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BRITISH HERPETOLOGICAL SOCIETY

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

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

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

Meetings

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

Subscriptions

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

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

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

LONDON MEETINGS 1988

Meetings are held in the Lecture Theatre of the Linnean Society of London, Burlington House, Piccadilly, London W1, and start at 7.00 pm, ending at 9.00 pm, unless indicated otherwise.

MARCH 3rd	Jonathan Wright (Department of Zoology, University of Oxford): Population ecology of two Mediterranean tortoises in northern Greece – account of a joint universities expedition, 1985.
MARCH 29th	A.G.M. (see separate Agenda), followed by Peter Curry (BHS Legal Officer): A case for captivity.
APRIL 27th	Dr David J. Bullock (Department of Zoology & Marine Biology, University of St Andrews, Scotland): Herpetofauna of the northern Mauritian islands (Indian Ocean).
MAY 26th	David Ball (Assistant Curator of Reptiles, Reptile House, Zoological Society of London): Captive breeding of reptiles in the London Zoo.
JULY 6th	*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, preserved specimens, amphibian voice recordings and 35 mm colour slides for display and to illustrate discussions.
SEPTEMBER	*Care and breeding of amphibians and reptiles: an open meeting.* Contributions from members – live animals, slides etc. There will be facilities for the sale and exchange of members' private home-bred stock. Saturday date and venue to be arranged.
OCTOBER 13th	Paul Edgar (herpetologist, Operation Raleigh): The herpetofauna of Seram, eastern Indonesia.
NOVEMBER 30th	Mike Linley ('Survival', Anglia Television, London, and Chairman, Captive Breeding Committee) will show some herpetological films not previously screened by Anglia TV. Date to be confirmed.

EDUCATION COMMITTEE REPORT – YEAR ENDING MARCH 1987

The last 12 months have seen an increase in the number of Junior members to an all time maximum of 120. The year has not been without its problems, however, the two most serious of which resulted in our supplying a less than satisfactory postal service to the J. Herps.

Problem number one was I accumulated a horrendous backlog of mail when my home was plagued by builders work over a nine month period; this resulted in a total disruption of all domestic routines etc. This backlog was eventually cleared but to a much lesser extent the danger of accumulating mail is always present since I am required to work away from home for time to time. In order to ease the problem and cut down the paperwork, – last year generated 217 items of incoming mail most of which required a reply, – I have instigated a Friday Surgery System whereby members are invited to telephone me with their enquiries and problems. Anyone is welcome to try to get me any evening but I make a conscious effort to be at home to answer calls between 6.30 and 9.30 pm on Fridays. This system seems to be working quite well and although I cannot guarantee to be in every Friday I should think that there is a 95% chance that I can be contacted. This system is obviously far more efficient than writing since it gets an instant response to what could be quite serious problems.

Once again our major expenditure over the year was postage. On average the cost of sending out Newsletters etc works out at about £30 per send out whilst the actual cost of printing is only about £20 per issue thanks entirely to the efforts of Colin Fitzsimmons. Despite these expenses at the end of the financial year we had a balance in our account of £691.21.

Problem number two relates to the supply of Bulletins to J. Herps. Since the Bulletin went quarterly we have yet to crack the logistical problems involved in getting a bulk supply from the Editors in order to send them out with the termly Newsletter. The matter is however under review and I am optimistic that we will eventually resolve the problem.

The most important new development was that Council approved the appointment of Colin Fitzsimmons to the Education Commitee with a special responsibility for all of our exhibition work. At the same time council granted us funding up to a maximum of £200 p.a. for 3 years to purchase display material so that we can improve the quality of our work in this area. Those members who have experience of exhibition work know all to well how time consuming preparation can be and the actual event may well be marred if our representatives keep falling asleep because they were up to the wee small hours producing posters etc. By producing some high quality display material that is permantly available we should be able to cut down preparation time considerably. As in previous years our exhibition work has been centred mainly in and around the London area but with a mobile static display available if the situation should change. It is encouraging to be able to report that some of our J. Herps have responded to the call and regularly help out at events where their help is invaluable and their presence a credit to the Society. Exhibitions generate new members, initiate local talks and, possibly most important of all, encourage public sympathy to our causes.

Encouraged by the interest shown in one day field trips in the Lea Valley and Epping Forest areas we are planning a Camp in Dorset from May 23rd to 26th. Response to this project has been good and the venture could become an annual event.

In conjunction with the London Borough of Enfield we attracted about 200 youngsters to a Reptile and Amphibian Activity Day at the Capel Manor Environmental Education centre and by popular demand we will be once again running a similar event this summer.

Over the next few months I plan to carry out a major review of both the role and workings of the Education Committee. Any member of the Society who is interested in any aspect of the work of the Education Committee is invited to contact me direct – preferably by telephone.

Vic Taylor

EDUCATION – A BRIDGE BETWEEN CAPTIVE BREEDING & CONSERVATION

VIC TAYLOR

Chairman, Education Committee

One view of the BHS is of an organisation whose members are either "Pet Keepers" or "conservationists". Some conservationists may tell you that the pet keeping element has been infiltrated by unscrupulous dealers who are not above breaking the law whilst some "pet keepers" may tell you that the "conservationalists" are secretly working towards a total on their right to collect and keep any herps. It may indeed be that a small minority of our membership do fit into one of the aforementioned steriotypes but the vast, and largely silent, majority are probably both keepers and conservationists. It is the view of the Education Committee that the long term future of the Society could well depend on our being able to come to terms with the "Pet Keeper" v "Conservationist" issue and one of the key messages that we actively seek to put across is that keepers and conservationists can not only live together but fact should have a symbiotic relationship.

Psychologically problems can arise by the use of the emotive terms "Pet Keeper" and "Conservationist" and so the Education Committee is pleased to be able to announce that both terms are now redundant. If you read any copy of our Junior Newsletter you will find reference to "Home" and "Field" herpetologists. Perhaps it is not possible to teach an old dog new tricks but as the present Junior membership graduate up into the main Society they will bring these new terms with them. Both terms are free of any stigma and it is hoped that the positive philosophies and high standards that we try to put across to the J. Herps will ensure that the new terms both carry the seal of general respectability.

Most of our efforts are aimed at one of two major target groups, these being either the general public or BHS membership and in particular the J. Herps.

Contact with the public normally fits into one of four categories these being through talks, exhibitions, activity events and correspondence. Under all of these circumstances it is often possible to positively link home and field herpetology but to do so effecrively one needs to be able to differentiate between conservation and animal welfare problems.

Contact with the J. Herps is maintained through the pages of the Junior Newsletter and also by way of letters, telephone calls, and meetings. The latest J. Herp meeting was our first residential camp held under canvas near Swannage. During this camp we managed to devise a programme which included elements of both home and field herpetology. All of our common species, together with some of our rare, were photographed in the wild during this extended weekend which included a guided tour by the local N.C.C. Warden and a behind the scenes look at the "World of Nature" in Poole.

In many instances the Education Committee sees its role within the Society as overlaping that of both the other Committees; we are not territorial however and hopefully look forward to many years of working with both for the benefit of all.

REPORT OF THE 1987 JOINT MEETING OF S.S.A.R., H.L. and C.H.N., HELD IN VERACRUZ, MEXICO

PAUL A. VERRELL

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One of the perks of working in an academic environment (and there aren't that many of them) is having the opportunity to attend scientific meetings in faraway, exotic places. In 1987 (9-15th August), the two major North American herpetological societies (the Society for the Study of Amphibians and Reptiles, and the Herpetologists' League) joined with the National Herpetological Society (Comite Herpetologico Nacional – CHN) of Mexico to hold a combined Meeting in the seaside town of Veracruz, on the Gulf of Mexico. This was the first time that the two "gringo" societies had held their Meetings beyond the U.S. border; most, if not all, of those present in Veracruz were not disappointed that a precedent had been set!

Mexico is not only an aesthetically beautiful country, but it is also a positive herpetological paradise. Fortunately, the sun, sea and herptiles did not detract from the scientific aspect of the Meeting. Not surprisingly, the Meeting had a decidedly Neotropical flavour, with close to one half of all papers and posters concerned with the biology of herptiles of this biogeographical region (many such papers were actually presented in Spanish). Old World amphibians and reptiles were not very well represented in Veracruz.

No special symposia were scheduled for this Meeting, but the paper sessions varied greatly in scope and included the following:

1. Anuran ecology and reproduction
2. Tadpole biology
3. Salamander population biology and reproduction
4. Crocodile biology
5. Chelonian ecology and reproduction
6. Lizard ecology and reproduction
7. Snake ecology, feeding and reproduction
8. Population genetics
9. Phylogeny and taxonomy
10. Embryology, morphology and physiology
11. Distributional herpetology (especially of Mexico)

Fortunately, the local organizing committee had not forgotton that the nights can be long after days spent in the lecture theatre. Our entertainment needs were more than adequately

satiated by a cheese and wine party, an auction of various herpetological paraphernalia, a chile con carne barbecue and a seafood banquet with a folk ballet. All of these events were accompanied by a seemingly endless supply of Mexican wine, beer and tequila (at the start of the Meeting, a swimming pool was filled with bottles of iced beer; by the end of the Meeting, the pool was empty).

As one who had never previously ventured further south than the northeast corner of Alabama, the faunal richness of Mexico (even in the vicinity of my hotel room) was inspiring. Pelicans, frigate birds, boat-tailed grackles, whiptail lizards and iguanas seemed to be almost everywhere. Unfortunately, so were masses of tiny flies whose bites provoked a great deal of itching (not made any easier by the heat and humidity). Those herpetologists brave enough to venture onto the Mexican roads took advantage of field trips to both high and low elevation sites in the Veracruz area. They were rewarded by seeing some of the native frogs, salamanders and turtles. It can only be hoped that the success of the Veracruz Meeting will spur the officers of the participating societies to organize future gatherings in interesting places.

Ed. note. The 1989 joint annual meeting of HL/SSAR will again be held outside the USA in Canterbury, UK, as part of the World Congress of Herpetology (1988's will, however, be held in the USA at Ann Arbor, Michigan). It will be the first HL/SSAR meeting to be held outside the New World.

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MIDDLE PLEISTOCENE HERPETOLOGICAL RECORDS FROM INTERGLACIAL DEPOSITS AT SUGWORTH, NEAR OXFORD

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INTRODUCTION

Few herpetological species have been recorded from Cromerian (Middle Pleistocene: Interglacial) deposits (Stuart, 1979, 1982; Holman, Clayden and Stuart, 1987). Thus, the identification of herpetological remains, two representing the exotic species *Rana arvalis arvalis* Nilsson, from a cromerian site near Oxford should be recorded. These specimens were collected by Dr. A. J. Stuart of the Castle Museum, Norwich. Dr. J. Clack of the University Museum of Zoology, Cambridge, kindly arrangd for me to study the specimens in Cambridge in August, 1986. I gratefully acknowledge these people as well as United States National Science Foundation Grant BSR-851-5665. Specimen numbers refer to the University Museum of Zoology, Cambridge (UMZC).

THE SUGWORTH SITE

The Sugworth fossiliferous channel fill has yielded a moderate number of Cromerian vertebrates, mainly of small size (Stuart, 1980). The site is about 4 kilometers east of Abington, Berkshire about 1.5 kilometers west of the River Thames. Unfortunately, the deposits now are buried beneath concrete in the sides of a cutting for the A 34 by-pass (Shotten et al., 1980). The site represents a series of Pleistocene channel fills into the Jurassic Kimmeridge Clay. The channels appear to represent an old meandering channel of the Thames that was much larger than the modern one (Briggs et al., 1980). The main channel fill was the only one that produced fossils. It was about 180-200 meters wide and up to 5 metres deep. It was made up of organically rich silts and sands, trending laterally into sands and gravels and upwards into about 0.5 metres of yellowish silty clay. The organic deposits were rich in plant macrofossils, pollen, freshwater moluscs, beetles, and vertebrates. The dating evidence is summarized in Shotten et al., (1980).

The herpetological material reported on here was collected by Dr. A J. Stuart from the main channel exposure. Fifteen samples of about 20 kilograms each were taken from horrizons A-E (A being the lowest). The position of these samples in the section are given in Shotten et al. (1980, fig. 4). Fossils were taken by using a 1 mm. wet sieve and by drying and sorting the materials from the concentrate. Important fossil publications from the Sugworth site are Gibbard and Pettit (1978) plaeobotany, Osborn (1980) beetles, Gilbertson (1980) molluscs, Robinson (1980) ostracods, and Stuart (1980) fishes, *Rana* or *Bufo,* cf.*N. natrix*, and mammals.

HERPETOFAUNAL SPECIES

Class Amphibia

Order Caudata

Salamander Indeterminate

Material.– A. T. Stuart Collection UMZC: SG 465, a limb fragment from Sample D 16. I am unable to identify this fragment to family or genus, but it does not appear to be *Triturus.*

Order Anura

The following identifications are from material listed by Stuart (1980) as "*Rana* sp. and/or *Bufo* sp., frog and/or toad".

Indeterminate Anuran Fragments

Material.– A. T. Stuart Collection UMZC: SG 58, a humeral fragment from Sample B2; SG 59, a humeral fragment from Sample B2; SG 60, a humeral fragment from Sample B2; SG 431; a humeral fragment from Sample B2; SG 431, a humeral fragment from Sample D4; SG 355, a partial radioulna from Sample C7; SG 371, a partial radioulna from Sample C9.

I am unable to assign these elements to family or genus.

Family Ranidae
Rana sp. indet.

Material.– A. T. Stuart Collection UMZC: SG 646, a fragmentary ilium from Sample B18. This bone is too incomplete to identify to species. The genus *Rana* may be distinguished from other European genera on the basis of the ilium. In *Rana* there is a well developed, thin ilial blade (vexillum of Böhme, 1977) that is absent from other European genera (Fig. 1).

Rana arvalis arvalis Nilsson

Material.– A. T. Stuart Collection UMZC: SG 190, right ilium from Sample B3; SG 647, left ilium from Sample B18. The ilium of *R. a. arvalis* is diagnostic at the subspecific level (Böhme, 1977, p. 295, Fig. 9d). The ilium of *R. a. arvalis* differs from *R. temporaria* and *R. graeca* in having a much better developed ilial blade (vexillum). The ilium of *R. a. arvalis* may be distinguished from the "water frogs", *R. ridibunda, R. "esculenta"*, and *R. lessonae*, in having a much more slender junctura ilio-ischiadic (Fig. 1). Finally, *R. a. arvalis* may be distinguished from *R. dalmatia* and *R. latastei* in having the dorsal border of the ilial blade (vexillum) sloping downward rather than upward from the tuber superior (Fig. 1).

This species does not occur naturally in Britain today, but occurs on the continental coast adjacent to England (Arnold and Burton, 1980, fig. 37, p. 258). *Rana a. arvalis* has also been reported from the late Pleistocene (Ipswichian:Interglacial) of Swanton Morley, Norfolk, (Holman, 1987) and from the middle pleistocene (Cromerian:Interglacial) of West Runton, Norfolk, (Holman, Clayden, and Stuart, 1987).

Class Reptilia
Order Squamata
Indeterminate Snake Vertebra

Material.– A. T. Stuart collection UMZC: SG 430, a fragmentary vertebra from sample B18. I am unable to identify this fragmentary snake vertebra to family or genus. I was unable to locate the two vertebrae that Stuart (1980) referred to as cf. *Natrix natrix*.

COMMENT

The presence of *Rana arvalis arvalis*, a continental form that does not occur in Britain today, from the middle Pleistocene (Cromerian: Interglacial) is of considerable interest, but not unexpected, as this species has been reported from two other British Pleistocene interglacial sites (Holman, 1987; Holman, Clayden and Stuart, 1987). Britain was part of the European continent during the times *R. a. arvalis* has been reported as a fossil (Cromerian twice, Ipswichian once) and the climate must have been at least as mild as it is today during the time these fossil frogs lived.

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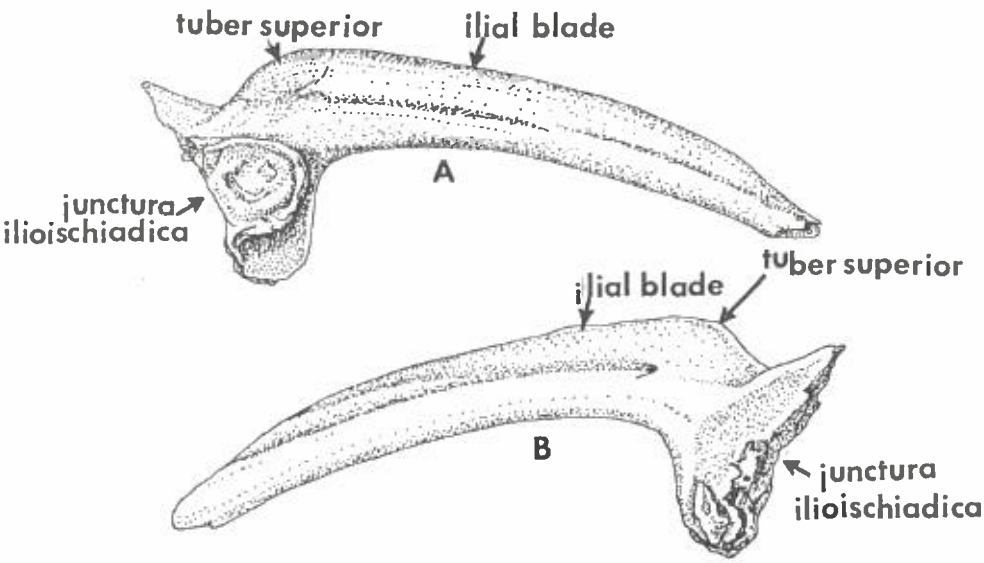

Figure 1. Generalized ilium of *Rana* (drawn from *Rana ridibunda* Michigan State University Museum Number 3881 by Rosemarie Attilio) to illustrate the terminology used in the identification of *Rana* sp. indet. and *Rana arvalis arvalis* Nilsson. A, lateral view; B, medial view.

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HERPETOFAUNA OF THE CHILKA LAGOON, ORISSA, INDIA

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SUMMARY

Seventeen species of reptiles and six species of amphibians are reported from the Chilka lagoon, Orissa, India. Brief comments on the habitat and behaviour of the animals in the field where possible are given.

INTRODUCTION

No research has been reported on the herpetofauna of the Chilka lagoon since the pioneering investigations by Annandale (1915) probably because the Indian herpetologists thus far paid little attention to the estuaries. Availing myself of the upsurge of renewed interest in the fauna of the lagoon generated by the multidisciplinary Chilka Lagoon Expedition taken up by the Estuarine Biological Station, Berhampore, I carried out extensive investigations in the waters of the lake at all depths, in the hills, and on the several islands dotting the lake, with herpetology as my primary objective.

Lake Chilka (Fig. 1) is a unique and well known brackish water body on the east coast of India, covering an area of 1165 sq. km. of Puri and Ganjam Districts of the State of Orissa. The pear-shaped lake is connected to the Bay of Bengal at its northeast and is subjected to tidal fluctautions. It receives water from the river Daya, one of the branches of the river Mahanadi, and also from several small local streams. The south and west portions of the lake bounded by hills. There are a number of islands covered with semi-deciduous tropical plants and scattered bushes. The depth of water ranges from 0.5m to 3 m and the salinity also varies in different portions of the lake.

Since a definitive herpetology of the Chilka lagoon must await more complete zoological exploration, the present paper, which comprises the results achieved so far, is aimed at updating our knowledge and providing a tentative inventory of the reptiles that I encountered and collected in the area.

METHODS AND LOCALITIES

The areas of the lagoon I visited were covered from bases in three camps viz. Rambha, Barkul, and Satpara, which are ideally located on the edge of the lake and where there are facilities for accommodation and cruising the lake by motor or country boats. I collected especially from four biotypes: the lake, the shoreline, the hills and islands. Furthermore I covered the major islands on foot for rare and interesting species. Local fishermen greatly helped me in augmenting the collections especially the ophidians, including the venomous varieties.

SPECIES ACCOUNTS

Included herein are seventeen species of reptiles and six species of amphibians. Of the reptiles, 3 species belong to *Gekkonidae,* 3 to *Agamidae,* 1 to *Scincidae,* 2 to *Varanidae,* 1 to *Typhlopidae,* 1 to *Acrochordidae,* 4 to *Colubridae,* and 2 to *Hydrophiidae.* As to the amphibians 4 species belong to *Ranidae* and one each to *Bufonidae* and *Rhacophoridae.*

Amphibia
Anura
Ranidae

Rana cyanophlyctis Schneider 1799
Skittering Frog

Found in the mid waters of the lake and also in the muddy pools on the edge. This frog is well known for its tolerance of salinity and has even been observed to breed in brackish water. Both juveniles and adults were taken from swamps and marshy areas.

Rana limnocharis Gravenhorst 1829
Southeast Asian Paddy Field Frog

Fairly common on the edge of the lake but far away from the water. Mostly juveniles were taken from the cultivated fields.

Rana breviceps Schneider 1799
Indian Burrowing Frog

A large frog, shy and solitary in habits. Found only among thick bushes. Probably introduced recently by human agency. Two adult specimens were taken from a well on the shore of the lake near Rambha.

