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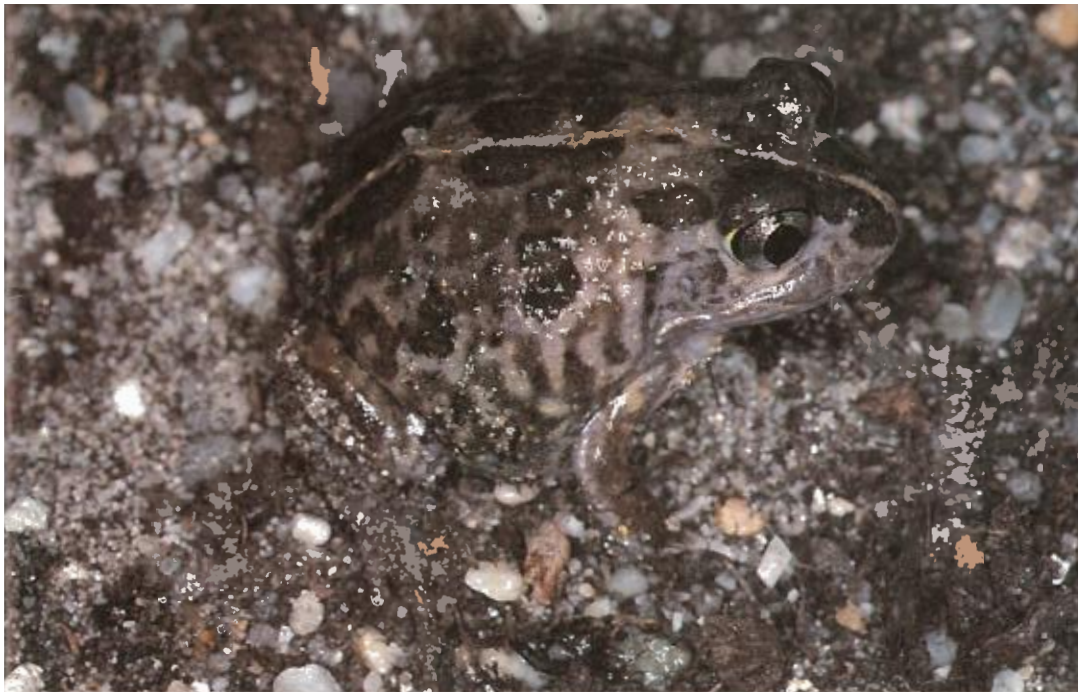
THE BRITISH HERPETOLOGICAL SOCIETY

BULLETIN



No. 53
Autumn 1995

THE BRITISH HERPETOLOGICAL SOCIETY

c/o Zoological Society of London
Regent's Park, London NW1 4RY
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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 and, among other activities, are invited to participate in an annual "camp" arranged in an area of outstanding herpetological interest.

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. 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	
Bulletin Membership	£12	(Receive YHC Newsletter)
Group Membership	-	For Schools, Youth Groups etc. Contact Education Officer (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) EXCEPT for YHC matters. YHC Membership and renewal details are available from the Education Officer (address on inside of back cover). 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

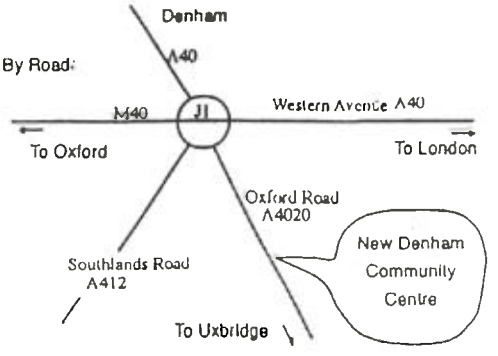
FRONT COVER
Neobactrachus sudelli (photographed by Walter Hödl). See article on page 3 by Birgit Gollmann.

BRITISH HERPETOLOGICAL SOCIETY REMAINING MEETINGS FOR 1995

November 11th Annual BHS Captive Breeding Open Day and Stock Sale. New Denham Community Centre, Uxbridge (off M40 J. 1 - see map). 2.00 pm - 6.00 pm.

Applications are invited from members, traders, societies and other organisations that would like to hire tables for this event. The cost of a 6' x 4' table is £15.00 (£5 to members). Restrictions on our licence mean that only BHS members may sell their privately bred captive stock. Traders and commercial breeders may only sell dry goods, equipment and herp foods. Application should be made to John Spence (0181 366 8127), 23, Chase Side Avenue, Enfield, Middlesex EN2 6JN. Admittance £2.00, Children under 14 free.

How to get there
From Uxbridge Tube (Piccadilly/Metropolitan): Turn right into High Street, continue on through shopping centre to Odeon Cinema. Follow right bending High Street until Oxford Road is met. Turn right (north) into Oxford Road and continue north, past Dog and Duck pub to Community Centre.



BHS NORTH WEST REMAINING MEETINGS 1995

December 5th Yet to be decided.

All meetings commence at 8.00 pm except where stated and are all held at Wildfowl and Wetlands Centre, Martin Mere, Burscough, Lancs. Tel: 01704 895181.

BHS POLICY ON ANIMALS IN CAPTIVITY, TRADE AND LEGISLATION

1. KEEPING REPTILES AND AMPHIBIANS IN CAPTIVITY

BHS recognises that keeping and caring for animals can be fulfilling and educational. Accordingly, the Society's functions include the improvement of welfare, husbandry and understanding of reptiles and amphibians in captivity. To this end, BHS policy is as follows:

(a) Anyone keeping reptiles or amphibians should seek to achieve the highest standards of health and welfare of their animals.

(b) BHS discourages members from keeping species with limited prospects in captivity. BHS will prepare and update regularly a list of such species. This list will also be circulated to dealers, with the intention of reducing or eliminating trade in such animals.

(c) BHS encourages members to opt for captive-bred animals whenever possible. In the event that animals must be obtained from the wild, members must observe any requirement for collection permits, export and import licences, health certificates, etc. and should act in a responsible, considerate and courteous manner towards land owners and other interested parties.

(d) Every effort should be made to breed rare and endangered species which are held in captivity, thus diminishing the case for abstraction from wild populations.

(e) Members are encouraged to make appropriate use of animals in their care for educational, conservation or scientific purposes.

2. TRADE IN ANIMALS AND ANIMAL PRODUCTS

BHS is not a trading organisation. In matters of trade, the role of BHS is one of concerned observer and advocate of codes of practice and principles. BHS is opposed to irresponsible trade in animals taken from the wild but recognises that there is a demand for certain animals and animal products. The Society accepts trade which is sustainable, humane and in accordance with the World Conservation Strategy, which involves habitat management and investment as conservation tools. BHS therefore recommends that trade should focus on captive-bred stock and/or animals obtained as part of a sustainable yield. The Society will oppose illegal and inhumane practices wherever they are found.

3. LEGISLATION

A Working Group comprising the Trade Officer and representatives from the Captive Breeding, Conservation, Education and Research Committees will formulate advice to government and other official bodies on behalf of the Society. Before imparting such advice, the Working Group will liaise with the BHS Chairman, who may refer matters to Council.

MAINTENANCE AND BREEDING OF THE AUSTRALIAN FROG *NEOBATRACHUS SUDELLI* (LAMB, 1911) IN CAPTIVITY

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INTRODUCTION

Neobatrachus sudelli is a burrowing frog found throughout most of the dry regions of Victoria (Hero et al., 1991), New South Wales and southern Queensland (Tyler, 1989, 1992). Habitats used include woodlands, shrubland, mallee as well as open and disturbed areas (Hero et al., 1991).

In appearance, *N. sudelli*, which grows to a size of about 40 mm (Cogger, 1986), resemble spadefoot toads of the family Pelobatidae: the body is plump, the hind legs are short, with large metatarsal tubercles (an adaptation for burrowing), the pupils are vertical (see front cover). The colour is grey or brown with large dark patches of marbling above and pale cream below; most specimens have a narrow, white or cream vertebral stripe (Cogger, 1986).

Neobatrachus sudelli is active at night, daylight hours are spent in the ground. During dry spells, the frogs remain underground, protected from water loss by a cocoon consisting of a thick layer of dead skin.

Breeding occurs after substantial rainfalls in marshes, dams and roadside ditches. The aquatic larvae metamorphose 4-5 and up to 7 months after spawning (Martin, 1965).

This paper describes the housing, feeding and breeding of *N. sudelli* in captivity.

ORIGIN OF SPECIMENS

Spawn of *N. sudelli* was collected in a farm pond at Yapeen, north of Melbourne in May 1988 for the purpose of comparing the embryonic development with that of other leptodactylid species. Most larvae or metamorphs were released at their site of origin, but six individuals were retained and exported to Austria in June 1989. The only female among them is still alive and well today (August 1995). Specimens used in the experiment described below were offspring of this frog.

