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THE BRITISH HERPETOLOGICAL SOCIETY

BULLETIN

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THE BRITISH HERPETOLOGICAL SOCIETY

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The British Herpetological Society was founded in 1947 by a group of well-known naturalists, with the broad aim of catering for all interests in reptiles and amphibians. Four particular areas of activity have developed within the Society:

The Captive Breeding Committee is actively involved in promoting the captive breeding and responsible husbandry of reptiles and amphibians. It also advises on aspects of national and international legislation affecting the keeping, breeding, farming and substainable utilisation of reptiles and amphibians. Special meetings are held and publications produced to fulfil these aims.

The Conservation Committee is actively engaged in field study, conservation management and political lobbying with a view to improving the status and future prospects of our native British species. It is the accepted authority on reptile and amphibian conservation in the UK, works in close collaboration with the Herpetological Conservation Trust and has an advisory role to Nature Conservancy Councils (the statutory government bodies). A number of nature reserves are owned or leased, and all Society Members are encouraged to become involved in habitat management.

The Education Committee promotes all aspects of the Society through the Media, schools, lectures, field trips and displays. It also runs the junior section of the Society - THE YOUNG HERPETOLOGISTS CLUB (YHC). YHC Members receive their own newsletter.

The Research Committee includes professional scientists within the ranks of the Society, organises scientific meetings on amphibian and reptile biology and promotes *The Herpetological Journal*, the Society's scientific publication.

Meetings
A number of meetings and events take place throughout the year, covering a wide range of interests.

Publications
The BHS Bulletin, Herpetological Journal and *YHC Newsletter* are all produced quarterly, and *The Natterjack* Newsletter is produced monthly. There are in addition a number of specialised publications available to Members and produced by the various Committees, such as notes on the care of species in captivity, books and conservation leaflets.

Subscriptions
All adult subscriptions become due on the first day of January each year. Payment by Banker's Order is much preferred.

Ordinary Members	£20	(Receive Bulletin only)
Full Members	£25	(Receive Bulletin and Journal)
Family Members	£30/£37.50	(Without/with Journal) Family members with children also receive the YHC Newsletter
Student Members	£18	(Receive Bulletin and Journal)
Institutional rates	£36	(Receive Bulletin and Journal)
YHC (Age 9-18):		
Basic Membership	£6	
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Group Membership	-	For Schools, Youth Groups etc Contact Membership Secretary (Address on inside of back cover for details)

Correspondence, Membership applications, subscription renewals and purchase orders for publications should be addressed to the Secretary (address as at page top) PLEASE INCLUDE A STAMP-ADDRESSED ENVELOPE WHEN WRITING TO THE SOCIETY.

The Society does not, as a body, hold itself responsible for statements made or opinions expressed in the Bulletin; nor does the Editorial necessarily express the official opinion of the Society.

The Bulletin is edited and produced by
Simon Townson and John Spence.
Contributions and correspondence arising from the Bulletin should be sent to:
John Spence, 23 Chase Side Avenue, Enfield, Middlesex EN2 6JN

FRONT COVER
The Green Road *(Bufo viridis)*. See "An Overview of the Herpetofauna of Slovenia" by Nuša Vogrin, P.26.

BRITISH HERPETOLOGICAL SOCIETY MEETINGS FOR 1997

Meetings are usually held at Birkbeck College, Malet Street, London WC1, unless otherwise stated

March 15th — Annual General Meeting. Programme: 10.30 am – Coffee; 11.00 am – A.G.M; 11.45 am – Quiz; 12.30 pm - 2.00 pm – Lunch (buffet with wine); 2.00 pm – Trevor Beebee – "Life at a range edge: the biology and conservation of natterjack toads in Britain; 2.45 pm – Tea; 3.15 pm – Mark Wilkinson – "Is it a worm? is it a snake? No, it's a caecilian. 4.00 pm – Close.

50th ANNIVERSARY MEETINGS

June/July — Captive Breeding Committee – Summer Buffet in the Reptile House at London Zoo (details to follow).

Aug. 2nd/3rd — N.W. Group – 50th Anniversary Reptile and Amphibian Fair at Martin Mere (details to follow).

September — The Scottish Branch will organise a 50th Anniversary in September (details to follow).

October 25th — Huddersfield Technical College – 50th Anniversary Day and Lectures (details to follow).

November 9th — Bristol University will host a 50th Anniversary Day with Lectures – provisionally on 9th November (details to follow).

Oct/Nov. — Captive Breeding Committee – Annual Stock Sale – New Denham (details to follow).

BRITISH HERPETOLOGISTS

For volume 2 of the series entitled "Contributions to the History of Herpetology" (Volume 1 published by SSAR in 1989, 202 p.), I need biographical materials about the following British herpetologists:

Beddome, Richard Henry (1830-1911): need portrait
Blandford, William Thomas (1832-1905): need biography
Catesby, Mark (1683-1749): need portrait and signature
Cott, Hugh Bamford (1900-1987): need portrait and biography
Fayrer, Joseph (1824-1907): need biography
Flower, Stanley Smyth (1871-1946): need biography
Fox, Harold Munro (1889): portrait, signature, and biography
Gadow, Hans Friedrich (1855-1928): need biography
Huxley, Thomas Henry (1825-1895): need biography
Ionides, Constantine John Philip (1900-1968): need portrait and biography
Jerdon, Thomas Claverhill (1811-1872): need signature and biography
O'Shaughnessy, Arthur W. E. (1844-1881): need portait and biography
Owen, Richard (1804-1892): need biography
Procter, Joan Beauchamp (1897-1931): need biography
Ray, John (1627-1705): need signature and biography
Theobald, William (1829-1908): need portrait and biography
Topsell, Edward (1572-1625 or 1638): need portrait and biography
Tyson, Edward (1650-1708): need portrait and signature
Watson, David Meredith Seares (1886-1973): need biography

Needed materials are indicated above. Any materials or leads to materials would be appreciated (and acknowledged in the book). Current addresses of family member descendents are also solicited. **Prof. Kraig Adler, Cornell University, Division of Biological Sciences, Seeley G. Mudd Hall, Ithaca, New York 14853-2702, USA.** *(telephone: 607-254-4392, fax: 607-254-4308, e-mail: kka4@cornell.edu).*

HERPETOLOGY AT HUDDERSFIELD TECHNICAL COLLEGE

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INTRODUCTION

Huddersfield Technical College is a large educational institution whose prime objective is to educate and train people for future employment. The college's course portfolio includes training in the handling and husbandry of a wide range of animal species run by its well established Animal Care Unit. The College has an extensive range of courses on offer in this area, for example, NVQ2 Caring for Animals, NVQ Horse Care and Management, BTEC First Diploma in Animal Care and BTEC National Diploma in Animal Care, in addition to a series of short courses in specialist animal management. At present herpetology forms part of BTEC National Diploma but a distinct course in herpetology with a special herpetological qualification is planned.

Herpetology is a recent addition to the college's increasingly diverse educational programme and students are given excellent opportunities to learn about and study the biology, ecology and husbandry of herptiles through active first-hand involvement with a range of species.

The Herpetology Unit is part of a self-contained complex standing in its own grounds surrounded by mixed woodland. Also present are small mammal and bird units in addition to a facility for horticultural studies.

FACILITIES

The amphibians and reptiles are housed in a large temperature controlled complex and one of the most impressive enclosures (with an area of approximately 112 cubic metres) is a walk-in forest complete with artificial rainfall, pond and a waterfall (Fig 1). Here Green Iguanas *(Iguana iguana)* Asian Water Dragon *(Physignathus cocincinus)* Blue-Tongued Skinks *(Tiliqua scincoides)*, turtles *(Trachemy scripta elegans, Sternotherus odoratus* and *Cuora amboinensis)* move around freely thermoregulating through a series of strategically placed heat sources when the weather is overcast (see Iguana in Fig 2) or through natural sunshine on fine days. An adjoining section contains a number of smaller (1.23 x 0.6 x 0.3m) but structurally diverse housing units which hold a variety of lizard species that include lacertids, iguanids, geckos and skinks. Two species of snake, *Elaphe dione* and *Elaphe quatuorlineata,* are also housed in this area.

Thermal diversity through cage design with natural daylight and UV emitting lights are fundamental features of all the reptile enclosures.

The unit also contains several species of amphibians. One enclosure has both *Bombina orientalis* and *Cynops pyrrhogaster* whilst *Xenopus laevis* live in a well planted aquarium. Patrick Wisniewski of the Wildfowl and Wetlands Trust at Martin Mere recently donated several Marsupial Frogs *(Gastrotheca riobambae)* and Snake Necked Frogs *(Phrynomerus bifasciatus)* to the unit, adding to its ever increasing species diversity.

The Herpetological Unit has been developed to allow the keeping of amphibians and reptiles in as natural conditions as possible. It is hoped that such environments will induce naturalistic behaviour and eventually allow for a programme of captive breeding to be initiated. The livestock are expertly cared for by three technicians, Brenda Mills, Paul Radcliffe and Ian Birkinshaw who liaise with the unit's herpetologist, Roger Meek.

STUDENT RESEARCH PROJECTS

A research programme examining behaviour, thermoregulation and activity patterns in a number of species is currently being undertaken by several groups of students. For example Janet Fountain, Hayley Barugh, Anita Jubb, Marie Heywood, Michelle Hyland, John Cahill and Shane Malik are currently studying foraging and feeding habits, movement patterns, social behaviour and territoriality in female and juvenile Green Iguanas in our large tropical enclosure. In most lizard communities the main factors in niche differentiation are feeding, activity patterns and microhabitat selection. Social lizards such as Green Iguanas lend themselves to such studies as a result of their relatively sedentary behaviour, particularly if they can be observed at close quarters in a naturalistic environment. Stamps (1977) commented on the bias towards studies of male iguanas in the literature as a result of their more conspicuous and elaborate behaviour patterns.

Janet Fountain is also involved in gathering data on thermoregulation and activity patterns in the old world rat snakes *Elaphe dione* and *Elaphe quatuorlineata* with Susan Blisset. Donna Thornton, Melanie Page, Sharon Ralphson, Emma Gibbons, Michelle Emsley and Elizabeth Hobson are monitoring horizontal and vertical movement patterns in *Physignathus cocincinus* in the tropical enclosure. Little is known about the biology of these species, particularly the old world rat snakes.

Thermoregulation in the Leopard Gecko is the interest of Lorraine Koskinas, Tracy Brierly, Sharanjit Kaur, Kimberly Naylor, Susannah Unsworth and Tina Johnson using the model hypothesis of Hertz (1992). Previously tests for thermoregulation in reptiles involved observing whether body temperatures were higher than air temperatures. This was until Heath's (1964) experiment with filled beer cans indicated that such a criteria would lead to the conclusion that either beer cans were thermoregulating or the method could be misleading.

A new method was then developed involving regression analysis using the equation,

$$y=m+b$$

where the constants m and b are derived from plots of body temperature y against environmental temperatures x. The estimator of evidence of thermoregulation is the value of m; m=1 indicates a thermoconformer, m=0 a perfect thermoregulator. The t-distribution is used to calculate significant departures from m=1 (Huey & Slatkin, 1976).

The model hypothesis argues that reptile body temperatures will not necessarily be in agreement with some environmental temperature in the absence of thermoregulation but that a real test would be in comparing the temperature that the reptile has and what it would have if did not thermoregulate. To test this hypothesis, models resembling the animals (in our experiments they are made of modelling clay and have approximately similar mass to the real animals) are then placed in key areas and at random in the environment (the null models) and their temperatures compared with the body temperatures of the real animals.

Plate 1. The main enclosure at the Herpetological Unit is a large tropical enclosure. This photograph shows the section with a pond and overhanging tree branches used by the lizards as basking sites.

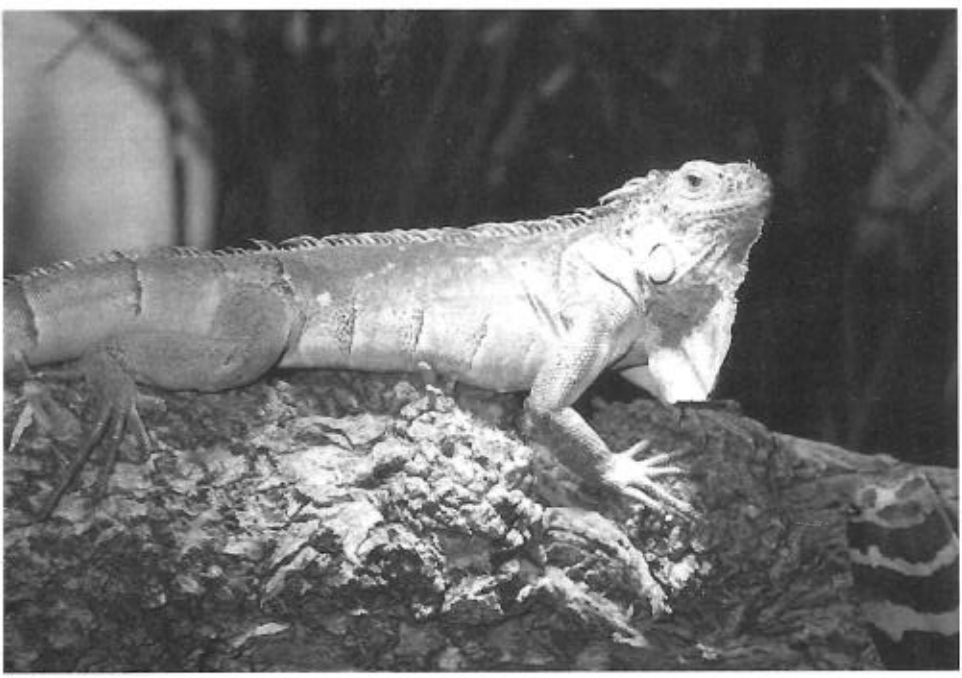

Plate 2. Green Iguanas are the conspicuous species in the tropical enclosure. Here a large female basks under a spotlamp on an overcast day.