*Rana breviceps*Schneider 1799
Indian Burrowing Frog

A burrowing frog with a toad-like body and an enlarged inner metatarsal tubercle which is used as a "shovel" for digging. One juvenile was picked up from a rain-soaked paddy field on the shore at Chatnagarh village near Barkul. A rare species.

Bufonidae

Buffo melanostictus Schneider 1799

Found in the cool, shady culvert alongside the Samal Island, off Rambha. One adult male was captured at night from the foreground of Pantha Nivas, Rambha.

Rhacophoridae

Rhacophorus leucomystax Gnavenhonst 1841
Common Tree Frog

One specimen found crawling on the wall of the dining hall in the premises of Pantha Nivas, Barkul was collected.

Reptilia
Sauria
Gekkonidae

Hemidactylus brooki Gray 1845
Spotted Indian House Gecko

Found under stones on the edge of the lake near Barkul. The commonest house-gecko found living in the buildings located on the edge of the lake.

Hemidactylus frenatus Schlegel 1836

South Asian Waif Gecko

Although it is a domestic gecko living in association with the preceding species, I collected it from a coconut tree adjoining the shoreline at Barkul.

Hemidactylus leschenaulti Dumeril & Bibron 1836
Bark Gecko

Despite its common name this gecko is found at home both in the areas inhabited by humans and outskirts. A fairly large individual was picked up from the open space near a lake at Barkul.

Agamidae

Sitana ponticeriana Cuvier 1844
Fan-throated Lizard

The only Indian lizard with four toes. Several juveniles were seen running on the ground near Kavutakuda on way to Satpara. They became very agile and alert on approach. A couple of specimens were, however, captured but not before giving them a hot chase.

Calotes versicolor (Daudin) 1802
Indian Garden Lizard

Occurs in fairly large numbers. A diurnal, arboneal lizard commonly seen among bushes of the islands and along the shoreline.

Psammophilus blanfondanus (Stoliczka) 1871
Dwarf Rock-Lizard

A typical lizard of the hills of peninsular India. Recorded for the first time from the Ghantasila Hill and Bird Island of the lagoon. The specimens I saw were basking in the midday sun at 13 hrs and were very alert and quickly escaped into rock crevices on approach. Some of the adults which were recognised easily as breeding males because of their swollen and blood-red cheeks were captured after chasing them in their habitat – the barren boulders of the Bird Island.

Scincidae

Mabuya carinate (Schneider) 1801
Common Skink
A diurnal lizard and a ground-dweller. Found both in the populated and forested areas. One large individual was seen on the steps of the Pantha Nivas, Barkul but it escaped quickly into the leafy litter in the adjoining garden.

Varanidae

Varanus bengalensis (Daudin) 1802
Common Indian Monitor

Not uncommon among the bushes on the shoreline and on the stony beaches of the islands. A baby monitor was picked up from a rocky outcrop in the Samal Island. Quite surprisingly the lizard offered no resistance while captured, probably because it was in a state of torpor. One large individual was found crossing the path in its leisurely gait near a swamp but unfortunately escaped into the dense vegetation on the Naupada Island.

Varanus salvator (Laurenti) 1768
Water Monitor

The largest lizard of India and a strictly protected animal. An adult was seen quietly surveying the scene of the lake from a huge boulder near the INS Chilka. The lizard became very alert and quickly retreated down amongst the rocks soon after our boat turned in its direction. This is the first report of the lizard's occurrence in the lagoon.

Serpentes
Typhlophidae

Typhlops acutus (Dumeril & Bibron) 1844
Beaked Blind Snake

One specimen was picked up as it crawled on the ground at midday at Kalijugeswar Hill near Balugoan. An interesting addition to the ophiofauna of the lagoon.

Acrochordidae

Chersydrus granulatus (Schneider) 1799
Indian Wart Snake

Incredibly numerous in the lake and can be expected with each haul of the fishing nets. Fishermen brought us several examples daily at every camp. Rarely seen during the day except when it rises to the surface to breathe. The snake is mainly a fish-eater and is inoffensive. On one occasion I saw a seabird, the White-bellied Sea Eagle *(Haliaetus leucogaster)* preying upon the Wart Snake, probably picked up from the lake near Maltikuda Island.

Colubridae

Dendrelaphis tristis (Daudin) 1803
Common Indian Bronzeback

Identified on the basis of the sloughed skin of the snake which was intact with details of scalation. Rediscovered after a lapse of nearly seventy years.

Xenochrophis piscator (Schneider) 1799
Checkered Keelback

The common water snake of India. Found in the lake and along the shore. I saw several individuals in the deep portions of the lake also.

Ehydris enhydris (Schneider) 1799
Smooth Water Snake

One example was picked up from the muddy edge of the lake at Ghodadowda village. A thoroughly aquatic snake frequenting rivers, estuaries, lakes, marshes and probably rain – soaked fields, but seems to be rare. An interesting addition to the ophiofauna of the lake and also the first documented record of its occurrence from the study area.

Cerberus rhynchops (Schneider) 1799
Dog- Faced Water Snake

Very common in the lake and along the muddy shoreline. Particularly abundant in the swamps and in portions of the lake which are heavily fished. Smith (1943) considered such an abundant species as 'rare on the coasts of India'. Whitaker (1969) and Murthy (1970) have commented on the widespread prevalence of this snake on the coasts of India. Both juveniles and adults were collected for comparative study.

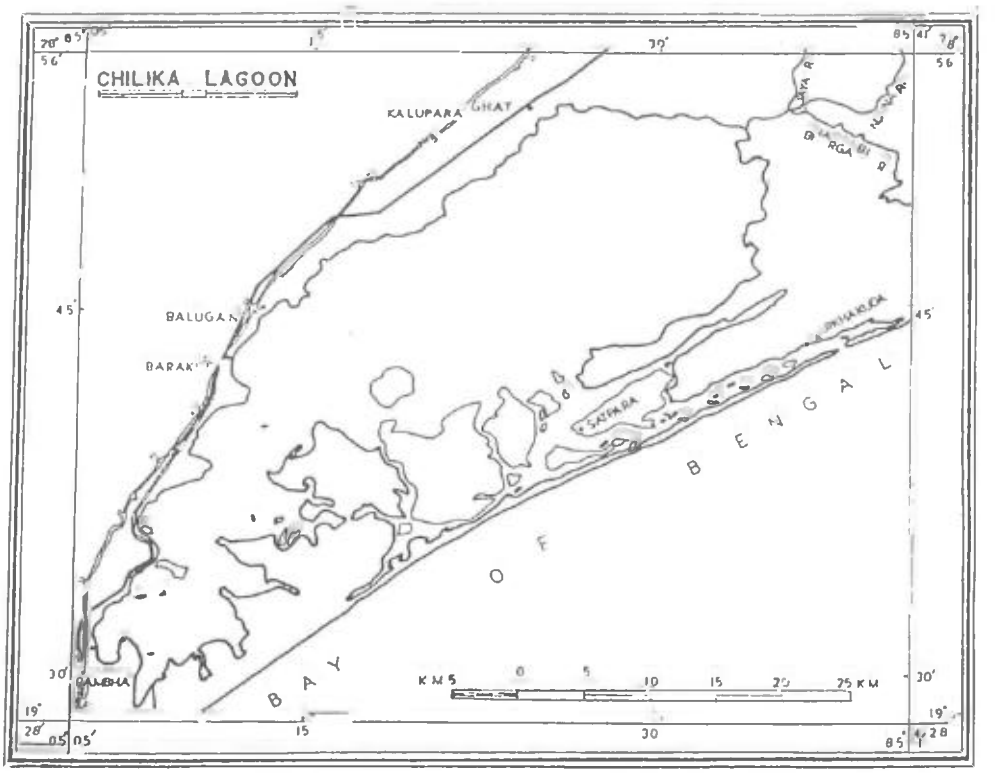

Fig. 1. Map of the Chilka Lagoon

Hydrophiidae

Enhydrina schistosa (Daudin) 1803
Beaked Sea Snake

Two specimens – one juvenile and one adult – were picked up from the fishing nets operated at Rambha Bay and Barkul. This is a common sea snake which enteres the estuaries freely but Annandale (loc. cit.) failed to secure one. Smith (loc. cit.) made no mention of the likelihood of the snake's occurrence in the estuaries. However, Murthy (1977) recorded it from various estuaries. It is the snake much feared by fishermen who call it 'Dusta sarpa' in Oriya which means a very bad snake, and they are apparently justified.

Hydrophis obscurus Daudin 1803
Estuarine Sea Snake

Fairly common. Specimens caught and examined are devoid of encrustations of hydroids and barnacles which are so characteristic of other marine snakes. Annandale (loc. cit.) rightly described this sea snake as 'mainly, if not exclusively, an estuarine form'. Fishermen appear to have no apparent fear of this sea snake because of its mild disposition, despite the toxicity of the venom.

DISCUSSION

The only species that is most unlikely to be met with is the crocodile *Crocodylus palustris*. This limbless skink *Barkudia insularis* which was first collected from the Barkuda Island to be described as new to science seems to have become extremely rare in the type-locality, if not extinct. Among the other saurians found in the lagoon, a special and note-worthy record is of the Dwarf Rock-Lizard *Psammophilus blanfordanus*. The mud turtle *Lissemys punctate* is reported from the lake but I failed to secure a specimen, although some fishermen tried to convince me of their occasionally trapping it.

Snakes, however, are a conspicuous and major component of the vertebrate fauna throughout the breadth and length of the lake and their sheer abundance cannot fail to delight any herpetologist. I had assembled enough evidence to convince me that the Little File Snake *Chersydrus granulatus* is the most dominant species followed by the Sea Snake *Hydrophis obscurus,* the Dog-Faced Water Snake *Cerberus rhynchops,* and the Checkered Keelback *Xenochrophis piscator,* in that order. The sea snake *Enhydrina schistosa* is not frequently found while the Smooth Water Snake *Enhydris enhydris* seems to be rare.

ACKNOWLEDGEMENTS

I thank the Director, Zoological Survey of India and Dr. K.V. Ramo Rao, Coordinator, Chilka Lagoon Expedition for encouragement. Mr. P. Verma, Photographer of the Estuarine Biological Station, Zoological Survey of India, Berhampore, took photographs of some snakes collected by me in the field.

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MORE OF THE HERPETOFAUNA IN THE COMMONWEALTH (ETHIOPIAN ZONE)

M. R. K. LAMBERT (Chairman, BHS)

This article has been developed from some slides shown at the end of the 39th AGM on March 18th 1986

The African Continent and Indian Ocean Islands include several Commonwealth countries (listed in full in the 118th (1986) Edition of *Whitaker's Almanack)* and constitute zoogeographically the Ethiopian zone. Darlington (1757) defined the Ethiopian zone as Africa, less its north-western corner, and optionally southern Arabia. However, many Western Palaearctic species penetrate northern Africa so that the Sahara Desert, stradling the boundary of the two zones, in effect forms a barrier to faunal exchange, but with the Nile Valley as an escape valve for some subSaharan, Ethiopian forms to extend northwards.

Apart from a private first visit to the Seychelles Islands and neighbouring Africa in 1970, HMG's Overseas Development Administration (ODA) has provided me with the opportunity since 1977 to visit several of the countries of eastern and southern Africa, primarily to investigate the biology contributing to the control of several insect crop pests. As at the 38th AGM of the BHS in 1985 (Lambert, 1985), slides shown hopefully gave an idea of the range of amphibians and reptiles that one might casually observe during cursory inspections of their habitats and, without undue skill or expertise, have the chance to photograph. The herpetology in general of the countries visited is also considered here.

INDIAN OCEAN ISLANDS

Seychelles (October 1970)

The Seychelles became an independent mmember of the Commonwealth in 1976. But in 1970, there was no airport on the main island of Mahe and the islands were still a British Colony with a Governor, at that time HE Sir Bruce Greatbatch. An earlier Governor, Sir John Thorp, coined the early description of the islands as being "1000 miles from nowhere"! Sadly, he drowned on the Seychelles in the 1950s at Grand Anse when saving his two children from a dinghy that had been taken by a current out to sea. Earlier, in the 19th century, General Gordon, later of Khartoum, visited these granitic islands and was so impressed that he described them as the original Garden of Eden. This thought was perhaps invoked by the curious and rather pudendoid or 'venusian' – looking female nut-seed of the endemic coco-de-mer tree *Lodicea maldavica),* whose double coconut is the largest seed in the world, and the rather phallic appearance of the male cone or inflorescence, the species being dicecious; reminiscent perhaps of Adam and Eve! The coco-de-mer trees grow in a tall forest in the Valfee de Mai on Praslin, making up one of the Mahe group of islands. Port Victoria, the capital on Mahe, could, in 1970, only be reached by ship from Mombasa in Kenya or from Karachi or Bombay on the Indo-Pakistan subcontinent. From "East Africa", the crossing involved four days of wallowing across the Indian Ocean. The voyage of the B & I Line ship took in Durban – Lorenço Marques (now Maputo) – Dar es Salaam – Mombasa – Port Victoria – Karachi – Bombay, giving some idea of the cross-section of passengers also travelling Bunk Class! Nowadays, swelled by package tourists bringing in hard currency, there are direct flights from London on Tuesdays.

One's first sight of the Seychelles from an eastbound ship is in the westernmost island of Silhouette, appropriately named as it arises above the horizon, capped with its characteristics greyish-white whig of clouds. Anchored off Port Victoria, a tender took the passengers to the quay of the small capital town, with its bustling local market of fish and brightly coloured tropical vegetables. Port Victoria even boasts a botanical garden.

Aldabrachelys (Geochelone) gigantea or ***Dipsochelys elephantina*** (Bour, 1984) – several giant tortoises were kept in an enclosure in the botanical garden. They were frequently chastised by children riding piggy-back on them. These tortoises had been brought to Mahe from Aldabra

Atoll in the south where a recent census (Bourn & Coe, 1978) has estimated the population at around 150,000. The tortoises have also been introduced to other islands, sometimes experimentally and for exhibition purposes in the Seychelles (e.g. Curieuse and Frigate Is).

Mabuya sechellensis– the endemic Seychelles skink is very abundant and seen active all over the Mahe and Praslin groups of islands. It scuttles over and amongst the half-buried granite boulders strewn with a tangle of tropical creepers and other vegetation. Honegger (1966) produced the first comprehensive survey of herpetofauna, but, in a useful chapter of a book, Cheke (1984) reviews our knowledge of the lizards on the Seychelles, drawing together information based on several collections and from a range of recently published papers.

Mabuya wrightii– a bigger skink than *M. sechellensis,* its presence on the islands correlates well with the absence of rats. It is also associated, as a scavenger, with sea bird colonies, like *M. sechellensis,* and quantitative information has been produced for Cousin I. (where there is a permanent warden and field station) which gives populations of 50,000 and 20,000 for *M. sechellensis* and *M. wrightii,* respectively. The density of *M. sechellensis* is up to 3600 ha^{-1} and for *M. wrightii* 1300 ha^{-1}.

Ailuronyx sechellensis – a large endemic gecko, which is only common on rat-free islands. Together with *M. sechellensis* at 20 g each (72 g ha^{-1}) and *M. wrightii* at 80 g each (104 g ha^{-1}), the 225 ha^{-1} for *Ailuronyx* (34 g; 7.6 g ha^{-1}) adds up to a remarkable lizard biomass supported by the sea bird colony of 184 kg ha^{-1}! On Aldabra Atoll, by way of comparison, giant tortoises range from 35.5 to 583.5 kg ha^{-1} on Grande Terre or South Island (Coe et al., 1979), a mean of 353.9 kg ha^{-1}.

An identification key to the geckos of the Seychelles has recently been published by Gardner (1985), who gave an account of the herpetofauna in general at the BHS meeting in February 1986 (Gardner, 1986). The best known of the Seychelles island lizards are probably the green day geckos of the genus *Phelsuma.* Previous attempts have been made to classify this genus (e.g. Loveridge, 1942; Mertens, 1962, 1966), but since these are best understood when alive in their full bright green colouration (unlike discoloured museum material), Cheke (1982) has successfully re-appraised their taxonomy.

Phelsuma sundbergi – a Seychelles endemic, the nominate subspecies occurs on Praslin and other of the north-west granitic islands of the central Seychelles group and is the biggest (snout-vent length 75-95 mm), and was seen abundantly on forest trees and in coconut plantations. *P. s. longinsulae* (snout-vent length 55-68 mm) was seen in houses on Mahe, while *P. s. landiguensis* (snout-vent length 60-78 mm) occurs on La Digue and other of the north-eastern granitic islands, and was seen near the island's government rest house.

Phelsuma astriata – the other species of green day gecko on the Mahe and Praslin groups of islands. The nominate subspecies occurs on Mahe and Silhouette, and is abundant on forest trees, coconut plantations and bananas. It is a smaller species than *P. sundbergi* and separated from the other species by keeled scales on the chest and at least the anterior of the belly. *P. a. semicarinata* was photographed on a banana plant on Praslin and it also occurs on La Digue, where it is abundant on trees, rocks and in houses, several individuals remaining active after dusk catching insects from around the light of a naked veranda bulb in the guest house. Gardner (1984) has considered the biology of this species and *P. sundbergi* in more detail.

Gehyra multilata – a nocturnal gecko, introduced, and together with *P. a. semicarinata,* was on the ceiling above the naked light bulb of the Rest House veranda on La Digue. It is a common gecko that is usually associated with houses and is grey-pink in colour.

Scelotes gardineri – finally of the lizards (not photographed), a single individual of this species of litter dwelling skink was observed one morning at the edge of the track near the summit of La Digue.

Chelonia mydas – the green turtle. A tethered individual that had been speared was seen lying upside-down at the bottom of the small motor launch which returned one from Cousin to Praslin. The species is now protected in the Seychelles.

Ptychadena mascareniensis – of the amphibia, the Mascarene frog has been introduced to the

Seychelles from the African mainland. An individual was caught and photographed at the end of the climb down from the Morne Seychellois. It was observed jumping amidst thick grassy vegetation.

Sooglossus sechellensis – a small frog, probably this endemic species, was caught on the Morne Seychellois mountain, which is normally, and was when visited, covered by cloud. The frog was on the heavy mossy layer that develops amongst the exposed roots and bases of low trees in the mist. It is a member of the *Sooglossinae*, a group of frogs unique to the Seychelles.

Hypogeophis rostratus – the Seychelles are one of the few places in the world where caecilians (Apoda – limbless burrowing amphibia) are common and successful. Two specimens of probably this, the commonest, species were caught in a lowland roadside stream near the Vallee de Mai on Praslin. Superficially very like an earthworm, the larger, a 150-mm long, individual was found under a half-submerged slab of rock. The few specimens collected on the Seychelles, including a number of *Scelotes* skinks passed over by Malcolm Penny (then Warden on Cousin), have been deposited in the BM(MH) spirit collection and the *Phelsuma* and other lizards were used by Anthony Cheke for his research interests (Cheke, 1984).

Mauritius (May 1981)

Mauritius is another island further south than the Seychelles in the Indian Ocean, and an independent member of the Commonwealth since 1968. Like the Seychelles, Mauritius was under French occupation until 1810. The island enjoys a sub-tropical maritime climate, but is subject to cyclones which hit the island at irregular intervals with demonic force between January and March. Sugar cane cloaks the island wherever the land is flat. Rats have devastated the herpetofauna, except on Round Island to the north-east. Here, the skink, *Leiolopisma telfairii,* and gecko, *Phelsuma guentheri,* survive in quite large numbers together with a species of boa. Both lizards have been captive-bred in Jersey Zoo. (Bloxam & Tonge, 1980; Tonge, 1985) and Gerald Durrell provides an entertaining description of their first capture in *Golden bats and pink pigeons* (1977). In fact, both he and his wife, Lee, together with his assistant, John Hartley, were on Mauritius in May 1981, and later that year, in October, John Hartley talked about their expeditions to Mauritus at a BHS meeting. These two lizard species are in effect ecologically equivalent to *Mabuya wrightii* and *Ailuronyx sechellensis* on Cousin I. in the Seychelles.

Dipsochelys elephantina– several Aldabran giant tortoises, as in the botanical gardens on Mahe in the Seychelles, were being exhibited in an enclosure in the Pamplemousse Botanic gardens. Two other giant tortoise species and other recently extinct reptiles from Mauritius and neighbouring Reunion have been described by Nick Arnold of the BM(NH) (Arnold, 1980).

A further visit to Mauritius is anticipated in 1987 and hopefully this will provide the opportunity to describe the herpetology and herpetofauna in more detail, and outline current activity.

EASTERN AND SOUTHERN AFRICA

Kenya (October 1970 and five subsequent visits, 1977-85)

Back on the mainland of Africa, Kenya, with Nairobi the capital, has been an independent member of the Commonwealth since 1963. Nairobi's Snake Park is situated opposite the National Museums of Kenya off Museum Hill.

Crocodilus niloticus – besides a variety of snake species in vivaria and concrete-lined pits, there was in 1970, and probably still is, a pen with a large shallow concrete pool and wire-netting around containing a single large African crocodile. A notice attached to the netting indicated that "Visitors throwing litter into the crocodile pit will be required to retrieve it". Extraordinarily, the enclosure was remarkably free of rubbish! Such is the reputation of the African crocodile.