HOUSING

The frogs were kept in glass or plastic containers of various sizes (minimum area: 15 x 10 cm for a single frog) filled to about 10 cm with soil and covered by a lid made of fly-wire on a wooden frame. Each tank contained a plastic dish with tap water, which was renewed at weekly intervals. Stones in the corners of the deeper dishes enabled the frogs to get out of the water more easily. Pieces of bark were added to some of the containers, and some stems of *Tradescantia* sp. were planted in one of the glass tanks.

All tanks were put on shelves in the same daylit room. No additional illumination was provided, and temperatures were not controlled (they ranged from about 17° in winter to 28° C in summer).

Soil is, of course, a major factor in the life of a burrowing frog. At the collection site, the soil was loamy and rather heavy (G.F. Watson, personal communication). In captivity, the frogs were at first kept in a mixture of approximately equal parts of commercially available peat and sand. Since it was found to be necessary to either clean or change the soil every three to six months (depending on the size, activity and density of the frogs), after about a year, only sand was used, which had two advantages: first, the moisture could be controlled well; the sand was sprinkled with aged tap water at about weekly intervals, except when the frogs were prepared for breeding (see below). Second, it could easily be cleaned by soaking it for 24 hours and then rinsing it thoroughly (the frogs were in the meantime removed to a spare tank).

Experiment on soil preference of the frogs

Each quarter of a plastic container of 40 x 33 x 25 x cm was filled to about 10 cm with a different type of soil (sand; dark, loose soil from a pine forest on limestone; dense loamy soil; and peat); the four compartments were separated by partitions made of thin (3 mm) wood in which a number of small holes were drilled to allow the exchange of moisture between the compartments. Additionally, removable partitions of the same type reached from the surface of the soil to the lid of the container.

The soil was sprinkled daily, and notes on moisture were taken (four categories were distinguished: dry, slightly moist, moist, very moist). Temperatures were between 17° and 20°C for most of the time, only for two animals they were higher (24° - 27°). The tank was put into a dark corner of the frog-keeping room. Sources of light - albeit little - were the window and, sometimes, a distant lamp.

At the beginning of the experiment, the upper partitions were removed and one frog was placed into a petri dish in the centre of the container, after it had become active at night. In the morning, when the frog had burrowed, the petri dish was removed and the upper partitions were installed; thus, the next emergence of the animal would show which type of soil it had selected. Each frog was kept in the experimental container until four choices of soil type had been protocolled. The tank was rotated three times (90° each) to reduce the influence of differental illumination on the behaviour of the frog. No food was provided during the experiment, except for cases of unusually long duration of the test (the average time needed for one frog was 12.1 days, the maximum 54 days, due to prolonged periods of inactivity by the frog), where prey items were offered in the central petri dish.

None of the twenty frogs tested burrowed in the pine forest soil. Sixteen frogs were consistent in their choice, burrowing in not only the same type of soil, but also in the same spot on each occasion. Eight of these selected loamy soil (under slightly moist to very moist conditions), six chose peat (under slightly moist to moist conditions) and two sand (under dry conditions). Two frogs burrowed in sand for two days and then changed to peat (dry to slightly moist conditions), two others used peat on three days, with a day in sand or loamy soil, respectively, in between. In eight cases, the hole made by the frog was situated in a corner, in four others it was near a wall of the tank.

FOOD

Neobatrachus sudelli feed mainly on the ground, but will also attempt to jump after insects climbing the wall of the tank. Metamorphs were fed on non-flying *Drosophila*, small mealworms, crickets and caterpillars of moths; the staple diet for adults was mealworms and crickets, but they were also offered grass-hoppers, caterpillars, flies (immobilised by cooling in the fridge), wood-lice and earthworms.

About every fortnight (more often during the phase of intense growth by the juveniles), the prey items were dusted with a mineral and vitamin powder, or sprinkled with a drop of vitamin solution.

BREEDING

A first attempt of breeding from the imported *N. sudelli* at the age of one year failed when three of the males succumbed to a bacterial infection. When the remaining two males and one female were about three years old, breeding was successful.

The tank housing the frogs had been kept dry for about three months; the frogs had remained burrowed for most of this time. In mid-October, the soil was gradually moistened (especially during rainy periods), and the frogs resumed their activity. Both males were heard to call (mostly underground) on several occasions.

For several consecutive nights, a tape with calls of *Neobatrachus sudelli* (Littlejohn, 1987) was played near the tank. The males were obviously stimulated by these calls: both tried to move towards the source of the calls, and the smaller one was seen in amplexus with the female both in the water and on land.

On November 24th 1991, the frogs were introduced into a breeding tank (the males a few hours before the female), and aquarium of 70 x 35 x 40 cm filled to about 10 cm with aged tap water. Part of the bottom was covered with sand, thus creating a shallow zone at one end of the tank. A small plastic container of about 15 x 10 cm, the rim of which was just above the water level, filled with soil mixture and weighed down with a stone was put into the centre of the tank. A big stone next to it enabled the frogs to reach this island, where they could burrow. A few pieces of aquatic moss were put into the water.

During the next month, periods of calling by the males, who sometimes stayed in the water even at day-time (while the female was underground) and were both seen in amplexus with the female, alternated with periods of reduced activity. After a 5-day period of low atmospheric pressure, during which the tank had frequently been sprayed and the tape had been played every night, spawning occurred on December 23rd while the female was in amplexus with the smaller male. Most of the about 1000 eggs were deposited in a broad layer on the bottom of the deeper part of the tank, about 10% were attached to the moss. The next day, the frogs were removed to their terrarium.

In April 1994, a pair of the offspring of this clutch was induced to breed following basically the same protocol, but combining the playing of the tape and spraying of the tank during a period of low pressure with an increase in the room temperature (about 3°). In this case, spawning occurred about a week after introduction into the breeding tank, and approximately 300 eggs were deposited in the deeper part of the tank.

REARING OF THE LARVAE

In 1991, more than 50% of the embryos failed to develop beyond gastrula stage, many others were retarded in their development. Hatching occurred 6 to 10 days after spawning. About 350 larvae died within their first month, even though they had been distributed to a number of containers. A possible source of this high mortality might have been the Viennese tapwater, the calcium content of which is rather high. The surviving larvae were gradually transferred to 5% Holtfreter's solution, in which they seemed to thrive. Only three tadpoles died after their second month.

Some tadpoles were raised singly in containers of 15 x 10 cm, filled with a gradually increasing amount (400 to 700 ml) of water or, later on, Holtfreter's solution. Larvae also did well at higher densities. The water was changed at approximately weekly intervals. Temperatures in the room were mostly between 18 and 20°C, no illumination except daylight was provided. The tadpoles were fed on parboiled lettuce leaves (stored in the deep freezer and thawed before use) and Tetramin fish food.

Tadpoles grew to a total length of up to 68 mm. Metamorphic climax (foreleg protrusion) was reached 80 to 155 days after spawning. The metamorphs were then transferred to a shallow water container in a terrarium. Sizes after tail resorption, measured from the tip of the snout to the end of the urostyle, ranged from 19 to 24 mm. Altogether, 51 frogs completed metamorphosis successfully. Of these, most developed very well, but a few did not grow at all and eventually died.

In the spawn of 1994 (F2-generation), two size classes could be distinguished: smaller eggs had diameters of 1.5 - 1.6 mm, larger eggs of 1.8 - 1.9 mm. Embryonic and larval mortality was extremely high (more so among the smaller ova), and only 16 animals reached metamorphosis after 62 to 111 days (room temperatures were higher than during the rearing of the previous clutch). Only 11 of these survived their first two weeks on land. They never grew as big as the frogs of the F1-generation. Possibly, inbreeding was responsible for developmental problems in these tetraploid frogs.

ACKNOWLEDGEMENTS

I want to thank Graeme Watson, who collected the *Neobatrachus*-spawn for me (National Parks and Wildlife permit number 87-122) and gave me valuable advice on the maintenance of this species. Vivien Porter and Joanne Wedgewood kindly looked after the frogs during vacations at the University of Melbourne. Helmut Pruscha helped with the transport of the necessary ingredients (mainly, large amounts of deionized water) for Holtfreter's solution. I am greatly indebted to all our animal sitters, especially Peter Pospisil, who took care of the frogs during our absence. Last, but not least, I want to thank Günter Gollmann for help along the way.

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AN HERPETOLOGICAL INTERLUDE IN EX-SOVIET CENTRAL ASIA (Part 2)

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TURKMENISTAN

A flight (23 May) with Kazakhstan Airlines - devolved Aeroflot - covered the distance from Almaty to Ashgabat in 3 hours, and followed a westerly line along the northern flanks of the snow-capped Kyrgyz range. Turning south-west, the flight continued over dry brown country making up the Kyzyl-Kum Desert, and then after crossing the Amu-Darya (Oxus) River on over the Kara-Kum Desert. The Institute of Zoology, Turkmen Academy of Sciences, Ashgabat, was visited 23-30 May 1994 (address: Azady Street, 59, 744000 Ashgabat; tel. and fax nos: (+7 3632) 25.37.91). The Director was Prof. Tanriberdi Tokgaev (orthopterist). Herpetologists met were Dr Sakhat Shammakov, Dr Chary Ataev and Prof. Anver Rustamov, Academician (ornithologist/herpetologist); Mrs Makhry Garagulova acted as interpreter. Sakhat Shammakov is co-organizer with Dr T.J. Papenfuss (University of California, Berkeley, USA) of the 2nd International Asian Herpetological Meeting being held at Ashgabat in August 1995. The Ministry of Nature Exploration & Protection of Turkmenistan (address: 102, Kemine Street, 744000 Ashgabat; tel.: (+7 3632) 29.60.24/29.63.13; fax: (+7 3632) 29.65.12) was also visited on 24 May. Met were Dr Geldiev O. Kurbanovich (Deputy Chairman, State Inspection Committee for Nature of Turkmenistan) and Dr Vladimir A. Glazovsky (Head, State Committee for Animals & Protection of Turkmenistan).