Plate 3. Donna Thornton and Melanie Page record movement patterns in *Physignathus* in the tropical enclosure.

Plate 4. Tracey Brierly and Susannah Unsworth work on collecting thermoregulation data in Leopard Geckos.

Lindsay Davidson and Melanie Parkinson are studying basking patterns in Lacertid lizards with particular reference to differences between adults and juveniles.

Such research projects encourage students to make detailed observations enhancing their knowledge of reptiles and amphibians (Figs 3 & 4). However to increase this programme of investigative learning, ecologist Martin Dunn plans a series of ecological projects (involving amphibians) utilising the grounds surrounding the unit.

LINKS WITH INDUSTRY

Links with local industry are an important asset in the college's educational programme and students as part of their training are actively involved in this area through work placement. For example several of our students are involved in wildlife conservation on the nature reserve of the industrial giant Zeneca at their Huddersfield works. Under the direction of the Zeneca's Environment Coordinator John Avison part of this programme concerns a reptile and amphibian conservation project (mainly concerned with Slow Worms) set up jointly by John Avison and the College's herpetologist Roger Meek.

The College has Institutional Membership of the British Herpetological Society and recently the society's president Dr Roger Avery visited the college (December 1995) and gave a talk on his research to the students.

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THE CROCODILE POOLS OF THE NORTH BANK DIVISION, THE GAMBIA, WEST AFRICA

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INTRODUCTION

In 1994 we reported on the Crocodile Pools in the Western Division of the Gambia (Moiser and Barber, 1994). It had been hoped to return to the country later in 1994 to visit the sacred crocodile pools at Berending in the North Bank Division. Unfortunately, due to the developing political situation we were prevented from visiting the country again until early 1996. At this time we again visited with a group of students.

THE NORTH BANK DIVISION

The majority of European tourists who visit the Gambia will probably never bother to visit the North Bank Division. This is mainly because of the large number of tourist attractions in the Western Division, and the greater difficulties and expense in getting to the North Bank Division from the tourist hotels in the Western Division. The majority of those who do visit the North Bank Division will probably do so in order to see the village of Juffure, the legendary home of Kunte Kinte in Alex Hailey's book 'Roots'; or to see the former slave houses at Albreda. Local traders and others passing through the Gambia will also pass through the North Bank Division on their way North to Dakar in Senegal.

For the visitor to The Gambia there are two means of getting to the North Bank Division; both necessitate crossing the Gambia river. The easier, and possibly safer, way is to cross the river by the main ferry which runs from Banjul to Barra, (see fig. 1). This is a large vehicle carrying ferry which runs every two hours during the day, and by which it is possible to take a tourist taxi across the river with you. The alternative is to hire a local pirogue at any suitable point along the river. This latter method of travelling is more exciting than using the scheduled ferry but is probably less safe, and would leave the visitor without any form of transport other than the local bush taxis, which are notoriously unreliable.

BERENDING 13º 29' N 16º 28' W

From the ferry terminal at Barra the village of Berending is about 12 kilometres due east along a passable, but at times poorly maintained road. At the village of Berending the crocodile pool is set a little distance from the road, at the edge of agricultural land, south of the village. The pool is not signposted in any way and might be difficult to find without local knowledge.

The pool is in fact a series of three to four, connected, naturally occurring, grassy edged pools that cover an area of about 100 square metres in an area of open savanna scrubland. The surrounding vegetation is mainly the natural vegetation for the area with some encroachment of introduced plants from the neighbouring farmland. The dominant trees are Oil Palms, *(Elaeis guineensis)* and Gingerbread Plum *(Neocarya macrophylla)*.

The area around the pools is used for cattle grazing, and the cows frequently drink from the pools. Plant life within the pools seemed to be restricted to a less than 50% cover of Water Lily *(Nymphaea lotus)* when we visited. It was difficult to establish the depth of the pool, and there were some obviously man-made embankments.

The birds observed in the area included African Darter *(Anhinga rufa)*, African Lily-Trotter *(Actophilornis africana)*, Grey Plantain Eater *(Crinifer piscator)* and Red-Billed Hornbill *(Tockus erythrorhynchus)*.

The local population use the pools as a water source for crop irrigation, and show no fear of the crocodiles, which are clearly very timid. A local cattle herder described the crocodiles, and from pictures identified them as Nile Crocodiles, *(Crocodilus niloticus)*. He was of the opinion that there were two large animals of just over 2 metres in length, and a number of smaller ones. The larger ones were said to immediately move into deep cover when either humans or the cattle arrived. The presence of the Nile Crocodile is hardly surprising as this is the only species of crocodile now thought to be extant in the Gambia outside the Abuko reserve (Jones, 1991).

Over the last ten years this area has become drier than it was previously and the pools are said to be reducing in size. Since this reduction in size the crocodiles are said not to wander so far from the pools.

THE ROLE OF THIS SACRED POOL

The village of Berending and the surrounding area, including this pool, belong to the Sunka family, who are of the Mandinka tribe. When they first arrived in the area they were Pagan and prayed regularly at the pool. Despite now following Islam they are said to still pray at the pool occasionally. Many other people also pray at the pool, and sometimes tourists visit it.

Those who pray at this pool are said to do so for one of two main reasons. The first reason that was given to us was praying for a good harvest. Interestingly this reason has

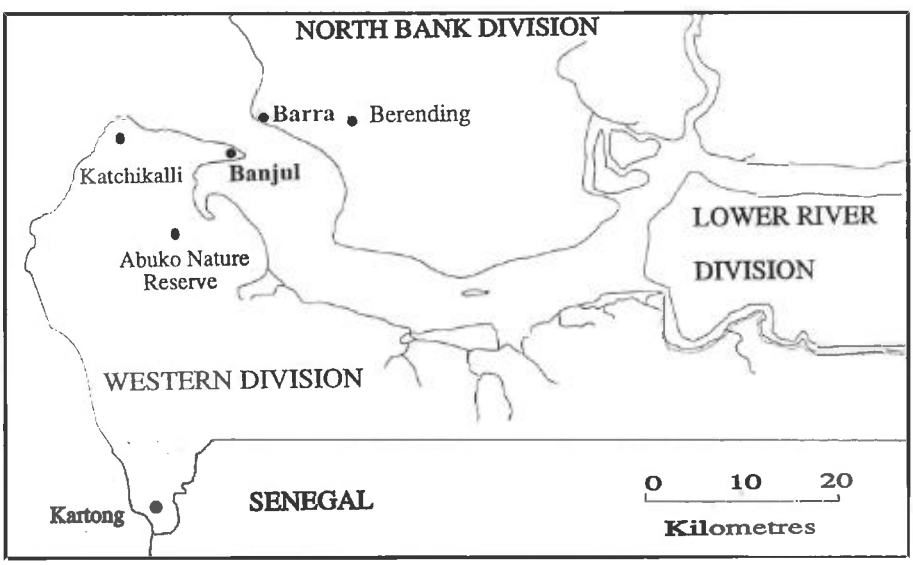

Fig. 1. Map of Western Gambia

not been suggested at either of the other sacred pools that we have visited previously. However as the other two pools are both in the Western Division where there is a much greater tourist presence, and correspondingly less reliance on farming, this is possibly not so surprising.

The second reason that we were given for people praying at the pool related to fertility. As with the pools at Katchikalli and Kartong (Moiser and Barber, 1994) it seems that women who have problems conceiving will come here to pray for a child. Unlike Katchikalli and Kartong there are no facilities to bathe in the pool here, nor, when we visited, was there any suggestion of bathing here, only praying.

Visitors who come to pray often bring Bonga fish for the crocodiles. These have been previously established to be *Ethmalosa fimbriata* (Lesack, 1986). In addition some visitors bring Tilapia, and a similar type of fish to the Tilapia were said to exist in the pool.

CONCLUSION

Unlike Katchikalli and Kartong, the two pools previously described, Berending is a natural pool with no retaining concrete block walls or fencing. There is no apparent regular income from tourists, although the local farm staff do seem to expect a tip if they are of particularly service. As the area has a much lower population density than the area around the pools in the Western Division, and it is only a short distance from the main Gambia river, it is quite possible that the crocodiles here may have contact with other crocodiles.

Plate 1. The Crocodile Pool at Berending

Despite the lack of income from tourists this crocodile pool is clearly retained by the locals as a centre for worship. In addition they seem happy to have both Gambian visitors and tourists visit the site.

FURTHER WORK

We would hope to visit the Gambia again during 1997 to revisit the pool at Katchikalli and continue to study the husbandry and history of the crocodiles there.

ACKNOWLEDGEMENTS

We would like to thank Mrs. I. Crowther for producing the map, and our colleagues at Plymouth College of Further Education for covering our teaching duties during our absence.

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NESTING BEHAVIOUR AND CLUTCH AND EGG SIZE OF THE HINGEBACK TORTOISE *KINIXYS SPEKII*

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[3] *Deceased*

INTRODUCTION

Nesting of wild tortoises is rarely observed, unless females converge to nest in particular areas (Swingland and Stubbs, 1985). We report the nesting behaviour of an individual *Kinixys spekii* which was being followed by thread-trailing. (This species has only recently been elevated from a subspecies of *K. belliana* (Broadley, 1993). Iverson, Balgooyen, Byrd and Lyddan (1993) have summarised information on clutch and egg sizes in tortoises. The only published data for *Kinixys* was for *'K. belliana'* estimated from Loveridge and Williams (1957). We therefore include information on the clutch and egg sizes of *K. spekii* maintained in a large outdoor enclosure in Harare.

METHODS AND RESULTS

Fieldwork was at the Sengwa Wildlife Research Area, described by Hailey and Coulson (1995). A female *K. spekii* (No. 500) of midline plastron length 148mm was fitted with a thread-trailing device on 31 December 1992 (Plate 1). She was trailed continuously until 14 February 1993, and located from two to five times each day during this period. The home range of female 500 was to the west of a footpath between the Institute office and the staff compound (Fig. 1). The female was first captured near the pools below the rocky outcrop, and ranged over an area of about 5.5 ha over the next six weeks. The mean daily movement distance of this tortoise was 236m. Most of the area south of the stream was mature mopane *(Colophospermum mopane)* woodland, with trees >10m tall, and had little ground vegetation and apparently low food availability. The female spent most time in mixed woodland near the compound fence or around the stream. The habitat north of the stream and west of the rocky outcrop was bushed grassland.

Plate 1. The late Ian Coulson with female 500 when she had returned to her home range after nesting. Note the thread-trailing bottle

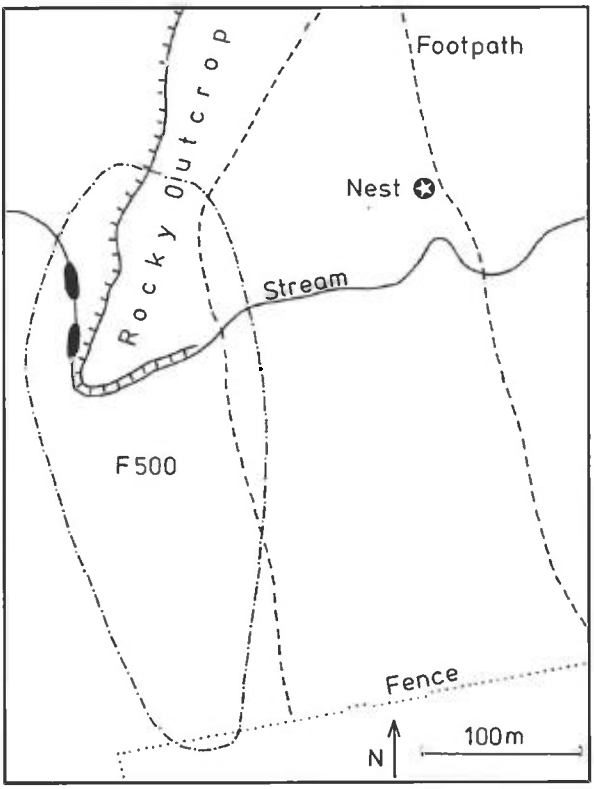

Fig 1. Position of the nesting area (star) in relation to the normal home range of female 500 (dot-dash line). The stream was usually dry, apart from the pools (shaded), but was flowing during February 1993. Dashed lines show the two footpaths between the Sengwa Wildlife Research Institute office and the staff compound, the fences of which are shown as the dotted line

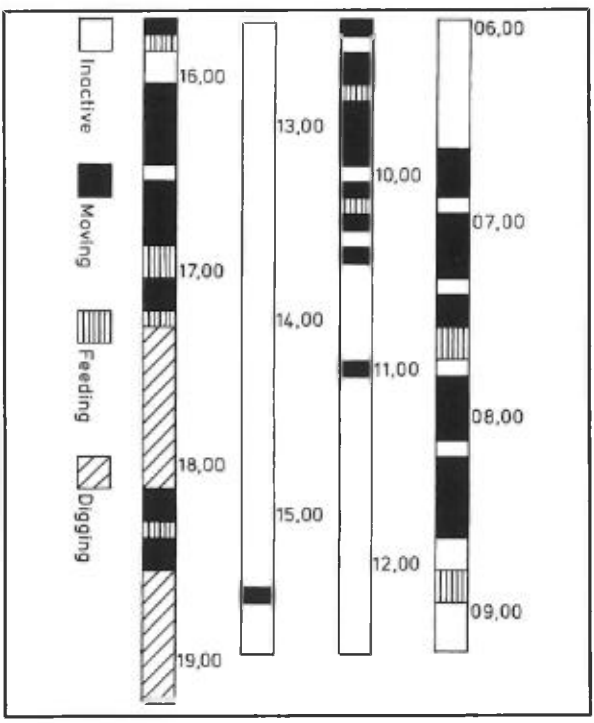

Fig 2. Activities of female 500 recorded at 5 minute intervals on 6 February 1993

Female 500 moved out of her previous home range on 5 February 1993, moving east along the stream, which she crossed three times. She moved a total of 405m on this day, the longest movement she had made since 13 January. The tortoise was observed continuously on 6 February, using binoculars, and her activity noted at 5 minute intervals. She was active in an area of bushes and small trees, 5m tall, about 130m east of her previous home range. This area had an incomplete canopy, and ground cover of grass about 30cm tall. The tortoise was active from 6.40 to 10.25h, with brief periods of inactivity and of feeding (Fig. 2), eating fungi, fallen fruits of the tree *Erythroxylum zambesiacum*, forbs, and a small dung beetle.