Arthur Loveridge was for some years Curator of Reptiles at the Museum and I have outlined his part in the development of herpetology in East Africa previously (Lambert, 1984), together with contributions from some other herpetologists. Dr Robert Drewes, Chairman of the Department of Herpetology at the California Academy of Sciences, who was on sabbatical leave at the University of Oxford in 1985, has also worked on the herpetofauna and collected extensively in northern Kenya and elsewhere in recent years. The resident herpetologist presently at the Museum is Alex Duff Mackay. He has worked recently on the amphibia (e.g. Duf

Mackay, 1980) and collaborated with Miss Alice Grandison at the BM(NH). With his wife, Joy, he has just published (1985) a small (4 x 5¾) handbook *Poisonous snakes of eastern Africa and the treatment of their bites.* The book took shape over many years and is aimed at enabling anyone to identify all the front fanged snakes (also two back-fanged ones known to be very venomous) of tropical eastern Africa. The principal basis for identification is the detailed line drawings of each species together with a brief account of any features which define them. The handbook describes three groups of snakes; I: back-fanged snakes (two species, including the vine snake, *Thelotornis kirtlandii,* whose accidental bite killed the great German herpetologist, Robert Mertens, in 1975); II: snakes with immovable front fangs (ten species, including the cobras and mambas), and III: snakes with folding front fangs (nineteen species, including the puff adder and other vipers). There is a section on the treatment of snake bite and recommendations for a snake bite outfit. I am sure this little book will prove useful, although, of course, one will have to see what happens in practice, especially in the habitats where local people live and snakes abound in eastern Africa. With a simple means of identification, this handbook might go some way towards preventing the wanton killing of "all" snakes, since no naturalist likes to see animals, including venomous snakes, summarily executed as sadly is so often practiced in most parts of the world, even if the main threat to species is really the destruction or irreversible change of habitat.

Tanzania (October 1970 and five subsequent visits, 1977-85)

I have described my herping in Tanzania during a visit in 1983 previously (Lambert, 1984). An earlier visit of much longer duration was made in 1978 (March to May) when a forecasting trap network for the African armyworm moth was set up in the eastern half of the country. Alice Grandison of the BM(NH) had collected in the Usambara mountains before this while based at Lushoto and was taking an interest in the frogs of the gonus *Nectophrynoides,* which are found at high altitudes (above 2000 m). Concentrating on the amphibia, I made a small collection in the Poroto mountains to the south-east of Mbeya and just north of the northernmost part of Lake Malawi. Just 5 km before Isongole, a dirt track going east led into the Rungwe Forest Reserve with mixed pine and deciduous trees. A small toad basking in the diffuse sunshine (it was 9th April and during the long rains) at the edge of a shrubby area in open grassland was collected and later identified as a juvenile *Nectophrynoides vivipara,* the Rungwe viviparous toad (BM 1980:297). It is an arboreal species which, as its name suggests, gives birth to live young, and at about 2500 m was about 6 km west of Mt. Rungwe summit (2961 m).

A further visit was made to Tanzania in November 1985. Journeying overland by Land Rover from Nairobi, across the now-open border at Namanga into northern Tanzania and thence via Arusha (at the foot of Mt. Meru) and Moshi (at the foot of Mt. Kilimanjaro – Africa's highest mountain) to Dar es Salaam (a distance of 913 km), one breaks for a night at Moshi. Departing from Lyamungu Research Station (coffee) the next morning (16.xi), a big, freshly-killed cobra, probably *Naja nigricollis,* lay on the side of the drive. The tarmac road continues through an area of dry country between Moshi and Korogwe formed in the rain shadow on the south-west side of the North and South Pare and Usambara mountains. Almost invariably, one sees a tortoise clicking its way across the road, especially in the vicinity of Same, an area between the North and South Pares.

Kinixys belliana – Bell's hinged tortoise, probably the commonest species of tortoise in eastern Africa. A specimen was photographed 16 km north of Same. In 1978 (19.iii), another adult was seen in almost the same spot (14 km north of Same)!

Geochelone pardalina – the leopard tortoise, two half-grown individuals were seen (19.iii.1978) on the road during a sunny morning after a night of heavy rain 38 km north and 8 km south of Same. About six adults of this same species were also later seen in an enclosure in the Oyster Bay Hotel in Dar.

Bitis arietans – a heavy-bodied puff adder was seen dead (26.xi.85) at the side of a murrem road 38 km north of Kilosa. There was a sisal plantation to either side of the road which at the time was being control-burned. The snake had presumably been flushed out by the fire and killed with a panga by one of the plantation workers.

The short rains broke late in 1985 and during the afternoon just after a very heavy storm

(30.xi), the flooded, near impassable murrem road through savannah country between Morogoro and Kilosa was almost alive with frogs, probably *Rana oxyrhynchus* and *Ptychadena anchietae* jumping in cohorts across unflooded sections. These were followed by their potential food, termites, in flying swarms, their dispersal brought about by the rain. Their fat-filled bodies left opaque oily smears behind the hard-worked windscreen wipers of the Land-Rover which only detergent added to the sprayer water removed.

Psammophis subtaeniatus orientalis – two juvenile southern stripe-bellied grass snakes, one of which was collected (BM 1985: 1270), were found inside and by the bungalow (24.xi) providing a base at Ilonga Research Station, Kilosa. They were identified using FitzSimon's (1980) *A field guide to the snakes of southern Africa,* London: Collins.

Earlier in 1985, Hercules Pakenham drew my attention to his paper (Pakenham, 1983) on the herpetofauna of Zanzibar and Pemba Islands off the Tanzania coast. This is a useful paper worked up over many years, and based largely upon the author's own collecting and observation from 1938 to 1948, supplemented by museum material. Agricultural Officers and the Superintendent of Prisons sent in specimens turned up by their working parties! The author was initially encouraged in this work by no less than Arthur Loveridge.

Malawi (March-August 1977)

Malawi has been a member of the Commonwealth since independence in 1964 and is among the smaller of the countries in Africa. Formerly the Nyasaland Protectorate, the country stretches along the western shore of Lake Malawi; and down the escarpment from the Shire Highlands, the Lower Shire Valley forms a tongue into Mozambique and almost reaches the Zambesi River. Herping expatriates have left their mark, including Sweeney (1961) on the snakes and again none less than Loveridge (1953a, 1953b) on both the amphibia and reptiles from his fifth collecting expedition to Africa. Steward (1967) produced a most useful work on the amphibia and Stevens (1974) published an annotated check list for south-eastern Malawi. Since my visit, Simon Tonge & Morgan (1984) have listed species that they recorded in southern Malawi. While based just off the Blantyre road 13 miles (21 km) from Zomba at Makoka Research Station for six months, I took the opportunity to visit much of the country, although time for making observations on the herpetofauna was limited by involvement with organising the completion of an ODA project on the use of sex pheromones to control the red bollworm of cotton. The rainy season, lasting until early May, was followed by cool weather with occasional Chiperone mists in the Blantyre/Zomba region from damp, warm air from the east rising up the Thyolo Escarpment into the Shire Highlands (1000-1500 m). A small collection was made, concentrating on the amphibia, especially during the rainy season, and notes were taken on the species seen.

Xenopus muellerl – a single individual of Mueller's clawed toad was seen in an ornamental garden pond by Chitipa Inn at Chitipa (formerly Fort Hill) in northern Malawi (5.viii).

Bufo maculatus – this common African toad was frequently seen at Makoka and several were collected (BM 1978: 856-858) by the bungalow used as a base and one on bare ground by an experimental cotton plot with a waterlogged area nearby 1 mile (ca. 21) north of Masawa.

Rana angolensis – eight males of the dusky-throated frog were collected (8.v) in water at the edge of the Mulunguzi Dam on Zomba Plateau at about 2000 m (BM 1978: 839-845). The frogs were basking in the sun (14.30-15.00 h) and jumped into the water upon being disturbed where they could be photographed without difficulty.

Ptychadena oxyrhynchus – a male and two other sharp-nosed ridge frogs were observed (29.vi) jumping into the water or deep grassy vegetation by the side of a small dam at Makoka. One was collected.

Ptychadena chrysogaster guibei – two yellow-bellied ridged frogs were collected in long grass by a stream (BM 1978: 846-847), into which they jumped when disturbed while basking in morning (10.50-11-15 h) sunshine, at Kapalassa Farm, 2 miles (3 km) north of Namadzi (4.v).

Ptychadena mossambica – a specimen of the Mozambique ridged frog (probably this species) was collected with the two *P. c. guibei* above (BM 1978: 848).

Phrynobatrachus parvulus – a small frog of this species was collected (BM 1978: 853) on an area of mud by the water's edge of the small dam at Makoka (28.iii) at night (22.00 h). Other frogs were calling – pink-pink-pink, probably *Arthroleptis stenodactylus*, and urrk-urrk, probably *Hyperolius pictus*, which was collected three days later here. The small lake formed by a dammed stream at Makoka provided irrigation water to areas of crops (maize, bananas) in the vicinity.

Phrynobatrachus moorii – a specimen of this frog was collected (BM 1978: 850) and two more seen at the edge of a field of recently cut grass one morning at 11.30 h (6.iv); Kapalassa Farm, 2 miles (3 km) north of Mamadzi. Two more frogs, probably also this species, were also collected here the next day (BM 1978: 854-855), and also on the bungalow lawn at dusk (17.00 h) two days after rain (30.iv) at Makoka (BM 1978: 851-852).

Arthroleptis stenodactylus – after hearing the common squeaker (probably) in the Makoka dam earlier, an individual was collected (31.iii) on the bungalow lawn at night (21.30 h) with the sky clear and a heavy dew (BM 1978: 849).

Leptopelis angolensis – the Angola tree frog was only seen once. An individual with a bright green dorsum and dark blotches laterally was photographed after being found one morning on the bungalow lawn damp from dew at Makoka (30.iii), and was collected (BM 1978: 867).

Hyperolius pictus – after hearing the call probably of the variable montane sedge frog three evenings earlier, an attempt was made to find the species in the Makoka dam. Three recently metamorphosed juveniles were collected (BM 1978: 859-861) with tails not completely resorbed. The adult had yellow and browny-gold longitudinal stripes on the dorsum, reddish orange line markings on the hind legs, light green between the eyes and yellow vocal saac. Later (23.iv), three more were caught on grass stems by the edge of the dam when heard calling during the day (BM 1978: 862-864).

Hyperolius parallelus albofasciatus – an adult of the white-banded sedge frog was found in a rain gauge supported by a four-foot (118 cm) wooden post on the bungalow lawn at Makoka, resting during the heat of the day (21.v); and individuals on other occasions were collected in the garden (4, 14, 20, 27 and 29.vi, 1.vii), three also in the rain gauge! The dorsum was greyish-white and the undersides of the fore and hind feet, and inner surfaces of the thighs, calves and tarsi of the latter were red (BM 1978: 856-858).

Hyperolius sp. – two froglets with pale brown dorsum and slight hour-glass markings were found at night (20.45-22.00 h) on blades of grass by the Makoka dam (BM 1978: 865-866), but have not been identified.

A few reptiles were also recorded in Malawi.

Pelusios sinuatus – the serrate terrapin; a half-grown individual probably of this species was found on the road between Mangochi and Monkey Bay, Lake Malawi, by an American biologist visiting the lake with his family who was working at Chancellor College (University of Malawi) in Zomba. He kept the creature in a small vivarium.

Kinixys belliana – an individual of Bell's hinged tortoise was kept in a large wired enclosure attached to the house of Kapalassa Farm, not far from Namadzi. The animal had been found by a local Malawian. Tortoises are seldom seen in Malawi for they are eaten. A colleague also recently saw a full-grown individual (2.iii.1986) on the road 15 km north-west of Mangochi.

Hemidactylus mabouia – the common house gecko was seen in the eaves of the bungalow veranda at Makoka (30.iv) and was collected (BM 1978: 873).

Hemidactylus platycephalus – this common gecko was caught on the ground amongst leaves from a grove of trees by buildings (8.viii) about 400 m from the shore of Lake Malawi at Karonga in the north of the country.

Lygodactylus capensis – a single Cape dwarf-gecko was found in the rain gauge (23.iv) on the bungalow lawn at Makoka where four *Hyperolius parallelus albofascinatus* were found on other occasions (BM 1978: 874).

Agama kirkii – Kirk's rock again, several, probably of this species, were seen on rocks by

Otter Bay, near Cape Maclear, Lake Malawi (19.vi) and again on boulders by the Livingstone (Kapuchiri) Falls of the Shire river as it flows down the escarpment in the Majete Game Reserve (18.vii).

Chamaeleo dilepis – a single flap-necked chameleon was caught on the branch of a tree by one of the field officers of Makoka Research Station just by an experimental field cage (18.v). Another individual was also once seen on the road between Zomba and Liwonde. It is a common African species and has been used as the logo for the first World Congress of Herpetology (1989).

Mabuya quinquetaeniata – a rainbow rock skink was caught on the floor of a laboratory at Makoka (24.iv). The tail was blue in colour (BM 1978: 875) and the body with pale stripes.

Mabuya striata – the common striped skink is often seen by and on buildings. One was caught on a laboratory outside wall at Makoka (25.iv) and collected as an example (BM 1978: 876).

Mabuya varia – the variable skink, another common skink in eastern Africa, an individual was collected (21.iii) after being seen in a patch of grass between maize and cotton plots at Mfumba Farm (Admarc Estate), Lunzu, 10 miles (16 km) north of Blantyre (BM 1978: 877).

Varanus niloticus – the Nile monitor. A big individual was disturbed amongst the rocks by Otter Bay, near Cape Maclear, Lake Malawi (19.vi). It crashed through the bushes and dived with a noisy splash into the lake. Another big animal behaving in a similar way was seen the same afternoon on Mumbo I. (also known as Elephant I.), 5½ miles (9 km) offshore from Cape Maclear.

Typhlops schlegeli dinga – the Zambesi blind snake, normally subterranean and typically occurring in this part of Africa, was found (8.iv) on the open surface of a muddy path through a grassy area one morning (09.45 h) at Makoka and a half-grown specimen later, at night (19.50 h), on the bungalow lawn (BM 1978: 880-881). The weather was dry, there had not been rain for 11 days.

Natriciteres olivacea – olive marsh snake, a dead snake of probably this species was on a track at Makoka (20.vi) not far from the dam. A very damaged specimen, just recognizably of the same species, had been found in nearly the same spot two and half months previously, and another, a road-kill, by the side of the main road 7 miles (11 km) kwest-north-west of Liwonde (24 miles (38 km) kfrom Zomba) not far from marshy ground (18.vi).

Lamprophis (or Boaedon) fulliginosus – two juveniles of the common house snake were seen by the side of the bungalow veranda at Makoka.

Dendroaspis angusticeps – the green mamba, one half-grown individual was seen on the zomba Plateau (1500-2000 m) on a track that proceeded through mixed coniferous and broad-leaved forest (7.viii). It is essentially an arboreal species and bright leaf green in colour. The venom is barely half as toxic as the black mamba's.

Bitis arietanas – the puff adder, an individual was seen on a murrem road passing through the Wallace Estate, 3 miles (5 km) south-west of Thondwe (13.vi). It was lying on the warm road at dusk (18.00 h) when the air was only 16°C. As still as a log in the poor light of dusk, it was stepped over and promptly arched its neck ready to strike! This snake was reported to be abundant on the hillside by the Thondwe women's seminary! It is treated with much "respect" by local Malawians. Another big individual was later seen (18.viii) dead by the side of the road just outside the town of Karonga in northern Malawi. It is a common snake in eastern Africa.

A visit was made one weekend to Mulanje Mountain (11.12.vi). On the Lichenya Plateau (1200-1600 m), small green lizards which could not be identified were seen on rocks and several large tadpoles, probably of *Arthroleptis stenodactylus,* were to be seen in small pools of streams.

Material collected has been deposited in the BM(NH) collection, the first collection from Malawi since material was received in exchange from Arthur Loveridge of the Agassiz Museum at Harvard University, and I am grateful to Alice Grandison for identification of the amphibia.

Zimbabwe (June-July 1981)

Formerly Southern Rhodesia and then simply Rhodesia with the independence of Zambia (Northern Rhodesia) in 1964, Zimbabwe became an independent member of the Commonwealth as recently as 1980. The leading herpetologist in Zimbabwe, even southern Africa, is undoubtedly Dr Donald Broadley (BHS Honorary Life Membere 1983), who is Curator of Herpetology of the National Museums and Monuments, situated at Bulawayo since 1981. Other active herpetologists include Dr J.P. Loveridge at the University of Zimbabwe, Harare (formerly Salisbury), and David Blake, who was certainly still at the Department of National Parks and Wildlife Management, Causeway, Harare, in 1981. Undoubtedly through the influence and international reputation of Don Broadley, a substantial interest in herpetology has been taken in Zimbabwe. Issue 10, volume 8 of *the Rhodesia Science News* (October 1974) had a special feature on herpetology with an editorial by Don Broadley, then Keeper of Herpetology when the National Herpetological Collections (from 1961) were in the Umtali (now Mtare) Museum. In this issue, Broadley described current research projects in the Museum and gave a bibliography of his herpetological publications, 1956-74. With Blake, he wrote on a preliminary investigation into the status of the Zimbabwean terrapins, while Blake contributed on account of crocodile (*Crocodilus niloticus)* rearing for commercial and conservation purposes, giving statistics on hatching success and annual stocks held by five rearing stations in Zimbabwe: Kariba Crocodile Farm, Bingi Crocodile Farm, Mini Crocodile Farm (Mubizi) (closed 1969) and Spencer's Creek Crocodile Ranch, Victoria Falls (slides of the last were shown at the BHS AGM on 18th March 1986). John Loveridge contributed an account on overwintering strategies in frogs, referring to his paper (Loveridge, 1970) in which he made the sensational finding that a common amphibian in central Africa *Chiromantis xerampelina)* is able to conserve water by excreting its nitrogenous waste in the form of uric acid, like reptiles, as solid crystals in only a little water.

The Rhodesia Science News' primarily herpetological issue followed an earlier one (issue 5, volume 8, May 1974) in which the history of the Umtali Museum had been recounted by Broadley, he himself being Curator in 1964 when the Museum was officially opened by Sir alfred Beit. A description of the departmental activities of the Museum starts with one of the Department of Herpetology from which Broadley's (1959) work was the first major publication to emerge. The amphibian collection was made available to Dr J.C. Poynton for his definitive work (Poynton, 1964). More recently (1983), Broadley has completely revised and rewritten *FitzSimon's Snakes of southern Africa* and Loveridge contributed a paper on thermoregulation in the Nile crocodile to the joint symposium held with the Anatomical Society of Great Britain and Ireland and the Zoological Society of London in honour of Prof. Angus Bellairs on the occasion of his retirement. The symposium proceedings, including Loveridge (1984), were published as a Festschrift volume by Academic Press *Symposia of the Zoological Society of London,* no. 52) and has recently been reviewed in *the Herpetological Journal* (Ricqlèsm 1986).

Among other herpetologists, John Akester has taken an interest in the captive breeding of Gaboon vipers (e.g. Akester, 1980) and other viperids, and Angelo Lambiris, a long-standing BHS member (now in Pietermentzburg, South Africa), has considered general aspects of the herpetofauna of Zimbabwe (Lambiris, 1980, 1981), having also carried out a programme of investigation at the Atlantica Ecological Research Station, situated about 12 miles (20 km) west of Harare (Lambiris et al., 1981).

The establishment of a Department of Herpetology in the National Museum in 1956 (then at Bulawayo) marked the beginning of intensive studies on the herpetofauna, and in 1957, the Herpetological Association of Rhodesia was founded. This was absorbed into the Herpetological Association of Africa in 1965 with, in 1974, over 100 members.

A check list of the reptiles of the national parks and other conservation areas of Zimbabwe was published in *Arnoldia* **8**(35), September 1979, by Broadley and Blake, and included species in the Victoria Falls and Matopos National Parks, which, together with Kyle (Zimbabwe Ruins), I had the opportunity to visit. It was winter and dry, and fewer hepetofauna were seen than one might have expected. Two species were photographed and later kindly identified by Don Broadley himself when he attended a BHS meeting in September later in 1981.

Mabuya striata wahlbergi – Wahlberg's striped skink. This is a common species and an individual

was observed (24.vi) mosaic-basking on a tree base in woodland adjacent to the rain forest formed by the spray from the Victoria Falls (known in the local tongue as & "Mosi on Tunya" – the smoke that thunders!). The species is widespread in Zimbabwe, in national parks and elsewhere in southern Africa, like the nominate subspecies.

Platysaurus intermedius rhodesianus – Vumba flat lizard. A male was basking (2.vii) at the base of a huge rock by the grave of Cecil Rhodes, founder of Rhodesia, on a flat rock face, part of the Matopos, from which there is a fine view overlooking many miles of dry woodland and rocky terrain as far as the horizon, and described by Rhodes himself as "the World's view". From a colour description, this species was also seen on flat rocks by the Chiwira Estates, about 20 miles (32 km) south of Centenary, to the north of Harare (27.vi).