COLLABORATIVE RESEARCH PROJECT PROPOSALS

Pesticide residue analyses are carried out by the Ministry of Nature Exploration & Protection, Ashgabat. During a visit to the Ministry to discuss the effects of pesticides on wildlife a project associated with the problem of the rising level of the Caspian Sea, resulting in flooding of Ogurchinskiy Island and the Krasnovodsky Reserve, was also discussed.

HERPETOLOGY IN TURKMENISTAN

The first publication on Turkmen amphibians and reptiles was by Boettger (1888). Bogdanov's (1962) work was much later. Shammakov (1981) covered the reptiles of lowland Turkmenistan, and Ataev (1985) the mountains, and through collaborative studies most recently, the biogeography (Shammakov, Ataev & Rustamov, 1993). Works on *Agrionemys horsfieldi* in Turkmenistan which I had seen previously included Korotkov (1967); Panov & Galichenko (1980); Makeev, Bozhanskiy & Khomustenko (1982), and Makeev, Bozhanskiy & Frolov (1986).

Publications received: The following herpetological works were received at the Institute: Ataev (1993), Bogdanov (1962) and Shammakov (1981).

RED DATA BOOK HERPETOFAUNA

Ataev, Rustamov & Shammakov (1985) had contributed a reptile section for the Turkmen Red Data Book.

HERPETOFAUNA RECORDED

Several groups of traditionally dressed Turkmen school girls posing for photographs in front of the statue of Lenin (whose pedestal is clad in a ceramic version of traditional elephant-foot Bukhara-patterned Turkmen rugs) were passed while walking through the tree-shaded Park of his name in the centre of Ashgabat (24 May). There was fast flowing water in small concrete-lined irrigation channels among the trunks at the side of the path. A few *Rana ridibunda* survived there, and one was seen to jump into the water and be carried away with the stream.

Two days later (26 May), a site visit to the Central Kopet-Dagh range was made by road from Ashgabat. Leaving the town and passing great blocks of newly constructed flats, the road proceeded south through hills towards Iran. At about 10 km before the border, the Institute Serpentary was visited. Unfortunately the superintendent was not there at the time, since he could not be contacted by telephone and warned of the impending arrival of our party. The heavy Russian military vehicle, formerly used in East Germany (one of those distributed after unification to Tajikistan, Turkmenistan and Uzbekistan), continued to the Iranian border and then turned east on an uneven dirt track. The area had been irrigated and cultivated by local people for many years, but was forbidden to scientists and foreigners until perestroika four years before. I was probably the first westerner to have visited the area for some 80 years, although the border with Iran, and Afghanistan, featured prominently during the times of the Great Game (e.g. Hopkirk, 1990). A silently sinister reminder that restrictions had indeed only recently been lifted was provided by look-out towers, now unmanned, over the unvegetated, wired-off and mined strip constituting the former Iron Curtain. Any potential dissidents in earlier days attempting to cross into Ayatollah Khomeini's Iran would have been rapidly apprehended. Only in recent months has the road continued south across the border towards Shirvan in Iran.

The frog *Rana ridibunda* was again the amphibian species observed basking by the sides of irrigation channels. The whole area was much drier than in Kyrgyzstan or Kazakhstan, and the weather considerably warmer. At a site (ca. 700 m) 30 km S.E. of Ashgabat (2 km south of Manush) with full sunshine by 12.30 h (30°C), reptile species sighted in the company of Chary Ataev included the skink *Eumeces schneideri* (mature and immature specimens) and the agamid *Trapelus sanguinolenta*. A specimen of the last was caught by Sakhat Shammakov amongst herbaceous ground vegetation (BMNH.1994.153), the throat of the male had become dark blue in warm sunshine; individuals were observed on the ends of branches of low shrubs. Several adult and immature agamids, *Stellio caucasica,* were observed running across rock surfaces, and approximately three geckos, *Cyrtopodium caspius*, were exposed by levering off flakes of rock on outcrops. A tortoise *Agrionemys horsefieldi* in refuge was unearthed by turning over a large rock. Makeev et al (1982) have investigated the population status of this and other reptile species in the Central Kopet-Dagh. Another frog *Rana ridibunda* was observed jumping from thick green vegetation into water at a point where an irrigation pipe opened out into a stream, the edge of which shaded by trees had from previous knowledge been selected by Sakhat Shammakov for luncheon *al fresco*.

The following day (May 27), the same heavy truck, after a diesel fill-up, rumbled along the tarmac road in a northerly direction from Ashgabat twoards Tashauz. After crossing the Kara-Kum Canal, the road continued into the bush. At a site in the Kara-Kum Desert

Plate 3. A male *Trapelus sanguinolenta* resting in morning sunshine on a branch extending from the side of a shrub (33°C, 10.16 h, 27 May 1994) in the Kara-Kum Desert, 32 km N.W. of Ashgabat, Turkmenistan.

Plate 4. Adult *Eumeces schneideri* hand-held by Dr Chary Ataev (Institute of Zoology, Turkmen Academy of Sciences), caught on disturbed soil amongst annual grass vegetation (30°C, 12.32 h) in the Central Kopet-Dagh range by the border with Iran (26 May 1994), 30 km S.E. of Ashgabat, Turkmenistan.

32 km N.W. of Ashgabat, the habitat consisted of sand dunes with shrubs that towards the end of May were still green and in flower. The tracks of the monitor lizard *Varanus griseus* were observed in sand, and also those of *Agrionemys horsfieldi*. With full sunshine between 10.00 and 12.00 h (32-36°C), and in the company of Chary Ataev, two small lacertids *Eremias lineolata* slid over patches of sand to the shade of shrubs, individual male *Trapelus sanguinolenta* (two different individuals photographed) were perched at the end of branches of small trees and bushes swinging in the light breeze, and several small agamids *Phrynocephalus interscapularis* (one collected - BMNH 1994.152) scuttled across the hot sand, curling up the ends of their tails during pauses. Newly metamorphosed toads *Bufo viridis* were seen in and by a small irrigation channel traversing scrub and damp vegetated sand.

By midday, the air temperature had reached 36.5°C, and reptile activity had declined, but individual *Trapelus sanguinolenta* could still be seen in the distance on ends of branches, and little *Phrynocephalus interscapularis* continued to scamper across the sand in front of our feet as Chary Ataev and I trudged our way through shifting sand back to the truck. We were grateful to seek the shade of a canvas awning stretched out from the side of the vehicle, and numerous cups of green tea with our meal, brewed in a pottery jug on an open fire compensated for the loss of liquid. However, the midday temperature at this time of year was, when there were flowering shrubs and some green vegetation still left from Spring, relatively low. By the end of June, and during July and August, the midday temperature could exceed 50°C. There would then be no activity during daylight hours - only at night does the Kara-Kum Desert become alive herpetofaunally!

ACKNOWLEDGEMENTS

This account has been developed from an unpublished report (Lambert, 1994) for the Royal Society, London, to whom I am most grateful for providing travel and subsistence costs. Time for the visit and report preparation were provided by the Natural Resources Institute, Chatham. I would also like to thank Drs Valentina Toropova, Rudolf Kubykin and Sakhat Shammakov for hospitality on numerous occasions, and for arranging accommodation and transport in respectively Bishkek, Almaty and Ashgabat, and, together with Dr Chary Ataev at the last, for general and specific herpetological information.

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Ed. note. Since correcting the proofs of this two-part article, Dr Leo Borkin (St Petersburg, Russia) has indicated that *Bufo viridis* in Central Asia occurs in two forms: the diploid, *B. viridis turanensis,* and tetraploid, *B. "danatensis"*. Toads recorded at Tashkent, Almaty and in Turkmenistan are tetraploid, while in water bodies of Bishkek, forms are either diploid, tetraploid or mixed depending on precise location. The dry-mounted *Bufo danatensis* in Bishkek's Zoological Museum could thus be of local origin and not from outside the former Soviet Union.

REPTILE OBSERVATIONS IN YEMEN, MARCH - MAY 1993

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INTRODUCTION

In the spring of 1993 from 16th March to 10th May, the Ornithological Society of the Middle East (OSME) mounted an expedition to survey some lesser known areas of southern and eastern Yemen. During this time I was able to make some observations of the reptiles that were encountered. (See also BHS Bulletin No. 52, 'Amphibian Observations in Yemen').