The tortoise remained in tall grass under a tree from 10.30 to 15.40, with only small changes of position of less than 1m. She stopped under a small *Combretum apiculatum* tree at 16.00h, and moved in small circles under this tree until 16.20h. In retrospect, this circling movement was probably investigation of the area as a nest site. Female 500 then moved to a small mopane tree, and scraped the litter of dead leaves from a small area under this tree. The tortoise dug a nest from 17.20 to 18.05h, using the hind legs, then moved 10m in a round trip back to the same tree. She then moved in circles covering about two square metres from 18.25 to 18.30h, and then dug another nest about 1.5m from the first. She was still digging this nest when the observer left at dusk (19.10h). The positions of these nests (1 and 2) are shown in Fig. 3. The female was active in the same general area on the following day (7 February). Her activities when located were: 7.38h active in thin grass; 11.05h active under *E. zambesiascum* tree; 12.22h inactive under same tree; 17.16h digging under *Mundulea sericea* tree (nest 4).

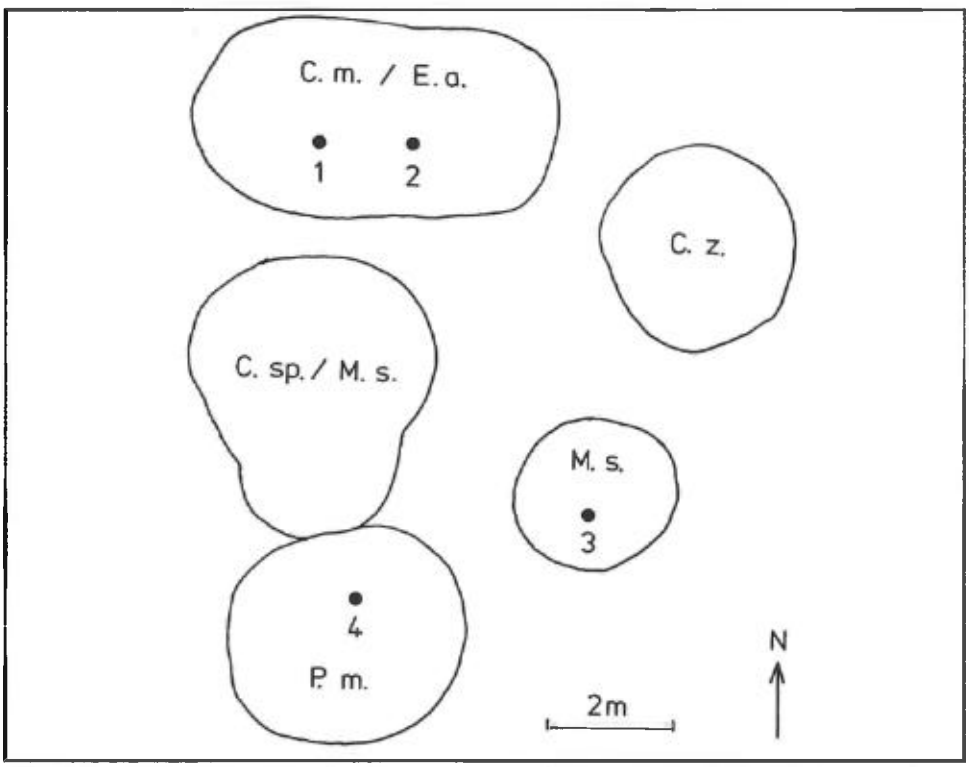

Fig 3. Location of abandoned (1-3) and successful (4) nests in relation to tree canopies. Tree species are: *Colophospermum mopane* (C.m.); *Erythrophleum africanum* (E.A.); *Combretum zeyheri* (C.z.); unidentified *Combretum* (C.sp.); *Mundulea sericea* (M.S.); *Pseudolachnostylis maprouneifolia* (P.m.).

Nests 1 to 3 were not used and left uncovered by the tortoise, but nest 4 was filled in when examined at 7.15h on 8 February. The nest was of similar stunted sock shape to those of other tortoises (Swingland and Coe, 1978). The hole was 4.5cm in diameter, widening to a chamber of 8cm diameter. The total depth was 10cm, with the egg chamber being 4cm in height. The chamber contained three eggs, and the hole was sealed with a compacted plug of soil 4.5cm deep (Plate 2).

Plate 2. Eggs and opened nest of *K. spekii*

The tortoise moved back to her original home range on 8 February, crossing the western path to the compound shortly before 17.00h. She moved a total of 578m on this day, compared to an average of 281m on the two previous (nesting) days. The movements from the home range to the nesting site on 5 February, and back to the home range on 8 February, were thus substantially longer than the usual daily movement distance of the tortoise. Nesting itself did not have a major effect on daily movement distance, or on feeding. There were 14 records of feeding on 6 February (some were between the 5 minute observations and are not shown on Fig. 2), compared to 16 on 23 January and 9 on 12 February, days when this female was also observed continuously. Female 500 was trailed until 7.06h on 14 February, and remained within the usual home range area. There were no further signs of nesting activity, such as thread trailed in circles over a small area.

Nesting activity was similar to that of the Mediterranean tortoise *Testudo hermanni* in being outside the normal home range and in taking place in the evening (Swingland and Stubbs, 1985). The major difference was that *K. spekii* nests were dug under the tree canopies (Fig. 3), whereas *T. hermanni* nests were in open areas, to which females migrated from woodland. Two advantages of nesting in the evening have been suggested for tortoises. First, to enable the female to assess the thermal characteristics of the nest site (Swingland and Stubbs, 1985), which will determine the sex of the hatchlings.

Second, to avoid overheating (Meek, 1988). *Kinixys spekii* nesting under tree canopies would not be under thermal stress at any time of day, and so the former seems to be a more general explanation of evening nesting in tortoises.

The positioning of nests in the shade presumably reflects the higher temperatures in the tropics. To test this, the temperature within the nest was monitored between 6.00 and 18.00h on 9 February 1993, using a YSI telethermometer with a soil probe inserted to a depth of 8cm (i.e. in the centre of the egg chamber). Another soil probe was placed at 8cm depth in the soil in an area of open grass nearby, and shade air temperature was also recorded. Nest temperature increased from 23.5 to only 27ºC, while the soil temperature at the exposed location rose to 36ºC (Fig. 4b). Shade air temperature reached a maximum of 30ºC; this is a typical value for the season (Fig. 4a), so the nest temperatures on 9 February were representative of the start of the incubation period. The nest was relocated in March 1994, and contained fragments of eggshell; it could not be determined whether the egg had hatched or been destroyed.

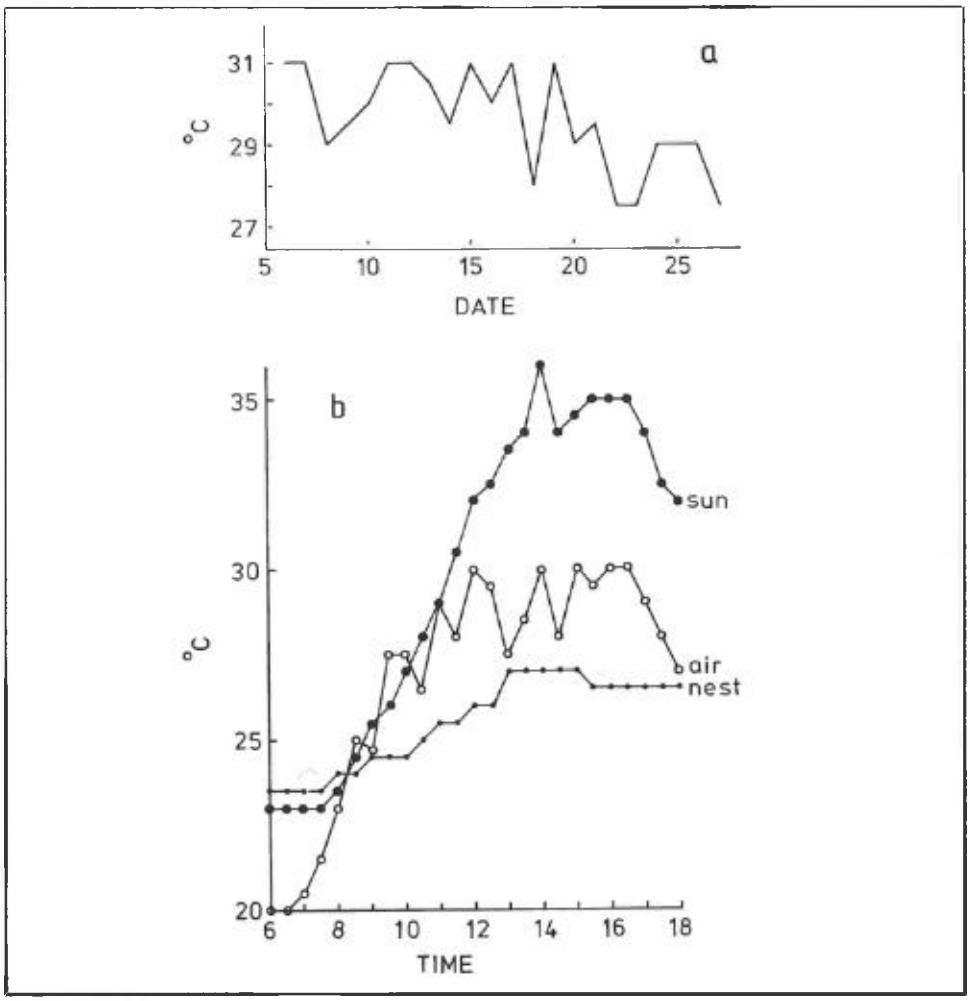

Fig. 4. a) Maximum shade air temperatures during February 1993. b) Temperatures recorded on 9 February 1993 at 8cm depth within the nest (•), at the same depth in unshaded grassland (●), and shade air temperature (o).

Female 500 weighed 885g after egglaying (at 17.47h on 8 February), allowing for the weight of the trailing box. The three eggs had mean dimensions of 40.7mm x 32.2mm and mass of 24.8g. Other data on clutch and egg size in *K. spekii* were obtained from tortoises kept in a 100 m² outdoor enclosure, with grass and trees, at the University of Zimbabwe. The tortoises were from several unknown locations, but probably from the highveld around Harare (18ºS). Fourteen female *K. spekii* were examined by x-ray (100 mAs, and 48-52 kV depending on body size) on 31 January and 6 December 1994, seven of them on both occasions. Seven individuals had eggs, with clutch size ranging from 2 to 5. Mean clutch size was 3.75 eggs (S.D.=1.0), including the female from Sengwa. Boycott and Bourquin (1988) give a clutch size range of 2-6 for *K. spekii* and 2-7 (exceptionally 10) for *K. belliana*, but do not give means or sample sizes. They indicate that both species may lay more than one clutch per year.

The eight females had mean midline plastron length of 161mm; this measure was used, rather than carapace length, as the carapace of this species is moveable. Most of these females were returned to the outdoor enclosure and the eggs were not obtained. Body mass excluding eggs has been calculated by subtracting clutch mass, estimated as clutch size x mean egg mass; mean body mass was 942g. There was a fairly strong correlation between clutch size and body size (Fig 5; r^2=42.5%). The correlation coefficient is greater than that found in *Testudo* (five populations studied by Hailey & Loumbourdis, 1987), although not significant because of the small sample size (P=0.079).