Gerrhosaurus major – the tawny plated lizard. An attempt was made to catch a lizard, probably of this species, as it ran actively across a patch of roadside grass on the Zambian side of Victoria Falls (24.vi).

Python sebae – a big 7-8 foot (2.1-2.4 m) rock python was seen on marsh ground by the overflow of an irrigation dam on Tavydale Farm owned by a settler of Belgian nationality (Chevalier Charles de Burbure de Wessenbeek) about 10 miles (16 km) from Mazoe, north-west of Harare (26.vi). The snake proceeded slowly along the edge of the marsh and quietly slid out of view over the lip of the dam into a clump of thick vegetation. Unfortunately, there was no time to photograph it.

This account essentially constitutes a miscellany of herpetological activities that one might become involved with or experience in some tropical developing countries of Commonwealth Africa and elsewhere in the Ethiopian zoogeographical zone. The number of local, or even expatriate, herpetologists in these countries can almost be counted on one hand and yet they cover a vast geographical area with a rich tropical hepetofauna. Cranbrook & Lambert (1983) have already placed down some ideas on how the BHS can help to further herpetological work in these regions, and in this context, it is important that fellow herpetologists working in often often difficult circumstances in the tropical developing "south", not only in the Commonwealth, should be given every encouragement and indeed the financial wherewithal to enable them to attend the first World Congress of Herpetology in 1989. Fortuitously, the Congress is to be held in the U.K., a country which happens to have links with the tropical developing world through the medium of the Commonwealth.

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HERPETOLOGY IN BOTSWANA

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This is another of a range of articles published in the BHS Bulletin on Herpetology in Commonwealth countries.

Formerly the British Protectorate of Bechuanaland with its capital outside the country (at Mafikeng in South Africa), Botswana (capital: Gaborone) became an independent member of the Commonwealth in 1966. It is bounded by South Africa to the east (the Limpopo river forms the boundary) and south, Zimbabwe to the north east and Namibia (South-west Africa) to the west, with the Caprivi Strip extending across the north to separate Botswana from Zambia. The renowned Okavango Swamp lies in the north-west corner of the country, and the south and west constitute the greater part of the Kalahari (now called Kgalagadi) Desert. To the naturalist's delight, over 10% of the country is set aside for National Parks and Game Reserves, and the Moremi/Chobe park complex in the north supports the largest remaining population of elephant in Africa.

HISTORICAL ASPECTS

One of the earliest studies on the herpetology of Botswana was made by Sir Andrew Smith. His 1934/1835 expedition covered the south-eastern Kalahari, where he collected a number of specimens. Dr E. Holub and Prof. L. Schultze also collected in the same area in the late 19th and early 20th centuries respectively (see Auerbach, 1985). In the 1920s and early thirties. J.H. Power collected extensively in southern Botswana, and published two significant papers dealing with the herpetology of the Lobatsi-Linokana area (now Lobatse-Dinokana). Between March and September 1930, the Vernay-Lang expedition from the Transvaal Museum collected in Botswana; the herpetologist of the expedition was the famous Dr. V.F.M. Fitzsimons, and his 1935 paper detailing the results is at present the most thorough work on Botswana's reptiles. Between January and March 1967, Dr. D.G. Broadley of the Natural History Museum of Zimbabwe (now in Bulawayo) made a herpetological collecting expedition to Botswana. The results of this expedition (Broadley 1967) provide an initial attempt at detailed assessment of the herpetofauna of Botswana. Since then, little work has been done on the herpetology of Botswana, save the regional account by Auerbach (1985) and some notes on Setswana names for reptiles (Auerbach 1986). The major reference works include Fitzsimons *Lizards of South Africa* (1943) and *Snakes of Southern Africa* (1962), the latter recently revised and updated by Broadley (1983). *The amphibia of Southern Africa* (Poynton 1964) remains the only standard reference work on the amphibia of the region.

RECENT RESEARCH

Blomberg (1976), Blomberg et al (1982), Graham (1976, 1977, 1979, 1980) and Graham et al (1976) have published on *Crocodylus niloticus* (Nile Crocodile) in the Okavango. This last work, along with that of Taylor (1973) was meant to justify commercialisation of the Okavango Crocodiles. An F.A.O. consultancy report by Medem (1981) explored similar possibilities. The Nile crocodile is currently the only well studied member of the Botswanan herpetofauna.

There are at present three active herpetologists outside the Department of Wildlife and National Parks; they are Ronald Auerbach, author of *The Reptiles of Gaborone* (1985), currently working on a guide to the reptiles and amphibians of Botswana, which should be available shortly, Stephen Spawls, author of *Sun, Sand and Snakes*, and Job de Graaf of the Lutheran World Federation, currently working on ecology of the herpetofaunal community on the savanna/ Kalahari boundary. One of us (S.S.) keeps a small collection of lizards and harmless and rear-fanged snakes for educational purposes at Moeding College; the college also has a small

wet reference collection. The students are encouraged not to kill snakes, but to report them for collection. All specimens are routinely weighed, measured and may be photographed. The information will be used in a forthcoming paper on the structure of the local herpetological community. So far, 24 species of snakes have been recorded in the area, including the Black Mamba, Spitting and Egyptian Cobras, and a previously unrecognised species of stiletto snake, *Atractaspis duerdeni*, which is in the process of being re-elevated to full species level by Dr Broadley. A number of range extensions and new records for Botswana have been submitted to SSAR's (U.S.A.) *Herpetological Review.* All herpetologists working in Botswana will in the near future start to contribute specimens to a wet collection to be maintained by the Department of Wildlife and National Parks, under the auspices of one of us (M.P.S.)

HERPETOLOGY ON DISPLAY

There are at present no snake parks or zoos exhibiting reptiles in Botswana. The National Museum in Gaborone has a small display of live reptiles, including Nile Crocodiles, Marsh Terrapins *Pelomedusa subrufa)* and Hinged Turtles *(Pelusios sinuata),* and has a fine display of actively breeding Leopard Tortoises *(Geochelone pardalis).* The Botswana Defence Force maintains a collection of dangerous snakes (including Mambas, Cobras and Puffadders) and Pythons. This collection is not open to the public (although the B.D.F. traditionally have a public snake display at the annual Gaborone International Fair) but has a unique purpose: the soldiers of the B.D.F. are probably the only soldiers in Africa who are taught how to identify, catch, prepare and cook snakes as part of their training. The B.D.F. have published a small booklet, *Snakes in the Botswana Defence Force.* There is also a commercial crocodile farm, at Maun, on the east side of the Okavango, which offers guided tours of the farm. They take eggs from the swamps and incubate, hatch and rear them at the farm.

PRESENT NEEDS

Much remains to be done on the lower vertebrates of Botswana. Virtually no work has been done on amphibians. The distribution of many species of reptile and amphibian within Botswana is almost unknown. This is cause for concern, since commercial utilisation of reptiles and amphibians requires sound knowledge of the status of the species. While our knowledge of the herpetofauna of Botswana remains as poor as is the case elesewhere (see Simbotwe 1986), then the zooeorgrahpic picture of the southern African fauna will remain incomplete. Like elsewhere in Africa nowadays, there is a shortage of trained lower vertebrate zoologists in Botswana. We are trying to rectify this by starting a National Zoological Collection, to be maintained by the Department of Wildlife and National Parks and used partly for training purposes.

In the biotic divisions of southern Africa, Botswana is divided into three main regions; a subtropical moist zone in the north and a temperate western zone south of the Tropic of Capricorn. Between these zones lies a subtropical arid zone. These biotic divisions are of great zoogeographical interest. We would like to know how our amphibians and reptiles deal with aridity and changing thermal conditions in Botswana. We are naturally interested in the nature of the distribution of herpetological populations; if we knew the ranges of our reptiles and amphibians we could use the knowledge in national land use management plans. To achieve this objective, we will shortly be starting a countrywide herpetological survey programme. At present we are running a countrywide Crocodile survey. There is a bright future for herpetology in Botswana. The current commercialisation of Crocodies in southern Africa is one of the best things that has ever happened to the region, invoking an interest in Crocodile biology and lower vertebrate zoology generally. The local biologists in various African member states of CITES (Convention on International Trade in Endangered Species) who have been assigned to work on Crocodiles will need to acquire some training in herpetology, and hence hopefully this generation of scientists will continue work with the African herpetofauna, and come to appreciate the role amphibians and reptiles play in the ecosystem. If these biologists could be stimulated by the International herpetological community into joining herpetological societies, this could change the current dismal situation concerning herpetological research in Africa and other less industrialised countries. We urge the international scientific community to aid us as we struggle to popularise herpetology in Botswana and southern Africa generally. We are in the process of building up our research library in Botswana and any donations of book or journals would be welcomed by the Department of Wildlife and National Parks.

We also welcome any visiting herpetologists, for we feel that such visits and the contacts made through them will go a long way towards cultivating an interest in herpetology among our local scientists. Suffice it to say that manpower training is an area that is lacking and of importance to us in Botswana. With your co-operation, we hope to be able to do a good job and put Botswana in it's rightful place in the world of science and herpetology in particular.

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Ed. note: Dr. Simbotwe is a Zambian who has already contributed an earlier account of the development of herpetology in that country (BHS Bulletin no. 18: 9-11, December 1986) and who is presently working in Botswana. Stephen Spawls is British and is currently working in Botswana. He has published a book on snake collecting in Kenya and lectured to the BHS in February 1982 on a savannah snake population in northern Ghana. He has also worked and collected in Egypt.

NOTES ON REPTILES IN CYPRUS

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In an earlier account, Demetroupoulos & Lambert (1986) commented on the relative lack of work, somewhat surprisingly, that had been carried out on the herpetofauna of Cyprus (a member of the commonwealth since 1960). During a further visit between 11 and 16 November 1986 upon returning from Tanzania, I took the opportunity to make a few further, rather desultory observations on the few reptiles seen at this late time of year. These follow, with BM(NH) accession numbers in parentheses for those specimens collected.

Tröodos range:

Arriving at Larnaca airport (after an 11 hour stop-over in Jeddah) on 11 November and continuing to Nicosia the next day, I departed for the Tröodos the following afternoon. The bus started to climb steeply up the Marathasa valley on the northern slopes of the Tröodos range and shortly proceeded through the villages of Kalopanyiotis (732 m), Moutoullas (762 m) and Pendhoulas (1128 m). Surrounded by forests of Aleppo pine *(Pinus brutia)* and the Cypriot endemic golden oak *(Quercus alnifolia)*, the bus finally reached Prodromos, the highest village in Cyprus (1402 m). Based at the Forestry College (1417 m), I accompanied the Principal, George Pattichis, on his rounds the next morning (14.xi) to oversee students carrying out forestry maintenance work as part of their training. The sky was crystal clear and the sun brilliant, but the air was cool for above 1500 m; the mountains had received their first fall of winter snow during the week before. Not unexpectedly, few reptiles were seen.

Ophisops elegans. A single half-grown lizard of this species (collected previously by Werner (1936) and Clark (1973) in the Tröodos) was collected (BM 1987:938) from bulldozer-exposed ground near the summit of a forest-cleared peak at about 1000 m, approximately 13 km east of Kalopanyiotis.

Agama stellio. Three actively-running adults were seen on the sides and the dirt surface of a small track passing through pine forest to the west of the main road between Kalopanyiotis and Moutoullas.

Paphos:

Departing Prodromos by the road to Töodos (1676 m) with light snow on the hillsides and edge of the road by Mt. Khionistra (Olympus) (1951 m), one can proceed down the southern slopes of the Tröodos range through Pano Platres (1128 m) to Limassol on the coast and thence west to Kato Paphos. At Paphos harbour, the Department of Fisheries of Cyprus's Ministry of Agriculture and Natural Resources has a wet laboratory where a marine turtle *(Chelonia mydas)* breeding project is based (Demetropoulos & Lambert, 1986). Through an introduction from Andreas Demetropoulos, Head of the Department of Fisheries, whom I had seen in Nicosia earlier in the week, and was responsible for initiating the project, the officer-in-charge, Mr. Andreas Pistentis, kindly showed me his breeding laboratory (16.xi). There were three large cylindrical tanks of galvanised iron where the hatchling green turtles were being reared (Plate 1) after emerging from eggs incubated in the laboratory. After a year, the turtles are transferred to rearing pens in the middle of Paphos harbour (Plate 2) to ongrow them and give them a "head-start" prior to release.

Behind Paphos harbour, there is dry, somewhat disturbed habitat in an area with many rocks on the ground and dry scrub vegetation (Plate 3). Turning over a number of rocks revealed two reptiles species (16.xi).

Ablepharus kitaibeli. Two of these small skinks (not *A. pannonicus* as listed by Boulenger (1910)) were exposed under a rock (one collected – BM 1987: 939) and another a little later. It is a Near Eastern/SW European species.

Hemidactylus turcicus. An adult and half-grown individuals were found under a rock (one collected – BM 1987: 937) and the following morning (17.xi), two further adults were found.

The species is distributed throughout Mediterranean coasts and islands.

The weather was warm with diffuse sunshine, but no *Vipera lebetina* were seen. It is very common near Paphos (A. Demetropoulos, pers. comm.).

Proceeding 2 km east from Paphos harbour and past an industrial area making up the Sodap Wine Factory, the primarily rocky coast has intermittent small sandy inlets. At the back of one of these coves thus formed, there was a small area of dunes with occasional thorny bushes. A pause of five minutes near one of these small bush clumps revealed another lizard species active in the warm, hazy sunshine at *ca.* 18° C air temperature (17.xi).

Acanthodactylus schreiberi. Two adults and about five immature individuals of almost certainly this species darted between bushes, occasionally entering burrows, using their fringe-toed feet to race across loose sand. With fawn-grey dorsal surfaces, their tails were bright orange-red. Clark (1973) collected 88 specimens of this species when he was in Cyprus and indicated that it was numerous in certain coastal sandy areas near Kyrenia and Galanoùpetra Point in the north of the island. Despite Werner (1936) collecting the species near Platres at over 1150 m in the Tröodos range, Clark was convinced that the species is principally an inhabitant of sand dunes and dry plains at low altitudes.

Ophisops elegans. Three small lizards, probably this species (Clark (1973) collected 38) if not *Lacerta laevis* (of which Clark (1973) also collected a large number – 77), were seen running over an area of dry rocky ground amidst thin vegetation making up a disturbed habitat on a low coastal cliff (17.xi) within the proximity of Paphos's coastal development.

On the final return journey, the service taxi passed through a dry, hilly area with vineyards near Pissouri, by a game reserve within the Episkopi Garrison area and by Kolossi Castle en route for Limassol, before continuing through more dry, hilly country with olive groves to reach Larnaca airport once again.

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Plate 1. Green turtle hatchlings in rearing tank of the Department of Fisheries' wet laboratory, Paphos (16.xi). The water flowing into the tank (left) maintains aerated conditions.

Plate 2. Paphos harbour with castle (left) and the three floating turtle ongrowing cages (right foreground). The open entrance of the wet laboratory is the one on the right in the long, pale-roofed building behind the harbour on the right.

Plate 3. Dry habitat behind the castle on the harbour looking north-east towards Paphos (17.xi). *Ablepharus kitaibeli* and *Hemidactylus turcicus* were found under rocks (see text).

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SNAKE BITES IN THAILAND AND BURMA

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INTRODUCTION

Many common South-east Asian snakes are venomous. Snakebite is a serious problem in the tropics. I have recently spent two months in South-East Asia, where I studied snake bites at Chulalongkorn Hospital, Bangkok, Thailand, The Department of Medical Research, Rangoon and Tharrawaddy District Hospital, Burma.

Most venoms contain several or many components designed to rapidly kill prey, but which cause a variety of problems in human victims. Clinical features can be divided into the local effects, (at the site of the bite) and systemic effects, (acting on the body in general or distant sites). In general systemic features of elapid venom (cobras, kraits) are primarily neurotoxic (affecting the nervous system), whereas those of viperid venom (viper) are primarily haemotoxic (acting on the blood). Contrary to popular belief, more than half of bites by all potentially lethal snakes result in slight or even no poisoning. Medical management of snake bite consists of reassurance, identification of the responsible species, assessment of the severity of envenoming, administration of antivenom if necessary, and supportive therapy.

The important species responsible for bites in Thailand and Burma are the Russell's Viper (*Vipera russelli siamensis),* Malayan Pit Viper *(Calloselasma rhodostoma),* Green Pit Viper *(Trimeresurus albolabris),* Thai Monocellate Cobra *(Naja kaouthia)* and the Malayan Krait *(Bungarus candidus).* Bites from sea snakes are rare.

RUSSELL'S VIPER (*Vipera russelli)*

The Russell's Viper is most commonly found in the central rice growing regions of Thailand and Burma. In Burma, more than 90% of bites are due to *Vipera russelli,* compared to 5% due to cobras. It is estimated that this species is responsible for over 10,000 bites per year in Burma and at least 1,000 deaths. This considerable morbidity and mortality has made snake bite between the fifth and seventh leading single cause of death in Burma, even in recent years.

The rural population is most at risk, particularly the young and fit breadwinners who are often bitten in the fields, especially at harvest time (November - December), where snakes come in search of rodents. In Burma, Russell's Viper bite is considered as an occupational hazard. The majority of bites occur in the early morning or in the evening. The foot being the commonest site, followed by the hand and ankle.

After being bitten, pain usually starts within minutes and swelling of the affected limb continues to a maximum at 1-4 days. Unlike other viperid bites, such as *Calloselasma rhodostoma,* bruising, blistering and necrosis (tissue death) are rare. The regional lymph nodes (eg in the groin), usually enlarge and are tender as a result of lymphatic absorption of the venom.

The earliest sign of systemic envenoming is non-clotting blood. This can be detected by leaving a blood sample to stand for 20 minutes (20 minute clotting test). In up to 40% of cases with systemic envenoming there may be continuous oozing from the bite wound, spontaneous bleeding from the gums, or bleeding into the conjunctivae, gastro-intestinal tract or pituitary gland. Russell's Viper venom contains several haemotoxic components which act at various steps in the clotting mechanism. In the snake's natural prey, this causes rapid and fatal intravascular coagulation (clotting in blood vessels) but in man, the venom dose is insufficient to have such a devastating effect and results in disseminated intravascular coagulation (widespread minute clots) with subsequent depletions of clotting factors and platelets. This in turn leads to non-clotting blood.

In about 35% of victims there is hypotension (low blood pressure) and shock resulting from a generalised increase in capillary permeabillity. Occasionally, abdominal pains and vomiting

occur. The most serious feature of Russell's Viper envenoming is kidney failure. This occurs in up to 40% of cases with systemic poisoning and may be preceded by loin pain or tenderness. Oliguria (small volumes of urine) and haematuria (blood in the urine) can develop in 24-72 hours of the bite and death is likely in severe cases of renal failure if dialysis is not available. Unfortunately, kidney machines are not generally available in Burma, particularly outside Rangoon. It was initially thought that the damage to the kidneys was a consequence of the disseminated intravascular coagulation but studies at the Department of Medical Research, Rangoon, suggest that there may also be a directly acting nephrotoxin (kidney poison). As previously stated, the mortality from these bites is about 10% with acute renal failure being the prime cause of death, although disseminated intravascular coagulation and haemorrhage into the lungs or pituitary may also be found at autopsy.

Victims usually bring the corpse of the offending snake with them to hospital. This enables accurate identification of the species. Hourly blood samples show any change in clotting ability and if non-clotting blood is found antivenom treatment is initiated. Pryogenic reactions (fever, chills and rigors) occur in almost 100% of patients given BPI (Burma Pharmaceutical Industries) monospecific antivenom but anaphylactic (allergic) reactions are uncommon. This is due to the presence of foreign proteins despite the antivenom having undergone a purification process. Antivenom will effectively restore blood coagulation in 4-48 hours. However it does not appear to prevent the development of renal failure even if adequate treatment is given within one hour of the bite. In non-fatal cases of severe envenoming recovery can take many weeks, although pituitary haemorrhage may lead to a syndrome of hormonal imbalance and subsequent ill health. This has been shown in patients bitten up to 24 years previously.

An interesting feature of Russell's Viper bites is the variability of symptoms and signs in the victims. For example, non-clotting blood may be found in conjunction with limited or absent local pain and swelling. Alternatively, local features may be marked whilst systemic features are absent! This may be related to genetic variations or perhaps differing rates of production of venom components. Genetic variation is more likely to explain regional differences, such as the frequency of conjunctival oedema (swelling of the outer layer of the eye), seen only in Burma or rhabdomyolysis and massive haemolysis (destruction of muscle and red blood cells) as described in Russell's Viper bites from Sri Lanka.

GREEN PIT VIPER *(Trimeresurus albolabris)*

There are several species of *Trimeresurus* in Thailand. *Trimeresurus albolabris* is responsible for most bites, primarily due to its abundance, followed by *T. macrops* and occasionally *T. wagleri* or *T. purpureo maculatus.*

It is common around Bangkok and up to 20 cases of bites may present per week at Chulalongkorn Hospital, especially during the rainy season. Relying on its camouflage rather than fleeing, it tends to bite people who come too close, albeit unsuspectingly, to the bushes or small trees in which it lives.

