early Middle Pleistocene interglacial cycle, and these deposits were designated the stratotype for the Cromerian Interglacial (Mitchell et al., 1973).

Stuart (1982) pictured the environment at the time of the deposition of the West Runton Freshwater Bed on the basis of the sedimentological and palaeontological evidence. The scene was of a slow-flowing river, rich in aquatic plants and fringed by fen, such as is found in a typical English lowland river today. The fossil herpetofauna is perfectly consistent with this picture (Holman, Clayden and Stuart, 1988; this paper).

## SYSTEMATIC PALAEONTOLOGY

The fossils reported in this paper were collected by John D. Clayden (specimens abbreviated JCWR88) and Bernie Landau (specimens abbreviated BLWR88). All of the fossils were obtained by sieving the lower brecciated unit of the West Runton Freshwater Bed (Bed F of West, 1980; equivalent to Unit A of Stuart, 1975). When precise localities are available these are designated by e.g. '168-172', which indicates the distance in metres along the Freshwater Bed eastward from the datum at West Runton Gap (see West, 1980). Fossils reside in the John D. Clayden Collection, Sunnyholme, Lower Common, East Runton, Norfolk NR27 9PG. Lisa Hallock made the drawings of Figure 1.

Order Anura
Family Bufonidae
*Bufo bufo* (Linnaeus)

**Material** – Two left ilia JCWR88 1-2; '173-177'. Two right ilia JCWR88 104-105; '178-182'. Right ilium JCWR88 122; '283-287'. Right ilium JCWR 138; '277'.

**Remarks** – Holman (1985) gave characters for distinguishing *Bufo bufo* from other anuran species on the basis of individual ilia. On the basis of these characters, all of the West Runton *Bufo* ilia represent this species. Nevertheless, three of the six ilia above represent what appears to be an ilial morph that may be unusual in modern *Bufo bufo* skeletons. This morph was not recognised by Holman, Clayden and Stuart (1988, Fig. 1a) because of a lack of modern comparative skeletal material at that time. In the three new fossil specimens with this conditions,

the dorsal prominence arises from the shaft as a low, irregular, sharpened crest (Fig. 1a). In fact, in one of the new individuals the crest is so low that the ilium has a superficial resemblance to ilia of species of *Pelobates* (Böhme, 1977, p. 294, Figs. 8e, f). In the other three new fossil specimens and in eight of nine modern *Bufo bufo* skeletons the dorsal prominence arises from the shaft as a smoothly rounded but somewhat laterally roughened tubercle (Fig. 1b). The functional significance of these differences, if any, in fossil and modern *Bufo bufo* is not known. Moreover, whether the apparent differences in the frequency of occurrence of the "unusual" morph in fossil and modern populations represent evolutionary changes or merely sampling error is unknown. Certainly dimorphic characters such as these stress the need for adequate samples of both fossil and modern skeletons.

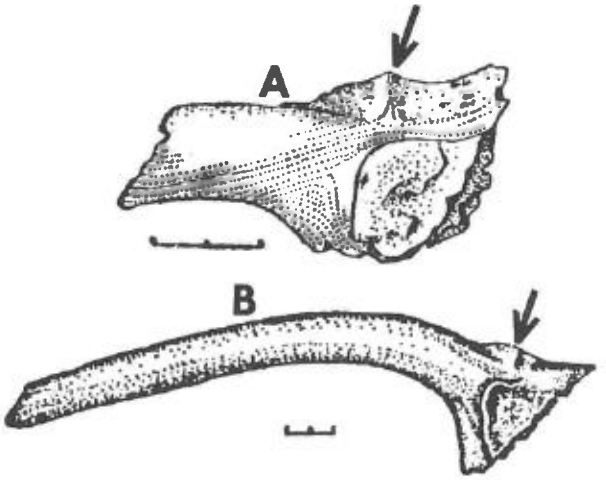


**Fig. 1.**

A. fossil left ilium of "unusual" morph of fossil *Bufo bufo* from West Runton Cromerian Site (from Holman, Clayden and Stuart, 1988).

B. modern left ilium of "normal" morph of modern *Bufo bufo* (from Michigan State University Museum Number 3380).

The lines each equal 2mm.
The arrows indicate the dorsal prominence in each specimen.

Family Ranidae
*Rana arvalis arvalis* Nilsson

**Material** – Left ilium JCWR88 12; '173-177'.

**Remarks** – Holman, Clayden and Stuart (1988) discuss characters for the identification of *Rana arvalis arvalis* on the basis of individual ilia. The recovery of additional material representing this species is important, as *Rana arvalis* does not occur naturally in Britain today, but occurs in the adjacent low countries of the Continent (Arnold and Burton, 1985, p. 258, map 37).

*Rana temporaria* Linnaeus

**Material** – Two left ilia JCWR88 3-4; '173-177'. Five right ilia JCWR 5-9; '173-177'. Two left ilia JCWR88 106-107; '168-172'. Right ilium JCWR88 137; '277. Two sacra JCWR88 8-10; '173-177'.

**Remarks** – Holman (1985) discusses the identification of *Rana temporaria* based on individual ilia and Holman, Clayden and Stuart (1988) discuss the identification of this species on the basis of individual sacra.

Class Reptilia
Order Squamata
Family Anguidae
*Anguis fragilis* Linnaeus

**Material** – Vertebra JCWR88 145.

**Remarks** – Holman (1988) discusses the identification of individual osteological elements of this species.

Family Colubridae
*Natrix natrix* (Linnaeus)

**Material** – Vertebra BLWR88 1.

**Remarks** – Szyndlar (1984) and Holman (1985) have discussed the identification of this species on the basis of individual vertebrae.

## DISCUSSION

The new material from the West Runton Freshwater Bed coupled with data provided in Holman, Clayden and Stuart (1988) has enabled the author to determine the minimum number of each herpetological species represented at the site (Table 1). Minimum numbers of individuals of each species are based either on the largest number of either non-paired elements (other than serially repeated elements such as vertebrae and ribs) or of right or left elements. If animals were represented by vertebrae only, lots of vertebrae from separate localities at the site were counted as one individual per lot.

The preponderance of semi-aquatic forms needing slowly moving or still aquatic situations in which to breed (Table 1) is evident at once. The abundance of *Bufo bufo* and *Rana temporaria* which together comprise 70.37% of the fauna is noteworthy. These two species are undoubtedly the most abundant herptiles in Britain today, and the fact that they appear to have been the most abundant herps in the diverse West Runton fossil fauna over 350,000 years ago (age estimate based on Stuart, 1982) is of considerable interest.

**TABLE 1:** Minimum number of individuals and general habitat of herptiles of the West Runton Freshwater Bed (Middle Pleistocene; Cromerian Interglacial).

| Species | Minimum No. Ind. | % of Total | General Habitat |
|---|---|---|---|
| *Bufo bufo* | 20 | 37.0 | Ubiquitous terrestrial, obligatory aquatic breeder |
| *Rana temporaria* | 18 | 33.3 | Moist terrestrial, obligatory aquatic breeder |
| *Rana arvalis arvalis* | 4 | 7.4 | Moist terrestrial, obligatory aquatic breeder |
| *Natrix natrix* | 4 | 7.4 | Terrestrial, but usually near aquatic habitats |
| *Rana "esculenta"* or *ridibunda* | 3 | 5.6 | Quiet aquatic habitats, obligatory aquatic breeder |
| *Anguis fragilis* | 2 | 3.7 | Ubiquitous terrestrial, semifossorial |
| *Triturus vulgaris* | 2 | 3.7 | Moist terrestrial, ubiquitous aquatic breeder |
| *Vipera berus* | 1 | 1.9 | Ubiquitous terrestrial |
| TOTALS | 54 | 100.0 | |

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# NOTES ON THE GENUS *BOMBINA* OKEN

## *(Anura: Bombinatoridae):*

## II. LIFE HISTORY ASPECTS

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### INTRODUCTION

This paper represents the second portion in a three-part series of papers summarizing pertinent information available on *Bombina*. Overall the series synthesizes information on distribution and characteristics of recognized species of *Bombina*, together with aspects of external appearances, morphology, life history, systematics and taxonomy. This paper focusses on the life history aspects of the species of *Bombina*.

### LIFE HISTORY ASPECTS

No life history data has been recorded for *microdeladigitora* and *fortinuptialis*, therefore the following descriptions pertain to the remaining four species of *Bombina: bombina, maxima, orientalis* and *variegata*.

### HABITAT

These semi-aquatic to aquatic toads live in shallow permanent to periodic bodies of waters and are predominantly diurnal although also active at night. *Bombina orientalis* is frequently found in swamps and rice paddies or low mountain streams. *Bombina maxima*, in contrast, inhabits mountainous regions and is found in small pools and ponds, especially those with dead vegetation. This species is less commonly found in small mountain streams. *Bombina variegata* is found from sea-level up to 1,800 m. and is very salt-tolerant (Parent, 1979), *bombina* at lower elevations, found in a variety of shallow bodies of water such as ponds, drainage ditches, pools and slow streams. *Bombina fortinuptialis* is found at elevations from 1200 to 1640 m in Guagxi, China (Tian and Wu, 1981). Excellent descriptions of habits of the European species can be found in Arnold *et al.* (1978). Day and night activity are predominant at temperatures between 10 and 30 deg. C in spring and summer.

### HIBERNATION AND BREEDING SEASON

European *Bombina* hibernate on land in animal burrows or in loose soil. These species emerge from hibernation at different times depending on temperature and the amount of rainfall; usually by mid or late April.

The breeding season of *Bombina orientalis* in Korea is May and June, but eggs can be laid all year round. The breeding season of *maxima* is rather short and is usually restricted to early May.

### NUPTIAL PADS

Nuptial pads are prominent on the inner aspects of the forelegs, palmar tubercle and first, second and third fingers during breeding season in *bombina, variegata* (Berger and Michalowski, 1971), *maxima* and *orientalis* (Stejneger, 1907). In addition *variegata* has nuptial pads on the toes of the hind leg (most frequently on the third toe).

### VOCALIZATION

Vocal sacs are present in *B. bombina*[1] but are completely lacking in *B. variegata B. orientalis* and *B. maxima*. Conditions in *fortinuptialis* and *microdeladigitora* are not known.

Vocalization occurs at night or during the day (when reproductive activity is at its highest peak) in warm pools, ponds and ditches. Males occupy a specific position along the bank for weeks. Interspecific distances are maintained by calls. These distances are 3 m in *bombina* and slightly less in *variegata* (Lörcher, 1969). A solitary male *variegata* calls with a temperature-determined call. Call repetition rate and pitch in *bombina* and *variegata* show a positive rectilinear correlation with temperature. The duration of the call itself is negatively correlated with temperature (Zweifel, 1959; Akef and Schneider, 1985; Schneider *et al.*, 1986). There is also a difference in frequency of calls. For example a frequency of 80 calls per minute at temperatures of 20 deg. C for *variegata* versus 18 per minute of *bombina* under identical conditions. The calls of these two species can be easily differentiated because *variegata* always has a frequency of more than 40 calls per minute, in addition *bombina* and *variegata* differ significantly in their vocal chord size (Schmid, 1977). Call duration and frequency also changes with animal size, with calls of larger males lower in pitch and longer than those of smaller animals (Akef and Schneider, 1985; Schneider *et al.*, 1986).