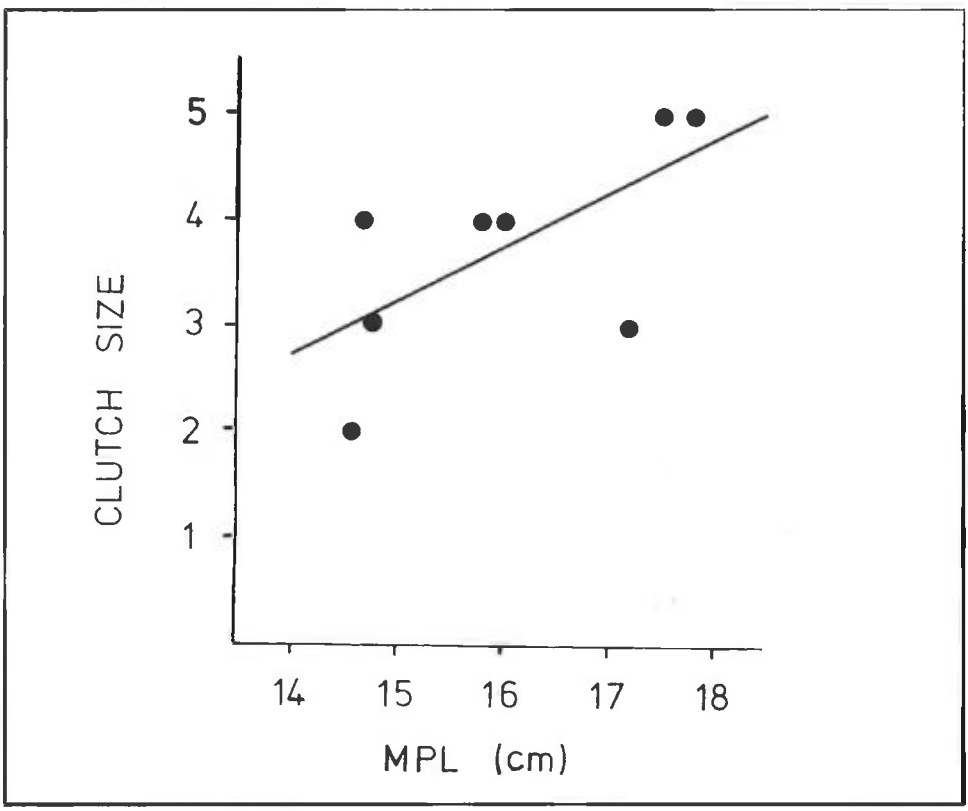

Fig. 5. The relation between clutch size (number of eggs, N) and body size (midline plastron length, MPL, in cm). The equation of the regression fit is: N = 0.52 MPL - 4.5.

Eggs were obtained from one female using oxytocin (Hailey and Loumbourdis, 1987). Twenty-one other eggs were laid by females kept in pens during feeding studies. Some of these eggs could not be assigned to particular individuals, but the timing suggested that they were laid by eight different females. Mean egg dimensions for the ten individuals (including the field and oxytocin-induced egglaying) are shown in Table 1. Mean egg size was towards the lower part of the range reported for *K. spekii* by Boycott and Bourquin (1988), which was 38-47x30-34mm and 20-31g. It is also of interest to compare these data with those for a temperate tortoise of similar body size; *T. hermanni* from Alyki and Litochoron (40ºN) in Greece (Hailey and Loumbourdis, 1987).

The eggs of *K. spekii* were of similar shape to those of *T. hermanni* (in which length/width=1.34), but larger; *T. hermanni* eggs were on average 37.3 x 27.9 mm and mass 16.9g. Relative egg size (mean egg/body mass) was about 40% greater in *K. spekii*, 2.44% (=23.0/942), compared to 1.68% in *T. hermanii*. This confirms the observation of Ewert (1979) that tropical chelonians produce larger eggs. The data for *'K. belliana'* (which may include *K. spekii)* from 80ºS continue this trend, with egg mass of 36.1g and relative egg mass of 3.00% (calculated from Iverson *et al.* 1993). The two populations of *Kinixys* also support the observation that clutch size decreases with latitude; *'K. belliana'* clutches averaged only 2.3 eggs. However, *K. spekii* clutches are of similar size to those of *T. hermanni* (mean 3.9 eggs). This suggests that larger egg size in the tropical *K. spekii* reflects greater reproductive investment than in the temperate *T. hermanni*, rather than a trade-off between egg size and clutch size.

Table 1.
Size and shape of eggs of *Kinixys spekii*. Means and S.D.s. were calculated from means for different females (N=10), but the minimum and maximum are for individual eggs. Shape = length/mean width.

	Mean	S.D.	Minimum	Maximum
Length (mm)	40.8	3.1	33.2	46.4
Mean width (mm)	30.7	1.2	28.3	34.2
Shape	1.33	0.12	1.10	1.52
Mass (g)	23.0	2.1	19.5	28.3

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NOTES ON BREEDING, TAIL GROWTH AND OTHER ASPECTS OF THE BIOLOGY OF THE RED-HEADED AGAMA, *AGAMA AGAMA* (SAURIA: AGAMIDAE) IN MAGO NATIONAL PARK, ETHIOPIA

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INTRODUCTION

Mago National Park is in south-west Ethiopia; it has an area of 2 162 km² and lies north-west of the main Ethiopian rift valley, between latitude N 05º 19' - 05º56' and longitude E35º56' - 36º26'; the altitude varies from 450 m (low-lying plains in the south) to 1 776m (top of Mt. Mago). The Mago river runs the length of the park. Virtually no herpetological work has been done in this conservation area and the adjoining Omo National Park, and a similar situation exists in much of Ethiopia. A recent checklist of the snakes of Ethiopia (Largen and Rasmussen, 1994) gives distributions, and a basic checklist of the lizards (Largen, undated) lists the species known to occur within the country, without further data. This lack of factual information on the Ethiopian reptile fauna constitutes a serious handicap to conservation within the country. Ethiopia is a known centre of endemism for birds and small mammals, but much work remains to be done upon the reptilian fauna (Spawls, 1992). This paper details aspects of the biology of *Agama agama*, one of Mago's larger and more conspicuous lizard species, as observed in and around the park. Data on identification, activity patterns, behaviour, diet, predation, habitat selection, tail regeneration and some meristic data are included. Agamas were collected from the habitat around the park headquarters, using the methods described by James (1991) and Harris (1964).

IDENTIFICATION

Agama agama is a common and conspicuous species, and occurs throughout the arid lowland, hot areas of Mago National Park. In appearance it is a relatively large (up to 32.3 cm total length) stocky, flat-bodied lizard with a broad, triangular head; the unregenerated tail is approximately half the total body length. Breeding males are conspicuously marked, with yellow to vermilion heads, purple flanks, a broad pale vertebral stripe and blue-green limbs, the tail has pale bands. Non-breeding males are duller; females and juveniles of both sexes resemble the adult females: they are brown, with pale cross-bands and are heavily speckled with green and whitish spots; the females have pinkish stripes on the flanks behind each limb where it is joined to the body. As juveniles increase in size, the spotting becomes more conspicuous. Both sexes are capable of distinct colour changes; this is very marked in the males, and depends upon seasonal, environmental and excitational stimuli. Such changes were very marked prior to and during combat displays.

MATERIALS AND METHODS

This species was studied in the vicinity of the park headquarters (Latitude N5,40, Longitude E 36.26) and the adjacent savanna. The vegetation types of the study area are savanna, riparian formations, semi-arid xerophilous and open woodland. The common

plant species are *Terminalia spinosa, T. brournii, Ficus sycamorus, Combretum aculeatum, Tamarindus indica, Grewia biolar, Acaca mellifera* and *A elatior,* growing on sand, silt and clay soils, with some minor basalt intrusions from the Miocene volcanics (Stephensen and Mizuno, 1978). There is a mean annual temperature range of 24 to 38 degrees Centigrade; highest temperatures occur between December and March. Rainfall is heavier in the northern (higher altitude) sector of the park; in the study area it is less, around 480 mm per year (Hillman 1993). There are two rainy seasons, March to April and August to September. The Park contains a good selection of Ethiopia's larger mammals (elephant, black rhinoceros, buffalo, lion, African wild dog, giraffe). Among the mammal species distinctive of the semi-arid lowland fauna are Lelwel Hartebeest and Patas Monkey, and over 230 species of birds have been recorded, including four endemic species.

HABITAT SELECTION

Within the National Park itself, this species was more common in low-lying areas, below 1000 m altitude, and fewer *Agama agama* were observed at altitudes above this. On the alluvial plains in the southern part of the park, this species is most often seen on rocky hills and outcrops. In southern Ethiopia, this species is also known from similar habitats in the Omo National Park, Gambella National Park and Woito valley, between Jinka and Arba Minch (Cherie Enawgaw and Gebrie Admassu, pers comm), and it seems likely that *Agama agama* is widespread in such semi-arid areas. In undisturbed habitat, these agamas favoured rocks as basking sites, but were also observed on tree trunks, and around the park headquarters were often seen on walls. Once warmed up, they foraged actively on both trees and rocks, but would descend to the ground to feed and often entered inhabited compounds in the headquarters in the pursuit of prey.

BREEDING

Mating was observed on several instances, with the male mounting the female and the genitals of each individual being turned sideways. However, there did not seem to be any fixed period for mating, with matings occurring randomly throughout the year, unlike egg-laying, which did occur during periods of heavy rainfall, as may be expected, to enable the female to dig a nest site easily, and for the neonates to profit from the large numbers of small insects present towards the end of an arid-country rainy season.

Eight undisturbed females in the park headquarters area that were obviously gravid were closely observed, and nesting behaviour was monitored, in order to record the numbers of eggs laid, the date of oviposition, the range of incubation periods and hatching successes. When a nest was located, a stick was placed near to the nest, and a card for recording information was attached to the stick. Such marked nests were inspected daily until the hatchlings emerged. Imminent emergence of the hatchlings were indicated by the appearance of a small depression in the soil above the nest site.

Initially, gravid females selected an area of loose, moist soil, usually near the base of tree or rock, occasionally near a building. The female dug a shallow hole, deposited the soft-shelled eggs and then buried them, the ground surface appearing relatively undisturbed after laying.

Data from eight monitored laying sites is given in Table 1. Clutch numbers 3 and 7 were both eaten by white-tailed mongooses, *(Ichneumia albicaudata)* during the third week after laying, the remainder of the clutches all hatched between 52 and 54 days after laying. Hatching success ranged from 77 to 100%. The neonates began to hunt and eat

insects within a few minutes of hatching. These eight monitored clutches were all laid during the rainy season. However, it is of interest that during October 1994, (which is normally a dry month), there were several unexpectedly heavy rainstorms, and five female *Agama agama* were observed laying eggs during this month.

Table 1.
Data from eight egg clutches

Sample	Date of Laying	Number of eggs laid	Hatching date	Number of Hatchlings
F1	1st April 1992	9	24th May 1992	7
F2	4th April 1992	7	25th May 1992	7
F3	11th April 1992	5	–	–
F4	21st April 1992	7	11th June 1992	6
F5	29th April 1992	8	19th June 1992	8
F6	10th May 1992	6	30th June 1992	5
F7	14th May 1992	8	–	–
F8	19th May 1992	8	10th July 1992	8

TAIL REGENERATION

According to Branch (1988), agamas cannot autotomise their tail or regenerate a new one. Observations around the study area suggested this statement to be incorrect, at least as far as *Agama agama* was concerned, as individuals with naturally broken tails were frequently observed, others were seen to lose their tails during combat, and regenerated tails (which are rarely as long or as uniformly tapered as original tails) were seen on several Agamas. Thus some experiments on tail regeneration were carried out. In August and early September 1992, a number of individuals were captured and their total length (snout-tail tip) and tail lengths were measured. Eight individuals were captured by noosing, placed on a sheet of white paper, straightened out and the position of the snout and tail tip marked. Two of these eight had freshly broken tails as a result of combat, and the remaining six had their tails cut off using a small sharp knife. Before cutting, the lengths detailed in Table 2 were measured, and before release, individuals were marked with a coded system of rings of white thread tied loosely but closely around the throat of the animal. Each individual was then recaptured three times between early October 1992 and mid-February 1993, and the tail length measured, this data is shown in Table 2. As shown in the table, the tails did regenerate, at an appreciable rate, over the six month period the increase varied from 0.5 cm to 4.5 cm length, with the most rapid growth occurring between August and December. The regenerated tail tip was very different to the original tail and never attained the length of the original piece, it constituted an unjointed rod of ossified tissues covered with scales similar to that of the original tail, much as observed by Harris (1963). In addition, the regenerated tail quite often had a prominent bulbous stump at the end, and this was observed to be used in combat.

Table 2.
Regeneration of truncated tails in *Agama agama*

All dates 1992, unless stated otherwise, all lengths in centimetres

Age of lizard	Sex	Date tail cut	Tail length before cut	Tail length after cut	Length increase on: 2nd Oct	3rd Dec	9th Feb 1993
Adult	F	26th Aug	14.5	4.0	1.5	2.3	lost*
Juvenile	F	31st Aug	13.5	2.2	2.0	2.7	3.1
Adult	M	31st Aug	lost in fight	7.5	2.5	2.6	2.6
Sub-adult	M	28th Aug	17.0	8.0	1.9	3.2	3.4
Juvenile	F	28th Aug	13.0	1.7	1.1	3.5	4.4
Sub-adult	M	26th Aug	17.5	5.0	1.1	2.3	2.4
Adult	F	26th Aug	14.6	4.0	swollen*	0.5	0.5
Adult	M	1st Sept	lost in fight	4.0	4.2	4.4	4.5

*lost = agama disappeared
*swollen = tail very swollen but no increase

MERISTIC DATA

A small number of adult agamas were collected and their snout-tail tip measurements taken. This information is given in Table 3. A number of hatchlings were also collected, and the mean snout-tail tip measurement of these hatchlings was 8.7 cm.