The bite of the green Pit Viper is rarely, if ever, fatal. Victims present with severe pain in the bitten limb, together with gross swelling and discolouration of that limb. Viper venom is composed of much larger protein molecules than cobra venom and therefore tends to be absorbed slowly through the lymphatic system rather than by venous drainage. Thus it may take several hours before the severity of envenoming can be gauged. The extent upwards of swelling of the affected limb is proportional to the dose of venom injected.

The venom contains haemorragin which damages blood vessel walls, causing extravasation of plasma and red blood cells into the limb accounting for much of the characteristic swelling and bruising. Non-clotting blood is a feature of severe envenoming resulting from both difibrination and platelet (requirements for clotting) deficiency from excessive repair of the damaged vessels. A direct antiplatelet toxin component in the venom may also be present.

Victims are observed and the severity of envenoming is graded by the extent of swelling, blood clotting time and platelet count. Only cases of severe poisoning are admitted to hospital and are treated with specific antivenom. There is no local necrosis and the affected limb slowly resolves to its normal size and colour.

MALAYAN PIT VIPER (*Colloselasma rhodostoma*)

The Malayan Pit Viper is found in many parts of Thailand and is the commonest cause of snake bite in the Malayan peninsular. It is often trodden on as it is well camouflaged and characteristically does not move away when disturbed.

The bite is rarely fatal and has some similarities with *Trimeresurus* bites. Local pain and swelling start within a few minutes but may continue to increase for 24-72 hours depending on the dose of venom injected. This is accompanied by bruising discolouration. Local necrosis also occurs in about 30% of cases and may be preceded by gross blistering of the skin. Necrosis is usually only superficial but, as with cobra bites, secondary bacterial infection is a common complication.

The systemic features of severe envenoming include non-clotting blood and a general haemorragic syndrome characterised by spontaneous bleeding from the gums into the skin, continuous oozing from the bite and occasionally haemoptosis (coughing up blood) or cerebral haemorrhage (bleeding into the brain). Untreated, this syndrome lasts 3-4 days, although the blood remains incoagulable for 5-11 days. Hypotension and shock may occur in some patients probably due to the loss of circulating fluid into the bitten limb and possibly also to the effects of intravascular coagulation.

Specific antivenom will reduce or prevent development of shock or haemorrhagic syndrome. Prior to its availability, mortality in hospital-treated cases was only about 1%. An occasional death may still occur due to cerebral haemorrhage, anaphylactic antivenom reactions or secondary infection. Swelling resolves in 5-20 days but, in the presence of local necrosis complete recovery may take 1-10 months.

THAI COBRA *(Naja kaouthia)*

Cobras represent about 5-10% of bites in Thailand and Burma, the Monocellate Cobra *(Naja kaouthia)* being the most common, although *N.N. sputatrix* is commoner in some parts of Central and Northern Thailand. Cobra bites are less frequent than might be expected as these snakes are generally active and escape when disturbed, striking usually only when cornered or threatened.

The bite of the Thai Cobra normally results in local pain and swelling within a few minutes. Systemic envenoming is characterised by ptosis (sagging of the eyelids) followed by glososopharyngeal palsy (difficulty in speaking and swallowing) and finally paralysis of the respiratory muscles. These features may take several hours to develop; the toxins responsible acting specifically on receptors at the junction of the nerve and muscle, thereby blocking the transmission of nerve impulses. In the absence of treatment, severe envenoming will lead to death from respiratory failure (ie suffocation). This poisoning is, however, reversible and these effects wear off in 2-5 days. Untreated, the natural mortality is about 10%.

Monospecific Antivenom is effective and available in Thailand, yet its use is currently controversial at Chulalongkorn Hospital, where supportive measures only are employed. All victims are admitted for observation and placed on an artificial ventilator in the intensive care unit if necessary. Once the patient has recovered from this initial life-threatening condition, he may have to spend several more weeks in hospital as severe necrosis and gangrene at the site of the bite often follows. This is a direct venom effect and the dead tissue may require surgical excision, followed later by skin grafting if the area is extensive. The wound must be kept clean as the risk of secondary infection is high. Some improvement in the clinical state can be produced by anticholinesterase drugs which increase the concentration of the natural neurotransmitter substance acetylcholine at its receptor site, thereby reducing the blocking effect of the venom at the same site.

MALAYAN KRAIT *(Bungarus candidus)*

Information relating to the incidence of *Bungarus candidus* bites is limited, but it is generally considered to be a rarer cause of snake bite in Thailand. However, since Krait bites in general are associated with a higher mortality (77%, reported in 35 cases of *Bungarus caeruleus* in India), they represent the commonest cause of fatal snake bite. Bites often occur at night in houses while the victims are sleeping, causing difficulty in identifying the species responsible.

There are normally no local effects from the bite except some numbness. Pain and swelling are not features of Krait bites, although there may be abdominal discomfort. The systemic features indicate that the venom is a powerful neurotoxin and 'Bungarotoxin' is well known to cause neuro-muscular blockade. Paralysis starts 1-12 hours following the bite with ptosis, difficulty in swallowing and talking, proceeding to difficulty in breathing and finally total paralysis affecting all limbs, face, eyes and respiratory muscles.

Supportive artifical ventilation may rapidly become necessary to prevent suffocation. There is no specific antivenom currently produced and it has been found that Thai *Bungarus fasciatus* antivenomm is ineffective, but a response to Haffkine poly-specific antivenom *(Bungarus caeruleus, Echis carinatus, Vipera russelli, Naja naja)* has been reported. Experiments on mice have found that Australian Tiger snake antivenom has a greater protective effect against *Bungarus candidus* venom than the Haffkine antivenom. As with Cobra bites, anticholinesterase drugs may be useful in treatment.

CONCLUSIONS

There are many misconceptions concerning snakebite. I hope in this article I have removed some of them. Current and past research has uncovered much interesting and useful information, although snakebite related problems have never been high priority and further work is undoubtedly required. In addition, treatment will continue to be difficult in Third World countries or where transport and medical facilities are limited.

ACKNOWLEDGEMENTS

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Plate 1. *Vipera russelli siamensis* (photo Prof. D.A. Warrell)

Plate 2. Conjunctival oedema, a feature of systematic envenoming by Burmese *Vipera russelli siamensis* (photo Prof. D.A. Warrell)

Plate 3. *Trimeresurus albolabris* (photo Prof D A Warrell)

Plate 4. *Calloselasma rhodostoma* (photo by Prof D A Warrell)

Plate 5. *Calloselasma rhodostoma* bite to hand, showing blistering of skin (photo Prof D A. Warrell)

Plate 6. *Naja kaouthia* (photo Prof D A. Warrell)

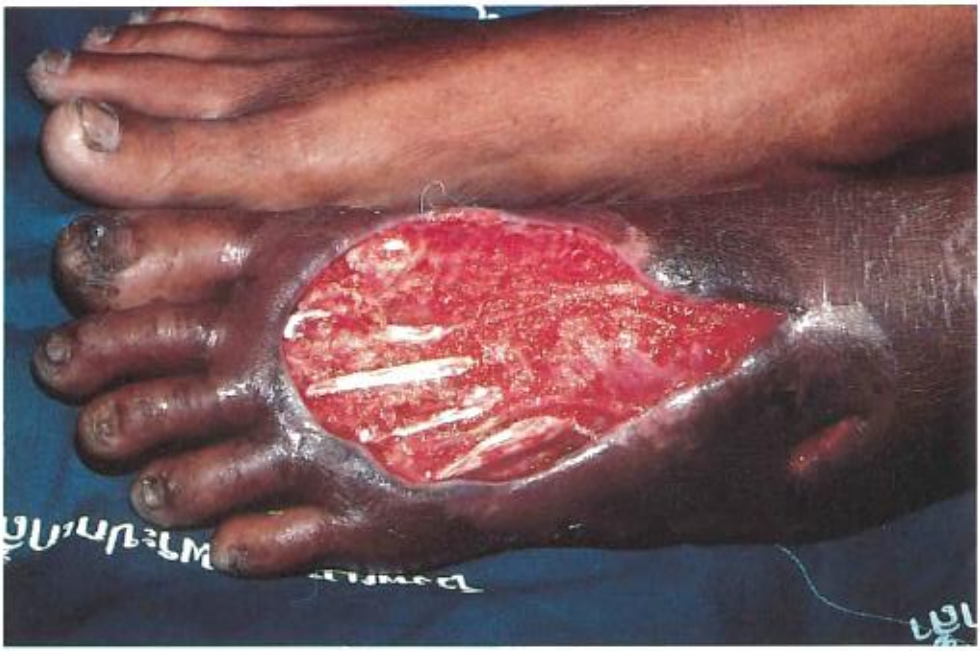

Plate 7. *Naja kaouthia* local uecrosis following bite to foot (photo Prof. D A. Warrell)

Plate 8. *Bungarus candidus* (photo Prof. D.A. Warrell)

TURTLES AND TOURISM IN THE IONIAN, THE PROBLEMS AND POTENTIAL

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Increasing concern about the status of loggerhead turtles, *Caretta caretta,* in the Ionian Sea has resulted in studies of their status on the island of Zakinthos, arguably the most important nesting site in the eastern Mediterranean, by Greek researchers. On the island of Cephalonia to the north, a smaller population exists and is facing the same problems now affecting the Zakinthos rookeries. The author worked on Cephalonia with an Earthwatch project led by Mr. James Sutherland during 1985 and assisted Mr. Sutherland's project during 1986.

The island of Cephalonia (Kefallinia) lies in the Ionian sea (38° 15'N, 20° 33'E), some 100 km south of Corfu and 40 km off the Greek mainland (Fig. 1). It has approximately 170 km of coastline although only a few beaches are used as rookeries by loggerhead turtles, *Caretta caretta.*

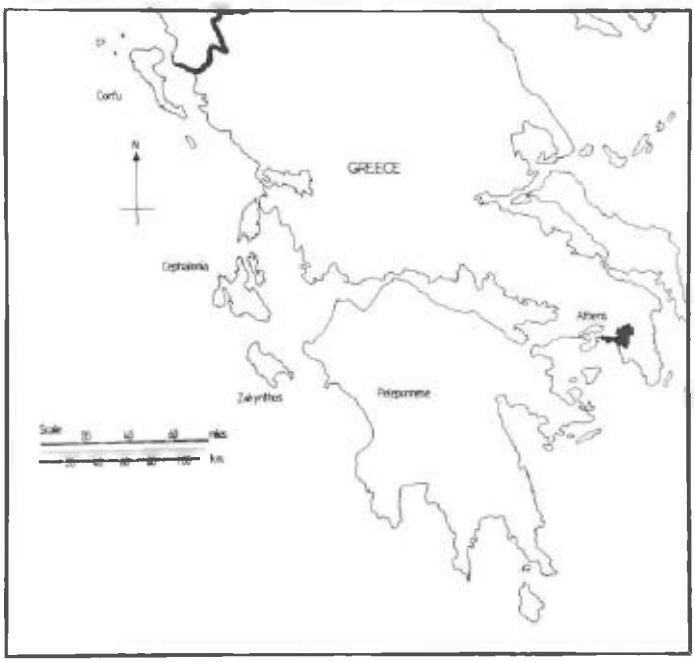

Figure 1 Outline map of southern Greece indicating the position of Cephalonia and Zakynthos.

To the south, the island of Zakynthos (Zakinthos/Zante) has five rookeries, described by Margaritoulis (1982). Twenty years ago the island had little pressure from tourism, but the last six years have seen a massive increase in tourist facilities (Spencer 1986), catering mainly for British tourists. This increase in pressure on the beaches has led to a drop in the number of turtles nesting on the island. The beaches around Lagenas bay on Zakynthos are of great importance as rookeries for the loggerhead in the Mediterranean, with densities of 214 to 525 turtles nesting per km per season (Spencer 1986).

On Cephalonia, the beaches have much lower numbers, approximately 22 nests per km during 1985 (Marine Turtle Research Project 1985), although records for the 1986 season on Cephalonia's

main rookery (Sutherland, unpublished data) suggest a higher density using the beach than in 1985.

Only one of the turtles observed on Cephalonia in 1985 had been tagged previously on Zakynthos, suggesting that the two islands have separate populations of nesting turtles. If this is indeed the case, then there is little chance of Zakynthos turtles moving to nest on the relatively undisturbed rookeries on Cephalonia.

The loggerhead turtle, *Caretta caretta*, a protected species in an endangered habitat.

From June to August, adult female loggerheads emerge to nest during the night, crawling up the beach leaving a distinctive track. In some cases a female may not dig but returns to the sea, leaving a "U-turn" track, though often these non-nesting emergences involve attempts at digging nests. Whether these non-nesting emergences are due to disturbance or lack of required nesting conditions is not known. Margaritoulis (1983) reports that this behaviour occurs on the Zakynthos rookeries. On Cephalonia females have been recorded emerging without nesting for several nights in a row, before eventually laying eggs.

Initially the female digs a body pit, digging herself lower into the sand and removing the dry sand from the area of the nest. Then, using only her hind flippers, the female excavates a nest pit. At this point it is unlikely that a cautious approach will disturb the turtle, and it is advantageous to be in position behind the turtle as the first eggs are laid in order to accurately record clutch size. Once all the eggs are laid the turtle covers the nest pit and then enters the camouflaging stage, which involves the scattering of sand across the nesting area. This may be repeated several times as the turtle moves forward and results in a considerable area being covered with scattered sand beneath which the nest lies, with often two or three similarly camouflaged areas. Once camouflaging is completed, the turtle returns to the sea.

Measurements were normally recorded while the turtle was covering the eggs and caused no apparent disturbance. Tagging was left until the turtle had completed nesting because of the possibility of the disturbance causing an interruption in laying, an occurrence observed on Zakynthos (Margaritoulis 1983). Turtles were weighed before they returned to the sea and this appears to have no effect on females, with individuals returning to nest soon after being examined during a non-nesting emergence.

The number of nesting females drops towards the end of August and the first hatchlings emerge.

Loggerhead hatchlings, *Caretta caretta*, emerge and crawl down the beach to the sea.

Hatchlings emerge in the late evening, night and early morning, generally in twos and threes, with often 50-100 emerging from anest during a night. If the hatchlings emerge too late in the morning, they may dehydrate and die during the crawl to the sea.

The Cephalonia project used wire cages with a plastic mesh insert to attempt to accurately assess nesting success, weight and condition of hatchlings. The plastic mesh insert restricted the possibility of the hatchlings being damaged by caging and of predators reaching them through a single mesh. The cages were placed over nests as they neared hatching date. By burying the cages some 15 cm in the sand and weighting them in position with rocks, it was possible to prevent them being dug up by dogs.

Some nests were monitored to examine how nest temperature relates to development and success rates. The temperature of the developing nest determines the sex ratio of the clutch. Mrosovosky and Yntema (1980) report that loggerheads have a "pivotal temperature" of approximately 30°C with hatchlings predominately female from nests incubated above that temperature. Incubation time varies over the season, again related to temperature, a 1°C decrease in nest temperature corresponding to a 5 day increase in incubation time (Mrosovsky and Yntema 1980).

During 1985, a total of 27 turtles were tagged on Cephalonia and 17 were recorded nesting successfully, producing 48 nests. Margaritoulis (1983) records multiple nesting on Zakynthos rookeries, a behaviour pattern observed in 13 loggerheads on Cephalonia in 1985. One individual was recorded emerging 12 times in 4 weeks, and laid three clutches. During the study period the maximum number of clutches laid by any individual was four (Marine Turtle Research Project 1985).

Of the 48 nests recorded, 43 clutches were examined and clutch size varied from 6 to 164 eggs (mean 100). The average hatchling emergence success rate was 47% with 34 of the 44 nests on the main rookery emerging and a total of 1302 hatchlings estimated reaching the sea from that rookery (Marine Turtle Research Project 1985).

The main rookery on Cephalonia remains undeveloped at present, though the numbers of

tourists camping behind the beach is high. The only apparent predation of hatchlings on the beach is by dogs, which pick off hatchlings as they crawl to the sea and dig up nests before they emerge, eating many eggs and hatchlings, scattering nests and exposing any remaining eggs. The dogs, belonging to both tourists and locals, seem to detect the nests and visit them regularly until the hatchlings are beginning to emerge. During 1985, only four nests were lost to dogs, but fewer numbers of nests were caged in 1986, and predation by dogs became a serious problem. It appears that caging does reduce this predation, but it is impossible to cage all the nests without a large budget. This could be solved by transplanting eggs to a fenced "nursery area" on the beach, or by transplantation involving the removal of associated clues, in a similar manner to methods used to reduce predation by raccoons, *Procyon lotor*, in South Carolina, U.S.A. (Stancyk, Talbert and Dean 1980). The hatchlings also face motorcycle and car tyre tracks in the sand, which they find very difficult to escape. This sometimes results in dehydration of individuals which emerge during early morning.

A hatchling loggerhead, *C.caretta*, predation by dogs on the main Cephalonia rookery seriously depletes numbers reaching the sea.

The threat of tourist development on the island is a serious one. During 1986, Skala, the village nearest to the rookeries has been developed as a tourist resort catering in particular for British tourists. Although no new hotels have been built, the pressure on the beaches in the area has increased dramatically within the two years the project has been running. A new airport will soon open the island to a greater number of visitors. Perhaps the most worrying of present problems on Cephalonia is lights and music at night disturbing adult females emerging to nest on the rookery nearest Skala. The main rookery is some distance from Skala and is still free from this disturbance to a great extent, though the potential for development is present, as this is one of the few completely sandy beaches on the island. It is important that some measures be taken to ensure that the situation on Cephalonia does not become similar to that on Zakynthos.

On Zakynthos the beaches are already under great pressure from tourists and developers. Although in the last five years, the loggerhead has become protected by presidential decree within Greece and a zoning law now restricts building on a 500 metre wide strip along the Zakynthos rookery, there has been little change in the situation on the island. Building on

the beach continues, with the islanders, outnumbered two to one in the summer months, relying on the income obtained from tourism. In some extreme cases, fear that loss of income would result from a reserve in the area has led to turtles being repeatedly disturbed during nesting. Despite this, research has been able to continue on the Zakynthos rookeries over the past 5 years and attempts are in progress to educate local inhabitants as to the importance of the rookeries. Any changes on the island must be brought about gradually and with great care or damage to relations with the islanders could put the turtle population at greater risk. Problems from tourist development include: lights and music disturbing emerging adults; shade trees reducing nest temperatures and humidity; tourist umbrellas piercing eggs and damaging nests; lights disrupting the hatchlings' sense of direction; the compacting of sand above the nest; and tour operators taking parties of tourists out to see the nesting turtles. The Greek team headed by Dr. D. Margaritoulis have set up a "Turtle Information Centre" on Zakynthos, and the potential for a wildlife reserve has not gone unnoticed.

Lagenas bay on Zakynthos has five nesting beaches, the two most important being those least used by tourists. If these two could be isolated as reserves, with restricted access, (proposed by Margarita Arianoutsou, Associate Professor of Ecology at the University of Thessaloniki[Spencer 1986]), it would be a major step forward in saving this important site. If correctly managed this could be an asset rather than a hindrance to the tourist industry. On the tourist beaches, it would be possible to continue the research programme presently in progress, but if the nests are exposed to damage from tourism, an investigation into transplanting the eggs each morning to the "safe" beaches would be of value. Such a scheme could eventually become self funding if a fee were charged for tourists to view the nesting turtles under the supervision of "wardens".

On Cephalonia, a "nursery area" could be set up on the main rookery, in order to try to restore the numbers of turtles nesting on this beach by increasing the number of hatchlings reaching the sea. This would involve some manipulation of clutch temperatures or a careful choice of a heterogeneous "nursery area" to ensure the sex ratio is not disrupted. Local people consider the number of adults using this beach to nest to have declined considerably in the last twenty years. The situation on Cephalonia is worsening, and it is important to consider the conservation potential now before the pressures which are causing so much difficulty on Zakynthos appear.

I hope this article will stimulate some discussion and that moves to improve the present situation will occur. The further development of these sites will lead to a reduction in the numbers of loggerheads in the Mediterranean, and we cannot allow these magnificient reptiles to reach such a precarious situation.

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1986: Thanks to James Sutherland, Andrew Beckett, Colin Adams and the people of Skala. Also thanks to Dr. David Harper for comments on the manuscript.

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Further information is available on the present situation in Zakynthos from:

The Sea Turtle Protection Society,
P.O. Box 51154,
GR-145 10 KIFISSA,
GREECE.

Post script: While writing this article, the threat to the Loggerhead in the Mediterranean has increased. Newspaper reports *(Independent* 7/5/87, *Daily Telegraph* 21/4/87) indicate that in Dalyan, Turkey, a tourist development worth •15 million per year is underway. This beach is reported to be as important a rookery site as Zakynthos once was. One can only hope that the damage to the Greek populations of Loggerheads is not repeated as Turkey 'opens up' to tourism.

CASE HISTORY OF BOOMSLANG *(Dispholidus typus)* ENVENOMATION IN THE EASTERN TRANSVAAL, SOUTH AFRICA

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INTRODUCTION

Bites from the Boomslang, *Dispholidus typus typus* Smith, still remain a rare occurrence, and are today mostly found among people handling the snakes. Being back-fanged, envenomation is hindered and therefore a firm grip is needed on its victim to ensure that the fangs penetrate the skin.