European *Bombina* also call while suspended in water. Calling is usually in the evening and may last all night. The minimal vocalization temperature is 11 deg. C and the maximal vocalization temperature is 30 deg. C (Zweifel, 1959). Song in *variegata* is a musical "poop ... poop ... poop", which is brighter and faster than the mournful "oop ... oop ... oop" of *bombina* (Arnold *et al.*, 1978). Mating calls of European *Bombina* as well as hybrids thereof exhibit both intra- and interspecific differences (Schneider *et al.*, 1986).

Male *orientalis* produce five types of calls: normal mating call, modified mating call (= male excitement call), clasping call and male and female release calls. During calling, males distribute themselves in the water in such a way as to maintain distances of a few centimetres from one another. They defend their territories by means of mating calls or aggressive behaviour. The latter takes on three forms: frontal attack, attack from the side, or jumping onto the opponent's back (Akef and Schneider, 1985). The mating calls of *orientalis* is a monotonous "uuh ... uuh ... uuh", sounding like the tinkling of a small bell, that can be rather loud when males use body cavities as resonance chambers on the surface of the water. As is the case with *bombina* and *variegata*, call repetition rate and pitch in *orientalis* show a positive correlation with temperature. The duration of calling is negatively correlated with temperature.

*Bombina maxima* produces a weak croak like the sound of a very young chicken (Liu, 1950).

Antiphonal calling is also observed in this genus. The calls are long, drawn out and monotonous. Frog "choirs" can be initiated by a single individual.

[1] Male *Bombina bombina* have two vocal sacs in the throat area. Tyler (1980) indicated that these were not true vocal sacs but rather that they represent a resonance chamber involving the ventral protrusion of the buccal cavity (and the *m. geniohyoideii lateralis)* between the superficial mandibular muscles: *m. intermandibularis* and *m. interhyoideus.*

## MATING

Female *orientalis* respond to mating calls of males by either swimming into the territory of a calling male or by generating water waves towards which the male swims (Akef and Schneider, 1985). The males clasp females in front of the hind legs in inguinal (lumber) amplexus. There may be two to three spawnings throughout the breeding season, but principally in May and June. However, individual females may spawn only once a year (Freytag, 1967; Kapfberger, 1984). *Bombina maxima* mates in inguinal amplexus in water (Pope, 1931, Sparreboom and van den Elzen, 1982). Mating in *variegata* is similar to that of *orientalis* as described above. Birkenmeier (1954) further gives details on mating behaviour in *variegata.*

## EGGS AND TADPOLES

Eggs are greyish-brown and measure 2 mm in diameter in *bombina* and *variegata* and 3 mm in *maxima.* The egg with gelatinous envelope measures up to 8 mm. Clutches of 80-100 eggs are reported for *variegata,* in contrast to 100-300 eggs reported for *bombina.* Eggs are laid several times during the breeding season. The eggs are laid with characteristic movements in small clumps on vertical plant stems or grass outside the water *(bombina)* or sink to the bottom of the pool (Illustration in Engelmann *et al.*, 1985). Development of the eggs of European species can also occur in temporary rain puddles or drainage ditches. The preferred breeding

habitats, however, are small ponds with lots of vegetation, but tributaries with clay and muddy bottoms are also used during breeding. *Bombina maxima* lays its eggmass in open water; the eggs sink to the bottom or attach themselves to the underside of floating vegetation. *Bombina orientalis* attaches its eggs to the under surface of stones in small mountain streams (Liu, 1950).

The fertilized eggs of *orientalis* require 25-30 days before attaining the stage of protrusion of the forelegs at 25 deg. C. The complete development requires between 43 and 48 days. In laboratory studies an average female *orientalis* will produce 100 to 200 eggs per ovulation, when the interval between ovulations is 6 weeks. If the interval is 3 months then the number of eggs expected is 200 to 400. Percentage fertilization of these eggs is 95% (Carlson and Ellinger, 1980).

Eggs hatch after 7 to 9 days. The hatching tadpoles measure 6-7 mm *(bombina* and *variegata)* and up to 10 mm *(maxima),* and weigh from 0.0087 to 0.0113 g.

The metamorphosed young measure 12-15 mm (European species and *orientalis* and 17 mm in *maxima).* The larval development of *variegata* takes about 50 days, with low temperatures and crowding during metamorphosis leading to smaller toadlets (Kapfberger, 1984). Full metamorphosis takes place within 90 days. Larvae at the end of the breeding season, however, will overwinter. The fully metamorphosed young of these larvae usually measure 20 mm or more.

Tadpoles of *variegata* are not inhibited (crowding-effect) by their own species or by 6 other european anurans. In fact, tadpoles of *variegata* that often live in ecological sympatry in temporary rain-water pools with other European species *(Bombina bombina, Bufo calamita,* and *Hyla arborea)* show mutual tolerance (Heusser, 1972).

Life history studies of *Bombina bombina* by Bannikov (1950) indicated rapid growth during the first year followed by determinate growth. Embryonic and larval mortalities were estimated at 45.8% that increased to 97.9% after the first year. The high mortality is due to hibernation death. An estimated population renewal of 3.5 years is predicted. Population studies of *variegata* in northern Bavaria indicate a 1:1 sex ratio (Kapfberger, 1984).

## SEXUAL MATURITY AND LONGEVITY

*Bombina variegata* and *B. bombina* attain sexual maturity in two years, at a length of 30-40 mm (Bannikov, 1950; Madej, 1964; Kapfberger, 1984). Maximal ages of *bombina* of 5 years and 10 months and 2 years 4 months for *orientalis* are reported (Bowler, 1975). Longevity of *Bombina* (sp?) in captivity of 12 years have been recorded. Sexual maturity of *orientalis* is reached at one year in this species and full size is attained at two years.

## PREDATORS

Newts and larvae of 4 species of *Triturus* prey on tadpoles of *variegata* (Heusser, 1970).

## MIGRATION

Local migrations of *Bombina* have been reported (Mertens, 1928; Madej, 1964). Reasons for migration are various: flooding, drying of bodies of water, looking for breeding sites or food sources and retreats for hibernation (Madej, 1964).

## BEHAVIOUR

When disturbed on land, *Bombina* becomes motionless and displays its striking ventral colouration in an "Unkenreflex." The back is arched, the hands are pull forward over the eyes and the feet are pulled into the mid-section of the body. On occasion the animals lie on their back exposing the venter. Cutaneous poison glands secrete a foamy substance irritable to oral-nasal mucosa even without contact in humans (histaminic effect) and can cause death in amphibians (Gessner, 1926. Csordas and Michl, 1972). When disturbed in water, they will dive and bury themselves in the slime or mud at the bottom of the body of water.

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# KEEPING AND BREEDING OVIPAROUS CHAMELEONS

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## INTRODUCTION

This paper presents basic requirements for the successful keeping of oviparous chameleons in the vivarium, based on long experience by the author. This is not to say that animals may not survive under differing regimes, but the conditions described here have been most successful in maintaining these animals in superb condition so that the full range of social behaviour can be observed, and also in obtaining regular captive matings and egg laying. Captive oviparous chameleons often do not dig a 'burrow' in which to deposit the eggs since proper facilities for nesting are not present in the vivarium. Such captive females often die without laying the eggs. Sometimes the eggs are dropped on the vivarium floor. These problems are totally unnecessary. Under the regime described below these problems have *never* been encountered, and the precise site of egg laying can also be controlled so that there is no problem in quickly locating the egg clutch for removal for incubation under controlled conditions.

Chameleons have a reputation for being 'difficult' vivarium subjects. This in my view is unjustified. If an attempt is made to understand their special requirements they can be as successful in the vivarium as most other lizards and infinitely more rewarding with their complex social behaviour and incredible repertoire and speed of colour change.

I kept my first chameleon some 35 years ago. It was a Common Chameleon *(Chamaeleo chamaeleon)* obtained as a three inch juvenile from a firm in the North-west – Robert Jackson. This chameleon thrived and grew speedily and most unfortunately was accidentally killed after about eighteen months. 'Casper', as I called him, firmly pointed me in the direction of chameleons, and I have never looked back. Food was a much more difficult problem 35 years ago than it is now in that only maggots and mealworms were available commercially. As outlined below chameleons have hearty appetites which must be catered for if they are to do well.

On the other hand the 'sandwich box brigade' of snake keepers will consider chameleons absurdly fussy about their surroundings. Whereas many snakes can be reared, live their lives, mate and produce fertile eggs, in turn producing healthy young, under the most 'unnatural' conditions, in sandwich boxes of varying sizes to allow for their growth, never see the sun (real or artificial), and be fed a monotonous diet, chameleons have a psychological need for a roomy environment with good light (natural sunlight wherever possible) and like to live among living plants, although many species prefer to rest on dead branches, a feature which is most noticeable in the 'giant' species. *All* my chameleons receive individual attention from me daily, as is described more fully under feeding below.

If one is prepared to devote time to them on a daily basis, to understand their psychological requirements, and to meet their hefty (and expensive) food requirements, they make fascinating vivarium inmates so completely different from all other reptiles.

This article is intended to be of practical use to both the beginner, who is about to embark on his first chameleon, and to the more advanced reptile keeper, who has so far either not got round to keeping chameleons, or would now like to attempt to breed them in the vivarium. By 'breed them' I do not merely mean having imported gravid females lay, but to rear the chameleons and have them mate on reaching sexual maturity and lay their eggs in due course. The real test, of course, is to raise one's own hatchlings and breed from them, an achievement so far restricted to only a small number of chameleon specialists.

Large numbers of chameleons are now being imported and it looks as if we could be in for the tortoise phenomenon all over again – 99.9% dead by the end of their first winter, largely due to ignorance of their requirements. Hence this article is timely, particularly as most accounts of chameleons in reptile keeping books do not give much *practical* advice,

nor do they indicate that the authors, with very few exceptions (e.g. Zimmermann, 1986), have practical experience of keeping/empathy for chameleons.

In a future article it is intended to deal with live-bearing (ovoviviparous) chameleons, a group which have also fascinated me from boyhood, and also with rearing the young in captivity. The requirements in this latter respect do not differ between those emerging from eggs and those that are born as baby chameleons.

## CHAMELEON BIOLOGY

It is important at the outset to describe the special features of chameleons. The most remarkable of these are the eyes, the tongue and the remarkable colour changes undergone by many species.

**The eyes.** The eyes of chameleons are covered by skin except for a small opening over the pupil but the most amazing aspect is that they rotate independently, looking quite literally in two different directions at the same time, and they only come together when it is necessary to judge distance, as just before projecting the tongue to catch an insect. The lesson for the vivarium enthusiast is that chameleons are remarkably visual animals, and their surroundings in captivity should reflect this. They should be bright and spacious, and if possible well ventilated, but only if this can be provided without cold draughts. Many chameleons only feel secure when they think they are hidden from view among the foliage of a well planted vivarium. If they do not feel secure, feeding will either not take place, or be impaired.

**The tongue.** Chameleons have a very long, extensile, tongue, at least as long as the combined head and body length, which can be 'fired' very rapidly, and with great aim, to catch fast-moving insects on which chameleons predominantly feed. Food can also be picked up by protruding the tongue in the more normal lizard manner at food very close by, but this is only used for food within 1-2" of the mouth (depending on the chameleon's size). It also follows that chameleons do not lap water in the usual manner. In nature they lick droplets of dew or rain off leaves or occasionally 'fire' their tongues at drops out of reach.