Table 3.
Total Lengths of adult *Agama agama* in Mago National Park. All lengths in cm.

Males	Females
32.0	24.5
27.0	23.3
28.4	25.0
30.6	25.5
31.4	23.0
32.3	22.3
Mean 30.3	Mean 23.9

ACTIVITY PATTERNS

Activity among the agamas was observed mostly around the National Park headquarters, and much of the observation took place from dawn until 11.30 a.m. and in the late afternoon, which was the time that most activity occurred.

Agama agama in Mago National Park appear to live in colonies, with one (sometimes two) adult males, and a larger number of females and juveniles. All sexes and all age groups of this species show head-bobbing behaviour. They bask frequently, and adult males seem to bask more often than females. More feeding activity was observed in the rainy season, when, of course, much more prey is available. Once warmed up after basking, they usually stationed themselves near the bases of trees or rock outcrops, and fed upon streams of ants. They favoured areas of partial shade, and rarely descended onto the ground, except to move across to another tree or rock (or building).

When threatened, they retreated rapidly to holes or rock cracks for shelter. They can move very rapidly, and climb the sheerest of rock faces, they were frequently seen to jump considerable distances (at least 50 cm) from one rock to another. If captured, they can deliver a painful bite.

DIET

In Mago, *Agama agama* were observed to be insectivorous and partially herbivorous. They were observed feeding on a broad range of small to medium sized arthropods; including ants, termites, winged and wingless insects, beetles, millipedes and centipedes. They were also observed to take bites from leaves and eat small grass stems. They appear to hunt arthropods by sight, and quickly spot moving objects. They were also seen to catch flying insects, leaping upwards from their perch in a most acrobatic manner. On several occasions, cannibalism was witnessed, with adult males eating juvenile agamas.

PREDATION

A number of other species were observed preying on *Agama agama* (both on the eggs, the juveniles and the adults) in Mago National Park. Due to their habits of basking, and that (of the adult males) of occupying a prominent rock, they are frequent targets for diurnal, keen-sighted predators. Females and juveniles were often captured and eaten by Grey Kestrels *(Falco ardosiaceus),* males were also attacked but nearly always escaped, due not only to their superior speed but to the fact that they would sometimes confront the kestrel. All class sizes except adult males were observed being captured and eaten by Sand Snakes *(Psammophis* sp.), and at night both Red Spitting Cobras *(Naja pallida)* and Black-necked Spitting Cobras *(Naja nigricollis)* were observed climbing on the walls of the headquarters compound and catching and eating sleeping agamas. At night, White-tailed Mongooses *(Ichneumia albicaudata)* dug up the egg nests and ate the eggs.

Man is also a significant predator in certain areas; these lizards (especially the adult males), are a frequent target for small boys displaying their prowess with stones and/or catapults, and in certain areas these lizards are feared due to local superstition and may be killed.

BEHAVIOUR

Males of this species develop vivid breeding colours to indulge in territorial displays, maintain exclusive home ranges and chase off vanquished opponents (Branch, 1988). Many instances of aggressive encounters were recorded among the study animals, in both sexes above the sub-adult age group. At times of combat, both individuals rapidly bob their heads up and down. At such times, they seem fearless of external danger, even ignoring humans approaching closely. They then shuffle and sidestep around in a tight circle, either with their heads pointing inwards or outwards. Once combat is joined, the bright body colour fades to a colour phase denoting fear (Harris 1964, Fitzsimons 1943) and the dorsal crest is fully erected.

If an intruder enters the territory of another adult male, the home male jumps down, as soon as the intruder is observed, and rushes towards him, raising and lowering his chest and gular fold. In combat, the males use their two fang-like teeth, and once they have seized their opponents, they attempt to use their tails as clubs. In most cases, the resident male triumphs, but such interactions were frequently observed, as maturing males attempt to seize and hold a territory for themselves.

DISCUSSION

Agama agama is a colourful and interesting species, which would repay further study, especially in the Mago area. Reptiles are an important component of many ecosystems, and they are universal, penetrating much of the remotest areas upon earth. Directly or indirectly, they are beneficial to man; they consume numerous arthropods, including many insects pests, and where they are commensal with man they control the number of noxious arthropods in the area. However, it is the author's wish that these useful creatures be respected and protected. It is hoped too that this paper will stimulate respect for and interest in the lizards of southern Ethiopia, and also lead towards the setting up of community-based conservation projects, which will involve local people in joint responsibilities for natural resources, with consequent shared benefits.

In the attached appendix, it can also be observed that, so far, a total of some 21 species of reptiles have been recorded in Mago. In some ways, this indicates the lamentable lack of knowledge of the herpetofauna of a most interesting area. The final list could well be expected to be over 50 species, and it is hoped that this paper will also stimulate zoological research in this area, and that interested organisations will provide funds for this research to be carried out.

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APPENDIX

Preliminary list of reptile species recorded in the Mago National Park.

Serpentes:	
Typhlops lineolatus	Lineolate Blind Snake
Python sebae	African Rock Python
Eryx colubrinus	Kenya Sand Boa
Coluber florulentis	Flowered Snake
Lamprophis fuliginosus	Brown House Snake
Psammophis punctulatus	Spotted Sand Snake
Psammophis sibilans	Stripe-Bellied/Hissing Sand Snake
Crotaphopeltis hotamboeia	White-Lipped Snake
Naja nigricolls	Black-Necked Spitting Cobra
Naja pallida	Red Spitting Cobra
Bitis arietans	Puff Adder
Chelonia:	
Geochelone pardalis	Leopard Tortoise
Pelomedusa subrufa	Marsh Terrapin
Pelusios sinuatus	Serrated Hinged Terrapin
Sauria:	
Agama agama	Rock Agama
Varanus niloticus	Nile Monitor Lizard
Varanus exanthematicus	Savanna Monitor Lizard
Mabuya striata	Striped Skink
Lygosoma sundevalli	Sundeval's Writhing Skink
Cordylus tropidosternum	Girdled Lizard
Crocodylia	
Crocodylus niloticus	Nile Crocodile

AN OVERVIEW OF THE HERPETOFAUNA OF SLOVENIA

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INTRODUCTION

In Slovenia little scientific work has been carried out on reptiles and especially amphibians. Until now, very few herpetological articles have been published (Brelih 1954, Berlin 1962, Brelih, Džukić 1974). In this paper I would like to show our knowledge about Slovenian herpetofauna and I would also like to contribute some new information about amphibians and reptiles in Slovenia.

GEOGRAPHY & CLIMATE

Slovenia is situated in central Europe, south of the Alps. The small country of about 20 000 km² contains four landscapes: the Alpine, Illyrian, Mediterranean and Pannonian regions. The Alpine region is restricted to the north-western part and encompasses no more than 12% of the most mountainous areas in the country. The sub-Alpine region is much larger, covering about 32% of the Slovenian territory. This is predominantly hilly terrain, ranging from about 200 to 500 m. Most characteristic of the Illyrian region are the Karst plateaus at an altitude above 400 m. Lowlands (sub-Pannonian area) represent about 22% of the surface of Slovenia. Here we find the three largest Slovene rivers: Drava, Sava and Mura. The Mediterranean region covers about 8% of Slovene territory in the west, mainly a littoral belt. Slovenia lies in the temperate climate zone and its climate is central European – a mixture of the three climates typical of this zone: Atlantic, Continental and Mediterranean.

From the phytogeographical point of view the Slovene territory can be divided into six regions: Alpine, sub-Alpine, Dinaric, pre-Dinaric, sub-Mediterranean and sub-Pannonian.

For amphibians the most important habitats are various standing water bodies suited for egg deposition. In the north-eastern part of Slovenia, especially along the Sava, Drava and Mura rivers, gravel-pits of different sizes have become increasingly important. In this, mainly lowland, part of country, intensive agriculture, regulation of streams and rivers and the drainage of wetlands has destroyed almost all natural habitats and turned the natural landscape into a cultural steppe. In this region, gravel-pits with standing water remain the only reproductive and wintering place for amphibians.

In the Karst region in the south-western part of Slovenia, water flows mainly underground and forms underground streams and caves (habitat for *Proteus anguinus).* Very characteristic of this region are so-called "kal" – a common watering place for livestock (in the shape of pools of different size).

In Slovenia there are also numerous ponds used for fish farming, which can also be important for *Bufo bufo*.

Slovenia is a country with an extraordinary floristic and faunistic diversity. We can find about 3200 species of higher plants, 60 of which are endemic, and more than 50,000 animal species, among them also many endemic ones. There are 430 species of vertebrates, including 69 species of mammals, 219 species of birds, 98 species of fresh and brackish water fishes, 25 species of reptiles and 20 species of amphibians (Vidic 1992).

Figure 1. Map of Slovenia showing main localities mentioned in the text.

THE HERPETOFAUNA

Species lists of the herpetofauna of Slovenia including IUCN Red List categories are presented in Table 1 and 2.

Amphibians

In Slovenia, 20 species and three subspecies of Amphibia are known. Seventeen species and one subspecies are listed in the national Red List. The high proportion of species in the "intermediate" category of the Red List indicates the poor state of knowledge on the Slovene amphibians. The most endangered species in Slovenia is the Olm *(Proteus anguinus)*. In 1986 the black Olm was found, the taxonomic status of which is still unclear.

Recent research, mostly by the author, suggests that more species must be in the highest category (Kropivšek 1995). For example: the Common Spadefoot *(Pelobates fuscus)* and the Fire-bellied Toad *(Bombina bombina)* are found only in northeast Slovenia. But this region is also one of the most developed agricultural areas in Slovenia and both species are strongly affected by the regulation of streams and rivers and the loss of wetlands. They are also indirectly threatened by the intense use of fertilisers and pesticides. Only a few localities are known for both species, mostly along the river Mura.

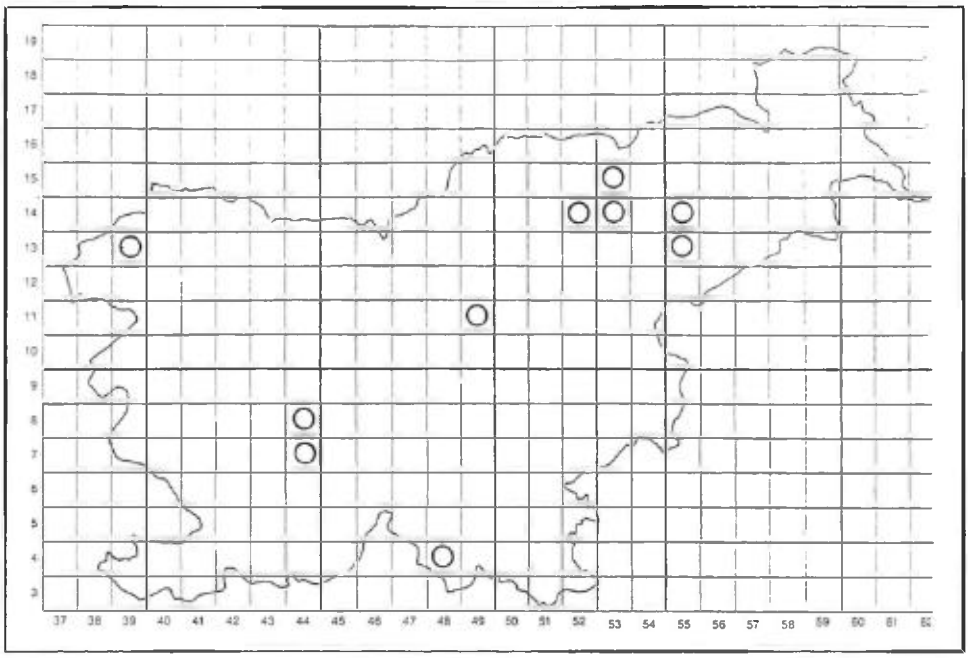

Figure 2. Provisional UTM Atlas (10 x 10 square grid system) of the distribution of the Yellow-bellied Toad *(Bombina variegata)* in Slovenia

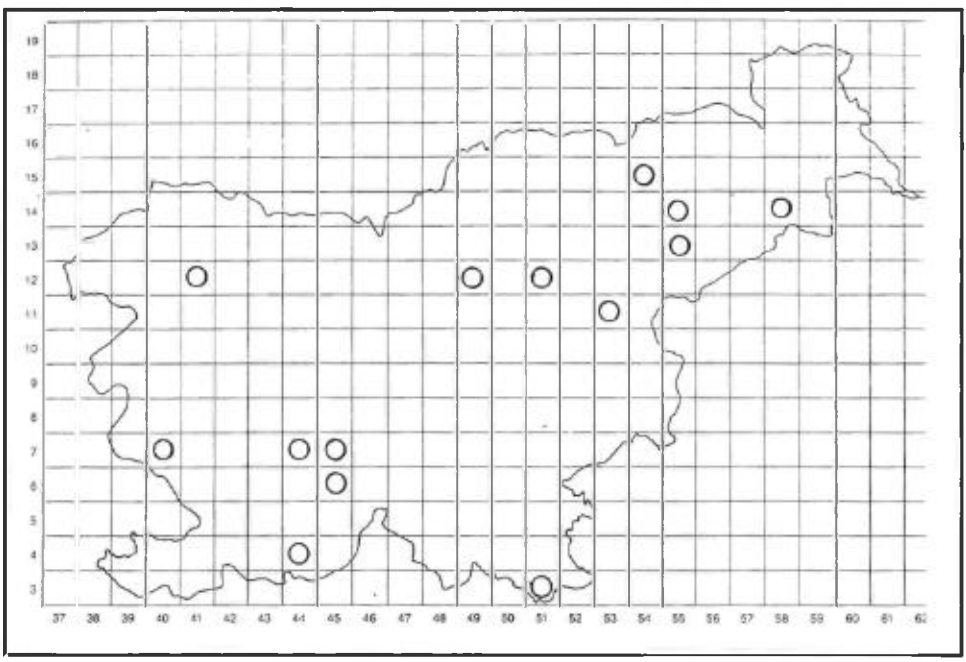

Figure 3. Provisional UTM Atlas (10 x 10 square grid system) of the distribution of the Green Lizard *(Lacerta viridis)* in Slovenia.