Yemen has a rich reptilian fauna consisting of about eighty terrestrial species (excluding the Socotra archipelago), five species of marine turtle and one sea-snake. Many of the terrestrial species are endemic or near endemic to the Arabian Peninsula. Several species are endemic within this region to a distinctive area of southern Arabia which encompasses the highlands of south-west Saudi Arabia, Yemen northwards to the southern edge of the Rub al Khali and the Dhofar region of eastern Yemen and Oman.

The terrestrial reptile fauna of Yemen may be broadly summarised as follows (numbers in parentheses refer to the number of species endemic to the Arabian Peninsula/number of species endemic to southern Arabia):

Testudinidae; Tortoises: 1 species (0/0)
Pelomedusidae; Side-necked terrapins: 1 species (0/0)
Agamidae; Agamid lizards: 8 species (7/3)
Chamaeleonidae; Chameleons: 3 species (2/2)
Gekkonidae; Geckos: 25 species (15/8)
Lacertidae; Lacertid lizards: 12 species (9/6)
Scincidae; Skinks: 8 species (4/0)
Varanidae; Monitors: 2 species (1/1)
Trogonophidae; Amphisbaenians: 1 species (1/1)
Serpentes; Snakes: 21 (up to 28) species (7/4)

SPECIES ACCOUNTS

During the OSME survey a total of 42 species of reptile were recorded; one terrapin, three marine turtles, six agamid lizards, two chameleons, fifteen geckos, four lacertid lizards, five skinks, one monitor and five species of snake.

Species endemic or near-endemic to Arabia are indicated with one asterisk. Species endemic to Yemen are indicated with two asterisks.

Order Chelonia – Terrapins, marine turtles and tortoises.

One species of freshwater terrapin *Pelomedusa subrufa,* and one species of tortoise *Geochelone sulcata* are known to occur in Yemen.

Five species of marine turtle; *Caretta caretta, Chelonia mydas, Eretmochelys imbricata, Lepidochelys olivacea* and *Dermochelys coriacea* have been recorded around the Yemeni coast and *C. mydas* is known to breed.

Family Pelomedusidae – Side-necked terrapins

Pelomedusa subrufa – Helmeted Terrapin
1- 19.3.93, Taizz lagoons, approx. 44°01E 13°34'N, 1150m.
One basking on floating mat of dead vegetation, another resting just below water surface with only nostrils protruding.
2- 27.3.93, Wadi al-Jahr, 46°23'. 50E 13°58.20N, 600m.
Two basking on boulders in flowing wadi.

Distribution & Comments: In Arabia this species is confined to the extreme south-west where it occurs in Saudi Arabia & western Yemen. The survey record from Wadi al-Jahr may represent an easterly range extension in Yemen. *P. subrufa* also occurs over much of sub-saharan Africa & Madagascar. This species is able to aestivate in drought conditions.

Family Cheloniidae – Marine turtles

Caretta caretta gigas – Loggerhead Turtle
1- 16.4.93, Mocha (Red Sea coast), 43°15'E 13°18'N
At least four adults observed close inshore, some holding their heads vertically above the water surface for several seconds.
2- 23.4.93, Sayhut, 51°17'E 15°14'N.
At least four offshore, several more in vicinity and along the coast eastwards.

Distribution & Comments: This species is widely distributed in tropical & sub-tropical waters of the Indian Ocean (also in the Mediterranean, Pacific and Atlantic) and there are some major nesting beaches on islands off the Arabian coast.

Chelonia mydas japonica – Green Turtle
Numerous observations from Mocha on the Red Sea coast 43°15'E 13°18'N, eastwards along the southern Yemen coastline to almost the Omani border. In the vicinity of Al Fatk, 52°42'E 16°31'N, approx. 400 recent nests probably of this species, were counted on the beach.

Distribution & Comments: Widespread in tropical & sub-tropical waters of the Indian Ocean (also in the Mediterranean, Pacific & Atlantic). Known to nest on the southern Yemen coast in significant numbers.

Eretomochelys imbricata bissa – Hawksbill Turtle
1- 16.4.93, Mocha (Red Sea coast), 43°15'E 13°18'N.
Small dead specimen on beach, carapace 30cm, cause of death not apparent.
2- 22.4.93, Al Hami, 49°50'E 14°49'N.
At least two approx. 50m offshore.
3- 23.4.93, Sayhut, 51°17'E 15°14'N.
Two close inshore.

Distribution & Comments: Widespread in tropical & sub-tropical waters of the Indian Ocean (also in the Pacific & Atlantic).

Order Squamata – Lizards and snakes

Sub-order Sauria – Lizards

About 58 species of lizard and one amphisbaenian have been recorded on mainland Yemen although the taxonomic status of some is uncertain. During the survey about 33 species were recorded. (Two species whose identification was not positively ascertained are indicated with a question mark).

Family Agamidae – Agamid lizards

**** Pseudotrapelus adramitanus***
Recorded at numerous localities in the west Yemen highlands but in many cases individuals were not differentiated from *P.yemenensis*. Also observed at Wadi Mararah (Dhofar), 52°55'E 16°39'N, 360m.

Distribution & Comments: Endemic to western and southern Arabia from Taif (Saudi Arabia) to Aden (Yemen) and east to Dhofar. It occurs usually below 2000m.

* ***Pseudotrapelus yemenensis*** – Yemen Agama
Several observations in the vicinity of Sana'a and also the Central Highland Research Station near Dhamar, at an altitude of 2400m.

Distribution & Comments: Endemic to the highlands of western Yemen & south-west Saudi Arabia where it occurs usually about 2000m.

Pseudotrapelus sinaitus
1- 19.4.93, Wadi Harim nr. Am Nabiyah, approx. 43°41'E 12°48'N, approx. 100m. Four observed.
2- 20.4.93, Ras al'Arah, 43°53'E 12°40'N, 50m.
One lying flat on stony ground in 'camouflage posture'. When picked up its head colouration turned from a buffy brown to blue in approx. 3-4 minutes.
3- 1/2.5.93, desert crossing between Al Ghayda 52°11'E 16°13'N westwards to the vicinity of Fughmah approx. 49°27'E 16°10'N, up to 875m.
Numerous observations.

Distribution & Comments: Widespread in Arabia (absent from Rub al Khali) north to Palestine & Jordan, and also Egypt and southeast Libya. During the survey this species was observed from almost the southern most tip of the Arabian Peninsula near Wadi Harim eastwards to Al Ghayda. It is probably widespread throughout Yemen in the lowlands (below 1000m). In sandy desert areas restricted to localities with at least some outcrops of rock and scattered boulders providing lookout points and refuges.

* ***Phrynocephalus arabicus*** – Arabian Toad-headed Agama
1- 5.5.93, Al Mudhur, 48°25'E 15°49'N, 790m.
Two in abandoned/fallow sandy fields with some patches of low xerophytic, vegetation.
2- 6.5.93, 10km N.W. of Arain & Turbaq hills, 46° 36'E 15° 44'N, 1000m.
Three or more, including one tail-signalling male, on shifting sand dunes with fresh growth of feather-grass *Stipa sp.*

Distribution & Comments: Endemic to the Arabian Peninsula where it is widespread except in the west. The survey record from Al Mudhur is close to the type locality on the 'Plateau of the Hadramaut'.

* ***Uromastyx aegyptius microlepis*** – Small-grain or Desert Spiny-tailed Lizard
1- 2.5.93, approx. 230km W of al-Ghaydah, approx. 51°E 16°N, 790m.

One taking refuge in burrow on almost flat, limestone rubble and dust hammada desert with very sparse vegetation cover, mostly of low mats of xerophytic shrubs and a few small *Acacia* trees.
2- 1.5.93, >< 61-84km west of al-Ghaydah 51°35'E 16°13'N, approx. 650m.
A *Uromastyx sp.* was seen retreating down a burrow. The habitat would suggest that this was *U. microlepis*.

Distribution & Comments: This species is widespread in the Arabian Peninsula north to Jordan & Iraq & east to Iran. The tail of *Uromastyx* is used for fat storage and they are sometimes caught and eaten by local tribes people as a traditional delicacy.

** ***Uromastyx benti*** – Yemen Spiny-tailed Lizard
1- 24.4.93, Ras Uqab (12km east of Sayhut), 51°20'E 15°15'N, 1m.
One basking on rock about 50m from shoreline.
2- 30.4.93, Shahrut (west of Damqawt), approx. 52°46'E 16°33'N, < 10m.
One basking on large boulder pile, took refuge in rock crevice when approached.
3- 2.5.93, 5km E of Fugmah, 49°27'E 16°10'N, approx. 670m.
Piece of dessicated tail found amongst rocks on steep-sided rocky wadi edge.
4- 3.5.93, Al Ghurfah, 48°45'E 15°50'N, 780m.
One immature at dusk 'wedged' into boulder crevice in rocky wadi bed.

Distribution & Comments: Known only from eastern Yemen. The survey records would suggest that this species inhabits very rocky arid areas in both coastal and inland localities.