Treatment and case histories of bites from this species have previously been described. Although a full bite from a Boomslang remains a serious event, most victims today survive and death resulting from Boomslang envenomation is rare. This is mostly due to the monovalent, species specific antivenom developed by the South African Institute for Medical Research. This is, however, only available on special request after positive identification has been made of the snake involved and is promptly flown to the relevant hospital.

THE SNAKE

A notably unaggressive, shy diurnal snake that spends most of its time in tree canopies and shrubs. Being arboreal they are normally light to olive brown in the females and a bright green in males. Colour variation, however, is far greater than in an other south African snake and depends on the locality. They are easily distinguished by the enormous eye which is green in colour. Adults average 1.2 to 1.5 m but may attain nearly 2 m in length.

If provoked they might inflate the neck region to more than twice the normal size. The snake will then strike sideways and forward. Boomslangs mainly preys on birds, chameleons and arboreal lizards, etc. (Broadley, 1983).

THE SPECIMEN

Juvenile, wild-caught Boomslang (TL approximately 400 mm)

THE VICTIM

An adult, 34 year Caucasian female, mass 104 kg.

BITE SITE

The victim was bitten, only one fang penetrating the outer surface of the left little finger, on 3 March 1981. The snake was being handled when it suddenly struck at the handlers left hand. The victim had experienced no previous poisonous bites.

SYMPTOMS AND TREATMENT

06h45	Immediate bleeding from the bite site. Oral suction was applied.
06h55	Burning pain in hand, spreading up into arm. Left for hospital.
07h45	Arrived at hospital. Severe pain in arm. Developing a splitting headache and watery blood oozes from the fang puncture. BP 120/70. Pulse 75.
08h30	Started intravenous treatment with Normal Saline. BP 120/75. Pulse 72. Victim started to vomit.
09h00	Prothombin Index – 0% (normally 100%). Urine tested – blood 4+. Colour of urine like black coffee. Pethedine 100 mg given intramuscular and 1 ampule Maxalon for vomitting. Apply the first unit of human plasma.
09h15	Second unit of Saline applied. BP 110/75. Pulse 68.
10h30	Second unit of human plasma started. BP 100/70. Pulse 68. Urine 4+.
11h15	Left for Johannesburg General Hospital by plane. Intravenous Saline continued on plane. 15 mg morphine given for headache and 1 ampule Valoid for nauseousness.
13h40	Arrived at hospital.

14h00 Unable to commence intravenous therapy. BP 90/60 Pulse 48. Vomiting +++. Blood oozing from needle punctures. Prothrombin Index still 0%. Profuse perspiration and nausea.

15h00 Intravenous treatment started on left hand with Saline. BP 90/55. Pulse 48. Vomitting +++. Bleeding from scratch on leg and left ear. Patient on strict intake and output of fluids.

17h00 First 10 ml Boomslag anti-venom injected intravenous over 15 minutes in saline drip. 200 mg Solu-Cortef and 50 mg Pherergan given intravenous. BP 70/35 Pulse 42. Patient sweating ++ Vomitting +++.

17h25 BP 70/35 Pulse 48. Platelet-rich plasma second unit given.

19h00 Second 10 ml Boomslang anti-venom injected with 200 mg Solu-Cortef and 50 mg Phenergan intravenous over 15 minutes. Third unit of Platelet-rich plasma given. BP 75/40. Pulse 48. Prothombin Index still 0%. 10 mg Konakion given. No appetite.

23h00 BP 90/45. Pulse 54. Another Saline unit as well as the fourth Platelet-rich plasma given. Urine output 0. Lasix 40 mg given intravenous. Headache ++ – Valaron 1/1. Still vomitting for which a Valiod 1/1 ampule was given intravenous.

4 March 1981

00h00 Slept on and off till 04h30.

09h00 BP 100/65. Pulse 58. Prothombin Index 0%. First unit of Blood vit K 100 mg given. Strict intake and output of fluids monitored. Intravenous therapy with Saline continued. Platelet-rich plasma given 6 hourly. Urine still like black coffee. Extensive bruising around the intravenous and injection sites.

15h00 Platelet-rich plasma.

16h00 Second unit blood given. BP 110/70. Pulse 62.

5 March 1981

09h00 Prothombin Index – 11%. BP 110/70. Pulse 64. Saline given intravenous 6 hourly and platelet-rich plasma 8 hourly.

15h00 Saline given. Blood still present in urine.

17h00 Platelet-rich plasma given.

6 March 1981

09h00 Prothombin Index – 25%. BP 110/70. Pulse 66. Saline given 6 hourly and Platelet-rich plasma 8 hourly. Prothombin Index twice daily till discharged from hospital.

9 March 1981
Prothombin Index – 70%

11 March 1981
Prothombin Index 89%

14 March 1981
Prothombin Index 92%. Discharged from hospital.

19 March 1981
Prothombin Index checked – 96% normal.

DISCUSSION

Factors contributing to this case being less serious were probably the relatively small size of the snake and the prompt admission to hospital. Being a keen amateur herpetologist, she was able to identify the snake positvely. Bites from this species are known to have delayed onset of symptoms. In this case the onset was fairly rapid, with vomiting after 100 minutes. Rapid symptoms have also been described by Broadley (1957) as well as Pinney (1981), although it can take a longer period (Visser & Chapman 1978, Marais 1985).

It is interesting to note that Broadley (1960) was administered Saw-Scaled Viper, *Echis carinata*, specific antivenom in addition to the polyvalent serum. Viser & Chapman (1978) also report a case where 30 ml *Echis carinata* antivenom was administered. In both those cases Boomslang antivenom had not yet been manufactured, and *Echis* being also haemotoxic, was the only antivenom considered auitable. the monovalent serum available today is highly efficient and normally 2 - 3 ampules (20 - 30 ml) would be adequate. Branch and McCartney (1986) reported

treatment of a Boomslang bite in a sensitive patient where only 2 ampules was used, with andrenalin as a standby.

CONCLUSION

The venom of the Boomslang is haemotoxic and affects the blood clotting mechanism, the most common symptoms being severe handaches, bleeding from the mucous membrane, nausea, vomiting and internal bleeding from the organs. The onset of the symptoms can be very quick, as shown in this case, although it is normally slower, serious symptoms often taking as long as 24 hours to develop.

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TOXINOLOGICAL RESEARCH IN WESTERN EUROPE REPORT OF A VISIT IN 1986

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Toxinology is the science of natural venoms originating from different living organisms. Toxins occur in plants, microorganisms (e.g. bacterial toxins), wasps, bees and ants (Hymenoptera), scorpions and spiders (Arachnoidea), and many marine organisms (sea anemones, jellyfish, scorpionfish, etc.). They are also found in some amphibians (salamanders, toads) and reptiles (Helodermatidae, snakes). In this last context, toxinology is closely associated with herpetology, since most of the venoms used today in various kinds of toxinological research originate from snakes. Furthermore, thousands of deaths every year are the result of venomous snake bites and these also fall into the field of clinical and experimental toxinology. The world's toxinologists are associated under the aegis of the International Society on Toxinology (IST), which issues a journal, *Toxicon.*

In October of 1986, the author had the opportunity to make a study visit to some institutes and universities in Western Europe where research on snake venoms and/or venomous snakes is being carried out. The visit was partially supported by the College of Pharmacy, Medical School of Szeged, Hungary. During the period of a month, a total of 29 institutes were visited in eight countries. In the following account some of those which could be of interest to BHS members are briefly introduced.

Italy: My visit started in Florence, at the Museum of Zoology, where B. Lanza, the President of Societas Europaea Herpetologica (SEH), introduced me to the Museum's collection. His studies involve the amphibians and reptiles of East Africa, especially Somalia, from whence he has described some new species (Lanza, 1978). At the same institute G. Delfino is carrying out investigations on the cutaneous venom glands of *Bombina variegata* and on the venom apparatus of *Polistes gallicus* (Hymenoptera, Vespidae) at the electron microscopic level.

At the Department of General Physiology, University of Torino, I met L. Cedrini who is studying the various effects of Gaboon viper *(Bitis gabonica)* venom on heart and muscle preparations. The evidence that *B. gabonica* venom is able to change the features of the transmembrane action potentials and causes the arrest of isolated preparations from guinea-pig hearts suggests a direct cardiotoxicity of this snake venom (Alloatti and cedrini, 1981).

France: The first station I visited in France was Latoxan (Laboratorie des Toxines Animales et Animaux Venimeux) in Rosans, situated in the French Alps 120 km north of Marseille. This laboratory probably has the largest collection of venomous creatures in Europe. Most of the animals have been captured by the Latoxan's own experts on their home territories.

The geographical place of origin is an important factor in the further use of venom in toxinological studies, because venoms from snakes of the same species collected from different areas may have different pharmacological properties. I received a very friendly and professional reception from Y. Doljansky, A.M. Saint-Michael and Y. Mittaine. The snake representatives of the *Elapidae, Viperidae* and *Crotalidae* are milked regularly by electrical stimulation through the application of electricity to the maxillary region, thereby stimulating contractions of the buccal muscles surrounding the venom gland and delivery of the venom. Besides venom production the laboratory puts a great deal of effort into breeding their animals. Apart from snakes, Latoxan also provides scorpion (e.g. *Androctonus* spp., *Buthotus* spp.) and amphibian (e.g. *Bufo bufo, B. calamita, Salamandra salamandra)* venoms.

From Rosans I moved on to Beauvoir-sur-Niort (150 km north of Bordeaux) and visited G. Naulleau at the centre d'Etudes Biologiques des Animaux Sauvages. Naulleau's research concentrates on the ethology and ecology of the genus *Vipera.* In order to investigate these aspects, he has at his institute numerous different outdoor cages (some of them are directly

connected to indoor terraria) equipped with special instruments registering various environmental factors affecting the vipers' behaviour and physiology. Another of his studies concentrates on the effects of temperature on digestion in *Vipera*. Naulleau (1983) has shown that among the five European vipers he studies, only *V. berus* can digest prey completely at 10°C. The other species can digest completely at 15°C, except *V. seoanei,* which perhaps needs a higher temperature. At every temperature level, *V. berus* digests faster than other species, except at 30°C, where temperature disturbs both the time and quality of the digestion. With the exception of *V. berus* the digestion period in every species shortens when temperature rises.

At the Pasteur Institute in Parish I met C. Bon, whose present research is mainly on the biochemistry of crotoxin. This is the major toxic protein of the South American rattlesnake, *Crotalus durissus terrificus.* Poisoning from the bite of North American rattlesnakes can lead to the onset of shock and, in anesthetised animals, many of these venoms produce circulatory failure associated with vasodilation and hypovolemia. In contrast, poisoning by the venom of *C. d. terrificus* involves neurotoxic symptoms and respiratory paralysis (Gopalakrishnakone *et al.*, 1980). The lethal effect of crotoxin has generally been attributed to a presynaptic blockage of the neuromuscular transmission. At this level, it causes a reduction of acetylcholine release by the nerve terminals simmilar to that observed with elapid neurotoxins (ß -bungarotoxin, notexin, taipoxin from the venoms of *Bungarus multicinctus, Notechis scutatus* and *Oxyuranus scutellatus* respectively).

The protein, crotoxin, has played its part as a milestone in the history of snake venom research. In 1938 Karl H. Slotta and Heinz Fraenkel-Conrat at the Instituto Butantan in São Paulo (Brazil) crystallized crotoxin and determined its molecular structure. This discovery provided the impetus for world-wide research on animal venoms.

Bon's studies in Paris also include other neurotoxins. Bon described the ceruleotoxin which blocks the neuromuscular transmission from the venom of *Bungarus fasciatus* postsynaptically (Bon and Changeux, 1975; Bon and Saliou, 1982). This toxin is very potent and is responsible for at least 35% of the total toxicity of the venom. When intravenously injected into mice, ceruleotoxin produces a flaccid paralysis of the skeletal muscles and death occurs by respiratory failure (Bon, 1976).

Spain: In Barcelona I met D. Gonzales, a clinical toxinologist from the Universidad Autonoma de Barcelona, Facultad de Medicina. His research includes work on the epidemiological and clinical aspects of various venomous animals of Spain. According to Gonzales (1982) the viperid species responsible for snake bites during 1965-1980 in Spain were *Vipera latasti* (54.8%), *V. aspis* (35.1%) and *V. seoanei* (10,1%). It is noteworthy that the opisthoglyphous *Malpolon monspessulanus* can sometimes also cause severe poisoning, however most of the bites by this colubrid species result only in local symptoms, like oedema and paresthesia (Gonzales, 1979).

Switzerland: From Barcelona, an overnight train took me to Geneva where I consulted with P. Sizaret at the Biological Standardization Department of the World Health Organization (WHO). In 1979, WHO held a Coordination Meeting on Venoms and Antivenoms in Zürich which was devoted to collecting data on the clinical effects of snake bites and scorpion stings and experience in their treatment. The snakes proved to be most important in causing major health problems are *Naja naja, Notechis scutatus, Echis carinatus, Vipera russelli, Crotalus adamanteus, Bothrops atrox asper* and *Trimeresurus flavoviridis* (WHO, 1981).

I next visited the Swiss Tropical Institute in Basle where A. Moser is carrying out telemetric studies on the populations of *Vipera berus* in the eastern Swiss Alps by tracking transmitter-tagged individuals. This method could also be of importance to research on snake bite epidemiology (Moser and Freyvogel, 1986).

The other organization in Basle of interest in this context is Pentapharm Ltd., which manufactures pharmaceuticals and diagnostics from snake venoms. At this firm, K. Stocker is carrying out research on thrombin-like snake venom proteinases (enzymes that coagulate fibrinogen). Several preparations of fibrinogen-coagulant snake venom enzymes have today found a current application. They can be used as enzymatic tools in fibrinogen and platelet research, as diagnostic reagents for the characterization of impaired fibrin formation in patients, as haemostatic drugs or as agents for therapeutic defibrinogenation (Stocker *et al.*, 1982). Stocker's present studies

involves the ancrod (Arwin(R)) from the venom of *Agkistrodon rhodostoma* and batroxobin (Defibrase(R)) from *Bothrops atrox moojeni (B. moojeni).* Both are currently being used as defibrinogenating drugs in man for the treatment of vascular occlusive diseases. Also in Pentapharm Ltd., J. Meier is studying the venom apparatus of snakes, namely the fangs of *Dispholidus typus* and *Thelotornis kirtlandi.* Despite both snake species being opisthglyphous, their bites can sometimes result in death, and so they also have some medical importance. One of the founders of modern herpetology, Professor R. Mertens, died in 1975 from a rare bite by *T. Kirtlandi.* Lung oedema and renal failure were the actual cause of his death on the 18th day after the bite (Kornalik *et al.,* 1978). Meier is also active in the field of snake venom pharmacology.

United Kingdom: My visit in England started at the Reptile and Amphibian Section of the Department of Zoology, British Museum (Natural History). C. J. McCarthy guided me throughout the Museum's collection and showed me various preserved specimens of venomous snakes which I was interested in. We also had a short discussion on the phylogeny of venomous snakes based on their venom apparatus, and I was also able to examine microscopically some fangs and other maximllary teeth of *Bungarus.* McCarthy is presently investigating the taxonomy and phylogeny of proteroglyph snakes.

I visited three toxinologists in London. Firstly I met B. Banks at the Physiology department, University College London. Her research includes the pharmacology of Hymenoptera venoms. At the Department of Physiology, Queen Elizabeth College (University of London), I met B. J. Hawgood, a physiologist investigating the action of snake venom. Her work, however, is concentrating on crotoxin. As mentioned above, this venom component has a presynaptic site of action. And so, based on Gopalakrishnakone and Hawgood (1984), the morphological changes in the diaphragm motor nerve terminals induced by crotoxin complex, which include a reduction in synaptic vesicle population, the appearance of omega shaped indentations in the axolemma and swelling of mitochondria, are associated with clinical signs of developing muscular paralysis during systemic intoxication. No postsynaptic or myofibrillar changes were observed at the stage when respiration ceased. Another part of Hawgood's studies includes work on Mojave toxin isolated from the venom of *Crotalus s. scutulatus* which has some biochemical similarities to crotoxin. Mojave toxin appears to have multiple sites of action and in addition to neurotoxic and myonecrotic activity, signs of cardiovascular involvement were observed by gopalakrishnakone *et al.* (1980). Mojave toxin and crotoxin also have antigenic similarities as shown by the ability of antiserum produced against cortoxin to provide protection against Mojave intoxication in mice (Gopalakrishnakone *et al.,* 1980). At the same department, N.A. Marsh is carrying out studies on the cardiovascular effects of *Bitis gabonica* venom. The results in collaboration with co-workers (Adams *et al.,* 1981) indicate the presence of two different components in *B. gabonica* venom affecting the cardiovascular system: a vasodilatory component responsible for the fall in peripherial resistance and hence arterial blood presure and a cardiotoxic component responsible for the progresive reduction in stroke volume.

During my stay in London, I was provided with very pleasant accommodation by T. Langton, Staff Herpetologist with the Fauna and Flora Preservation Society, who is active in the conservation of amphibians and reptiles. I also had the opportunity to meet up with M.R.K. Lambert, Chairman of the BHS.

I next travelled to Liverpool and visited the Liverpool School of Tropical Medicine (LSTM) where D. Theakston and D. Iddon introduced me to their work. Theakston's research expands into many fields of snake venom toxinology, including epidemiology, immunology, etc. According to Theakston and Reid (1982) there is a yearly total of almost 10,000 deaths due to snake bite in the Nigerian savanna and about 23,000 deaths per year in West Africa as a whole. It is interesting that contrary to the widespread view of the lay public and even some medical personnel, antivenom if used correctly can reverse systemic poisoning even when given hours or even days after the bite. It is therefore wise to wait for the appearance of signs of systemic poisoning before administrating antivenom, rather than using it routinely (Reid and Theakston, 1983). WHO has designated the LSTM as a Collaborating Centre for the Control of Antivenoms, and this centre now holds a collection of reference venoms from several important snake species.

The Netherlands: From England I returned by sea to the Continent. In Leiden, Netherlands,

I met P. Dullemeijer at the Zoological Laboratory, University of Leiden. His world-renowned research includes work on the morphology, biomechanics and evolutationary biology of animals, and in this context he has outstanding results on the functional morphology of snake venom apparatus and in the biomechanics of the feeding mechanisms of snakes.

F.R. Germany: I started my visit in West Germany at the Behringweke A.G. in Marburg which is a great antivenom producer for the treatment of European, North and Central African, as well as Near and Middle Eastern, venomous snake bites.

In Waibstadt (near Heidelberg) I was able to meet J. Fehres at the Antitoxin Dr. Helmbold GmbH, where, under the direction of W. Helmbold, the production of antivenom in goats (antivenoms for humans are generally raised in horses) is being carried out for the management of Southeast Asian snake bites.

Next, in Hannover, I visited to G. Habermehl at the Department of Chemistry, Hannover School of Veterinary Medicine. He is President of the European Section of IST and is now active in plant toxin research. The most famous case of plant poisoning is without any doubt that of the sentence against the Greek philosopher Socrates who had to drink an extract of *Conium maculatum* with wine. From he and his student Platon come the first exact descriptions of a fatal poisoning including all of the symptoms by the alkaloid coniin (Habermehl, 1986).

Unfortunately, on account of a business trip that he was making at the time, I could not meet D. Mebs (University of Frankfurt) the Secretary-Treasurer of IST. His research work is also of great importance to Western European toxinology. Apart from his extensive pharmacological studies on snake venoms, including a chapter on reptilian venoms in the *Biology of the Reptilia* series, Mebs recently created and recommended a system for the classification of various snake venom toxins, which now exceed 300. The proposed nomenclature of venom components includes, beside the genus name of the snake, the principal biological function and a number when more than one toxin exists followed by the complete scientific name, i.e. Naja neurotoxin 1 *(Naja naja)* (Mebs, 1986).

Austria: On my return journey to Budapest, I visited F. Tiedemann at the Museum of Natural History, Vienna, with whom I discussed the status of the endangered *Vipera ursinii rakosiensis.* Regrettably, this subspecies seems to be extinct in Austria, and the situation for probably the last populations of this viper in Hungary is also not encouraging.

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I would like to express my gratitude to everyone that I visited for the kind way in which they received me, some of whose names are not mentioned above. Dr. M.R.K. Lambert's helpful suggestions on the manuscript and his linguistic corrections are gratefully acknowledged. My special thanks are due to Miss Edina Dorothy Hidveghy (Veres Pálné Gimnázium, Budapest), Mr. Lajos Kómár and Mr. György Czéher for their invaluable assistance in the arrangements of this visit.

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Ed. Note. Through the kind aegis of the British Council in Budapest, Zoltán Takács became a member of the BHS in 1986. He has completed his first year at the Medical School of Szeged, in Szeged, Hungary, specialising in pharmacology.