On the other hand, the Yellow-bellied Toad *(Bombina variegata)* is distributed all over Slovenia (Figure 2). We can find hybrids between the Fire-bellied toad and Yellow-bellied Toad in north-eastern Slovenia (Vogrin, unpublished). The exact range of the hybrid zone, however, is not known yet but researches are in progress. In the last few years numbers of Green Toads *(Bufo viridis)* have decreased.The reasons for this decline are not known. Green Toads can be found in gravel-pits, in the brackish lagoon near Koper, but also in some towns (Koper, Ljubljana, Žalec).

We have two subspecies of the Common Toad: *Bufo b. bufo* and *Bufo b. spinosus*. The latter is limited to the southern part of the country (Bressi, 1995, personal observation). The greatest threat to the Common Toad is road mortality. Many populations of this species have to cross roads on the spring migration and there is a site (Slivnica Lake) where tunnels for amphibians with temporary driftfences exist. The system was built in 1995 and was designed to preserve one of the biggest populations of Common Toads in Slovenia, numbering about 10,000 adults (Vogrin 1995).

On Mt. Pohorje (the most eastern part of Alps) the European Tree Frog *(Hyla arborea)* was found at an altitude of 1050 m. This is the highest known locality in Central Europe. Until now the highest known locality was in Austria at 800 m (Nöllert, Nöllert 1992). In the western part of Slovenia, near the border with Italy, additionally the newly described Italian Tree-Frog *(Hyla italica)* (Nascetti, Lanza, Bullini 1995) has been found.

The Moor Frog *(Rana arvalis wolterstorffi)* can be found in the eastern part of Slovenia, mainly near the border with Croatia, along the three biggest rivers Sava, Drava and Mura. Recently a new locality for the Moor Frog has been found on Dravsko polje (Drava field) (Vogrin, Vogrin 1995). The Moor Frog is also endangered for mostly the same reasons as are the Common Spadefoot and the Fire-bellied Toad.

The Grass Frog *(Rana temporaria)* and the Agile Frog *(Rana dalmatina)* are the common species. The Italian Agile Frog *(Rana latastei)* has been found near the border with Italy in the woods of Panovec. In the past few years no records of observations of these species could be found, but efforts will continue.

The distribution of the *Rana esculenta* complex including *R. lessonae, R.* kl. *esculenta* and *R. ridibunda* is still largely unknown.

The Smooth Newt *(Triturus vulgaris)* is represented in Slovenia by two subspecies. *Triturus v. vulgaris* seems to be distributed in north-eastern Slovenia, *Triturus v. meridionalis* can be found in the other parts of the country (Pozzi in Lapini, L., A. Dall'Asta, D. Scaravelli 1991, personal observation).

The Alpine Crested Newt *(Triturus carnifex)* is common in some gravel-pits in the north-eastern part of the country. At some of these sites it seems to be quite numerous, as up to 200 individuals could be found.

The Alpine Newt *(Triturus alpestris)* can be found from the lowlands to the high mountains. From the Črno jezero (Črno Lake) in Triglav National Park was described a subspecies, *Triturus alpestris lacusnigri*, that is extinct because of fish populations (Sket 1992).

On the mountain Pohorje were found large populations of the Alpine Newt, the Alpine Crested Newt and the Smooth Newt in only one pond at an altitude of 1150 m. The population of the Alpine Newt is estimated as at least 1500 individuals, the population of the Alpine Crested Newt is estimated as about 300 individuals and the population of the Smooth Newt about 1500 individuals. One other place – called Menina planina, also has all three species of newts, found at an altitude of 1360 m.

In the deciduous mountain forests the Fire Salamander *(Salamandra salamandra)* is common. It is rare in the pine forest. The Alpine Salamander *(Salamandra atra)* lives in the Alps and on some other mountains (i.e. the mountains Snežnik, Gorjanci).

Table 1.
Amphibians in Slovenia with IUCN categories of endangerment.

Species	IUCN categories
Proteus anguinus	V
Salamandra salamandra	–
Salamandra astra	–
Triturus alpestris alpestris	(V) I
Triturus alpestris lacusnigri	Ex
Triturus vulgaris vulgaris	(V) I
Triturus vulgaris meridionalis	(V) I
Triturus carnifex	(V) I
Bombina bombina	(R) I
Bombina variegata	(V) I
Pelobates fuscus	(V) I
Bufo bufo bufo	(V) I
Bufo bufo spinosus	*
Bufo viridis	(V) I
Hyla arborea	(V) I
Hyla italica	*
Rana arvalis wolterstorffi	(V) I
Rana dalmatina	(V) I
Rana latastei	R
Rana temporaria	(V) I
Rana kl. esculenta	(V) I
Rana lessonae	(V) I
Rana ridibunda	(V) I

Legend: Ex – Extinct, V – Vuilnerable, R – Rare, I – Intermediate

* This sub-species or species is not mentioned in the Red List of Endangered Amphibia in Slovenia (Sket 1992).

Plate 1. The Alpine Crested Newt *(Triturus carnifex)* is numerous in some places in Slovena

Reptiles

Twenty-five species of reptiles are known for Slovenia. The occurrence of the following species has not been reliable determined yet: the Cat Snake *(Telescopus fallax)*, the Turkish Gecko *(Hemidactylus turcicus)* and the European Glass Lizard *(Ophisaurus apodus)* (Mršić 1992). Three species of sea turtles come to the Slovenian sea only periodically – the Loggerhead Turtle *(Caretta caretta)*, the Leathery Turtle *(Dermochelys coriacea)* and the Green Turtle *(Chelonia mydas)*. One of the most endangered reptiles in Slovenia is the European Pond Turtle *(Emys orbicularis)*. Because of habitat loss only a few localities, mainly in the southern part of the country (Bela krajina), have remained. The Viviparous Lizard *(Lacerta vivipara)* lives in various habitats, depending on altitude. In the mountains, it can be found on pastures, rocky areas and in bogs. In the lowlands it lives on swamp meadows and similar habitats. A similar distribution can be found for the Smooth Snake *(Coronella austriaca)*, the range of which includes both mountain areas and lowland parts of the country.

The Horvath's Rock lizard *(Lacerta horvathi)*, which is an endemic species for this part of Balkan peninsula, is distributed in the South-west part of the country, mainly in the Julijske Alpe (Julian Alps) (De Luca 1989).

Plate 2. The Green Lizard *(Lacerta viridis)*

Plate 3. The Bosnian Adder *(Vipera berus bosniensis)*

All photographs by Nuša Vogrin

In the coastal areas live the Italian Lizard *(Podarcis sicula campestris)* and the Dalmatian Algyroides *(Alygroides nigropunctatus)*. The Dalmatian Wall Lizard *(Podarcis melisellensis fiumana)* is distributed in the south-western part of the country.

There are different subspecies of the Common Wall Lizard *(Podarcis muralis)* in Slovenia. In the coastal area lives *Podarcis muralis maculiventris*, in the other parts of the country *Podarcis muralis muralis*. We also have two subspecies of Common Viper, *Viper berus berus*, and *Vipera berus bosniensis*, which lives in the Southern part of the country, mainly on Mount Snežnik. The Bosnian adder reaches here the northern border of it range. Our most populous lizard is the Green Lizard *(Lacerta viridis)*; it seems that it is distributed all over in country, except in the mountains (Figure 3). In some places it is still numerous.

The Slow Worm *(Anguis fragilis)* is a common species but is endangered on account of killing and the use of rotational mowers on the meadows.

The south-western part of Slovenia is of particular interest because it represents the northern border of the distribution of some snakes. These species include the Four-lined Snake *(Elaphe quatuorlineata)* (Škornik 1985), the Balkan Whip Snake *(Coluber gemonensis)*, the Western Whip Snake *(Coluber viridiflavus carbonarius)* and the Montpellier Snake *(Malpolon monspessulanus insignitus)* (Mršić 1992). These snakes are among the most endangered reptiles in our country, the biggest threat being people killing every snake they see. Another threat arises from reforestation. About 120 years ago only 14% of the karst region was covered with woods. Due to planting of *Pinus niger*, today about 50% of this area is wooded, and still increasing. As a consequence of the loss of suitable habitat, the distribution areas of the mentioned snakes have continuously decreased.

The Aesculapian Snake *(Elaphe longissima)* is distributed in the whole country but the number of specimens has decreased (Mršić 1992).

The Grass Snake *(Natrix natrix)* is a common species. In some places (for example on Cerknica Lake (Cerkniško jezero)) it is very numerous in a small area. The distribution of the Diced Snake *(Natrix tessellata)* is unknown and its numbers in the known localities are low. It seems to be more endangered than the Grass Snake because of water pollution and a loss of suitable habitats.

The Asp Viper *(Vipera aspis)* lives (lived?) on the Slovenian border with Italy in an area called Goriško. In the past few years no specimens have been found, but efforts will continue.

In Slovenia we can probably find two subspecies of the Nose-horned Viper. One is *Vipera ammodytes ammodytes*, that is distributed in the south, and *Vipera ammodytes gregorwallneri*, which probably lives in the north, near the border with Austria.

Table 2.
Reptiles in Slovenia with IUCN categories of endangerment.

Species	IUCN categories
Caretta caretta	E
Chelonia mydas	E
Dermochelys coriacea	E
Emys orbicularis	E
Hemidactylus turcicus	I
Algyroides nigropunctatus	V?
Lacerta agilis	V
Lacerta viridis	V?
Lacerta horvathi	R
Lacerta vivipara	*
Podarcis melisellensis fiumana	V?
Podarcis muralis	V?
Podarcis sicula campestris	V?
Anguis fragilis fragilis	*
Ophisaurus apodus	I
Coluber gemonensis	E
Coluber viridiflavus carbonarius	V
Coronella austriaca	*
Elaphe longissima	V
Elaphe quatuorlineata	E
Malpolon monspessulanus insignitus	E
Telescopus fallax	E
Natrix natrix natrix	V?
Natrix tessellata	V?
Vipera berus berus	O
Vipera berus bosniensis	R
Vipera ammodytes	V?
Vipera aspis	Ex?

Legend: Ex? – Probably extinct, E – Endangered, V – Vulnerable, R – Rare, I – Indeterminate, O – Out of danger.

* Species are not mentioned in the Red List of Endangered Reptilia in Slovenia (Mršić 1992).

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THE HERPETOFAUNA OF THE UNINHABITED ISLANDS OF THE SPETSAI/HYDRA ISLAND COMPLEX, GREECE

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INTRODUCTION

Between the autumn of 1969 and the summer of 1971 a series of investigations were carried out on islands/islets in the Argo-Saronic Gulf. The author has already written a number of reports on this area (Clark 1967, 1969, 1970, 1972, 1989) which is seldom referred to in herpetological literature. The last named paper was a general checklist of the islands and adjacent mainland and did not go into details of micro-distribution. In this account I have selected the region bounded by the inhabited islands of Spetsai and Hydra; these are referred to in the text where necessary but the thrust is on the uninhabited islands. Descriptions of the localities are given, a species account and some taxonomic discussion. Of interest is the existence of a distinct race of *Lacerta trilineata* on Stavrònissos, the abundance of *Tenuidactylus kotschyi* on the miniscule islets and colour variant of *Coluber gemonensis* on Dhokòs.

The islands vary is size from little more than above water rocks and reefs under 100m. long, to substantial masses of land with peaks of up to nearly 300m. above sea-level.

It should be noted that in Clark (1989) two island localities were given in error: Kartèli and Vèntzna. These islands were not visited and the localities should have read Tagàri and Strongylò. This correction has been made with reference to Greek maritime charts.

LOCALITY DESCRIPTION

AGIOS IOANNIS: a low island sloping up to the highest point, 9.5m. on which a chapel is built. Not very rocky with much low shrub cover.

MICRO IOANNIS: a small satellite to Agios Iòannis. Maximum elevation 6m. with a small area of dense undergrowth. The shoreline is strewn with small rocks and stones. Both these islands lie to the east of Spetsopòula.