**Colour change.** It is not possible to generalise about this among the approximately 90 different species of chameleons, but typically chameleons are greenish coloured, (some are always brown and never go green), and able to change from various shades of green to near black or whitish, with at various times, spots or blotches of different colours. Each species (and often each sex with a species) has its own repertoire of colours and this may even vary between individuals of a species. The habit of chameleons of remaining motionless for long periods of time, and the frequent tendency of the colour – in the absence of other over-riding stimuli – to blend in with the natural surroundings, means that they may be extremely difficult to see even in a well planted vivarium, i.e. that colour aids their camoflage. This trait certainly aids their survival in nature. But colour is also a reflection of their emotions (Common Chameleons, *Chamaeleo chamaeleon,* turn black with anger), and their sexual state, including, for instance, their readiness to mate, the fact that they are already gravid, that they are a territory holding male ready to mate, that they are a subjugated male and so on.

**The feet.** Chameleons have specially adapted hands and feet for climbing and holding on to branches. They prefer branches where the hands and feet can grasp the branch, so the size should be adjusted to suit the species. The toes of both hands and feet are divided into two opposing groups (three toes inwards and two outwards on the hands and three toes outwards and two inwards on the feet) fused for most of their length and ending in sharp claws.

**The tail.** The tail is usually at least as long as the combined head and body length, and in almost all species is prehensile, acting just like a fifth limb.

**Movement.** Chameleons are slow moving animals and very deliberate in their actions at all times. This behaviour also helps to camouflage them. Without their remarkable tongue they would never catch any food. Sometimes when moving they sway back and forwards. This is said to be imitating a leaf in the breeze (a side to side swaying movement, on the other hand, is part of female chameleon display, warning off another chameleon, often an amatory male).

**Body shape and adornments.** Chameleons tend to be laterally flattened, that is to have high sides and not be very wide from side to side. There is often a dorsal crest of some sort and the head is subject to adornment in many species either by the development of a casque covering the rear of the head (see plates), or by snout projections of some sort, culminating in the horns of some horned forms. Such snout appendages are usually lacking, or at least much reduced, in females.

## OBTAINING YOUR CHAMELEON

Before obtaining your chameleon please read the section on 'Housing and Heating' and have the vivarium ready and adequately planted prior to the purchase. If you feel you cannot provide the very minimal requirements set out then please do not try to keep chameleons. Make sure also that you can cope with the food requirements.

Since breeding chameleons in captivity is a recent occurrence your chameleon will have been imported from the wild – should you be offered a captive bred juvenile, jump at it, of course.

In the wild many species of chameleons are solitary; those that are not, i.e. where several may share one bush, each have their own preferred basking and sleeping sites. Hence they do very badly under modern bulk collection methods where financial considerations seem to result in ever larger shipments. One must also consider how they are kept prior to shipment to Britain and of delays in getting them on to aircraft in Third World countries (where livestock is regularly offloaded in order to give the space to perishable fruit and vegetables!).

On arrival in this country the treatment they receive is critical. They have been jam-packed with many others of their kind, so they are 'upset'. They have also had nothing to drink for some time and are usually seriously dehydrated. They have also had no food. It is critical to rehydrate them before they may even consider food. The importers bundle them out to pet shops, who generally know nothing about their specialised requirements, and hope that they are sold before they die.

Of course, there are good importers, with modern facilities and 'know how' who rehydrate them individually on arrival, and set them up with a drip system so that they can drink at will, and who will also feed them well prior to despatch to retail outlets.

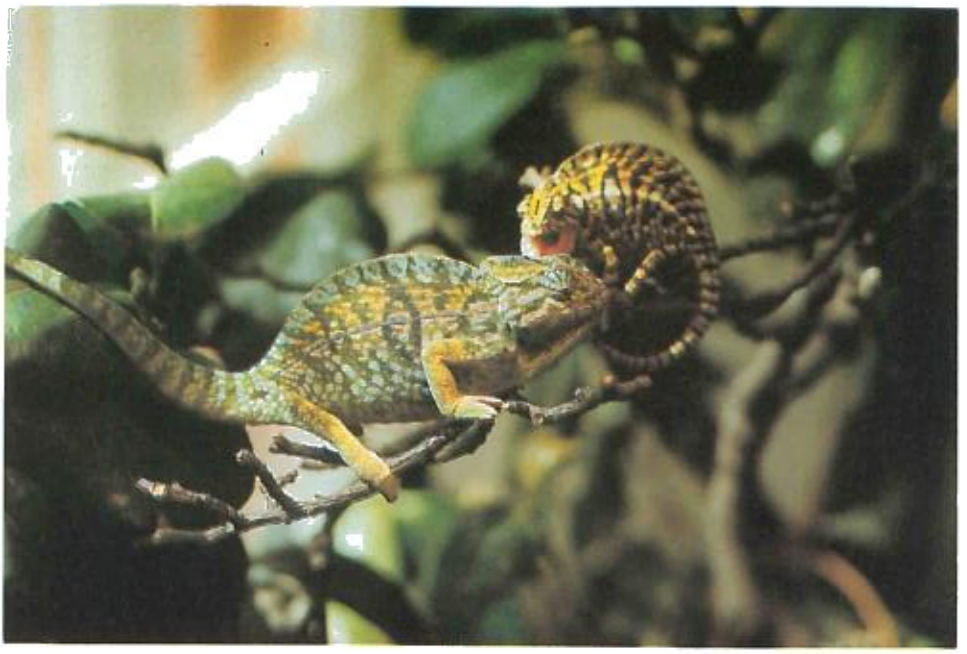
Since it is always better to get a good animal to start with, rather than try to get a poor individual back to health – and this is vital for the beginner – it is best to obtain your chameleons from the importer if at all possible, and to get them as soon as possible after their arrival in this country. There are a number of points to look for when choosing chameleons:

1. **The eyes.** These are a key clue to the animal's condition. *Animals with sunken eyes must be avoided.* This is not to say that these will necessarily die. They may do so or they may recover, but animals with sunken eyes include those that are 'irrecoverable', even to the chameleon expert, as well as those that are just badly dehydrated and which can recover under good husbandry regimes.

2. **The basal portion of the tail.** In chameleons which are in poor condition, such as those which have had poor feeding opportunities for a considerable time – they may have been collected in the dry season when food was scarce and then kept for some considerable time unfed – this area will be thin with longitudinal grooves clearly visible. I am not referring to the bulge at the very base of the tail, clearly noticeable especially on the ventral surface of the tail base in sexually active males, but more dorsally and laterally and also over a longer portion of the tail. In emaciated chameleons the dorsal tail region will have lost all its fat layer so that the tail vertebrate can be seen as can the spine along the animal's back.

3. **The animal should be alert (eyes open) and a good colour.** It is impossible to be precise about the latter point as colour varies so much between the species and also intraspecifically, but in a predominantly green species for example, select attractively marked, bright coloured individuals, not those that are drab or extremely pale or very dark.

4. **Do not select the largest individuals.** Rather select ones that are obviously juveniles. Large adults often suffer the most stress. Furthermore, juveniles will usually settle in much better



Sexual dichromatism in the Jewel Chameleon *(C. lateralis)*, a male (larger, in foreground) being threatened by a gravid female in full gravid colouration.

A large male Oustalet's Giant Chameleon *(C. oustaleti)* being held by my eight year old daughter.

Mating position in *C. oustaleti* male colours are enhanced to reddish-brown to maroon in the breeding season

Female colouration in *C. johnsoni*. Note the typical orange markings on the head.

The vertical pale yellow bands indicate that this is a territory holding male of *C. johnsoni.*

Adult male *C. pardalis* in non-breeding season – drab colours, no green seen. The same individual as shown on the Cover Plate.

Female colouration in *C. pardalis*.

A young Flap-necked chameleon *(C. dilepis)* of the Tanzanian race, which almost doubled its length and quadrupled its weight in the preceding two months, displaying.

than large adults and are more adaptable. Large adults may anyway be old individuals, in an animal which may, even in nature in many species, be rather short-lived (compared to geckos for instance where longevities of ten years or over may not be unusual). Under proper husbandry conditions juveniles will grow extremely rapidly – they can double their size in a matter of months – and you will have the added advantage of seeing them develop, including changes of colouration to the adult pattern, often markedly different from that of juveniles.

Price is unfortunately no key to quality with chameleons and may reflect merely how far they have been passed along the line.

Recently giant chameleons from Madagascar have been available from time to time. It may be better to gain experience first with more normal sized species, as not only will such giant individuals (which I keep) require much more space, but their appetites are prodigious, and must be catered for. Such 'giant' chameleons in my collection, measuring up to about 20" in total length, regularly, day-in day-out, take 7-10 final instar locust hoppers at a meal or their equivalent in crickets. This can be expensive to provide if purchased (say 70/individuals per week) or time consuming to breed in sufficient quantities.

## HOUSING AND HEATING

Chameleons are visual animals. As such they like roomy surroundings and do not like the feeling of being shut up in a box, i.e. solid walls on all sides except for a glass front. As a boy I designed an ideal chameleon greenhouse for the montane species from East Africa, *C. bitaeniatus* and *C. hoehnelli*, and this was also used for another montane species, *C. jacksoni* – all to be covered in the concluding article. This greenhouse, heavily planted to give maximum cover, had a glass front and roof (we get too much rain in Britain) but the sides were half height brick and the remainder fine wire gauze to create breeze and prevent over-heating. This greenhouse faced West. The plants provided good shade and there were no overheating problems in Scotland with the wire mesh sides. Copious supplies of food were always available and since *bitaeniatus* is not a quarrelsome species and *hoehnelii* has well marked dominant and submissive colours they did well as a sizeable colony. Young of both of these ovoviviparous species could be left in the chameleon greenhouse in the presence of regular large supplies of *Drosophila* and also house flies *(Musca)*. I never observed any instance of cannibalism in these species, either in the greenhouse or in groups kept indoors for intensive study.

Such a greenhouse, ideal as it may be for such species, may not be within the realms of possibility. Furthermore, it has its drawbacks for species which are more or less solitary, and is totally unsuitable for very territorial species, as one cannot provide a greenhouse each and as long as sight contact can be maintained, conflict will continue. So that unless the greenhouse is very large, males will glare across at each other, and fights, with fatal consequences in some species, will constantly occcur. Even where these are not lethal, constant challenges are very debilitating for the individuals concerned as they cannot escape – in nature such territorial behaviour serves to spread the animals out in the available habitat. Clearly such males must be housed separately and in such a way that they cannot see each other. Many species of chameleons do well housed individually just as many snake keepers keep their charges. The only problem is that of space, which may determine the number of chameleons that can be kept.

For an average-sized chameleon of say 8-10", I recommend a vivarium 3 feet long, two feet deep and four feet in height. A network of branches, size adjusted to the size of the inmates, so that they can grasp them with their hands and feet, should be arranged to utilise the area fully, and then growing plants added. For ease of cleaning out I prefer to grow the plants in pots so that they can be removed as necessary. The substantial food requirements of chameleons result in much faecal matter.

The substrate can vary with individual preference, plus whether or not egg laying is anticipated. If no breeding females are kept newspaper or paper towels can be used. I prefer bark chippings removed on a regular basis. Ordinary garden soil can also be used, preferably enriched with peat, and has the bonus that it can be kept moist and help maintain the humidity required by wet forest/rainforest species. I have had consistently good results using all three.

Where egg laying is expected, and a large area of moist soil is provided, any droppings which fall on this area can be removed manually without trouble.

Plants should be chosen so that they provide cover and also climbing facilities i.e. trees or bushes with stout branches. Some of the *Ficus* are ideal and like the warm, humid environment; others have such spindly branches as to be useless. *Camellia* do well as do *Magnolia* and have excellent climbing branches as well as large leaves which provide excellent cover as well as providing good surfaces for licking water droplets from. *Cissus antarctica* and *Rhombocissus natalensis* can both be grown to provide excellent cover and arranged over the dead branches. Both are vigorous growers.