Family Chamaeleonidae – Chameleons

* ***Chamaeleo arabicus*** – Arabian Chameleon
1- 25.4.93, Saqr, 51°56'E 15°32'N, 5m.
One in scrub in irrigated agricultural strip along the coastline with *Sorghum* fields and small date palm *Phoenix dactylifera* groves.
2- 28.4.93, Wadi Mararah, 52°55'E 16°39'N, 360m.
Dessicated head found in undergrowth.

Distribution & Comments: Endemic to southern Yemen & Dhofar. The record from Saqr represents a new but not unexpected locality for this species.

* ***Chamaeleo calyptratus calyptratus*** – Yemen or Dumeril's Chameleon
1- 19.3.93, Taizz lagoons, 44°01'E 13°34'N, 1200m
One male climbing quickly into dense cover.

Distribution & Comments: This species is endemic to the south-west Arabian peninsula. The subspecies *C.c.calyptratus* is restricted to west Yemen and the record from Taizz lies within the known range. The subspecies *C.c.calcarifer* occurs in north-west Yemen and south-west Saudi Arabia.

Family Gekkonidae – Geckos

* ***Bunopus spatularus spatularus***
1- 27.3.93, Yashbum/Wadi Habban, 46°59.04'E 14°19.63'N, 1200m.
One spot-lighted after dark (21.00hrs.) on bare rocks in dry wadi bed.

Distribution & Comments: Endemic to the Arabian peninsular where it is known from Yemen, Oman, U.A.E. and central Saudi Arabia.

Bunopus tuberculatus
1- 5.5.93, 3km west of Shabwa, 47°01'E 15°23'N, 800m.
One spot-lighted after dark (20.00hrs.) on loose sand/gravel substrate with small hummocks of scattered xerophytic vegetation and occasional *Acacia* trees.

Distribution & Comments: Widespread in Arabia northwards to Syria and eastwards to Pakistan.

Hemidactylus flaviviridis – Yellow-bellied House Gecko
1- 16.4.93, Bajil, 43°17'E 15°04'N, 250m.
One observed on house wall after dark.

Distribution & Comments: In Arabia found mainly in coastal areas. It also occurs in coastal north-east Africa and east to northern India.

Hemidactylus turcicus – Turkish Gecko
Identified from photographs taken in the vicinity of Sana'a.

Distribution & Comments: Widespread in peripheral Arabia east to Pakistan, coastal areas fringing the Mediterranean and the Red Sea and north-east Africa south to Somalia.

Hemidactylus yerburii
1- 27.4.93, Wadi Mararah, 52°55'E 16°39'N, 360m.
Two observed after dark on boulders by small flowing stream with some marginal herbaceous vegetation.

Distribution & Comments: Occurs in the southern Arabian Peninsula from southwestern Saudi Arabia (Asir), Yemen eastwards to southern Oman. It also occurs in Somalia.

** ***Pristurus collaris*** – Collared Semaphore Gecko
Recorded at ten localities, the most westerly at al-Shihr, 49°36'E 14°46'N to as far east as 10km west of Wadi Mararah, 52°50'E 16°40'N, and at altitudes from just above sea-level up to 760m in the hills inland from Quishn 51°41'E 15°25'N.

Distribution & Comments: A Yemen endemic previously known from Bal Haf to Ras Fartak and inland to the Hadramawt (Hadhramaut). The record from near Wadi Mararah represents an extension to the known range being about 150km north-east of Ras Fartak. This species appeared abundant in these localities and was observed to be diurnal and nocturnal.

Pristurus crucifer – Semaphore Gecko
1 - 20.4.93, Ras al'Arah, 43°53'E 12°40'N, 50m.
Several observed running across ground on gravel substrate with sparse vegetation cover of low xerophytic plants in *Acacia* savannah. Sympatric with *P. ornithocephalus* and the mainly arboreal *P. flavipunctatus*.

Distribution & Comments: In Arabia restricted to the west and south-west coasts of Yemen. Elsewhere occurs in Somalia and the far north of Kenya. The one survey record lies within the species known range.

Pristurus flavipunctatus – Semaphore Gecko
1- 22.3.93, Jebel Iraf, 44 15.31'E 13°07.02'N, 1400m.
Two seen on trunk of *Juniperus sp* in open juniper dominated woodland with some *Acacia* and other tree species.

2- 20.4.93, Ras al'Arah, 43°53'E 12°40'N, 50m.
Two in small branches of an *Acacia* approx. 2m from the ground and one at base of a small *Acacia* tree in *Acacia* savannah with a gravel/stone substrate.

Distribution & Comments: In Arabia occurs in the coastal Tihama of south-west Saudi Arabia and Yemen and also north-east Africa. The survey records lie within the known range. Unlike most other semaphore geckos this is generally an arboreal species.

* ***Pristurus minimus*** – Small Semaphore Gecko
1- 26.4.93, al-Faydami plain, 52°28'E 16°25'N, < 10m.
At least ten observed at dusk on loose sand and especially amongst or near to small hummocks of woody, xerophytic vegetation.

Distribution & Comments: The first record of Yemen. It was previously known from Oman and has also recently been recorded in south-west Saudi Arabia.

** ***Pristurus ornithocephalus*** – Bird-headed Semaphore Gecko
1- 28.3.93, Bir Ali, 48°19.50'E 14°0.50'N, < 20m.
One on basaltic rocks almost devoid of vegetation approx. 300m from coastline. 'Played dead' for almost one minute when caught (such behaviour maybe stress induced) before running off at great speed.
2- 29.3.93, Wadi Hajr, 44°41.33'E 14°05.66'N, 30m.
One on arid, sandy and rocky plain with occasional tussocks of xerophytic vegetation.
3- 19.4.93, Ras al 'Arah, 43°53'E 12°40'N, 50m.
One female observed at dusk (18.15 hrs.) on gravel plain in *Acacia* savannah.

Distribution & Comments: This species is endemic to coastal south-west Yemen. The three survey records lie within the known range.

Pristurus rupestris – Common Semaphore Gecko
Recorded throughout the west Yemen highlands at altitudes up to 2400m near Dhamar 44°21'E 14°39'N down to 600m at Wadi al-Jahr 46°23.50'E 13°58.20'N. The most easterly observation was at Yashbum/Wadi Habban, 46°59.04'E 14°19.63'N.

Distribution & Comments: Found around the periphery of Arabia, Djibouti, northern Somalia and Ethiopia, coastal Iran and possibly Pakistan. A common species of rocky areas in the Yemeni highlands.

Ptyodactylus hasselquistii
Recorded at nine localities the most westerly at Jebel Iraf 44°15.31'E 13°07.02'N, and the most easterly at Al Ghurfah (15km south-east of Tarim) 49°08'E 15°50'N. Observed at altitudes from 600m to 2000m and often heard calling at dusk.

Distribution and Comments: Widespread in Arabia probably north to Palestine, Syria and Iraq, southwest Iran and also North Africa. In Yemen a common species in rocky areas and also observed on building walls at Tarim.

* ***Stenodactylus doriae***
Recorded at up to seven localities; along the coast between Wadi Hajr 48°41'E 14°06'N eastwards to Saqr 51°56'E 15°32'N and inland to Wadi Sh'hout 50°43'E 16°20'N and Shabwa 47°01'E 15°23'N, at altitudes from just above sea-level to 800m.

Distribution & Comments: Widespread in Arabia and east to southwest Iran. All of the survey observations were in areas of loose sand except at Wadi Sh'hout which consisted of compacted limestone dust. At this locality a positive identification was not made and the species observed could have been *S. doriae*, *S. slevini* or *S. leptocosymbotes*.

* ***Stenodactylus yemenensis***
1- Wadi el Kubt (Tihama), 44°23.80'E 13°03.47'N, 460m.
One spot-lighted at night walking across bare, loose sand.

Distribution & Comments: Endemic to southwestern Arabia occurring in coastal western Yemen and southwestern Saudi Arabia.

* ***Tropiocolotes scorteccii***
1- 24.4.93, hills inland from Ra's Sharwayn, 51°35'E 15°24'N, 700m.
One under a loose rock on the summit of bare hill covered in fragmented slabs of limestone.

Distribution & Comments: Known only from the Hadhramaut region in Yemen and Dhofar, Oman. This is a tiny gecko not reaching more than 40mm in length from snout to vent.

Family Lacertidae – Lacertid lizards

** ***Acanthodactylus arabicus*** – Yemen Spiny-footed Lizard
Observed at several localities the most westerly at Wadi El Kubt, 44°21.85'E 13°04.62'N, eastwards to al-Shihr, 49°35'E 14°44'N and at altitudes from just above sea-level to 460m.

Distribution & Comments: Endemic to the Red Sea coast of western Yemen eastwards along the south coast to Qisn. Immatures have a bright green tail and when at rest it is constantly wriggled, perhaps as a predator distraction display.