TRIKKERI: a substantial island, butterfly-shaped the two halves joined by a narrow neck. Trìkkeri lies about 8 km. east of Spètsai, is 1.8 km in length and has a maximum elevation of 127m. The landscape is rocky with areas of scrub and a few stunted trees.

STAVRONISSOS: steep and rocky with vertical cliffs on its eastern and southern sides. The top of the island is a small plateau with an elevation of 111m. There is some vegetation and the remnants of hillside terracing. The island is approximately 700m x 500m and lies 76km off the south-west extremity of Hydra.

ASTERI: a low reef 6m broad and 84m long. A little vegetation in protected hollows but in rough weather the islet is nearly swept by waves.

DHRAPI: rather larger than Astèri, conical with a circumference of about 1km. Maximum elevation 15m.

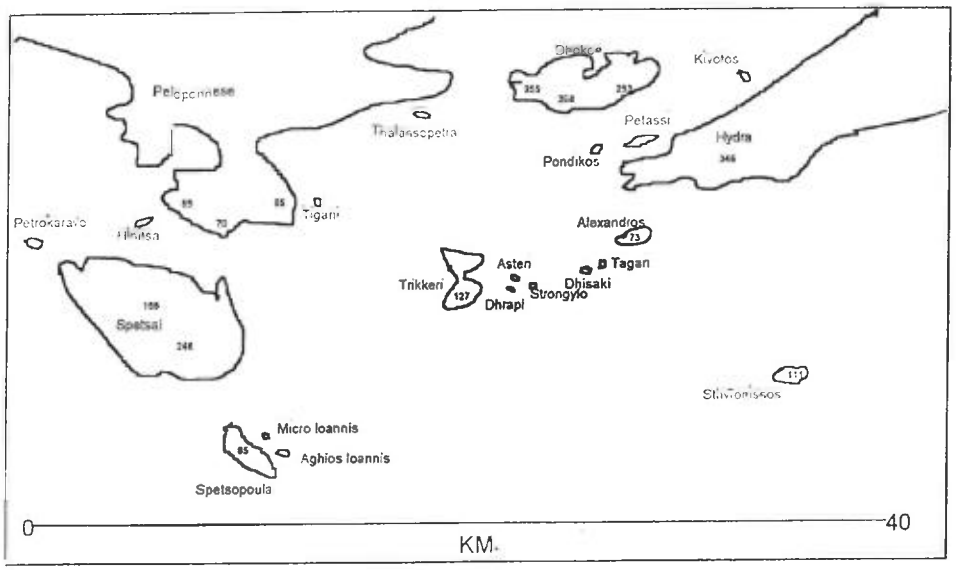

Fig. 1. Map of the Spetsai/Hydra Island Complex

STRONGYLO: the largest of this group, rugged and steep. Maximum elevation 38m. Astèri, Dhràpi and Strongylò lie about 1.5km, east of Trikkeri.

ALEXANDROS: long and steep and about the same area as Stavrònissos with a narrow, flat central ridge. A ruined building stands on the highest point at 73m.

TAGARI & DHISAKI: a pair of tiny islets separated by a narrow, rock-studded channel. Both these and neighbouring Alèxandros lie close to the western point of Hydra and east of Trikkeri.

PONDIKOS: narrow and steep-to with considerable scrub cover. Maximum elevation 34m.

PETASSI: precipitous and rocky up to a narrow central spine. Both Pondikòs and Petàssi are situated off the east coast of Hydra in Stenòn Petàssi.

KIVOTOS: one of a pair of islets with evidence of former use in the presence of a small chapel and some ruined walls. Kivotòs is to be found between Petàssi and the port of Hydra.

DHOKOS: the largest of the islands. Dhokòs is 8 km in length and about 2.5km at its broadest point. The southern side has vertical cliffs which fall abruptly away from the summit of 293m. There are extensive olive groves but the small settlement is now nearly deserted. Otherwise the island is densely covered with scrub and is rocky with deep crevices.

TIGANI: a comparatively well vegetated islet with low scrub and bushes and a few Aleppo pines. Maximum elevation 24m.

THALASSOPETRA: a steep-sided islet with difficult access. Rock and earth banks which are heavily eroded.

HINITSA: low, undulating and well vegetated with a maximum elevation of 17m. These three islands lie close to the mainland coastline.

PETROKARAVA (BOURBOULO): this islet, 1.5 km off the north west point of Spetsai, is steep, rocky and difficult to explore though there is a rough path up to an automatic beacon. Maximum elevation 22m.

Although the islands in question are uninhabited, or in many cases uninhabitable, some are used for seasonal grazing of sheep and goats. The animals are largely left unattended although on Trìkkeri a shepherd was in residence, in April 1971. No reptiles were found on Hìnitsa nor on Alèxandros.

Localities are shown in Fig. 1.

SPECIES ACCOUNT

TESTUDINIDAE

Testudo m. marginata Schoepff 1792 Marginated Tortoise

Distribution. Dhokos. 2 adults and 2 juveniles 20.11.69 and the species was found to be common on the island on re-visits in March and May 1971. The species does not occur on other islands, but is abundant on Spetsai. Both the juveniles as well as one of the adults had a prominent thigh tubercle. It is possible to misidentify juveniles as *T. graeca ibera* on account of this feature though the flared-out carapace is a characteristic that serves to identify adult *T. marginata*. (Fig. 2).

GEKKONIDAE

Hemidactylus t. turcicus (Linnæus) Turkish Gecko.

Distribution. Dhokòs. A single specimen, a female, was caught under the cover of a cistern near a deserted building. Another example was seen at the same locality.

Tenuidactylus kotschyi subsp. (Steindachner 1870). Naked Fingered Gecko.

Distribution. Ubiquitous. 103 examples were collected, 82 adults and 21 juveniles, the majority – all except nine – in November. It was generally found in hiding under stones and on Dhrapi eight were disclosed under one boulder. It was further identified on Trìkkeri from numerous examples seen in the open. It was especially common on Agios and Mìkos Ioannis (28), Dhrapi (20), Asteri (16) and Pondikos (12). The duration of time spent on the tiny islets was an hour or less so this gives some indication as to the population densities. More examples were found on Dhrapi in 30 minutes than on Spetsai over a period of several months.

There is some variation in the colouring and patterning, which would appear to be linked with the islet/island groupings:

Dorsal barrings: bold (Agios/Mìkro Ioannis)
faint or nearly absent (other localities)

Venter: Dull white minutely and densely black spotted (Tigani, Thalassòpetra Petrokàravo).
white with lighter black dotting (Pondikòs, Petàssi, Stavrònissos).
immaculate white with minute dark dustings (Dhokòs, Tagàri, Dhisàki).
yellow, minutely and densely black dotted (Dhràpi, Astèri, Strongylò).

Plate 1. *Testudo marginata*

Plate 2. *Lacerta erhardii livadiaca*

On one specimen from Tigàni the dorsal barrings are replaced by three longitudinal stripes and there is a tendency for this condition in the presence of nape stripes in geckos from Agios Ioannis.

Diagnostic data is summarised in Table 1. On islands where samples are reasonable the data is listed separately. The dorsal tubercle keeling is weakly developed, the interspaces no wider than the tubercles themselves as in the case in all populations from the Argo-Saronic Gulf islands examined by the author.

LACERTIDAE
Lacerta t. trilineata Bedriaga 1881. The Balkan Green Lizard.

Distribution. Dhokos. Sight identified on 20.11.69 and 23.05.70. Three adult males and two juveniles were caught on 11/12.03.71 and a gravid female on 24.05.71. In all respects these were typical for the nominate form: adults had a bright green dorsum minutely black dotted; belly white or cream and the throat/chin yellow; pileus Olive/grey with green vermiculations (males), female nearly black with yellow/green flecks. Juveniles were dark chocolate with three longitudinal dorsal yellow stripes, the vertebral line broken in one individual. There was a row of lateral spots. This species was fairly common and encountered on all visits to the island.

Lacerta trilineata new subsp.

Distribution: Stavronissos. Green Lizards from this island differed in a number of characters from the nominate form as tested in combined samples from the Argo-Saronic Gulf islands of Salamis, Aegina, Hydra, Dhokos, Spetsai, Plateia and Ipsili: The most striking difference was in appearance: lizards from Stavronissos were either sombre grey/green heavily overridden with darker grey so that the ground colour was nearly obliterated. In one male and one female the ground was a brighter green, the normal minute black dotting typical of the nominate form replaced by an irregular coarse patchwork. Otherwise meristic differences were found in the number of supraciliaries, supraciliary granules and dorsals: Table 2. Note that the supraciliary, supraciliary granule and dorsal counts are low in the Stavrònissos form. In addition there was a difference in the submaxillaries (not shown in Table 2). The Stavrònissos population invariably had four scales in each series. On the other islands either five or four large and one small, occasionally six.

Three visits were made to Stavrònissos. On the first occasion two males and two females were caught and a further six seen (19.11.69). On 10.06.70 two males one female and one juvenile were secured and an additional three lizards seen. The last visit was on 18.06.71 when a further two males were caught. Most of the lizards were observed on the summit plateau where there were plenty of bushes and scrub in which they took refuge, as well as amongst rock piles and crevices.

Podarcis erhardii livadiaca (Werner 1902) Erhard's Wall Lizard

Distribution. Petassi. This is the only small lacertid that occurs and is also found on neighbouring Hydra. Petassi was visited on three occasions: 19.11.69, two specimens seen; 10.06.70, nothing seen; 19.06.71 four adult males and two females caught. An analysis of the Wall Lizards from Hydra, Petassi, Attica and Agios Geòrgios is in preparation and publication intended at a future date. This species was photographed on Hydra in April 1993. (Fig. 3).

SCINCIDAE
Ablepharus k. kitaibelli Bibron & Bory 1833. The Snake-Eyed Skink

Distribution. Agios Iòannis, Tigàni, Dhokòs, Petàssi. This species has had some success on the small islands but not to the same extent as *T. kotschyi*. Two adult males were taken on Agios Iòannis, a female from Tigàni, a male from Dhokòs. It was sight identified on Petassi. Quite possibly it occurs on more of the islands than those listed here.

COLUBRIDAE

Coluber g. gemonensis (Laurenti 1768)

Distribution. Trìkkeri, Dhòkos, Stavrònissos. Common on all these islands. For details see Table 3.

Most specimens were normally coloured and patterned but in two males from Dhokos the colouring and markings were unusual and distinctive. The ground colour was plain grey dorsally and silver grey dorso-laterally. The dorsum had bold black bars which were either single or offset. These bars extended down to the mid-lateral zone with additional black markings below. These markings gradually became reduced posteriorly and confined to scale edges giving a striped pattern. On one example the venter had large black spots on the outer scale edges and a single row of smaller black spots either side of the mid-line which was speckled with black, this continuing down the tail as a continuous line. In a female from Dhokos the dorsum had large black markings down its length but not in the form of organised bars.

As had already been remarked on (Clark, 1989) the distribution of *C. gemonensis* in the area is unpredictable. The species is absent from the islands of Spetsai and Hydra as well as from Poros. On the mainland it is also absent in the Argolid peninsula, but occurs at Mycenae and then widely through the rest of the Peloponnese both at low and higher altitudes. Its survival on the three islands in question is due to the lack of competition from other species in a limited area. On Trìkkeri and Stavrònissos it is the only snake and on Dhokos, a considerably larger island, it is sympatric with *C. najadum dahlii.*

Coluber najadum dahlii Dahl's Whip Snake

Distribution. Dhokos. Two cast skins were identified on 20.11.69 and three live snakes sight identified on 23.05.70. This snake occurs on Spetsai but has not been recorded from Hydra. No evidence was found of its presence elsewhere.

Table 1
Data on *Tenuidactylus kotschyi*

Locality	Ventrals R	Ventrals M	Ventrals SD	Tubercles R	Tubercles M	Number
A	24-29	26.50	01.57	10-13	12	28
B	21-28	23.90	01.53	11-14	12	39
C	23-26	24.25	01.04	11-13	12	8
D	21-27	24.67	02.07	11-12	12	6
E	23-27	25-58	01.08	10-13	12	12
F	21-29	24.99	01.75	10-14	12	138

Locality legend to Table 1: **A** Agios/Mìkro Iòannis **B** Astèri, Dhràpi, Strongylò **C** Tigani, Thalassòpetra **D** Petrokàravo **E** Pondikòs **F** All Saronic Gulf localities.

Table 2
Data on *Lacerta trilineata*

Locality	D/R	D/M	D/SD	S/R	S/M	S/SD	G/R	G/M	G/SD	No.
A	47-54	49.50	2,44	4-8	5,71	8.86	4-12	7,87	2,43	30
B	43-49	46.33	1,97	3-5	4	0.74	1-7	3,36	2,1	10
C	47-55	49.41	0,55	5-7	5,6	0.55	6-14	9,55	1,95	17
D	47-58	51.72	3,13	4-7	5,65	0.74	7-11	8,1	1,58	11
E	48-53	49.90	1,7	5-6	5,5	0.50	7-14	9,56	2,03	10

Legend to localities: **A** Saronic Gulf Islands **B** Stavronissos **C** Attica **D** Peloponnese **E** Central and South Euboia.