Chameleons like good lighting conditions. Natural sunlight is unsurpassed due to its brightness and also UV content. The latter can perhaps be provided artifically, but it is difficult to simulate the brightness of natural sunlight. John Coburn (1987) makes this point well:

"When one considers that the intensity of light provided by a 40 watt tungsten bulb at a distance of one metre is only about one three-thousandth of that provided by the full summer sun, it can be seen that some difficulty will arise in finding a good substitute. Even the so called 'daylight' tubes provide only about one five-hundredth of natural sunlight intensity, while a high wattage mercury-vapour lamp will emit roughly one hundred and fiftieth. It is, therefore, an impossibility to artifically reproduce natural sunlight intensity."

For this reason I favour standing the large vivariums in a South, South-west or West facing window. This means, of course, that overheating has to be guarded against but the advantage of the bright light and sun provided to the animals far outweighs this. I am usually on hand during the key daylight hours, and, if absent, and it is a sunny day, I merely pull curtains over one half of the vivariums so that, although they will receive less sunlight during my absence, they are safe from overheating.

Artificial lighting is another factor in which choice has increased enormously in recent years. All my chameleon vivariums of the dimensions recommended above have a GEC (U.S.A. General Electric Company, not the U.K. company of the same name) two foot 'Blacklight' F20T12 situated high up but where the chameleons can sit close to it. They also have two x two foot or one four foot Thorn 'Artificial Daylight' tubes (which also have a UV output). Where two foot 'Artificial Daylight' tubes are used one is mounted high up and one at the middle height of the vivarium so that the animals get the maximum benefit. Where a four foot tube is used it is angled across the rear of the vivarium from top to bottom with care being taken to arrange the plants and branches so that there is a good emission close to where the chameleons can bask. Exactly as terrestrial sun-loving lizards will lie over a 'Blacklight' lying on the ground, some of my chameleons do likewise. The vivariums also have two spotlights, with fully adjustable mounts, generally mounted on a track so that they can be moved to suit the animals and the vegetation. The primary function of the spots is to provide warm basking areas. They, unlike the tubes referred to above, are controlled by a Microclimate thermostat (which dims the lights rather than putting them out). Hence, as the vivarium heats up, the lights do not go out, and the basking spots remain, but merely vary in intensity like the effects of normal intermittent cloud cover. The only time these actually go out is in bright sunshine when the temperature setting is exceeded. In the presence of sunlight they are redundant anyway. The thermostat is set at 84F (c29C) and the probe monitoring the temperature is suspended mid-way in the vivarium. All the lights are controlled by a time clock which switches them off at night. The 'Blacklights' and 'Artifical Daylight' tubes are on all day.

There is also a heater or heating cable in each vivarium, which for these, non-montane, egg-laying species cuts in to provide a minimum night temperature of 60-65F (c15-18C) depending on the species. It should be noted that some egg-laying chameleon species (e.g. *Chamaeleo chamaeleon* and *C. africanus)* are used to hot summers and cold winters and a quiescent period during the winter when temperatures should be allowed to fall to normal room temperature, and night time heating (unless the room is very cold) will not be required. An over-wintering temperature of 50-60F (c 10-15C) will be suitable. During this period the animals should be disturbed as little as possible and the vivarium moved out of the sunny window. Food should be offered whenever the animals appear active. This quiescent period will greatly increase the likelihood of breeding, as is known by snake breeders. The quiescent period will not, of course, be as long as our winter. A duration of 6-8 weeks will normally be adequate but can be extended if the chameleons remain inactive. As far as possible one should aim to copy the natural habitat of the species being kept, so as to provide a similar annual cycle

as well as daily temperature cycles. Extensive data on world meterology is available at most Public Libraries. My own oviparous chamaleons with night temperatures of 60-65 during the winter are all equatorial species. It is always a good idea not to treat the animals as severely as extremes of heat and cold which may occur in their natural habitat where they may have the means to ameliorate these in a way which is not possible in the vivarium.

The heating/lighting arrangement described above enables the chameleons to select temperatures between that of the background temperature (84F) and that attainable below the spots. Chameleons often do not orient as well to temperature as many sun-loving lizards, so it is important to have a basic vivarium temperature that is suited to the species concerned, and a background 80-84F is suitable as a day temperature for most egg layers (but see above). Any additional temperature required is then obtained by basking under a spot lamp. Many chameleons like high temperatures, a point that is usually overlooked in books dealing with reptile keeping. My *Chamaeleo lateralis* from Madagascar bask under the spots at temperatures of up to almost 40C on occasions, and regular basking under spots is a regular feature of the Madagascan giants – Oustalet's Chameleon *(Chamaeleo oustaleti)* and the so-called Panther Chameleon *(Chamaeleo pardalis).* After feeding I have noted a *C. pardalis* male, which in the breeding season has to be separated from another mature male, and at such times lives with my basilisks, not be content with the temperature high up in the vivarium (approx. 90F (32-33C) and to bask under a light bulb in order to raise its body temperature further. This individual is very tame and I have been able to record its rectal temperature without disturbing it – at 33.8C (92.8F), and this is a forest chameleon. Similarly my leaf chameleons *(Rhampholeon)* bask at temperatures of at least 33C.

It is crucial to *know* the range of available temperatures in the vivarium, which may be very different from what we *think* they are, hence one thermometer is totally inadequate. I have found the 'Maplin' indoor/outdoor thermometers excellent. They record max and mins (and 'remember' these) and show the current temperatures as a direct digital readout changed every 15 seconds and this can be switched to read either °F or °C at the flick of a switch. Each thermometer comes with one probe on a long cable so that the digital thermometer itself and the probe can each be used simultaneously to give constant temperature readings. The small probe is ideal for siting so as to give the temperature at a selected hotspot and can, of course, be moved around the vivarium with the minimum of disturbance at will in order to check on relative temperatures.

The materials from which the vivarium is constructed have not been mentioned. I stated at the outset that chameleons are visual animals liking light and space so an appearance of space is important. I use either clear plastic, which is glued together directly using plastic glue without any frame, or glass with minimum wood framing. The clear material is used for all four sides, making the vivarium very light. The appearance of space can be further enhanced by continuing the planting outside the vivarium on both sides. This also gives an additional feeling of security to the chameleons. The roof is generally made of plywood and has ventilation panels covered with fine gauze extending the total breadth of the vivarium and about six inches in depth. Finally, it goes without saying that chameleons should not be able to see chameleons in other vivariums.

## FOOD AND FEEDING

I mentioned the prodigious appetites of chameleons in the Introduction. In the wild some species eat and digest several meals a day. Throwing some crickets into the vivarium twice a week will not be satisfactory for chameleons.

Chameleons, furthermore, will not feed if thirsty. So the first thing is to get the water regime correct. For those animals coming from humid forest areas I recommend spraying the vivarium twice a day. In nature there is often a heavy dew and chameleons drink at dawn before searching for food. It is good to emulate this in the vivarium. Much of the tropics has a rainstorm in the wet season in the heat of the afternoon and I provide this also. The vivarium should not remain damp but at the temperatures here recommended and with adequate ventilation this will not be a problem. Rather the vivarium may tend to dry out too quickly, and I sometimes use plants growing in deep moss to enhance the water retaining contribution of the plants and increase humidity. Typically chameleons lick drops of water from leaves. In captivity

they will also lick droplets of water from the sides of the vivarium, and many will also drink from a water dish, provided this is large enough and full to the brim. An ideal situation for a busy person who cannot have two 'storms' a day, is to instal a drip system, set up so that water slowly drips from the tube onto leaves at various heights, before ending up in the pot of one of the larger plants. Chameleons will quickly learn to lick the water drops from the end of the tube (provided this is positioned to give them easy access) and excess water dropping from leaf to leaf will increase the humidity.

Chameleons will also learn to drink from a hand held dropper. This can be useful when giving them medicine or vitamins. Tameness is a great advantage should an animal need treatment. I do not handle my animals unnecessarily but those that want such attention are always given it. For instance my largest *C. pardalis,* which is always hand fed, after some time always came to the front of the vivarium when it saw my approach. On opening the vivarium it at once comes to the front and if I hold out my hand it climbs onto this up my arm and perches, apparently very content, either on my shoulder or top of my head! I have never had a chameleon show such behaviour before. Remarkably another large male *C. pardalis* has also adopted this precise trait. Chameleons do not like to be grasped or have their bodies touched (nor do they like the water spray to land on their bodies when the vivarium is being sprayed). They should always be allowed to climb onto a hand rather than being grasped.

I strongly recommend food supplements, and vitamins should be given twice a week with the water. With chameleons it is a simple matter to hand feed these to them, either from a dropper and they will lick up the required amount, or to get them to gape their jaws, when the correct amount can be dropped in varying from 0.5ml for a small chameleon to up to 5 ml for a giant rain forest chameleon.

There is bound to be a marked drop in sunshine level for captives in Britain compared to their native countries. Some chameleons seem to suffer from this, especially on arrival, and your veterinary surgeon can get you calcium/vit. D tablets which may be useful. I have obtained chameleons in very poor shape and in time they have made a complete recovery. I consider that vitamin supplements and possibly the calcium/vit. D tablets played an important role in this recovery and that in the absence of any such supplements these animals would not have started feeding and merely starved to death (which chameleons can do very quickly).

Some individuals have been obtained in such poor shape that I have had to resort to getting them feeding by getting them to gape their jaws and inserting a freshly *killed* cricket or pink mouse. This was slowly chewed and if repeated with an insect(s) twice daily (pink mice never more than twice weekly, and only then for medium to large species) the animals often made a complete recovery and even went on to mate and lay eggs. Clearly great patience – and time – is required with such individuals initially.

The readily available books are generally unhelpful concerning food, making only very general statements. For instance Zimmermann (1986) says 'Insects, spiders' with the addition of 'pillbugs' (woodlice) for *C. jacksoni* and Coburn (1987) states 'a great variety of small invertebrate food'. Obst *et al.* (1988) says 'various arthropods are acceptable'. Mattison (1987) gives the best feeding advice. Coburn, Obst *et al.* and Mattison all stress the need for variety in the diet. This is an over-simplification. Of course all animals, ourselves included, thrive best on a balanced and *varied* diet. But chameleons need *bulk* in their diet also. In nature many species feed extensively or even almost exclusively on one or a small group of food items and will prefer these over all other food items. But chameleons are opportunistic feeders and will select from what is available. It is perfectly satisfactory for one or a couple of food items to make up 80-90 per cent of the total diet. Incidentally, none of the above books recommend pink mice for chameleons. As all snake keepers know mice are a superb food with all necessary supplements contained within them! They are a very good food for all chameleons large enough to accept them. Although my 'giant' chameleons can swallow half-grown mice, due to the fast digestion of food by the chameleons, I prefer to feed them smaller ones which are unfurred – pink rats as well as pink mice. These are well chewed by their powerful jaws and sharp teeth prior to swallowing. I try to give all large chameleons a pink mouse/pink rat twice a week. I once had a *C. africanus* which would take strips of raw meat caught on the tongue in the usual way. I found this out by accident when a piece of meat on a stick was moved past the front of its vivarium and it projected its tongue in an attempt to secure it. Pink mice are, of course, much preferable.

There are marked individual food preferences as well as interspecific ones.