OBSERVATIONS ON CAPTIVE JUVENILE SALT-WATER CROCODILES *CROCODYLUS POROSUS*

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INTRODUCTION

The salt-water or estuarine crocodile, *Crocodylus porosus* Schneider is the largest living crocodilian (perhaps reaching 9 m length in hisltorical times, the largest living specimens are of the order of 6-7 m length). It is the only species known to traverse great distances at sea, which probably explains its very wide geographical distribution (Sri Lanka to Northern Australia) (IUCN, 1982). Endangered in most parts of its distribution, the wild populations are generally listed on CITES Appendix I. However, the species is the mainstay of many crocodile farming operations in the Far East, and some populations (e.g. those of Papua New Guinea and Australia) have been transferred to Appendix II to facilitate managed ranching/ farming operations (Luxmore *et al,* 1985).

In May 1987, 12 hatchling salt-water crocodiles arrived in Menai Bridge from Australia. Their dispatch and export permit documentation in Australia had been arranged by Dr. Graham Webb of the Conservation Commission of the Northern Territories; an appropriate CITES import permit was obtained in the U.K. The funds for the animals' transport and the subsequent scientific work to be performed upon them were provided by a grant from the Nuffield Foundation to the author. The animals were purchased from a crocodile farm (where they would have been reared for their skins and meat) and it was agreed that most would be sacrificed for anatomical/histological studies at the end of the experimental programme, but that any remaining live animals could be transferred to a recognized zoo.

The experimental programme is in progress, being devoted mainly to the gut function of the animals, but with side projects involving studies of locomotory mechanisms and behavioural responses to temperature and salinity. The intention in this report is to describe handling and feeding techniques, and to comment on some aspects of the animals' behaviour.

ACCOMMODATION

The young crocodiles are held in a tank of flowing low salinity water (usually fresh water, but sometimes with added sea water as this is known to promote good skin condition), constantly circulated through a biological filter and header tank. The holding tank (5m long x 0.4 m wide x 0.6 m deep) is made of epoxy-coated ply with a perspex front for observation. A feeding platform constructed of varnished marine ply may be reached by gently sloping ramps, cross cut to provide purchase for the crocodiles' claws. The whole arrangement is held in a temperature controlled room at 30°C. Given that the species is a "salt-water" crocodile, it might appear strange to keep them in fresh water. However, although wild hatchlings have been seen in full strength sea water (Gregg, pers. comm.), and possess lingual salt glands which secrete a salt-rich fluid to remove a salt load, they do not thrive in captivity in this medium for reasons which are as yet obscure.

FEEDING & HANDLING

For convenience, routine feeding is upon fish or squid available in the laboratories (mackeral, condemned rainbow trout from a trout farm fish kill, and squid from the Falklands area have all figured in their diet). Chopped whole food organisms are used to ensure plenty of calcium in the diet (crocodilians are prone to skeletal deformities if fed on filleted fish). Usually, no single food organism is used for more than a week. Experience has shown that daily feeding is wasteful, the animals showing a poor appetite and feeding over a prolonged period. Instead, the animals are fed every second day, which results in rapid and complete consumption of meals. At intervals, the animals have been supplied with large insects, as this elicits interesting

feeding behaviour (see below). Cockroaches, locusts and crickets have all been taken readily.

Handling of the animals has so far involved neither gloves nor special apparatus. Although the crocodiles will snap at hands when they are out of water they do not do so when immersed. The normal capture procedure is to chase each animal into the water and then catch it with two hands, one encircling the throat and immobilising the head, the other immobilising the tail.

BEHAVIOUR

For a few weeks the young crocodiles were shy and reacted violently to movements outside their tank. They did not feed in the presence of observers and grew very slowly. Handling was initially kept to a minimum of once per week during weighing sessions. Over a period of 4-5 weeks the animals became progressively tamer and fed more readily. They were handled with increasing frequency as it was intended that they be used in experiments demanding repeated manipulation (e.g. for serial X-radiography). At the time of writing, all animals feed within about 15 minutes of being offered a meal and their sole reaction to handling is to emit loud squawks when first grasped. An initial tendency to urinate when handled has subsided. Initially 50-70 g in weight, the animals have now grown to 110-280 g (5 months' growth).

Feeding behaviour is fairly complex. As soon as regular feeding started, a feeding hierarchy developed, with a few animals growing much more rapidly than the rest as a result of monopolizing (and defending) space on the feeding platform. Initially, attempts were made to counteract this problem by offering more food, but this simply exacerbated the differential growth rate. At present, any animals showing an unusually high rate of weight increase are separated from the others for a few weeks and fed separately until their smaller fellows have "caught up" as far as weight is concerned.

Feeding responses to dead food (fish, squid) are very different from the reactions to live food (insects). At no time have the crocodiles taken dead food placed in their water. Dead food is only taken into the mouth out of water, although the crocodiles often retreat to the water when they have a mouthful of food. In contrast, live insects struggling at the water surface are taken readily and immediately. The crocodiles are also capable of jumping out of the water to catch insects moving on objects above water. To do this, the crocodile first takes up position at the water surface with the snout pointing towards the insect and the eyes focussed upon it. The body is held obliquely or vertically in the water (obliquely if the prey is some distance in front of the crocodile, vertically if the insect is above the predator). The rear feet are drawn forward and their toes parted to deploy the webs between them completely. The crocodile then propels itself upwards and forwards by a powerful downwards and backwards thrust of the hindlegs. As the snout clears the water, the jaws begin to part and are wide open by the time the whole head is above the water line. The jaws snap shut around the insect, which may be as much as a complete body length above the water surface, since the crocodiles are capable of jumping completely out of water. When on land, the young crocodiles are also able to catch insects, either by side snaps of the jaws if the prey is nearby, or by lunges or jumps if the insects are further away (again, the hind limbs provide propulsion). Insects which sank below the water surface, even if still alive and showing limb movements, were not eaten.

Whatever the nature of their food, the crocodiles have a problem when swallowing it. Normally, whether on land or immersed in water, the throat of the crocodile is closed by the upper surface of the back of the tongue forming a seal against the palate (air is drawn in through the nostrils). The tongue is not mobile, so cannot be used to move food from the front of the jaws towards the throat. Instead, the crocodile has to throw its head back and use gravity to supply food to the oesophagus (food items are tossed about by head and jaw movements until their longitudinal axes point towards the gullet). This behaviour is effective when the animal is on land, but when a crocodile has taken food into the water, or has captured food at the water surface, the buoyancy of the food items (particularly insects which have a density well below that of water) means that he gravity-based mechanism would become ineffective if the crocodile tried to swallow whilst under water. Instead, the animal adopts a vertical position in the water, with the head projected above the water surface. The crocodile treads water vigorously (by movements of all four limbs), with the jaws pointing skywards, until the food is swallowed.

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OBSERVATIONS ON THE REPRODUCTION OF THE AMERICAN ALLIGATOR (ALLIGATOR MISSISSIPPIENSIS) IN CAPTIVITY

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The following account is based on personal experience in the keeping and breeding of alligators *(Alligator Mississipiensis)* in captivitiy in South Africa.

These observations have not been conducted as scientific experiments, but rather as practical field observations.

HISTORY

The two alligators with which we have successfully bred, arrived at the Ranch in 1984. They were imported from America. They are a 2.13 metre male (21 years old) and a 1.83 metre female (19 years old). A further female was added to the enclosure of 1.52 metres (15 years old), however, she was attacked by the larger female and was subsequently moved to another enclosure.

ENCLOSURE

The physical features of the enclosure in which the breeding pair are kept is as follows.

The pen is 10 metres x 10 metres with the pool being of irregular shape with a service area of 45m^2, the average depth being 1 metre. The pool is of concrete construction and is drained approximately twice a week, the emphasis being on recreating as natural an environment as possible. At the rear of the enclosure, is a small room which is kept heated in winter; this has a river-sand base, but is not used by the alligators for nest building purposes. The water in the enclosure is not heated.

TEMPERATURE RANGE

The temperature range in Oudstshoorn is not ideal. However, these alligators have adapted well, as can be seen from their breeding record. As a point of interest, I have listed below Oudstshoorn' temperature and rainfall range as cycling temperature conditions throughout the year may also be crucial in bringing these alligators into breeding conditions. Although photoperiod may play the primary role in activating gonadal activity, this may not be triggered unless temperature conditions are correct. (Bustard 1965).

OUDSTSHOORN

	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	Year
MEANMAX°c	18,9	21,3	23,2	25,9	28,2	30,4	32,2	32,3	30,0	26,7	22,5	19,9	26,0
MEANMIN°C	3,4	4,8	7,3	9,9	12,4	13,6	15,3	15,4	14,0	10,7	6,7	3,3	9,7
RAIN mm	19	16	22	21	31	21	10	13	26	21	21	11	232

DIET

The diet for our alligators is unique and is determined by our locality, being close to the ostrich abbatoirs: we have freely available supplies of ostrich meat. The diet for the alligators therefore, consists of ostrich heads and wing-tips, the wing-tips being a red meat with a fairly high flesh content. In the summer we feed approximately 4 times per week.

BREEDING

The alligators at Cango Crocodile Ranch have laid eggs for 2 years in succession. The eggs in 1986 were laid on the 14 January and in 1987 on the 26 January. In both years, the laying was preceeded by heavy bellowing in December. It is surmised from the diagram of the chronology of the reproductive biology in Louisiana of the alligator (from Joanen and McNease 1975) in which they show the courtship beginning on first March with egg-laying occurring from

mid-June to end-June, that our alligators began courtship 6-7 months later than in the States (ie around mid-September). This initial courtship was never observed and therefore possibly took place at night; however, as stated, intense bellowing was observed around mid-December corresponding with the period late in the U.S.A.

In the 1987 laying, 45 eggs were laid in a next which was built from grass cuttings and leaves from reeds which had been placed in the enclosure. The moment the eggs were laid, the female exhibited aggression. As this was the first time that the alligators had bred, uncertainity existed prior to the laying as to whether she hadn't delayed, and therefore during a period of two weeks prior to the lay, the nest was disturbed 3 times in order to establish whether there were eggs or not. This could have led to stress and therefore retention by her of the eggs, as the eggs, when discovered, had already begun banding. Of the eggs laid, 19 were fertile and these continued to band for a further 14 days and then ceased further development with embryonic regression.

In 1987 the procedure was much the same, and in both years copulation was not observed, therefore probably taking place sometime between 6 pm and 7 am. Bellowing occurred towards the end of December and nest building began in mid January, being completed around the 25 January. This time, however, I waited for a show of aggression by the female before opening the nest. This aggression was observed in the afternoon of the 27 January and the nest was uncovered at 6 pm. The temperatures of the 26th and 27th were noted as 32°C and 33°C respectively. Both were dry, hot days. The 28th however, was cold and wet. This time 49 eggs in total were laid with three being badly damaged, yolk from these had fallen onto some of the undamaged eggs and, although wiped off, when incubated formed a fungus. A further 2 eggs were cracked but were still placed in the incubator. Of the remaining eggs, 28 were fertile and had begun banding. This was evident by a spot on the surface of the eggs at the time of collecting. This caused us to believe that the eggs were laid on the night of the 26th. On the 1 February, on all 28 eggs, the banding had progressed to a thin band extending around the eggs. On the 20th March, 5 eggs were removed as banding had ceased at approximately day 14. These eggs also displayed large air pockets of approximately 30% of the total egg. All had embryo's which compared with those of 14 day embryos. On the 26th March, 40 eggs were removed, in all cases there were large air pockets where the embryo had detached from the shell and in the few fertile ones, embryonic regression was visible. However, one healthy embryo was discovered which seemed to be developing at it's normal rate. At this point, we had 5 eggs left which had banded well and appeared to have a chance of hatching. These also had air spaces of between 20 and 25%. No external cracking on the shell was visible. On the 27th I cracked the outer surfaces of the shells, in the hope of enabling a better gas exchange and also to aid the hatching of the embryo. On the 2nd April, 1 hatchling broke through the membrane with it's head in an upside down position. This occurred at 5.30 pm. By 2 pm on the 3rd, it still had not emerged, I therefore slit the membrane thus allowing the hatchling to free itself. By the 7th, the remaining 4 eggs had shown no sign of hatching. We therefore opened the eggs and found 4 fully formed dead embryos.

The eggs were incubated in a laboratory incubator, kept at a temperature of 31°C. A wet-dry thermometer was placed in the incubator in order to monitor the humidity; the dry bulb registered 90-95% humidity. During incubation, the eggs were placed on racks with no substrate. Distilled water was placed to a depth of 5 centimetres at the bottom of the incubator, with fresh air passing through the water; above the eggs was a tray with a further 3 cm of water. It would appear from the large air-pockets in the eggs that the humidity was not as high as shown by the wet-dry thermometer – the particular model used not being of a very high quality. Further, problems were experienced with the door seal which has since been corrected. I feel that alligator eggs possibly need a higher humidity than those of the Nile crocodile *(Crocodylus niloticus)* as we have successfully hatched these in the same incubator on numerous occassions. There is also possibly a need for a substrate to encourage chemical decomposition of the egg-shell.

HATCHLING

The hatchling when born was approximately 2 weeks premature with a largely distended abdomen and a large amount of retained yolk. It has, at time of writing, continued to improve and has absorbed all its yolk, with the stomach closing well. The diet being fed consists of mince,

fish and liver. The length at birth was 233mm and its weight was 35 gms. The average measurement of the eggs was 71 mm long, diameter 39.5 mm with a eight of 66 gms.

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PICKETT'S PIECE

An irregular column of personal observations, notes and commentary.

Crested Newts in the Italian Apennines

Those of us living in northern Europe are familiar with the Crested Newt *(Triturus cristatus)* as a widespread, though somewhat difficult to find, even secretive, animal. Where old grazing lands and the small ponds associated with them are still maintained, such as in parts of the Pennines, the Crested Newt remains common and secure for the time being. However, because of the general change in agricultural land use in the lowlands to intensive arable farming, the old stock ponds in permanent grass fields, once so numerous on heavy lands, have almost disappeared, the newts with them. Though still not uncommon, suitable breeding ponds are much reduced in number, giving rise to concern for the future of the species. Some people have even, contrary to the evidence, classified it as endangered. It is in England, accordingly, given especially strict "protection". Where found it is usually, though not always, less abundant than the smaller species *(Triturus vulgaris and helveticus)* with which it shares its habitat. It is decidedly nocturnal, so that the standard method of detecting its presence and surveying its numbers is to search the margins of ponds at night by torchlight, where it can often be seen in numbers where in daylight there is no indication of its presence. Such are its habits here that the differences in its natural history in the southern European part of its range, from the north, seems astonishing.

In the Italian peninsular the Crested Newt is the common newt, and dominant in most populations. Other species occur with it usually in much smaller numbers. It inhabits a wide variety of country and climate, from sea level along the Mediterranean coast to subalpine conditions in the Apennines, where this species is found breeding as high as 1818m, the highest recorded altitude in its range. It shows a greater adaptability than in northern Europe. Physically it is different too. It is larger and more robust than the northern race, more distinctly marked, and much more variable in colour and pattern in different breeding populations, even those only a few miles apart. The differences are sufficiently great for some authorities to regard the Italian form as a separate species, *Triturus carnifex,* rather than just a subspecies.

In my wanderings in the Abruzzi in the central Apennines, I have noticed several aspects of the life of this newt with interest. It can be found in almost any body of water, from small temporary pools, the quiet waters of the bows of streams, to large permanent mountain lakes. The first striking thing is its abundance: great numbers can be seen in some lakes. Secondly, it is neither secretive, nor especially nocturnal as northern animals are. Its presence is at once obvious. It can be seen swimming boldly in the sunshine around the shallow, vegetationless margins of mountain lakes. It is very aquatic in habits, though to a varying degree in different populations. I have seen large numbers of animals of all ages in the water from early Spring to late Autumn, and suspect that many are permanently aquatic.

The first time I saw *carnifex* in the wild was in a high altitude Abruzzi lake set in a treeless expanse of sheep pasture. It is a characteristic of these high altitude grasslands that they support huge numbers of grasshoppers. These were continually falling into the water around the lake edge, and were quickly seized by the newts, obviously forming a large part of their diet in summer, perhaps the largest part. I had never anywhere seen as many Crested Newts as in that lake that summer – an astonishing and wonderful sight for someone used to the comparative scarcity and very different habits of the same species in England. However, it is not in all years that the grasshoppers are abundant; their numbers vary from year to year, rather like voles in English grasslands. Another time, visiting the same lake one Autumn, in a poor grasshopper year, the newts were less numerous and quite underweight and weak in appearance. In the spring of 1987 Mike Linley also visited this lake, and saw only a few individuals which were in a pitifully emaciated condition. An Italian colleague, in another lake in the same region, noted similar conditions. One year, large numbers of newts were seen, but thin and in poor condition; in other years only small numbers could be found. It seems from these observations that these montane newts are subject to great variations in food supply, and

that they are commonly subject to starvation and subsequent fluctuations in their numbers. It seems that there may often be too many newts for the amount of food available: a case of natural overpopulation. It is possible, of course, that the newts change their habits in response to these conditions, and perhaps in lean years become more terrestrial. Or there may be large scale famine and population crashes, with sufficient large adults surviving until the food supply increases again. These conditions must have existed for a long time, and newts have evolved to cope with them. Whatever the cyclical fluctuations in the size of individual populations, the species remains common and ubiquitous. Types of country, climate and land use are so varied in the Italian peninsular, with age-old forms of pasture in the mountains, that it is difficult to foresee any major sudden change which will threaten this animal, and no doubt for a very long time to come we will be able to relax and observe, in the good years, such large numbers of them moving slowly in the sunshine along the shores of mountain lakes.

Poison Arrow Frogs, CITES, and other interesting matters

The proposals to include all species of the Poison Arrow Frogs, *Dendrobates* spp. and *Phyllobates* spp., on Appendix II of the Convention on International Trade in Endangered Species, at the meeting in Ottawa, July 1987 revealed some interesting and surprising facts, both about the frogs themselves and the delegates to the Convention.

The IUCN recommended rejection of the proposals on the basis of the best scientific advice available. This advice was ignored by the delegates, including, strangely, the members of the Nature Conservancy Council who were representing the U.K. and supposedly act as *scientific advisors* to the U.K. government and EEC. But more about that later.

The IUCN analyses of the proposals reveal some very interesting facts about the status, distribution and ecology of the Poison Arrow Frogs, detail which is not usually published and not easily accessible; some of this is worth quoting here.

Information and advice was sought by the IUCN from Charles Myers, Curator of Herpetology, American Museum of Natural History, and who is acknowledged by the IUCN as the world expert on Dendrobatid frogs; Marinus Hoogmoed, Rijksmuseum van Natuurlijke Historie, Netherlands, Stefan Gorzula of Venezuela; and Stephen Edwards, Executive Officer of the IUCN Species Survival Commission. These authorities were able to put together some convincing information on the status of Poison Arrow Frogs. All of it makes fascinating reading, but I can only summarise a few points here:

No species is endangered. Where they occur they are, or are among, the most abundant vertebrates in their habitats, with observed densities of up to 10 adults per square metre. There is no knowledge of range contractions in historic times. There is no evidence of decreasing populations, "even in those very few places that have been subject to unusually heavy collecting. . .the few heavily collected populations of *D. auratus* and *D. pumilio* remain as dense as ever". The natural history of the frogs explains their resistance to collection: "reproductive success is inversely density dependent and therefore suppressed in large stable populations, but that reproduction is greatly facilitated if the population is either reduced in size or maintaining itself in less than optimal habitat". Myers and Daly reported "that they had monitored the effect of collection of large numbers of specimens, fearing that such collection might suppress local populations. In no single instance did collection appear to adversely influence the population; in fact, on several occasions, they seemed more abundant. For example, Myers reports that during a 4 year study on *D. histrionicus* during which he collected 7,600 specimens from one population for scientific purposes, the population actually increased rather than decreased. He notes as well that this number – 7,600 – greatly exceeds the combined imports of all Dendrobatids into the U.S. in 1984 and the Netherlands in 1984-1985. Myers reports having similar long-term data (unpublished) for single populations of other species occurring in the pet trade, namely *D. auratus, D. pumilio,* and *D. tricolor* and smaller amounts of data on other species, e.g. *D. bombetes* and *D. speciosus.* Gorzula reports that based on his own field experience with *D. leucomelas, D. pictus, D. rufulus,* and *D. steyermarki,* he finds little to indicate that collecting at a level of a few thousands of any of these species would ever affect wild populations". Surprisingly, fears that forest clearance may threaten Dendrobatids has been shown so far to be unfounded: the frogs adapt to secondary forest and disturbed areas, and there is no evidence that they are dependent on primary forest. Even species with

small ranges tend to be abundant. Of *D. histrionicus,* one of the species most often commercially exploited, Myers reports that "it occurs in countless dense populations throughout many thousands of square kilometres of undisturbed rain forest in western Colombia and Ecuador". Most of the authorities concluded that the proposal (to include Dendrobatid frogs on Appendix II) "did not accurately reflect the biological and ecological situation of these species", and "most felt that the assumption that trade poses a threat is neither sufficiently substantiated nor justified by fact".