Acanthodactylus boskianus – Spiny-footed Lizard
1- 8.4.93, Wadi Himarah, 46°53'E 14°03'N, 625m.
2- 27.4.93, al-Faydami plain, 52°28'E 16°25'N, < 10m.
3- 3.5.93, al-Sawm, 49°14'E 16°08'N, 800m.
One caught, snout-vent = 79mm tail = 165mm; 10 ventrals
26 dorsals (12 large dorsals, 7 smaller laterals on either flank).
4- 4.5.93, Sayawn, 48°50'E15°56'N, 830m.
5- 5.5.93, Al Mudhur (Hadramaut), 48°25'E 15°49'N, 790m.

Distribution & Comments: Widespread in Arabia northwards to south-east Turkey and also North Africa. The survey observations suggest that this is a common and widespread species in Yemen at low to medium altitude. It inhabits sandy/gravely areas with at least some vegetation, and sometimes occurs in cultivated fields with sparse crop cover. This species was undoubtedly encountered at more localities than indicated but possible confusion with *A. felicis/yemenicus* could not be ruled out.

* ***Acanthodactylus opheodurus*** – Spiny-footed Lizard
1- 5.5.93, Al Mudhur (Hadramawt), 48°25'E 15°49'N, 790m.
At least ten immatures and three adults.

Distribution & Comments: Widespread in Arabia north to Palestine, Jordan and Iraq. The immatures of this species are characterised by a reddish tail and like *A. arabicus* it is almost constantly wriggled when the animal is at rest.

* ***Mesalina adramitana ?***
1- 2.5.93, 250 km west of al-Ghaydah, approx. 51°08'E 16°15'N, approx. 670m. Three *Mesalina* lizards observed on ground in palmetto (dwarf fan palm) habitat were probably this species.

Distribution & Comments: Known from eastern Yemen, Oman, U.A.E., Qatar and south-east Saudi Arabia. The type locality of this species is in the Hadramaut and the survey record lies within the known range.

Family Scincidae – Skinks

Chalcides ocellatus – Ocellated Skink
1- 29.3.93, Wadi Hajr (1km N. of road), 48°41.33'E 14°05.66'N, 30m.
One in *Acacia* undergrowth, retreated down burrow when disturbed.
2- 7.4.93, Wadi Hajr (4km N. of road), 48°42'E 14°07'N, 30m.
One on embankment alongside irrigation ditch and *Sorghum* field, retreated down burrow when disturbed.

Distribution & Comments: Occurs in North Africa, parts of Mediterranean Europe, Asia Minor eastwards to Pakistan. In Arabia it is mainly found in coastal localities especially in cultivated areas where the ground is often damp, as was the habitat at Wadi Hajr.

Mabuya brevicollis
1- 28-29.4.93, Wadi Mararah, 52°55'E 16°39'N, 360m.
Several observed amongst leaf-litter in dry scrubby areas and one basking on a rock one morning at 07.00hrs.

Distribution & Comments: North-east Africa, peripheral Arabia from Taif (Saudi Arabia) To Dhofar, Oman, eastern U.A.E. and coastal Pakistan.

* ***Mabuya tessellata***
1- 23.3.93, Jebel Iraf, 44°15.31'E 13°07.02'N, 1200m.
Two skinks (approx. 15-20cm total length, bronzy-buff dorsum slightly more rufous tail, dark line running from nostril through eye and ending above forelimb) observed on boulders. Neither animals were caught and a positive identification was not possible but they were probably *M.tessellata.*
2- 2.5.93, 5km E of Fugamah, 49°27'E 16°10'N, approx, 670m.
One immature found dead under rock (positively identified by Dr. E.N. Arnold, B.M.N.H.).

Distribution & Comments: Occurs in Yemen, Dhofar and northern Oman.

* ***Scincus mitranus mitranus***
1- 28.3.93, Wadi Hajr, 44°41.33'E 14°05.66'N, 30m.
Dessicated head and left forefoot found on sand dune.
2- 29.3.93, Wadi Hajr, 44°41.33'E 14°05.66'N, 30m.
Dessicated body (with tail missing) found on sand dune.

Distribution & Comments: Widespread in south and east Saudi Arabia the Gulf states, Oman and eastern Yemen.

* ***Scincus scincus conirostris ?***
1-22.4.93, Wadi Masilah, 51°08'E 15°14'N, approx. 50m.
One observed wriggling across loose sand. An attempt to catch it caused it to dive rapidly beneath the surface of the sand and it could not be relocated. It had a pale buff dorsum, orange flanks. It was probably *S. scincus* but a positive identification could not be made.

Distribution & Comments: *S. scincus* is found throughout much of the Arabian Peninsula, Iraq and south-west Iran. In Yemen the subspecies *S.s. conirostris* is known from the Hadramawt (Hadhramaut) region.

Family Varanidae – Monitor lizards

Varanus griseus – Desert Monitor
1-20.4.93, near Qa'wah, approx. 44°25'E 12°42'N, 50m.
One immature approx. 60cm long running off quickly across sand and taking refuge in burrow when disturbed.
2- 22.4.93, Wadi Masilah, 51°08'E 15°14'N, approx. 50m.
One on sand dunes with some scattered stands of *Calotropis procera.*
3- 1.5.93, 61km west of al-Ghaydah, approx 51°35'E 16°13'N, 260m.
One adult observed retreating down burrow when approached.
4- 5.5.93, 2km east of Al Mudhur, 48°25'E 15°49'N, 790m.
One immature in habitat consisting of flat, sandy, dry abandoned/fallow fields with scattered low xerophytic shrubs.
5- 6.5.93, 10km south-west of Wadi Shabwa, 47°00'E 15°22'N, 800m.
One adult running rapidly across sand dunes.

Distribution & Comments: Widespread in Arabia and also occurs in north Africa and south-west Asia. In Yemen they are caught locally (but probably not to any great degree) by Bedou tribes people for food.
The habitat at all localities was characteristically arid, fairly flat, sandy and sparsely vegetated.

Sub-order Serpentes – Snakes
Twenty eight species of snake have been recorded on mainland Yemen (plus one species of sea-snake). However the validity of the occurrence of seven of these species is open to some speculation as localities where specimens were collected may be erroneous or in some cases they may have been misidentified.

During the OSME survey five species of snake were identified on the Yemen mainland. Several other snakes were observed but poor views meant a positive identification could not be made.

Family Colubridae – Typical snakes
Coluber rhodorachis rhodorachis – Jan's Desert Racer, Jan's Cliff Racer
1- 26.3.93, Wadi al-Jahr, 46°23.50'E 13°58.20'N, 600m.
One immature found trapped in an empty oil drum sunken into ground (presumably an old fire place/oven). Numerous dead, dessicated immature *Bufo arabicus* were also found in the drum.

Range & Comments: Widespread in Arabia in rocky montane areas. Also found from Libya eastwards to Pakistan and northern India. It is a diurnal or crepuscular species and is very fast moving.

* ***Coluber thomasi*** – Thomas' Snake
1- 28.4.93, Wadi Mararah, 52°55'E 16°39'N, 360m.
One observed at about mid-day in a small *Acacia nilotica* tree approx. 4m in height, where it sought refuge in a hollow in the trunk.

Range & Comments: Endemic to the coastal plains and mountains of the Dhofar area of Yemen and Oman. The survey record lies within the known range but represents only the second Yemen record. Little is known about this micro-colubrid and there are few records. It may however be quite common and the paucity of records simply a reflection of the lack of herpetologists visiting this region.

Psammophis schokari schokari – Sand Snake, Tree Snake
1- 14.4.93, Mahwit, approx. 43°36'E 15°33'N, 700m.
One dead by path (killed by local villagers) near valley bottom.
2- 29.4.93, base of Wadi Mararah, 52°55'E 16°37'N, 30m.
One crossing coast road.

Range & Comments: A widespread species in Arabia occurring also throughout North Africa eastwards to north-west India. The survey record from Wadi Mararah represents a substantial (although not unexpected) eastward extension to its known range in Yemen. It has mildly toxic venom.

Telescopus dhara dhara – Cat Snake
1- 22.3.93, Jebel Iraf, 44°15.31'E 13°07.02'N, 1400m.
One spot-lighted after dark on ground in open *Juniperus* dominated woodland.

Range & Comments: Widespread on the Arabian Peninsula but distributed mostly in the montane periphery to about 29°N. It occurs throughout most of Yemen. A separate subspecies *T.d. obtusus* is found throughout much of north and north-east Africa. A nocturnal, back-fanged snake with mildly toxic venom.

Family Viperidae – Vipers

Echis coloratus – Saw-scaled Viper, Carpet Viper
1- 28.3.93, Bir Ali, 48°19.50'E 14°0.50'N, < 30m.
A dark individual found in a small burial chamber amongst basaltic rock approx. 200m from coastline.
2- 1.5.93, Wadi Sh'hout, 50°43'E 16°20'N, 800m.
One spot-lighted after dark (20.30 hrs) side-winding across loose sand.

Range & Comments: A near Arabian endemic occurring outside the region in north-east Egypt. The record from Wadi Sh'hout represents an easterly (but not unexpected) range extension in Yemen. This species moves almost entirely by side-winding and is extremely venomous.