Apart from pink mice my chameleons are fed mainly on four food items which together comprise 90 per cent of the diet: black field crickets *(Gryllus bimaculatus),* locusts *(Schistocerca gregaria),* house crickets *Acheta domestica)* and the larvae of the waxmoth *(Galleria mellonella).* The first two of these items comprise at least two-thirds of the diet of most of the chameleons by weight and are hand fed. Waxmoth larvae are a treat which most chameleons are particularly fond of, and can often be used to coax a new arrival in poor condition into feeding. They are given about once a week. In addition to the above, blowflies, purchased as pupae which hatch in the vivarium, are provided from time to time. Again all chameleons are attracted to the newly emerged flies before they have expanded their wings. Mealworms are rarely given although readily eaten and provide under five per cent of the annual food supply by weight. Any other harmless insects which come to hand, including moths and butterflies, are fed to the chameleons.

Most locust hoppers and house crickets are liberally dusted with 'Cricket Plus' vitamin/mineral supplement prior to feeding. I find this excellent as the very fine particle size adheres superbly to the insects and it is, therefore, most economical to use and most nutritious.

I feed house crickets two or three times a week. They are ignored by some very large chameleons (all of which accept the much larger field crickets, *Gryllus bimaculatus,* but readily eaten by most. At each feed I deliberately over-feed as chameleons will feed throughout the day and *there should always be live food available.* I hand feed large field crickets (which are not coated in 'Cricket Plus') but any of the 'ration' not eaten are liberated in the vivarium for later capture and I see both sorts of crickets being taken throughout the day. Locusts I hand feed only but this purely reflects the damage that they do to the vegetation if left in the vivarium.

Under vivarium conditions both cricket species do well and live until eaten. Some food can be kept in a corner for them, and as John Pickett first pointed out to me, the *bimaculatus* crickets thrive under the same conditions as reptiles so make excellent vivarium inmates.

One word of warning. Chameleons do not like insects crawling over them, nor do they like their bodies to be touched. Hence excess food should always be kept within proportion. If it is so numerous as to become a nuisance and to be seen by them at all times they will not take it and may not feed at all.

## STOCKING RATES

My personal preference is to keep several chameleons together wherever possible. Although they do well kept individually, one then loses the chance to watch their superb social behaviour, and I have not found any deterioration in their condition when several are kept together. This may mean that during the (restricted) breeding season only one male can be kept in the vivarium with the females or that males must be kept apart at all times. This depends on the species, and sometimes even the individuals, concerned. As an animal behaviourist, interested in their behaviour and ecology, I naturally prefer to keep them in groups. The best guide is to do this and remove individuals if there are problems.

By way of practical example, I have a male *lateralis* (from Madagascar) which has been with me for over a year now, which is very quarrelsome with other males, and tends also to 'harass' females. This male is, therefore, kept away from others of its own species. It lives with several adult *pardalis* for whom it shows scant respect, but at least it does not trouble them. The *pardalis* group includes two adult males which live together happily outside of the breeding season. When one male assumed breeding colours this situation persisted, but when the second male came into breeding condition and tried to show breeding colours, it was persecuted by the dominant male in often subtle ways, so that it tended to hide, was obviously unhappy, and was removed. Oustalet's chameleon, on the other hand, is a quiet species and seems perfectly happy with other adults of its own species of both sex and I have kept up to four together. This group includes two adult males which never quarrel even during the breeding season. There is no obvious dominance of one by the other, indeed both males successfully court and mate with the adult female, and this has happened on many occasions.

Males of *C. johnsoni* inter-act aggressively during the breeding season, but in a well planted 3 x 4 x 2' vivarium, as described, I have found that two males can live successfully with a number of females and avoid each other without stress. The possible encounters, where they fight with their three horns, only occur during the breeding season, when sexually active colours are 'worn', and one male will take on drab subjugated colours and any attacks will cease. Outside the breeding season both males are draber coloured and no harmful interactions occur.

A further reason for my wishing to keep a number together when possible is that ideal sunny sites are limited and I want to make the best use of the best sites. In this connection chameleons can often be kept with other lizards, provided these are not too large, or too boisterous, and will not try to climb all over the chameleons – especially at the basking sites. As an example of ideal lizards to share a large chameleons' vivarium I have kept my Chinese crocodile lizards *(Shinisaurus crocodilus)* with my Oustalet's chameleons. There is no interaction. Although the crocodile lizards climb the branches they do so slowly and deliberately in a way that does not disturb the chameleons and they do not bask under the spots. Like chameleons they remain motionless for long periods of time and do not appear to mind when the chameleons climb right over them as if they were a branch. In this large, sunny, vivarium, the crocodile lizards display mating behaviour almost daily and eat surplus food on the ground. Another lizard which does excellently with forest chameleons is *Corytophanes* and another the forest dragon *Acanthosaura*. Both remain stationary for long periods of time and neither use the hotspots.

## BREEDING

Animals kept according to the regime described here will come into breeding condition naturally in the due season. As a possible aid to this I vary the day length using solar dial time clocks to control the lighting. These are set to the British seasons but the day length is of tropical duration – varying only from 12 to 15 hours daylight/day.

My chameleon vivarium of 'maximum interest' is in my office window where I seem to observe most of the key happenings such as mating behaviour. But even with those elsewhere I am lucky and I have actually observed most egg-layings, often purely by chance.

As every snake breeder knows, it is important to have your females in good condition, i.e. very well nourished *prior* to mating them. The fairly rapid growth of the eggs depletes the female's reserves and as the time of egg laying approaches, the females of many reptiles may refuse all food. In lizards this is often due to all available space in the body cavity being filled with eggs/embryos, so that it is physically impossible to 'process' food. Hence it is doubly important that the chameleon starts off its pregnancy in first class condition.

Among chameleons of mine laying in the first two months of this year, was a young female *oustaleti* which was hand tame, having been reared up last summer and which fed excellently every day. Several weeks prior to egg laying it refused all food and on 28th January it laid thirtyeight eggs. Post-laying care is most crucial with chameleons, especially those which lay large egg clutches. Even in the wild such animals may die in the days following egg laying (Bustard, pers. obs.). My formerly plump female *oustaleti* had a very thin tail after egg laying and the skin was wrinkled in folds along its flanks. It was given the usual vitamin treatment and had to be hand fed by gaping its jaws to get it to feed again quickly. Within a week, however, it was looking better, and taking a few hearth crickets. Soon it had regained its normal appetite and by early March had mated three times again and was ravenous. A further eggclutch is now awaited.

Chameleons which lay smaller clutches may be less affected by breeding. For instance a group of gravid *C. johnsoni* all fed normally up to and including the day that egg laying occurred, and those within the group that laid smaller clutches appeared little different before and after egg-laying. This species averages 10-12 eggs/clutch.

It is the need to provide good care during the egg developing period that makes it inadvisable to purchase animals that are obviously gravid, at least until one has gained experience.

**Egg laying facilities**
Chameleons, which are almost all arboreal animals, descend to the ground to lay their eggs. This they do by digging a hole or burrow in which they make a wider egg laying chamber at the end. They must have facilities to do this in captivity.

Always allow gravid lizards to give birth in their normal vivariums where they feel at home. Hence the egg-laying area should be supplied in their normal home and *well in advance* of expected egglaying. Schifter (in Grzimek, 1984), in an excellent account of chameleons, refers to a short-horned chameleon *(C. brevicornis)* of his laying its eggs in a flower pot. No young hatched from these eggs. There is no excuse for eggs being laid in plant flower pots. Such areas are not sterile. Much more desirable areas from the chameleon's viewpoint should be available elsewhere in the vivarium.

I build a nesting area using good loam mixed with peat, which is moisture retentive, and also easy for the chameleons to excavate. The depth of this depends on the size of the chameleon but for 8" chameleons it is between six and eight inches deep.

It is useful to be able to pin-point the area where the eggs will be laid so that if one is absent during the actual egg laying the vivarium does not have to be extensively excavated to locate the eggs. I achieve this by building on the basic tendency of the animals to nest in a corner, by making one corner site very attractive, which means secluded. The area of soil occupies one-third of the vivarium floor area running from front to back. The rear corner which is soil covered I cover on the outside, using cardboard coming in from the corner in each direction for a distance of 15" and two feet in height. There is little chance of the clear-fronted corner being used. I then arrange plants to give it a secluded appearance. In recent nesting by *Chamaeleo johnsoni,* in which I kept the gravid females prior to egg laying in a melamine-sided vivarium with glass at the front only, I planted a small *Hibiscus* to 'hide' the corner by sinking its pots into the compost and arranged a *Cymbidium* orchid's strap-like leaves to project over this to virtually 'roof in' the corner. This provided just the 'edge of cover' site that chameleons of many species choose for egg-laying in the wild. I have found *johnsoni,* which is a little-known species, to be very adaptable, and even females moved into the above vivarium only a few days prior to egg-laying (this necessitated by the sheer number of females which were gravid at the same time) all laid in this same spot identically. Indeed nine clutches of eggs were all laid in this secluded corner allowing minimum disturbance and immediate removal of the egg clutch before it could be destroyed by digging by the next nesting female!

**Incubation**
Eggs should always be removed from the vivarium to an incubator where careful control of humidity and temperature is possible at all times. I use 'Brinsea' chicken incubators and an incubation temperature of 27 or 30C for chameleon eggs. But any arrangement which permits thermostatic control of temperature is suitable. Indeed a forced air incubator would be preferable, as mine show considerable temperature differences at different levels, which must be guarded against if egg containers are arranged in two layers. The temperature should not exceed about 33C nor drop below 25C for prolonged periods and between 27-30C is, I feel, ideal.

The incubation medium depends on personal preference. Chameleon eggs are soft-shelled which means they will dessicate if not kept moist – in contact with a moistened medium. Vermiculite is widely used for soft-shelled or parchment-shelled reptile eggs, but any compost which is water retentive, and relatively 'open', and which can be heat sterilised, is suitable. It is improtant that the mass of the incubation medium is many times that of the mass of the egg clutch so that the medium is setting the environment and is able to release moisture to the developing eggs.

The eggs can be buried as a clutch as the mother does, but this does not facilitate inspection, nor does it allow for removal of any eggs which have gone bad/been infected by mould, so is not recommended. I place the eggs singly in a slight depression only, on the surface of already moistened vermiculite, or other medium, and space them approximately 1" apart in each direction, so that each egg remains completely separated from its neighbours, and the eggs can easily be checked visually. This method results in about 40% of the egg surface

being in contact with the moistened vermiculite. I start off with equal weights of water and vermiculite. The container is a sandwich lunch box with small ventilation holes at one end. I record the weight of the container containing the medium and the eggs so that water can be added to keep this up. If the eggs appear at all shrivelled on the regular inspections, then I spray a little water around them. Similarly if the container is up to weight and the vermiculite appears too dry I spray this. This latter situation is possible as the eggs absorb water and increase in weight, so in order to keep the medium at the same moisture level, slight additional amounts of water will be necessary. Healthy eggs should 'grow' during the incubation period, especially in breadth, but also in length. This is perfectly normal. Egg shrinkage, on the other hand, is a bad sign and if definitely not due to lack of available water and wrong temperature conditions indicates that all is not well within the eggs. Such eggs should be watched closely and removed at the first sign of collapse or appearance of mould.

The main problem with hatching chameleon eggs is the length of time that they must be carefully watched. This is frequently 9-11 months as in nature the female may only be able to lay during the annual monsoon season when the ground is workable (at other times it may be as hard as concrete) and the female chameleons usually benefit from the abundant food in the wet season to mature the eggs. The young in such habitats hatch about a year later, when escape from the nest is relatively easy with the soil moist, and there is again an abundance of insect food.

A clutch of fiftyeight *C. senegalensis* eggs laid last October, now after about five months have well developed embryos but these are still some months off hatching.