One would have thought that following these statements and the IUCN's recommendations the delegates at the meeting would of course have rejected the proposals. But in fact the scientific recommendations were completely ignored and the proposals passed in spite of them. From this one must naturally conclude that scientific evidence is not generally considered by the CITES meetings, and that voting is more influenced by politics and "protectionist" pressures. This is sad. Also surprising and saddening – and hard to understand – was the position taken by the U.K. scientific authority, the Nature Conservancy Council, representatives of which voted at the meeting as part of the U.K. delegation. It is important to remember that the NCC act as scientific advisors to the Government on the trade in, and issuing of import/export licences for, live animals. They are also the scientific advisors to the European Community: powerful and responsible positions. Yet in this case they actually disregarded the scientific evidence, and voted contrary to it. They behaved similarly on other issues. Why? We do not know. Certainly it seriously undermines their credibility as objective scientists. How can they be relied upon to give unbiased *scientific* advice to the whole of Europe?

The facts revealed by the IUCN's scientific authorities give rise to other, unfortunately heretical and no doubt fanciful thoughts, difficult or impossible to implement. More respectful attention has been given in recent years to preserving wild places by controlled harvesting of their produce: using their productivity as a natural resource which ensures conservation and pays for conservation. Successful examples which spring to mind are Alligator harvesting in Louisiana, crocodile harvesting and ranching in Australia, New Guinea, and other places; butterfly "ranching" in New Guinea; wild game cropping in some African countries. Those people better informed on these forms of conservation will know of other developments. There is much concern about the destruction of tropical rain forests. Conservation agencies in the countries concerned are feebly financed. Like butterflies in New Guinea, natural products of the forest which will bring a financial return, stimulate conservation, pay for it, and integrate it into local economies are badly needed. We have learnt how exceptionally resilient Poison Arrow Frog populations are to collection. They would seem to me to lend themselves ideally to limited exploitation. Cannot a responsible regular harvest be used to pay for wardening and other costs of rain forest reserves? If conservation takes a more enlightened turn, enough natural forest products could be exploited to ensure the long term preservation of areas of rain forest as economically productive and useful areas, of value to local people as much as cropland and cattle pasture. Amphibians may have their small part to play in this, just like Papuan butterflies. Better to have a forest with frogs and parrots in it than eroded pasture, producing hamburger meat.

REFERENCE

IUCN Analyses of the CITES Amendment Proposals submitted to the Sixth Meeting of the Conference of the Parties, Ottawa (Canada), 12 to 24 July 1987. Prepared by the Trade Specialist Group of the IUCN Species Survival Commission, 15 June 1987.

SUMMARY OF CITES MEETING, 1987

The sixth meeting of the parties to the Convention on International Trade in Endangered Species of Fauna and Flora took place in Ottawa, Canada, in July 1987.

Changes in listing on the Appendices of the Convention of reptiles and amphibians are as follows:

Ibiza Wall Lizard, *Podarcis pityusensis.* Included on Appendix II. No previous listing.

Lilford's Wall Lizard, *Podarcis lilfordi.* Inlcuded on Appendix II. No previous listing.

Hierro Giant Lizard, *Gallotia simonyi.* Inlcuded on Appendix I. No previous listing.

Queensland Snake Lizard, *Paradelma orientalis.* Deleted from Appendix II.

Orsini's Viper, *Vipera ursinii.* Included on Appendix I. No previous listing. Russian populations excluded.

Argentine Boa, *Boa constrictor occidentalis.* Included on Appendix I. Previously listed on Appendix II.

Hammond's or Two Striped Garter Snake, *Thamnophis couchi hammondi.* Deleted from Appendix II.

Dwarf Crocodile, *Osteolaemas tetraspis.* Congo population transferred to Appendix II, (from Appendix I), subject to quotas.

West African Short-Nosed Crocodile, *Crocodylus cataphractus.* Congo population transferred to Apendix II (from Appendix I), subject to quotas.

Poison Arrow Frogs, *Dendrobates* spp. *Phyllobates* spp. Included on Appendix II. No previous listing.

Tomato Frog, *Dyscophus antongilii.* Included on Appendix I. No previous listing.

Lake Lerma Salamander, *Ambystoma lermaense.* Deleted from Appendix II.

The proposal to include the Golden Frog, *Mantella aurantiaca,* on Appendix I, was rejected, on the grounds that it has been found to be more widespread in Madagascar than previously realised.

The USSR delegate also successfully objected to the inclusion of the Russian populations of *Vipera ursinii* on Appendix I, as this Viper is common and has a wide range in that country.

The French proposal to transfer the populations of the Green Turtle, *Chelonia mydas,* of the islands of Europa and Tromelin from Appendix I to Appendix II, to allow the controlled trade in ranched turtle products, was rejected.

A more detailed analysis of, and commentary on, the 1987 CITES meeting will appear in the spring 1988 issue of the Bulletin. See also PICKETT'S PIECE, this issue.

BOOK REVIEWS

HANDBOOK ON THE MAINTENANCE OF REPTILES IN CAPTIVITY

By K.R.G. Welch
Published by Robert E. Kreiger. Publishing Co., Malabar, Florida.

This work by Kenneth Welch is in fact a collection of short papers or accounts by a variety of authors including Welch. Contributions are from:

O. F. Jackson, J. L. Cloudsey-Thompson, D. G. Garthwaite,
A. S. Wright, A. B. Van Woerkom, C. J. Howard, D. Wright,
P. S. Cooke and J. W. Verkerk

From the very first sentence in the text of the book I was in a quandry. The disclaimer that the "text is *not* to tell the reader how to keep reptiles" left my head spinning. But I pressed on.

The book is divided up into four main sections, three Appendices, a Bibliography and an Index. Sections two and three are written by the variety of contributors besides the main Author.

In section I – Maintenance of Reptiles in Captivity, a general section covering the subject of the Book title, little or no distinction is made of, or reference to, the four orders of the Class Reptilia. *All* reptile needs are simply lumped together into the simple sub-headings of Space and Habitat, Light, Temperature, Moisture, Food. Notably absent here is any consideration of, or information about, the large variety of aquatic fresh water turtles kept by Reptile-fanciers in terms of water temperature, depth, quality etc. For these maintenance details the reader is referred to another author, Tryon, who published in the Herpetological Review in 1978 and 1979.

The Section – The Keeping of Reptiles Outside, completely ignores the Crocodilians, which, as a major Order of the Reptilia is given short shift in this book. The only reference to them is given later in the Species-Reference list where only four species of *Crocodylus* and one of *Caiman* are listed with Author references. I am left to suppose that the reader who needs to know more about the maintenance of these Reptiles in Captivity will have to consult these authors who form part of an amazingly numerous bibliography.

No warnings are given on the impact on a neighbourhood of a back yard full of snakes or large lizards, much less even one Crocodilian. No guide or advice is offered as to the advisability or suitability of trying to keep tropical reptiles outdoors in a temperate or semi-temperate climate.

The "Keeping Reptiles Inside" section covers the Main Structure (of Cages), Substrate, Light, Heating, Water, Hides, Plants and Labelling.

This section would have been greatly enhanced by some drawings or photographs illustrating typical cages or enclosures for at least the most available and most often kept snakes, tortoises or lizards.

Though the admonition about labelling Venomous Snakes Cages "where everyone can see" may be a commendable one, it presupposes, and seems to sanction, the keeping of poisonous snakes by everyone. However, this sanction does not take into consideration the advisability or non-advisability of keeping dangerous venomous snakes (or for that matter large pythons and boas) in an apartment or neighbourhood by sometimes young, foolish, exhibitionistic or inexperienced herp-fanciers who unfortunately often constitute not a small body of the keepers. A survey done in Britain for 1970-1977 (Trestrail 1985) revealed that 75% of the venomous bites reported were from private individuals in their homes. In the United States of America for 1976-1980, of bites registered from exotic venomous snakes, 71.4% involved amateur collectors, and the bites registered annually, from both domestic and exotic species was found to be 6,680.

In this section on Handling, Identifying, Measuring and Feeding very little emphasis is put on the chances of venomous snake-bite. It is during these activities that the majority of bites occur.

Further along in the book J. W. Verkerk casually tosses off the information that the venomous *Trimeresurus albolabris* young can be "force fed with newborn mice" and adds as a Conclusion that "*T. albolabris* is not particularly venomous" in direct contradition to his earlier statement that "It lives high in trees as well as the rice fields "*when it can be a danger to man*" (my emphasis).

Except for the admonition to handle reptiles only when necessary, the cautions, equipment, and techniques are supposedly left to other authors quoted in the Bibliography. Greater attention is given to Identifying, Measuring, Feeding Problems, Sexing, Pregnancy and Ill Health.

Section 2 – Authorised in the main by Verterinarian Oliphant Jackson is a useful addition to the knowledge needed by Keepers.

In Section 3 – the entire subject of Maintenance of Reptiles in captivity covering approximately 240 Turtles, 2300 snakes, 3100 lizards, 20 Crocodilians and one Rhynchocephalian, is addressed by personalized accunts of the keeping in captivity of four species of the family Gekkonidae, two species of the Iguanidae, six species of one genus in the Boidae (Sub family Erycinae – The genus Gonglyophis has been ignored for years (Stimson 1969, Dowling et. al. 1974-1978), 19 species of the Colubridae, one species of the Crotalidae and 3 species of the genus Vipera in the Viperidae, a total of 34 species of the Order Squamata, the largest in terms of number of species. There are no accounts of Turtles, Terrapins or Tortoises nor of any crocodilians. I did not expect much information to be available about the one Rhynchocephalian – the Tuatara, but surely somewhere in the Introduction, which does state that the book is supposed to be a "base for the beginner" and "a handbook for the more experienced", this could have been included. This Introduction ignores completely the overall concept of what a reptile is, how they differ from other vertebrates, or one another, which information I would have thought would be of prime importance to a beginner.

The balance of the book Section 4, the Appendices, Bibliography and Index is of questionable practical use in a Handbook on Maintenance for the Herp Fancier or Keeper.

There is a vast list of species (700+) which the average amateur or professional, pet shop, or dealer is unlikely to ever see, much less maintain. The section on the Envenomation by Colubrids once again refers the reader to other Authors whose information is published elsewhere..

The section on the incubation of Reptile Eggs seems extensive and I am only able to comment that the majority of records of hatching information by the Pythoninae (Ross 1978) are omitted, though Ross's work is listed in the extensive Bibliography.

Herpetological Societies and Associations are listed for what they are worth and a most useful and extensive Bibliography is given which lists 1221 papers. At best it is good to know, if not bewildering to the amateur who will wonder where to start, that so much has been written and published elsewhere, but the availability of such a mass of information is questionable in a book of this scope.

As a final observation, and at the risk of being accused of being too finicky, I must take Mr. J. W. Verkerk to task again, for he states that he feeds his *T. albolabris* young frogs of the species *Limnodynastes perroni.* One hazards the question as to where he got the parents of this obviously successfully breeding colony. This frog is found exclusively in Australia (Frost 1985) and I believe all faunal exports are strictly controlled and subject to stringent permit regulations from the sub-continent.

The mass of scientific names in the Species Reference List and Index I did not have the fortitude to check for accuracy as they have little reference to the expressed purpose of the title of this book.

Minor typographical errors and taxonomic gender differences (p. 5 – *Amphisbaena fuliginosa)* appearing in the text, do little to mar what must have started out as a well intentioned addition to the mass of Herpetological Literature, but which seems to have become lost along the way with an overload of useful but not-applicable baggage.

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Hans Boos

A FIELD GUIDE TO THE SNAKES OF TEXAS

By Alan Tennant. Published by Texas Monthly Press, PO Box 1569, Austin, Texas.
Pbk, 260 pages – illust. in colour and line drawings. Price $14.

"Snakes of Texas" by Alan Tennant has been widely acclaimed; it is vast, encyclopeadic in content, beautifully illustrated, scholarly yet eminently readable and very expensive. If, like me, you have found the price tage (£55) prohibitive then the current volume is what you have been waiting for.

"A field guide to Texas Snakes" is a slimmed down version of the magnificient original; complete with colour plates of all the Texan species, distribution maps and extensive descriptions of natural history. The descriptions follow the pattern:

1. Risk to the handler e.g. venomous, willingness to bite etc.
2. Abundance.
3. Size.
4. Habitat.
5. Prey.
6. Reproduction.
7. Colouring/scale form.
8. Similar snakes (in appearance).
9. Behaviour – including notes on captive care.

Although it has no bibliography it does have an excellent illustrated key to the genus level and a complete index.

Texas is blessed with one hundred and ten different snakes some of which (for instance the Trans Pecos Rat snake) occur in different colour forms – and all are illustrated in this book.

The colour plates are concentrated at the front of the book and the species descriptions follow. These are grouped according to gross appearance eg. "small burrowing snakes", or "aquatic snakes" so – should you be fortunate to actually use this book in the field then it should be a simple matter to locate the appropriate pages even without using the key.

The quality of printing is superb and further testament to the skills of that industry in Hong Kong.

This is excellent value and highly recommended.

David Blatchford

THE ENCYCLOPAEDIA OF REPTILES AND AMPHIBIANS

Edited by Dr Tim Halliday and Dr Kraig Adler (1986). 144 + xvi pages. Hemel Hempstead: George Allen & Unwin. ISBN 0-04-500037-9. £15.00.

An encyclopaedia is defined in *The Shorter Oxford English Dictionary on Historical Principles* as a work containing exhaustive information on some art or branch of knowledge, arranged

systematically. Many wildlife 'encyclopaedias' have fallen short of this and one might be excused initially for saying "oh no, not another 'encyclopaedia'!". But only a cursory glance at the list of compilers and the very fact that there *is* a list, not just a single name, for the *Encyclopaedia of reptiles and amphibians* edited by Tim Halliday and Kraig Adler (both authorities in their own right on their respective fields in any case) confirms that this is not just a run-of-the-mill work. The authors to the various sections have been carefully identified, albeit with a slight (not unexpectedly) ethological bias, and the photographs to illustrate points, or for their own sake, are superb, often taking one's breath away, and among the best I have ever seen. The complementary illustrations are highly accomplished and accurate, as one has come into the habit of expecting routinely from David Dennis through his work for the Society for the Study of Amphibians and Reptiles, U.S.A., as co-founder with adler. The half-title page with a serendipitous-looking emerald-green, White's tree frog of Australia and title page with a splendid photograph of a pair of Galapagos giant tortoises in their natural habitat set the tone, while Mike Fogden's prize-winning shot of male golden toads (*Bufo periglenes)* at a mating pond confirms the first impression. Halliday writes a neat Preface, making reference to Appendices I and II of CITES, and then more traditionally, using adaptive radiation as a principle, there is a description of the amphibians under the subheadings caecilians, salamanders and newts, frogs (I am not quite sure why this is not frogs and toads), and reptiles under the subheadings turtles and tortoises, lizards, snakes, worm-lizards, tuatara, crocodilians. Adler writes a concise introduction to the Amphibia (clear evidence of his teaching experience coming through!), recounting the group's evolution and life-history. There is a splendid photograph of a cluster of cooperatively breeding grey tree frogs *(Chiromantes xerampelina)* beating a female secretion into a foam nest high up in the branches of a tree in the southern African savanna to end the section and lead into metamorphosis – appropriately headed "A key amphibian event". A turquoise poison-dart frog *(Dendrobates auratus)* illustrates "kaleidoscopic" colour adaptations of amphibians and the South American pygmy marsupial frog *(Flectonotus pygameus)* an extreme example of parental care under a catchy heading "conscientious parents"! Yes, the mouth-brooding male Darwin's frog *(Rhinoderma darwini)* is also there! Appropriately, Marvalee Wake (Berkeley, California) describes the caecilians and the Open University team of Halliday and Verrell the salamanders and newts (I like David Dennis's drawings of different species illustrating the range of form and colour), and what a superb close-up of the terrestrial cave salamander – *Eurycea lucifuga* (to contrast with the aquatic axolotl) – used to illustrate extremes in life-style, not to mention the marvellous shot of the dusky salamander *(Desmognasthus fuscus)* and her grape-like cluster of eggs which must technically have been very difficult to obtain. Two sections cover the arguably most significant aspects of urodelian biology: courtship (by Halliday himself) and defense. I did not know about the Chinese spiny newt (a useful photograph) – *Echinotriton andersoni* – before. Frogs and toads (Order Anura) is introduced by Anthony Arak and again one keeps saying "where did they find these photographs?" e.g. that of the see-through glass frog *(Centrolenella vireovittata).* There are sections on jumping, an adaptation to the lack of a tail, and calling, so important in mating among the large number of different species of frogs and toads that may, especially in the tropics, gather together at the same pond.

The Reptilia are introduced by no less than Angus Bellairs – the editors could not have chosen a more experienced contributor. Not unexpectedly, the section is introduced in a masterly way: from the link-up of the modern and fossil forms within the overall evolutionary scheme to skin and its function, the skeleton and its adaptations and reproduction and its variety. Alan Charig contributes a section on 'dinosaurs' and Raymond Huey on reptilian ectothermy who concludes that the thermoregulatory abilities of reptiles must contribute to their success in hot, dry and, to other life forms, inhospitable environments. As in the case for the Amphibia, the quality of the photographs is astonishing, for example, a baby green mamba hatching (page 66), three Florida redbelly turtles in a swamp pool (page 84/85), the blue tongue of *Tiliqua scincoides* (page 87), the montane chameleon of West Africa (page 96/97), *Takydromus sexlineatus* in long grass (page 102/103), the terrestrial monitor in threat posture (page 106/107), the hog-nosed viper swallowing a frog (page 120), the rattlesnake striking (page 130/131) and the underwater shot of a Nile crocodile feeding on an impala (page 140/141).

Interspersed amongst the authorities' sections, there are sections on classification of the various families with straight factual information, notes and examples of species falling within each.

The Bibliography is comprehensive, thought out (not just a list of indiscriminate titles) and consequently useful to the novice and professional alike. Few titles are excluded that I would not also have left out. I wonder, however, although appreciating that this is for convenience, whether conservation should have been placed with husbandry and care in captivity. Other than these being applied aspects of herpetology, I would have separated conservation for care in captivity is connected more with welfare, although husbandary/captive breeding do constitute a potential conservation tool. There is also a Glossary of terms used in the book and an excellent cross-referenced Index. Accuracy and painstaking attention to detail are applied throughout the work, both in the editing and production; an example of successfully pooling Anglo-American resources!

It is difficult to find valid criticism of the work and I can only praise this *Encyclopaedia*. Other than not listing toads with frogs (mentioned earlier) in the way that tortoises are with turtles and newts with salamanders, I only noted the slight inconsistency of headings – regulation in Contents and control in the Section – and a few typographical errors in authors' names e.g. Townsend should be Townson in the Bibliography. But this is to niggle over minutiae. The book should appeal to the beginner in herpetology, it should also help to develop a sympathetic awareness for amphibians and reptiles amongst the otherwise fur and feather brigade (the herpetofauna have been allowed to speak for themselves through the beautiful photographs) and I believe it will even replace some of the earlier more coventional texts on herpetology that university undergraduates have been referred to in the past. The information on the amphibians and reptiles is largely definitive – comprehensive enough to enable one to glean enough information, attractively presented, without having to spend a lot of time reading through a mass of verbage unless the more detailed information (which is there) is required.

Every member of the Junior Section of the British Herpetological Society should ask a parent or uncle to give them a copy of this book for Christmas. At £15.00, good value! Other herpetologists should consider the same, not only for the comprehensive record of photographs, surely the apogee of this work, but also for the authoritative texts. As a reviewer for the British Herpetological Society, my copy will be placed with the Library, but I think I shall buy a personal copy which I would much appreciate the co-editors signing!

M.R.K. Lambert

LETTERS TO THE EDITORS

Dear Sirs,

A friend of mine, who has recently bought a cottage near Abersoch, North Wales, informed me of a large lizard inhabiting a bank in his garden. When I questioned him as to the appearance of this lizard the following description was given; the lizard was about 30cm. long with a head the size of an orange. It was a mud brown colour and usually only poked its head out of its burrow. It had a large tongue which it, supposedly, used to attract flies which it then ate. Its eyes were continually rolling in their sockets. This strange lizard also possessed a large dew-lap. As well as this lizard, another of the same description but only about half the size inhabited the burrow.

I questioned one of the locals who immediately seemed to know what I was talking about. He replied, "Oh, I thought they had all died out now. There used to be hundreds about when I was a boy".

This lizard is locally called cenaprugwirion or genaprugwirion. The name means Daft Fly Catcher. I, personally, cannot imagine what this lizard can be; it certainly does not fit the description of any of our native species. Does anybody know what the animal is and how it could have got there?

Yours faithfully,
Richard Wallis
Forest House, Kelsall, Tarporley, Cheshire, CW6 0PE.

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.

* **Request:** Are there any vets or laboratories willing to carry out post mortem analysis on amphibia, especiall unrodeles? If so please contact P.J. Wisniewsky, Amphibian Breeding Centre, 38 Hesketh Road, Burscough, Lancs. Tel: 0704 894503 (evenings).

* **For sale:** Royal Python, 3-4 years old. Martin Ford, 46 Neville Road, Gargrave, Skipton, North Yorkshire.

* **Wanted:** Day, House, Leopard or other similar geckos. Pairs preferred for breeding. Andrew Pettitt, 33 Runnymede, Colliers Wood, London SW19. Tel: 01-543 3295.

* **Wanted:** Yellow Bellied Toads, *Bombina variegata* R. Nutt, 6 Bembridge Drive, Kings Thrope, Northampton. Tel: 0604 720963.

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. Registration begins January 1988; £90 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.*

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