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OBSERVATIONS ON THE FIRE SALAMANDER IN PORTUGAL, WITH NOTES ON OTHER TAILED AMPHIBIAN SPECIES AND THEIR CARE IN CAPTIVITY

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INTRODUCTION

The following is a report of observations made during three separate trips to Portugal over the past five years. Each trip, of one week, was made during the last week in December. Two of the trips were made to the Estoril region just West of Lisbon and the third was centred on the Monchique area of the Algarve.

ESTORIL REGION

Salamandra salamandra gallaica

During the first trip larvae were found at only one location at the site of a monastery in Peninha. The area immediately around the monastery was deciduous woodland and larvae were found in a small cistern of approximately one square metre. The water was between 30 and 40 cm deep, clear and weed free. Apart from the small area of deciduous woodland, the majority of the area was of *Eucalyptus* plantations. No adults or juveniles were found in the vicinity.

The second visit proved more successful with adults, larvae and a single juvenile being collected. The adults and the juvenile were collected from ornamental gardens at Sintra. They were all collected in the daytime during a period of heavy rain and rain had been falling for several days prior to the visit. Three adult specimens were collected beneath a pile of rotten logs, one juvenile from under a stone and the fifth specimen was found between long grass and a stone wall. All appeared to be using temporary refuges during the period of rain, a visit to the same location later in the week after only a few days of dry weather revealed no further specimens. The trees were mainly deciduous with ivy *(Hedera sp.)* and *Helixine* covering a layer of dead leaves and leaf mould at the base of the trees. The soil underneath appeared to be well drained having quite a high sand/grit fraction. Large boulders and groups of rocks could be found throughout the gardens and these are possibly permanent refuges for salamanders during the summer and other dry periods of the year.

Larvae were found in a number of artificial ponds within the gardens and the size of the ponds varied between one and four square metres. Some contained water plants, whilst others were completely bare and the depth of water varied between 20 - 40 cm. Larvae were also found in temporary rivulets of water running alongside paths and roads within the gardens. It is likely that many of these larvae would perish during the onset of dry weather.

The four adults and one juvenile specimen were brought back to England under licence with the intention of setting up a captive breeding group. Unfortunately the sex ratio was only one female to four males and this female has only produced larvae on two occasions. The five specimens, now adult, are maintained in a 90 x 30 x 30 cm glass aquarium with

a six cm gravel base covered with a 10 cm layer of leaf mould. The aquarium is kept in a centrally heated room with an east facing window, the temperature rarely drops below 10ºC. Feeding is relatively simple with the main food being field crickets (*Gryllus sp.*) dusted with Nutrobal multivitamin supplement. Earthworms and slugs of various species are also provided at irregular intervals. A bowl of water 15 cm in diameter and 3 cm deep is placed in one corner of the aquarium. Adults are sexually active throughout the year with most activity in the Spring and Autumn. Males vigorously pursue females manoeuvring underneath them and attempting to link their front legs with hers. Deposition of the spermatophore has not been observed.

The female deposited 15 dead larvae, six undeveloped ova and a single live larva on the 23rd June 1992, and two live larvae on the 25th of May 1992. All were deposited in the water bowl. Only the single larva deposited in June metamorphosed. It was reared in a plastic box 20 x 15 x 8 cm with 2 cm of water, some water plants (*Cabomba sp.*) and a piece of earthenware pot to enable metamorphosis. The larva was kept outside and fed on a mixture of bloodworms, chopped earthworms and *Daphnia* and metamorphosed after 54 days. At metamorphosis the baby salamander was 3.7 cm in total length of which the tail comprised 1.6 cm.

At the time of writing all specimens are alive and feeding well and it is hoped that breeding will be more successful in future years. An attempt at cooling and then simulating heavy rainfall may be successful in eliciting females to produce young. This method has been used successfully by other breeders.

Triturus boscai

Individuals of this species were found on both visits to the Estoril region. During the first visit only a solitary adult was found under a piece of bark in the ornamental gardens at Sintra. During the second visit breeding adults and terrestrial juveniles were found throughout the park at Sintra. A total of five juveniles were found beneath piles of dead leaves that had blown alongside a stone wall. None of the juveniles appeared to be greater than 4 cm and it is likely that they had metamorphosed earlier the same year. Adults were found in a number of artificial ponds throughout the park and the size of the ponds varied from approximately one to ten square metres. A total of four specimens were seen in the smaller pond although it is very likely that further specimens were present. No eggs of this species were obvious although a thorough search was not made. All specimens observed and collected were returned to the wild, no specimens were brought back to England.

Triturus marmoratus marmoratus

This species was found in two locations in the Estoril region and all with one exception were observed in breeding condition in a variety of artificial ponds. A solitary male was found at the base of a stone wall within the main park at Sintra. Other specimens at Sintra were observed in both the large and small artificial ponds in which the *T. boscai* were breeding. The male found at the base of the wall was much greener than the aquatic specimens, some of which were darker and almost brown in colouration. No more than half a dozen specimens were seen in total.

The species appeared to be more prolific at Mafra where again it was found in a number of small artificial ponds of approximately one square metre. The ponds were within a public garden in the centre of Mafra and contained water approximately 60 cm deep. Larger ponds were present but because of the cloudiness of the water no specimens were observed. Although small, one of the ponds contained at least ten adults and smaller numbers could be seen in other ponds. The pond containing most adults also contained large quantities of blanket weed (filamentous algae) in which were found large numbers of

newt eggs. A total of six adults were collected and brought back to England under licence.

A small group of adults (one male and two females) have been successfully maintained and have bred each year since their collection. They are housed in an outdoor glass vivarium 120 x 35 x 35 cm and normally enter the water (in the vivarium) for breeding in the Autumn. They are removed from the vivarium in December and before the temperature drops low enough to freeze the water. During the winter, spring and early summer they are maintained in a glass aquarium 90 x 30 x 30 cm in a shed where the temperature is maintained above 4ºC. Aquatic adults are fed on crickets, worms and slugs. Eggs are laid on *Cabomba sp.* or *Elodea sp.* and removed weekly to a separate tank for the subsequent rearing of the larvae. Newly metamorphosed young are fed on newly hatched crickets *(Gryllus sp.)* dusted with Nutrobal. Young have matured after only two years and are now in breeding condition.

MONCHIQUE REGION, ALGARVE

Salamandra salamandra crespoi

A single, successful trip was made to this region during December of 1991, the main collecting area being centred on Monchique and its surrounding villages. The area was visited specifically to collect specimens of the recently described subspecies *S. s. crespoi* Malkmus, part of the *S. s. gallaica* complex. Details of its distribution and distinguishing characteristics are to be found in the paper by Malkmus (1983). However the main differences from the subspecies *S. s. gallaica* are the extremely long digits, smaller flattened head and the presence of large numbers of very small light coloured spots on the body of the adult. It is distributed throughout the Serra de Monchique in the Algarve. It is a large subspecies with adults commonly exceeding a total length of 25 cm.

During the week of the visit the weather remained dry with daytime temperatures reaching the low 20's Centigrade. This meant that adults and juveniles were unlikely to be found easily outside of their normal refuges. Larvae were however found at three different locations within the Serra de Monchique and their presence in all cases was associated with the cegonhas or albercas used by many of the growers in the region. Cegonhas are deep cylindrical wells, often surrounded by a retaining wall whilst the alberca is a rectangular and often quite shallow cistern. The importance of these and other manmade structures to amphibians and their larvae has been discussed by Malkmus (1982).

Larvae was found at Foia in a small temporary stream no more than 30 cm wide and 8 cm deep, the water was fairly fast flowing but contained grass and other emergent vegetation that had fallen into the water. The stream linked two albercas at different points on the hillside which was terraced with each level being separated by dry stone walls. The vegetation on the hillside consisted mainly of deciduous trees interspersed with grass and bramble covered areas, rock outcrops could also be found. The larvae were small, not exceeding three centimetres and appeared to have been recently deposited.

More larvae were observed and collected at Peso, a small village to the North of Monchique, the size of the larvae found here was greater than at Foia and many larvae observed exceeded five centimetres, the maximum recorded size was 5.4 cm. The larvae were found in a concrete alberca of approximately sixteen square metres. The water was clear, deep (45 cm), absent of any vegetation and fed by an outfall pipe from a second alberca further up the hillside. The vegetation in the area was similar to that at Foia but the terraces were better maintained and used for hay making. A fully metamorphosed specimen was also observed and collected, this specimen was approximately seven centimetres long. It had either only recently metamorphosed or had fallen into the alberca

the previous evening. Further specimens were collected by a colleague from the same locality during March 1993 which at metamorphosis had a mean snout vent length of 2.93 cm and a mean tail length of 2.62 cm (n = 6).

Observations of larvae were also made on the road from Monchique to Alferce. Where the road ran through dense cork oak (Quercus ruber) woodland both types of wells could be found. Brambles, ferns and mosses were found covering the ground. A large adult, over 25 centimetres long, was found swimming in one of the ceghonas, and small larvae (4-5 cm) were found in the alberca. The adult had obviously fallen into the well but was successfully netted. The alberca was approximately the same depth as those at Peso but had a rich weed growth of Starwort, *Callitriche sp* and duckweed *Lemna sp.*; recently deposited larvae, 3 cm long, were netted and brought back under licence.