To date (14th March) ten clutches of chameleon eggs have been laid this year and all ten have been laid in normally constructed nests dug by the females and all ten clutches appear to be developing well in incubators.

## THE FUTURE

As a result of captive breeding, captive-bred juvenile chameleons will become available to reptile keepers for the first time. This will revolutionise the keeping of chameleons, exactly as it has done for many species of snakes, where even the more difficult species are now being bred in Britain (for instance Simon Townson's breeding of the Emerald Tree Boa *(Corallus canina)* for the first time in 1988). Captive bred chameleons, as is the case with snakes, will be much more desirable than wild caught individuals, as the trauma of capturing, shipping and retailing, together with accustoming them to the very different conditions in captivity will be avoided. The availability of reasonable numbers of captive-bred chameleons will revolutionise the keeping of chameleons even more than it has done for snakes.

The concluding article will discuss the keeping and breeding of live-bearing montane chameleons and the rearing of both oviparous and ovoviviparous species.

**TABLE 1**

Oviparous chameleon species available in Britain with comments on their suitability for the vivarium.

| SPECIES | AVAILABILITY | SUITABILITY |
|---|---|---|
| *C. africanus* | sometimes | very good; over-winter |
| *C. chamaeleon* | now difficult to obtain | a species complex good to very good |
| *C. dilepis* | frequently | good/very good |
| *C. fischeri* | frequently | good |
| *C. gracilis* | frequently | AVOID |
| *C. johnsoni* | available now | appears good, no long-term experience, however |
| *C. lateralis* | sometimes | very good |
| *C. oustaleti* | sometimes | ) good for experienced |
| *C. pardalis* | very occasionally | ) herpetologists with space and able to meet ) their food requirements |
| *C. senegalensis* | frequently | AVOID |

## ACKNOWLEDGEMENTS

I am greatly indebted to John Pickett for supplying me regularly with field crickets and locusts without which I would not have been able to maintain – let alone breed – the large and varied chameleon collection which forms the basis of this article. Also to Dave Lester (of the Serpentarium, Walsall) and Stuart Worth who have taken very great trouble to get me rare and unusual chameleons for my research work.

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# A SURVEY OF AMPHIBIAN SITES IN THE UPLAND POOLS OF MID-WALES

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This is a summary of a survey made in 1987. A full report of the survey has been deposited in the BHS Library.

## INTRODUCTION

This survey was carried out from 5.6.87 to 1.10.87, using a trapping technique on a similar principle to the crab pot, but without bait (funnel trap).

The objective was to trap adult and larval urodeles and larval anurans and, to a lesser extent, to sight young and adult anurans at the pools as these were not expected to be caught in this type of trap.

Pools included in this survey were those at 300 metres above sea level and higher although fourteen pools which are below 300 metres were included for the sake of supplementing the amphibian records for Mid-Wales as no previous data had been collected.

104 pools were visited. Of these 85 were trapped and amphibians were recorded in 52 of them.

Six species of amphibians are native to Britain but only the following five are to be found in this area: three urodeles, the great crested or warty newt *(Triturus cristatus),* the palmate newt *(T. helveticus),* the smooth or common newt *(T. vulgaris)* and two anurans, the common frog *(Rana temporaria)* and the common toad *(Bufo bufo).*

The ponds were classified in size as small, medium and large and I took as my examples, Beilibedw Mawn Pool, Llanerch and New House (Maelienydd) pools which were 180, 875, 2200 square metres respectively. (These figures are approximations only).

## METHOD

The number of traps laid down reflected the size of the pools. Traps were placed in order to cover a variety of habitats that were available in each pool, except in large deep pools where it was not possible to reach the deep water.

The traps were, in the majority of cases, lying on the bottom of the pool or in aquatic vegetation just above the bottom. In many of the pools, because they were shallow, this was also near the surface. Whenever there was dense aquatic vegetation, submerged or emergent, a trap (or traps) was placed amongst it. A few traps were tried floating in open water but specimens were never caught in them even when amphibians were present and were caught in other traps in the same pool. As a result, the placing of floating traps in open water was abandoned.

The traps were placed out in the afternoon and collected on the following morning to avoid asphyxiating the adult newts although there were occasional mortalities (notably when a warm evening followed a hot sunny day and the water temperature remained high so that the newts' metabolic rate and, consequently, oxygen consumption, was higher).

Clear plastic squash bottles had been used to make the traps, with the top cut off and inverted into the base, secured with three or four paper clips. They were made more easily seen and retrievable by attaching to each one, with cord, a brightly coloured (red and yellow taped) floating cork. The traps also had holes to facilitate sinking but these were not large enough to allow larvae to escape. Traps were sometimes thrown out into deeper water attached to a line and weighted with a stone or lead weight.

I found that it facilitated collection and avoided loss of the traps if a diagram was made of the pool, marking the location of each trap.

## SUMMARY OF RESULTS

**1. Altitude**

There was no significant relationship found between the number of amphibian species present in a pool and the altitude of pools between the parameters encountered. Great crested newts and toad larvae were found up to 420m above sea level. Palmate newts and smooth newts were found up to 440m above sea level, although palmate/smooth newt larvae were found at 500m above sea level. (In the conditions that prevailed these were most likely palmate newt larvae). Frog larvae were found up to 500m above sea level.

**2. pH**

Of the urodeles, the palmate newt was found at the lowest pH of 4.8. Smooth newts and great crested newts were found only down to pH 5.4. They were all found at the highest pH encountered of 6.6. At the lower pH range the populations of all urodeles was smallest.

Of the anurans, toads were found at pH 6.4 to pH 6.8 and frogs from pH 6.6 down to pH 4.7, and froglets were encountered on a mire where the pH range was 4.2 to 8.1. Frog larvae were found in the severest conditions encountered: pH 4.7 at 500m above sea level, with a very high ammonia level (probably due to a black-headed gull colony) and a high aluminium level. But they were by no means universal.

**3. Size and Depth**

All the amphibians were found in small, medium and large pools except the toad, which was not found in medium sized pools (probably due to the limited number of pools in which they were found). The newts were found in the shallowest pools, 8-10cm, the anurans in pools of minimum depth 23cm. All the amphibians were found in pools with depths of over 1m. The great crested newt was found in the smallest pool (Aberedw Hill 8) which was only 8-10cm deep and 6m$^2$.

**4. State of Hydration**

Great crested newts were not found in pools that dried out readily (not in *Calluna* heathland) and the same applied to frogs and toads. Palmate newts were found in pools that could dry out by late summer (surrounded by *Calluna* heath). They were found in smaller numbers in these pools but these were also the least productive. Smooth newts were found in pools that did dry out by late summer and in one of these pools a palmate/smooth newt larva was found.

**5. Substrata**

The amphibians were found in pools with clay, peat and concrete substrates, all with overlying silt, except the toads, which were not found in peat pools. The great crested and smooth newts were only found in a peat-based pool with a relatively high pH of 6.3. The palmate newt was found in a peat-based pool with a low pH of 4.8.

**6. Inter-Association of Amphibian Species**

Of 85 pools trapped, amphibians were found in 52 of them. Great crested newts were found in 21 pools, 6 of these without any other amphibians. Smooth newts were found in 19 pools, 5 of these without any other newt species, only 2 pools without other amphibian species. Palmate newts were found in 10 pools, 2 of them with no other amphibian species. Great crested and palmate newts when associated with other newt species were found mostly with smooth newts. Smooth newts when in association were found mostly with great crested newts. Palmate newts when associated with other newts were the predominant species only in the least productive pool (Red Hill).

Frog larvae were found in 15 pools, in 5 pools with no other amphibians. When they were associated with other adult amphibian species, in every case smooth newts were also present. In the 5 pools where found alone the frogs had either appeared to quickly colonise recently dug out pools or were living in adverse conditions perhaps unsuitable to the other amphibian species.

Toad larvae were found in 5 pools, in 3 of these without any other amphibian species. When they were with other amphibians, smooth newts were present as well.

**7. Land Quality and Animal Grazing**

There were larger populations of great crested newts where the pools were fertilised by cattle. They have a preference for pools in better quality land (where the land is usually artificially fertilized and limed, if necessary), where there are cattle with high stocking densities and, here, the most productive pools.

There was a trend with smooth newts towards better population in the more fertilized pools and smaller populations in those with low stocking densities of sheep, which was also the poorer land. They showed a preference for the better quality land where cattle grazed and watered but this was not as marked as with great crested newts.

The largest population of palmate newts from catches per trap were found in a pool fertilized by cattle, but this did not bear any relationship to where they were usually found which was particularly in the poorer quality land where there were no cattle, only sheep, horses/sheep or no animals grazing.

Frog larvae populations did not bear any relationship to the animals grazing the pools (although approximately 2 out of 3 pools were in better quality land).

Toad larvae were not found in poorer quality land and the populations were bigger in the more productive better fertilized pools with cattle. However, the least productive pool (few animal taxa and plant species) had a huge population of minnows which may be affecting the toad larvae.

**8. Fish**

Great crested newts and palmate newts were not found in pools with fish. Smooth newts and frog larvae were found with fish (mirror carp – not active carnivores) in only one pool. The toad larvae were also found in this pool and had managed to colonize 2 other pools where there were fish (sticklebacks and carp/minnows) which the other amphibians had not succeeded in doing. This maybe because they are unpalatable.

Statistically, it was found that the presence of fish in a pool makes it much less likely that amphibians will also be found there.

**9. Populations**

Of the three urodele species, adult smooth newts were in greatest abundance in the upland pools, the great crested newts second and the palmate newts were the smallest population.

Of the anuran species the frogs had by far the greatest population of larvae and therefore adults, with a very much smaller population of toads.

**10. Immigration-Emigration**

Larval frogs and toads were caught from the first week of June at the start of the survey. Larval great crested newts and palmate/smooth newt larvae did not appear until the beginning of July. During July some frog larvae were metamorphosing and all found had metamorphosed by August. Larval palmate/smooth newts and larval great crested newts were still being caught in the second week of August although the great crested newt larva caught was almost completely metamorphosed. There is insufficient data to indicate in which month the larval toads metamorphosed and emerged from the pools. Adult anurans had already left the pools at the start of the survey, having spawned before the newts. No adult urodeles were caught after the first week in August.

# HOW NOT TO SAVE A SPECIES

## Britain's wildlife protection laws could be doing more harm than good, says Trevor Beebee

*This article and the subsequent correspondence was first published in the New Scientist, and is reprinted here by kind permission of the Editor*

With the green revolution sweeping through British politics, it is to be hoped that the government finds time for a new look into the tangled under-growth of our wildlife protection laws. In 1981, the Wildlife and Countryside Act became the cornerstone of species and habitat protection in Britain, and was meant to see these issues through into the 21st century. However, many conservationists have been dissatisfied with the workings of the act almost from day one. Many of them now feel that, despite the massive amount of debate that the legislation engendered, and the substantial costs (most notably in renotification of Sites of Special Scientific Interest), the law is failing to curtail the destruction of habitats or the decline in species in many situations. What, then, are the major failings of the act, and how might they be remedied?

Fundamental to the current law is a distinction (albeit incomplete) between the protection of species and protection of habitats, covered in parts one and two of the act respectively. It is my view that this initial distinction has led to a serious imbalance in conservation efforts, and is in need of urgent reconsideration. I contend that the protection of species has been grossly overdone, and in many cases has been useless (perhaps even detrimental) to conservation, while the protection of habitats remains weak and is all too often ineffectual.