Legend to Characters: **D/R** Dorsal range **D/M** Dorsal mean **D/SD** Dorsal standard deviation **S/R** Supraciliary range **S/M** Supraciliary mean **S/SD** Supraciliary standard deviation **G/R** Granule range **G/M** Granule mean **G/SD** Granule standard deviation **No.** Number of lizards in sample.

Table 3
Data on *Coluber gemonensis*

Locality	Date	Sex	A	B	C	D
Stavrònissos	19.11.69	male	264	117	172	110
	27.02.70	male	630	280	172	104
	27.02.70	female	625	172	183	62+
Dhokòs	20.11.69	male	505	220	181	103
	23.05.70	male	750	162+	169	48
	23.05.70	male	547	246	170	101
	23.05.70	male	488	223	169	98
	24.05.71	male	486	223	166	101
	08.06.71	male	443	203	171	102
	11.03.71	female	630	171+	183	64
	07.06.71	female	585	227	181	96
Trìkkeri	07.02.70	male	267	125	171	112
	08.04.71	male	235	100	171	106
	08.04.71	male	488	224	169	105
	08.04.71	female	553	230	178	99
	08.04.71	female	491	207	178	99

A Body length mm.
B Tail length mm.
C Subcaudals x 2
D Ventrals anal divided
E Dorsals
+ Tail damaged

SUMMARY

The following species were found on the uninhabited islands: *Testudo m. marginata* (Dhokòs); *Hemidactylus t. turcicus* (Dhokòs), *Tenuidactylus kotschyi* (ubiquitious); *Ablepharus k kitaibelli* (Agios Ioannis, Tigàni, Petàssi, Dhokòs); *Lacerta t. trilineata* (Dhokòs); *Lacerta trilineata new subsp.* (Stavrònissos); Podarcis erhardii livadiaca (Petàssi); *Coluber g. gemonensis* (Trìkkeri, Stavrònissos, Dhokòs); *Coluber najadum dahlii* (Dhokòs). Trinomial nomenclature is given in all species except where taxonomic uncertainty exists: *Tenuidactylus kotschyi.*

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BOOK REVIEW

The Reptile Keeper's Handbook. Susan M. Barnard, Krieger Publishing Company, Malabar, Florida, USA, 1996. ix + 252 pp., line drawings, black and white photographs. $58.50. H/b ISBN 00-89464-933-7.

The occupation of maintaining live reptiles in a healthy captive environment has exploded over the course of the past twenty years. Zoos that once happily boasted "postage-stamp collections" - a series of many species represented by single specimens - are now engaged in large-scale programmes of captive breeding, habitat conservation, and species re-introductions into the wild. Private individuals who once considered themselves fortunate if they could keep a few lizards and snakes alive for a season are now keeping and breeding species unknown to collectors of the 1970s. The sub-discipline of herpetology has even been baptized with its own name, herpetoculture, and today boasts an impressive number of successes in the areas of reptile husbandry and breeding. Concurrent with this expanding young field has been the proliferation of numerous periodicals and books spanning the breadth and depth of contemporary interests. Not surprisingly, the vast majority of the books leave a great deal with which a reviewer may find fault. Such, fortunately, is not the fate of the *Reptile Keeper's Handbook*.

Susan M. Barnard presents a wealth of husbandry data culled from both the literature and her own extensive work at Atlanta Zoo. As is often the case in a comprehensive volume published by one author from a particular branch of a diverse science, the text contains noteworthy biases of a zookeeper. This translates to a book with a rather loose grasp of contemporary taxonomy, but a strong presentation of parameters for artificial environments and disease prevention and treatment. It is to Ms. Barnard's credit that where her text is weakest, it does not appreciably detract form the overall, and considerable, worth of the book.

The nit-picking has to do with minor errors, such as stating that "all lizards possess internal pelvic girdles" and "with the exception of most geckos, lizards have movable eyelids" (p. 7). It is not a universal truth about lizards that "Unlike snakes, lizards possess external ear openings" (p. 7). All these statements sidestep the fact that lizards gloriously exemplify the definition of biology as the science of exceptions. Appendix I contains some interesting mixes of typos (e.g., listing the 35 cm lizards of the genus *Acanthosaura* as reaching 91 cm, p. 101) and dated taxonomy. Examples of the latter include retaining the family Agamidae rather than the currently accepted Chamaeleonidae; lumping Bearded Dragons in *Amphibolourus* while omitting the contemporary *Pogona*; keeping *Anelytropsis* and *Dibamus* in distinct families; retaining eublepharine and pygopodid geckos in the Gekkonidae; retaining the conventional "iguanine" genera in the polyphyletic Iguanidae; retaining *Tejovaranus* (now *Callopistes*); and similar diversions from the taxonomic mainstream.

However, the scope of this book is neither taxonomy, phylogenetics, nor ecology, so the discrepancies are of little consequence. Ms. Barnard has presented the nuts and bolts of maintaining a large collection of reptiles under proper captive conditions. The value of her book lies in the chapters about selecting and handling, housing, feeding, health care, and reproduction of reptiles. Chapter 3, "The Captive Environment" provides one of the best general introductions to preparing a terrarium available today. Novice herpetoculturists will particularly benefit from the section on enclosure dimensions, in which Barnard clearly states the parameters of a terrarium based on multiples of the resident's length. Cage crowding is a common implication in the failure of terrarium

animals to adjust to captivity, and Barnard's guidelines should thus help alleviate a common source of veterinarian visits. Chapter 3 also includes a good overview of substrate materials, including explanations about why unsuitable materials are potentially harmful. The gem in the chapter, though, is the chart of temperature ranges for a variety of herpetofauna (p. 27) coupled with a good argument propounding the value of providing captives with a thermal gradient.

Chapter 4, "Feeding and Nutritional Disorders", will be familiar material to most reptile keepers. However, the review of nutrients, their functions and sources will be instructive to most serious keepers. With the uneven teaching of basic biology in universities today, it is a good idea to include such a primer of nutrient roles in physiology to reptile keepers. The coverage of when and how to force-feed reptiles is practical and easy to follow; it should reduce the stress of force-feeding for animals if readers learn these techniques correctly.

Chapter 5 "Health, Medical, and Necropsy Considerations" reflects, I believe, the author's bias towards a veterinarian point of view. This, the longest chapter, covers a variety of topics from animal hygiene and human health through treatment of herpetological ailments, and conducting a postmortem. While not intended as a replacement for a good veterinary treatise, Barnard nevertheless provides a wealth of useful observations about the health of reptiles. Novice zoo keepers will be able to determine which animals can be treated in-house, and which require the care of the staff vet. Private keepers will be able to recognise common disorders and have practical information to allow them to proceed with treatment or arrange veterinary consultation. In scanning Chapter 5, one is impressed by the simple layout, accompanied by illustrations, that allow ready diagnosis to a variety of ailments. Such a presentation is much more useful to the non-veterinarian than would be a search through a specialist's volume. Barnard gracefully omits much of the veterinarian jargon that would confuse the lay reader.

The appendices take up considerable text space, and offer a useful set of documents. Appendix I purportedly lists all the reptile genera of the world (with some errors, such as those noted above), an undertaking not seen in print since Ditmars (1910). Appendix II details how to establish and maintain feeder insect colonies. It is ironic that at a time when herpetoculture is expanding as a major business, so few authors make any attempt to discuss the keeping of insect colonies, certainly a cost-efficient measure for larger collections, and one that guarantees availability of adequate foodstuffs for captive reptiles. Appendices III-VII display the nutrient compositions of a variety of foodstuffs, and Appendix VIII lists the preferred foods for the genera of reptiles. This is followed by appendices on poisonous and mechanically dangerous plants, drugs and recommended dosages, and a comprehensive glossary. The glossary is good, but spotty; it lists "b.i.d." but not "q.i.d.", and I wonder why Barnard defines "coelenterate" in this section, as I could not find the word elsewhere in her book. The bibliography reflects, again, a bias towards more veterinary publications, but includes a considerable variety of pertinent references on herpetology and general herpetoculture.

The Reptile Keeper's Handbook provides an above-average introduction to herpetological husbandry that should make it valuable to novice reptile keepers at any level, and there will be much of interest for serious keepers of larger collections. It will be particularly useful in university environments where students are being introduced to herpetocultural techniques for the first time, such as when maintaining lab colonies of specimens being used for research purposes. At a time when the few good resource books are largely centered on taxon-specific presentations, Barnard's contribution will

serve as a counterbalance for general herpetoculture. While it lacks the fine view of Ross and Marzec (1990) or detail of Barker and Barker (1994), two books presenting complimentary and excellent overviews on pythons, Barnard may join them in giving interested readers an informed starting point towards the broad view of terrarium keeping. This is a good book at a slightly inflated price that nonetheless deserves a place on the bookshelf of any serious reptile keeper.

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MEMORIAL TO C.J.P. IONIDES ERECTED IN KENYA

A plaque commemorating the life and work of C.J.P. Ionides, the famous herpetologist and naturalist, was unveiled at the Nairobi Snake Park on Wednesday, 31 July 1996.

C.J.P. Ionides, ("Iodine"), died in Nairobi in 1968, having spent 43 years of his life in East Africa. He contributed much to African zoology and was particularly recognised for his work on venomous snakes.

Over 40 people attended the ceremony and these included a number who had known and worked with Ionides in the past, two former Curators of the Snake Park and the present Curator. The event opened with an introduction by Professor John E. Cooper who outlined the history of the Ionides Memorial Fund. This was set up in the early seventies by five Trustees – J.H.E. Leakey, J.E. Cooper, C.R.S. Pitman, A. Duff-Mackay and M. Mitton – with a view to perpetuating the work and memory of Ionides. For various reasons the Fund was not used at the time other than providing some books for the Museum Library. Instead, however, it had accrued interest and was now available to assist in the renovation and development of the Snake Park. Professor Cooper explained that those who had contributed to the Fund included a number of institutions and associations, many eminent herpetologists and one of Ionides' biographers as well as his friends and supporters.

Mr. Owen Sumbu, the current Curator, welcomed visitors and explained that, with the help of funding from the Kenya Museum Society and others, important changes were being made to the Snake Park and to the accommodation provided for its reptiles. There followed some reminiscences about the life and work of Ionides. These were led by Mr James Ashe, a former Curator of the Snake Park, who recalled Ionides' kindness and generosity, particularly to people who were in trouble. He also reminded those present that Ionides had a breadth of knowledge of subjects in addition to herpetology; he was, for example, a widely-read historian. Mrs. Mollie Leakey followed with recollections of Ionides when he was collecting snakes in the Kerio Valley. She described how he liked to sit in the bush listening to classical music records on his wind-up gramophone! Mr. Ashe then introduced Mrs. Judith Rudnai who, in the sixties, had been a student at the University of Nairobi and had close professional contact with Ionides. She spoke with warmth about Ionides who had been the guest of honour at her graduation party.

Professor Cooper then introduced Dr. Mohammed Isahakia, Director Chief Executive of the National Museums, who had kindly agreed to unveil the memorial plaque to Ionides. Dr. Ishaakia said that he was grateful for an opportunity to speak about the Museum and the Snake Park and to expand on plans for their development. He stressed the importance of the Snake Park, particularly in terms of educating local people about the reptiles of East Africa and in giving advice on matters relating to venomous snakes and allied issues. He welcomed the ceremony, not only as a way of commemorating the life of a great naturalist but also because it helped to draw attention to the Snake Park and its work and encourage visitors. Dr. Isahakia then unveiled the plaque which read:

C.J.P. IONIDES ("IODINE")

This plaque commemorates the life and work of C.J.P. Ionides who contributed much to the study of reptiles of East Africa and who died in Nairobi on 22nd September 1968. The plaque was provided by the Ionides Memorial Fund with contributions by his friends and admirers.

In closing the ceremony, Professor Cooper paid tribute to those who had attended and to those who had contributed in the past to the Fund. The latter are being contacted and informed of developments. He thanked the Director and staff of the National Museums, who had helped to publicise and film the event, the Curator and staff of the Snake Park who had arranged the venue and Mrs. Margaret Cooper who, in addition to giving much support to the establishment of the Fund, had taken photographs of the occasion which would be available in due course for distribution and publicity.

Following the formal proceedings, those present took refreshments together at the Bustani Restaurant in the Museum.

The unveiling of the plaque in Nairobi on 31 July was the first step towards marking in a tangible way the life and work of C.J.P. Ionides. The remainder of the Fund is to be used for a special exhibit within the Snake Park. The ceremony provided an excellent opportunity to remember Ionides and his contributions to herpetology and, at the same time, to give much needed support and publicity to the Museum and Snake Park. The latter has contributed a great deal to East African herpetology in the past and continues to do so.

A full report of the Ionides Memorial Fund, including a list of the original contributors and further details of the unveiling ceremony is available. Copies of this, together with further information about the Fund or the life and work of C.J.P. Ionides, can be obtained from:-

Professor John E. Cooper, The Durrell Institute of Conservation and Ecology, The University of Kent, Canterbury, Kent, CT 7PD, UK
or
Mr. Owen Simbu, Curator, The Snake Park, National Museums of Kenya, P.O. Box 40658, Nairobi, Kenya

J. E. Cooper

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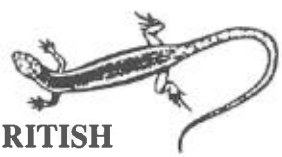

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