There are, of course, instances in which special protection must be given to particular species of animals or plants. By and large, however, these boil down to cases where direct or indirect human predation has a major impact on the species' prospects. It is easy to think of examples, almost always of large animals near the top of the food chain (golden eagles, wildcats and so on), or plants so restricted that collection of a few specimens could cause national extinction (such as some of our rarest orchids). There are, however, really rather few organisms in these categories, certainly far fewer than currently given total protection under Schedule 5 of the act. Most creatures given high-level protection are endangered primarily by loss of habitat; these inlcude numerous invertebrates, amphibians, reptiles, some small mammals and so on, and preventing direct human predation makes little or no difference to them.

So why should it matter if the law errs on the overcautious side? Well, some unfortunate consequences can arise. First, there is the question of cost. Protecting species has meant setting up a licensing procedure, currently run by the Nature Conservancy Council, and spending several thousands of pounds a year issuing documents of little consequence for the conservation of most of the species involved. Indeed, in many cases, a rubber-stamping operation has evolved: 85 per cent of licence applications to handle great crested newts have been granted over the past few years, for example, so why bother with the bureaucracy in the first place? Surely these funds could be better spent in practical conservation.

Secondly, there is the question of honesty. At least some species protected under Schedule 5 of the act are not even rare, and were placed on the list for reasons related more to politics than on the basis of scientific evidence. The crested newt is again a good example: although it is widespread all over lowland Britain, it is now an offence for children wielding pond nets to catch this animal deliberately – even just for a quick look, followed by immediate release.

Does this increase public sympathy towards conservation? More importantly, perhaps does it not devalue conservation efforts for more seriously threatened species? How long will it take developers to realise that crested-newt ponds are all over the place, and then attack conservationists for crying wolf? This could have serious consequences when defending sites with seriously endangered species. To take the example of another amphibian, the natterjack toad is seriously endangered in Britain, but has exactly the same level of protection in law

as the great crested newt. It isn't difficult to imagine assaults based on the principle of "but that's what you said about crested newts and they're everywhere".

So why has species protection been so popular? Well, to be cynical, it is relatively easy, and cheap, to create a pointless licensing procedure that effects a tiny proportion of the electorate, especially when this includes the conservationists who made the fuss in the first place. Good publicity, to be sure, to say that species X is now "protected", but all too often meaningless in practice. Most creatures covered in part one of the 1981 act have continued to decline as fast or faster than previously, when, as is most commonly the case, the problems lie with the habitat. There are fewer sand lizards and smooth snakes today than there were a decade ago, though both were given maximum protection in 1981. This is simply because the destruction of their heathland habitat has gone ahead unabated. Of course, animals like crested newts, though still widespread, are also declining, and do need to be protected, but the only way to do this effectively is to change the balance of the law to encourage conservation of habitats. The way forward is to cut out much of the species protection with its associated bureaucracy and general inconsequence for conservation, and put some real teeth into habitat protection. Make SSSIs truly inviolate, not to be overruled by planning permissions, but subject to compulsory (and government-funded) management regimes. Let's also give landowners real financial incentives to keep heritage features in our countryside outside the SSSIs, and put an end to the opposite situation that has prevailed since the Second World War. It will be more expensive than a licensing office, but not excessively so in the context of existing agricultural subsidies (which could, of course, simply be redirected). It is the only real hope for many species "protected" so ineffectively at present. Will the government rise to the occasion? Or is talking green simply the best form of camouflage?

*Article by Trevor Beebee, reprinted from the New Scientist, 26 November, 1988.*

*Reply from A.S. Cooke and R.S. Oldham, published by New Scientist, 24/31 December, 1988:*

**Protecting amphibians**

We are perplexed by Trevor Beebee's article "How not to save a species" (Forum, 26 November). Can genuine concern for conservation be reconciled with his suggestions? On one hand he recommends that the crested newt would be favoured by scrapping the species protection laws and inviting developers to regard it as commonplace. One the other hand he believes that there should be increased protection of Sites of Special Scientific Interest and increased incentives to landowners to conserve features of interest outside SSSIs. These latter suggestions, although desirable, would seem to offer little real help to the crested newt because fewer than 5 per cent of recorded newt sites occur within SSSIs and how many sites could be additionally protected by incentives?

The Convention on the Conservation of European Wildlife and Natural Habitats (1979) required certain species to be given strict protection; the crested newt and the natterjack toad among them. Britain is a party to the convention and both species are protected by the Wildlife and Countryside Act 1981. The natterjack toad is regarded as endangered in Britain and the crested newt as vulnerable. During the period 1966 to 74, Beebee's own inquiries revealed that at least 50 per cent of breeding sites for crested newts were lost. However, during the period 1980 to 85, an investigation by Leicester Polytechnic (funded by the Nature Conservancy Council) revealed that the loss had been reduced to some 2 per cent. It would appear, therefore, that recent amphibian conservation efforts, including species protection, have paid dividends.

It is quite wrong to imply that the Nature Conservancy Council's involvement in the conservation of protected species is centred on the licensing function. The major effort is directed at safeguarding habitats, site management and research, and is executed in accordance with conservation needs. For crested newts, effort is concentrated upon the most important breeding sites. For natterjacks, every established site is defended and the population has stabilised during the 1980s.

Leicester Polytechnic's national amphibian survey was initiated as a direct result of the inclusion of the crested newt as a protected species and has engendered enormous public interest. Literally thousands of volunteers have participated; contrary to Beebee's suggestion, there is no absence of public sympathy. Equally important is the enhanced awareness of planning authorities,

and hence developers and land owners, that breeding sites need to be taken seriously in land-use programmes. We are increasingly involved in advising on development proposals to ensure the satisfactory conservation of newts and other species.

Perhaps most significant of all is the increased number of requests that staff at Leicester Polytechnic are receiving for "land sifts". These are investigations undertaken on behalf of developers to avoid conflict with nature conservation interests–an excellent example of habitat protection resulting from species protection. If species protection had not been afforded to the crested newt there is little doubt that none of this activity would have occurred.

Yes we need greater protection of habitats, but not at the expense of the level of species protection that we already prossess.

*A.S. Cooke, Nature Conservancy Council, Peterborough*
*R.S. Oldham, Leicester Polytechnic.*

*Response from Trevor Beebee, published by New Scientist, 28 January, 1989:*

**Wildlife and the law**

The response of A.S. Cooke and R.S. Oldham (Letters 24/31 December) to my article on wildlife protection legislation (Forum, 26 November) seems to confirm some of my worst fears. I find the thrust of their comments surprisingly complacent.

My criticism was levelled at the law, not its enforcers. The Nature Conservancy Council is the executor of the government's will, and is charged with running licensing procedures to comply with the Wildlife and Countryside Act 1981. In this it has no choice. It was not my intention to impugn the NCC, which in my view generally carries out its duties remarkably well considering its scandalously low funding base.

The 1979 Berne Convention allowed signatories scope for how species were to be protected by national law at the time of ratification; there was no requirement for natterjack toads and crested newts to be treated similarly, though change would be very difficult (technically impossible!) now.

Cooke and Oldham's view of improvements since 1981 is at variance with my own. If losses of crested-newt sites were reduced to 2 per cent between 1981 and 1985, this was not a result of the 1981 act. Virtually no action under the law was taken to protect the species during that period. In my district, 5 out of 13 crested newt ponds I knew of in 1979/80 have been completely destroyed, and one more almost so. All were known to the NCC by 1982, but the act gave no powers to prevent the losses (which were mainly the result of neglect or accident, the major problems identified by Leicester Polytechnic's survey). It is also incorrect to suggest that the population of natterjacks has stabilised. Three of the remaining 30 to 40 British sites are likely to go extinct within the next year or so (indeed, they may already be lost), and one of the largest surviving populations is under serious threat from developers.

Cooke and Oldham also mistake participation in a survey for public sympathy. This is like a minor political party judging its national esteem solely on the comments of its members. Of course, there has been valuable spin-off from the work on crested newts, and this is highly commendable. But two major problems remain: Do the ends always justify the means? And are the ends in any case good enough?

I believe that most of the limited benefits for crested newts which resulted directly or indirectly from the 1981 act could have been obtained without pretending that it is an endangered species. More importantly, any real conservation impact will need stronger habitat protection than we have at present. The vigour with which Cooke and Oldham defend the current situation leads me to conclude that the government's strategy of species protection is an even more effective red herring than I first supposed.

*Trevor Beebee, University of Sussex, Falmer, Brighton.*

# BOOK REVIEWS

## FIELD GUIDE TO THE SNAKES AND OTHER REPTILES OF SOUTHERN AFRICA

by Bill Branch

New Holland (Publishers) Ltd., 37 Connaught Street, London W2 2AZ. 328pp, 550 plus plates, price £10.

This book at last provides us with a comprehensive and modern guide to the reptiles of Southern Africa.

The geographical scope of the book covers that part of Africa "south of a line connecting the Cunene and Zambezi rivers", which includes South Africa, Namibia (South West Africa), Botswana, Lesotho, Swaziland, Zimbabwe and Mozambique. Within this region are a great range of climates, soils and vegetation, which have produced a tremendously varied and extremely interesting fauna.

The book is introduced with a useful outline, including maps, of the climate, land forms and vegetation of the region. It is concise and informative.

The species accounts are prefaced by introductory sections on the biology and history of each main group, nicely written and crowded with facts.

The species accounts themselves follow the pattern of a physical description, notes on biology and breeding, habitat, range and subspecies. Considering the huge number of species covered (almost 400), there is an unusual amount of information in the accounts. It is particularly gratifying to see some detail in the notes on biology and breeding, where it is known. Bill Branch has a gift for writing very concisely, and telling us much in few words, yet without compromising the quality of writing, which is excellent throughout. His subject is dealt with thoroughly and seriously, and reflects the obvious wide knowledge and enthusiasm of the author.

With an increasing amount of work on the Southern African reptiles, and with the general increase in interest in herpetology, have come many new discoveries and revisions of classification, which are really only beginning, as the author makes clear in his preface by describing his book as "premature". The information in the book is as up to date as possible, though there are bound to be many important changes in the near future. The author has done a first class job in synthesising current knowledge. An example of a group of animals subject to new discoveries and revisions of classification and relationships is that of the Dwarf Chameleons, *Bradypodion*. There has always been confusion about this diverse group of lizards, and the current names must only be provisional, with new species recently discovered. Bill Branch brings us right up to date with accounts and beautiful plates of all the known forms and their likely relationships.

A very useful feature of the book is the distribution maps, the first published for the whole of the region. The maps include subspecies. they are conveniently situated in a column on each page adjacent to the individual species account, which aids clarity and use; this is a better system than that commonly used in field guides of printing the maps in a separate section at the end of the book.

The plates are superb, and are the most immediately striking feature of the book. All are in colour. The quality of both the photographs and their reproduction is very good. For most of us this will be the first time we have actually seen the likeness of many of the species. It is a pity that only the common names appear on the plate captions, apart from the indication of subspecies, but possibly this was a practical compromise with space to allow so many plates to be included.

The book is well designed, compact in shape, clearly printed, and sells at an amazingly low price of £9.95 (U.K.)

John Pickett

## DICTIONARY OF ANIMAL NAMES IN FIVE LANGUES: AMPHIBIANS AND REPTILES

1988. Edited by V.E. Sokolov. Hardback, 559 pages. Russky Yazyk Publishers, Moscow. Obtainable, price £10.95p., from Collets, Denington Estate, Wellingborough, Northants NN8 2QT.

This pleasingly produced volume lists 12,126 names of herptiles in phylogenetic order giving them in Latin, Russian, English, German and French. This takes up the bulk of the volume, but is followed by alphabetical indices in each of the five languages. The work gives every impression of thoroughness, and is clearly global in its coverage.

*Jeffery Boswall*

# LETTERS TO THE EDITORS

Dear Sirs,

**Should reptiles and amphibians be in ordinary pet shops?**

Nearly every pet and aquarist shop I have looked into recently has had reptiles and amphibians for sale. Without exception, a large proportion of the stock, sometimes all of it, was sick and dying. Individuals of species completely unsuitable for the general public were on sale and in general the animals were housed inadequately, were thin, dehydrated and parasite-ridden. Even given care by an expert with laboratory facilities and veterinary back-up many would not have recovered. A few examples will illustrate the depths of ignorance and lack of care to which the animals were being exposed: a five-inch *Trionyx* housed with terrapins of the same size (the frilled edge of its fleshy carapace was not a pleasant sight); a common boa carrying so many mites that it appeared to have another layer of skin; a chamaeleon housed in a simulated desert; fire-bellied newts housed in tropical fish tanks and so thin they were just bags of bones.

The proper keeping and breeding of reptiles and amphibians in captivity can be defended: it enables study; it develops methods for captive propagation that can be applied in conservation and animal (including human) health and welfare; it assists in the education of others about the natural world. But distribution through the general pet trade of unsuitable, improperly cared for and unhealthy animals cannot be defended. Is it not time that this Society and its members campaigned effectively for the elimination of these animals from the general pet trade?

I am quite prepared to accept that in most cases collection from the wild has no deleterious effect on the survival of species and may, for economic reasons, have a beneficial effect in preserving habitats. But the present situation is intolerable from the point of view of animal welfare. While that consideration must be paramount, those who buy unsuitable animals or individuals in poor condition will be disappointed and resentful and will be lost from developing into herpetology proper. Entry into the biological sciences through amateur herpetology while young has been the route for many of us and it is not a route I would like to see damaged. Also, in an age where credibility and image are of major importance in dealings with 'opinion-formers' the appearance of half-dead animals in tatty shops for sale for their entertainment value is not one that serves herpetology well.

I know all the arguments that will be used to oppose my view. One is that the 'animal rights' loonies and the high priests of the new and intolerant religion of environmentalism will see it as a chink in the armour through which to achieve their objective of banning completely the importation, keeping, breeding and sale of reptiles and amphibians. I do not accept that argument. We must have the confidence to try to change things for the better. If we do that properly and state our achievements in captive breeding technology over the past decade then we have nothing to fear. We must get across the case that serious keepers of reptiles and amphibians (and birds and mammals for that matter) are not pet keepers (keeping pets and wild animal husbandry are distinct activities) and that ordinary pet shops should be restricted to furry, feathery and finned domesticated animals.

Some may suggest that tightening of existing controls or new legislation are not necessary since market forces will prevail. Indeed, I understand that one major importer and distributor through the pet trade has recently stopped dealing in reptiles because there was no money to be made. But others will try and have tried over the last thirty years. Market forces are slow and much as I dislike legislation that may be the only way forward. Amendment of the Pet Animals Act (1951) (itself a misnomer!) which licenses the selling of animals could be an aim.

A possible mechanism is through national licensing of dealers in non-domesticated animals. Such a licensing system could impose standards and be based on inspection by experienced, knowledgeable and responsible herpetologists. After all laboratories using animals, zoos and

even pet shops are subject to licensing and inspection (the reason for the lack of effective licensing for pet shops is that knowledge of wild animal husbandry at local authority level is, not unexpectedly, inadequate). The good dealers with knowledge and dedication (some of whom have played a full role in the enormous advances in reptile breeding since the mid-1970s) would have nothing to fear and would no longer be dragged down by the poor reputations of others.

Should we not then be briefing Members of Parliament and others to gain support and be pressing for a change in the law?

Prof. Malcolm Peaker
Ayr

Dear Sirs,

**How aquatic is the Common Frog *(Rana temporaria)*?**

In contrast to the water frogs *(Rana ridibunda, R. esculenta* and *R. lessonae),* the Common Frog is generally assumed to be a "grass frog", living on land from the end of its breeding season until it goes into hibernation. I first began to wonder about this in 1975, when I was looking at newts in the New Forest and came to examine a minute pond with vertical concrete sides. By torchlight after dark I found individuals of *R. temporaria* resting head-up in the corners at the surface of the water. This was in May, and I wondered what they were doing, half-submerged in the water.

The follow-up came by chance in 1988, when members of the Kent Trust for Nature Conservation were rescuing newts and invertebrates from a pond that was going to be destroyed. During May, June and July a total of 22 adult Common Frogs were captured and removed (contrasting with the mere two individuals found there on the only April visit). I must stress that these were all *R. temporaria.* The Marsh Frog, *R. ridibunda,* can be heard calling only a hundred yards or so away, but none were found in this pond.

So what does *R. temporaria* do on summer nights?

Deryk Frazer
Warren Farm, Boxley, Maidstone, Kent

## MEMBERS' ADVERTISEMENTS

*The attention of members is drawn to the various Acts of Parliament and EEC regulations governing the import, possession and sale of reptiles and amphibians. Advertisements are accepted on the understanding that animals are legally obtained and offered for sale.*

* Free holiday accommodation available for 3 weeks July/August in N. Yorks. village – in return for overseeing tortoise collection. Suitable for 1 or 2 responsible persons. Interested persons write to the Secretary, BHS, c/o Zoological Society of London, NW1 4RY.

* **Wanted:** Hatchling to 2 year old female Speckled King Snake for breeding.
Robin Wells, tel: Newbury 30424.

* **For Sale:** Captive hatched Amethystine Pythons *(Liasis amethystinus).* Captive bred Emerald Tree Boas (babies) expected in July.
Simon Townson, tel: 01-531 1378.

*Program Announcement*

# FIRST WORLD CONGRESS OF HERPETOLOGY

## Canterbury, United Kingdom – 11-19 September 1989

THE CONGRESS will be held at University of Kent and in Canterbury. H.R.H. Prince Philip, President of the World Wildlife Fund, will serve as Patron of our Congress and Professor Angus d'A. Bellairs as Honorary President. The Congress will also serve as the official 1989 meetings of Societas Europaea Herpetologica, Herpetologists' League, and Society for the Study of Amphibians and Reptiles. It will be co-hosted by the Zoological Society of London, Fauna and Flora Preservation Society, Societas Europaea Herpetologica, and the British Herpetological Society.

The Scientific Program, subject to modification is listed below. Plenary speakers and Convenors are now being invited. *Persons who wish to participate in events should contact the Convenors*, whose names and addresses may be obtained from the Secretariat (see below). There will be poster sessions open to all persons but no oral contributed papers. All presentations will be in English, but discussions can be in other languages.

### PLENARY LECTURES

THE STATE OF HERPETOLOGY - EVOLUTION AND ECOLOGY OF PARTHENOGENSIS - BIOGEOGRAPHY OF SOUTH AMERICA - INTERNATIONAL CONSERVATION - SEXUAL SELECTION - SYSTEMATICS AND PHYLOGENY - PALEOHERPETOLOGY - ECOLOGICAL PHYSIOLOGY - COMMUNITY ECOLOGY - BIOLOGY OF SALAMANDERS

### SYMPOSIA (S), WORKSHOPS (W) and ROUNDTABLES (R)

*Conservation*

S.1. CONSERVATION AND MANAGEMENT OF SPECIES
S.2. EFFECTS OF POLLUTION ON HERPETOFAUNA
S.3. CAPTIVE MANAGEMENT
S.4 HEALTH AND DISEASE
R.1. IUCN HERPETOLOGY SPECIALIST GROUPS
R.2. CONSERVATION PROBLEMS

*Behavior*

S.5. SEXUAL SELECTION AND COMMUNICATION
S.6. ENVIRONMENTAL SEX DETERMINATION
S.7. ORIENTATION, NERVOUS SYSTEM AND SENSES
R.3. OPTIMAL SIZES OF EGGS AND CLUTCHES
R.4. MIMICRY AND PREDATOR-PREY BEHAVIOR

*Ecology*

S.8. LONG-TERM STUDIES
S.9. SNAKE ECOLOGY AND BEHAVIOR
S.10. ADAPTATIONS TO EXTREME ENVIRONMENTS
S.11. AMPHIBIAN COMMUNITY ECOLOGY
S.12 HERPETOFAUNAS: EXPLORATIONS & STUDIES
R.5. THE ECOLOGY OF THE TUATARA
W.1. SKELETOCHRONOLOGY
W.2. FIELD METHODS AND BIOTELEMETRY

*Evolution*

S.13. EVOLUTION AND PHYLOGENY OF FROGS
S.14. ORIGIN OF AMPHIBIA AND REPTILIA
S.15. PALEOHERPETOLOGY
S.16. ISLAND HERPETOFAUNAS
S.17. LIFE HISTORY EVOLUTION OF TURTLES
R.6. BIOGEOGRAPHIC REVIEW OF THE CONTINENTS
R.7. CAECILIAN BIOLOGY AND EVOLUTION

*Systematics and Genetics*

S.18. MOLECULAR SYSTEMATICS
S.19. CYTOGENETICS
S.20. PARTHENOGENESIS AND HYBRIDOGENESIS
S.21. SYSTEMATICS AND PHYLOGENY
S.22. BIOLOGY AND GENETICS OF PIPIDAE
R.8. PHYLOGENY AND CLASSIFICATION OF LIZARDS
W.3. MOLECULAR TECHNIQUES
W.4. AMPHIBIAN LARVAE
W.5. PHYLOGENETIC ANALYSIS

*Physiology and Development*

S.23. ENERGETICS
S.24. ECOLOGICAL PHYSIOLOGY
S.25. FUNCTIONAL MORPHOLOGY
S.26. REPRODUCTIVE PHYSIOLOGY
S.27. DEVELOPMENTAL PROCESSES

*General Topics*

R.9. FIELD RESEARCH & NATIONAL REGULATIONS
R.10. AMATEUR CONTRIBUTIONS TO HERPETOLOGY
R.11. MEDICAL AND RESEARCH ASPECTS OF VENOMS
W.6. PHOTOGRAPHIC TECHNIQUES

**EXCURSIONS:** Pre- and post-Congress trips are planned to Europe, Russia, the Mediterranean, Belize, Honduras, the Amazon, Ecuador, various sites in Africa, Indian Ocean, Malaysia, China and Australia, each led by professional herpetologists. Day or half-day trips to Darwin's home, London, Cambridge, Oxford and Paris are also planned.

**FIRST CIRCULAR:** The complete program and full details of excursions, including prices, are given in the First Circular, available from the Secretariat. This includes a Provisional Registration Form. £100 fee covers abstract book and program, refreshments, and costs of hiring meeting rooms and equipment. *Advance registration is **strongly encouraged*** for planning purposes and to insure that you receive all other announcements promptly.

**SECRETARIAT:** Address all inquiries to: First World Congress of Herpetology, Ecology Research Group, Rutherford College, University of Kent, Canterbury, Kent CT2 7NY, U.K. *Telephone: (0277) 76400, ext. 3501. Telex: 965449.*

## BRITISH HERPETOLOGICAL SOCIETY COUNCIL 1988/89

Society address: c/o Zoological Society of London, Regent's Park, London NW1 4RY

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| | | |
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| **British Museum (Natural History) Representative:** | Dr C.J. McCarthy | Reptile and Amphibian Section, Department of Zoology, British Museum (Natural History), Cromwell Road, London SW7 5BD. Tel: 01-589 6323, Ext. 9292 |

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