A total of 20 specimens from the three locations are now maintained and observations on their behaviour, colouration and growth are being made. Although specimens were only separated by a distance of less than eleven kilometres the colouration and growth rate of specimens has varied greatly. The differences are possibly due to the fact that natural barriers in the form of a series of hills confine certain populations to isolated valleys. However the *S. s. gallaica* complex in Portugal has a diversity of colour morphs and patterns throughout its range. Some of these have now been given sub specific status ie. *crespoi* and the electrophoretic and morphometric work of Joger and Steinfartz (1994) has identified a further two subspecies from Southern Spain, *S. s. morenica* and *S. s. longirostris*. It is likely that further investigations will identify other subspecies in the future.

Specimens originally collected as larvae have now matured and sexual activity has been observed in the specimens collected from Foia. Of the five specimens three are males and one of these has been observed attempting to mate with one of the females. A total of sixteen larvae were produced by a single female early in December 1993. All appeared to be healthy but premature with only the first pair of legs being developed, some specimens still having retained remnants of the yolk sac. The mean total length of eight specimens was 2.37 cm of which 1.09 cm was the tail. A further 19 larvae were deposited in early January 1994 but these were further developed than specimens in the previous batch and all possessed hind limbs or hind limb buds. A third batch of 45 larvae was deposited later in January 1994, these appeared to be well developed although four pairs of larvae were joined at the yolk. Development of all batches has progressed normally with the first specimens metamorphosing at the end of April 1994. The first juveniles to metamorphose did so during a period of exceptionally warm weather when temperatures in the greenhouse, in which they were maintained, reached 25-30ºC. The mean snout/vent length of the first metamorphosing juveniles was 2.73 cm, the mean tail length 2.41 cm (n=18). All larvae were reared in groups of eight to twenty and fed on bloodworms and *Daphnia* in aquaria with biological or undergravel filters. Adult specimens from both Foia and Alferce are maintained in similar vivaria to those from Sintra, however a large water container (25 L x 20 W x 15 D cm) has replaced the original water bowl. Water in the container is circulated using a small biological filter, and regular water changes are also made. The addition of a water container with a circulation system may be an important factor in stimulating the females to deposit juveniles.

From the few observations I have made and from discussion with other colleagues it is likely that in the wild most larvae are deposited in the Autumn and Winter months and during times of high rainfall. It is likely that larvae would metamorphose throughout the Winter and Spring, with development being accelerated during warm weather. Certainly the larvae collected during December of 1991 metamorphosed within 12 - 39 days of

Plate 1. Habitat of *Salamandra salamandra crespoi*, Foia

Plate 2. *Salamandra salamandra crespoi*, adult male, Foia

Plate 3. *Salamandra salamandra crespoi*, portrait of adult male, Foia

Plate 4. Early metamorphosed juvenile of *Salamandra salamandra crespoi*, note the absence of adult colouration

collection, mean 25 days (n = 11), and before they reached the maximum size attained by some larvae observed at Peso. Metamorphosed specimens were olive brown in colouration and only attained the yellow and black adult colouration after a few weeks. This contrasts with other subspecies, e.g. of *S. s. salamandra* and *S. s. terrestris*, which have developed the adult colouration prior to metamorphosis. The deposition of premature larvae may be an adaptation to the extreme environmental conditions or simply be a factor of captivity.

Specimens collected from Alferce reached a mean snout/vent length of 5.37 cm and a mean tail length of 4.6 cm (n = 7) after only eight months, those from Foia had reached 5.86 cm snout vent length and 4.5 cm tail length during the same period (n = 5). Six of the specimens from Alferce had attained a mean snout vent length of 7.38 cm and a mean tail length of 7.58 cm 20 months after metamorphosis. Although no sexual activity has been observed in the latter group it is likely that some specimens are sexually mature. All juvenile specimens were reared indoors at room temperature and at no time has any attempt been made to hibernate them. Judging from the reproductive capacity of specimens from Foia this appears to be unnecessary.

Triturus boscai

Adults of this species were found at three separate locations in the Algarve. The largest number of adults were found in an alberca at Foia and of seven specimens captured only one was female. All were in breeding condition. The alberca contained large quantities of filamentous algae and Starwort, *Callitriche sp.*; no eggs of this species were found. Adults were also found in the same albercas during March of 1993. A newly metamorphosed juvenile was found close to small stream in which the previously mentioned larvae of *S. s. screspoi* were found. Adults were found in the same albercas as the *S. s. crespoi* larvae found at Peso, probably no more than six adults could be seen in the clear and weedless water. Both males and females were present. A solitary adult was observed in another alberca on the road between Caldas de Monchique and Marmalette.

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INSECTS THAT MIMIC REPTILES

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The phenomenon of mimicry has been marked by controversy ever since its inception, long before the publication in 1858 by Charles Darwin and Alfred Russel Wallace of their joint paper on the theory of evolution by natural selection. As far as reptiles are concerned, the concept of 'mertensian' mimicry among coral snakes has provoked especial disagreement. This hypothesis has been summarized by Wolfgang Wickler (1968) as follows: in the past, herpetologists have sometimes rejected mimicry as an explanation of the conspicuous colouration of coral snakes on the ground that, if a predator were to attack so deadly an adversary, it would almost certainly be killed. According to R. Mertens, however, harmless 'false' coral snakes are typical batesian mimics of the moderately venomous forms, while the deadly elapids are mimics of the same mildly poisonous species. (Batesian mimics are protected from predators because they resemble distinctive species with warning colouration). Since most predatory vertebrates are territorial, and drive rivals away from their feeding places, it would be better for coral snakes to teach them severe lessons so that they were avoided in future, rather than to kill them outright, as the territory would then probably be occupied by another inexperienced enemy. According to Harvey Pough (1988), however, uncertainty about the probability of envenomotion of a predator by a snake, and of the toxicity of different snake venoms, preclude complete evaluation of the hypothesis of mertensian mimicry. Indeed, coral snakes may actually be avoided mainly because they are unpalatable. Scavenging birds in Costa Rica, which quickly consume other snakes killed on the roads, apparently leave dead coral snakes undisturbed.

Another topic of disagreement concerns the apparent mimicry of reptiles by insects. For instance, as their name suggests, dragonflies of the genus *Ophiogomphus* resemble snakes: they twist their abdomens over their heads so that they look like miniature cobras. Again, the larvae and occasionally, the pupae of butterflies and moths of the families Papilionidae, Sphingidae, Geometridae, Noctuidae, Oxytenidae and Notodontidae may have snake-like markings and show movements reminiscent of those of snakes. In a recent book, *Predation and Defence amongst Reptiles* (1994), I have cited a number of examples (see Fig. 1). When disturbed, the larva of the South American *Leucorhampha ornatus,* which is normally cryptic and resembles a broken twig, turns over and exhibits its ventral surface. The thoracic segments are simultaneously puffed out laterally to display a pair of dummy 'eyes' so that the whole larva looks like the head and neck of a snake (Fig 1a). Then it begins to sway from side to side, as though about to strike. Vine snakes *(Oxybelis* spp.) are mimicked by third and fourth instar larvae of the Neotropical hawk moth *Hemeroplanes triptolemus* (Fig. 1b), whereas the last instar is said to mimic the pit-viper *Bothrops schlegelii.*

Examples are also to be found among British caterpillars, such as those of the elephant hawk *(Deilephila elpenor)* and the small elephant hawk *(D. porcellus).* These withdraw their head and thorax when disturbed, so that the first abdominal segment, which bears eye-like markings, looks like the head of a snake or lizard (Fig. 1c). Not only larvae, but pupae also may present abstract mimicry of snakes as, for instance, does the chrysalis of the butterfly *Dynastor darius* (Nymphalidae) in Panama (Fig 1d). Snake-mimicking

caterpillars are also found in places where there are no tree-dwelling vipers, or even no vipers at all. Yet such caterpillars appear neither more nor less snake-like than do those of species that live sympatrically with arboreal vipers. Perhaps, therefore, these displays are simply deimatic. (Deimatic, or intimidating behaviour, serves to warn off potential predators. It can be pure bluff or may precede retaliatory behaviour, as when a cobra spreads its hood before striking).

In tropical South American bugs *(Laternaria* spp.) (Fulgoridae) the anterior part of the head is extended into a large hollow structure (Fig. 1e) which bears a marked resemblance to the head of an alligator or caiman. One consideration which prevents this resemblance being accepted as a simple case of batesian mimicry is the enormous disparity in size between the two animals. If the display is purely deimatic, however, then the resemblance must be fortuitous. The same argument applies to the extraordinary resemblance of some butterfly pupae of the genus *Spalgis* to monkeys' faces. One oriental species is said to look like the common macaque of the region, while a related African species bears some similarity to the face of a chimpanzee. It is not inconceivable that, just as a man may recoil in horror from a piece of rope that he mistakes for a snake, so may a bird that gets a fleeting impression of an alligator or of a monkey be startled sufficiently to move away without investigating any further.

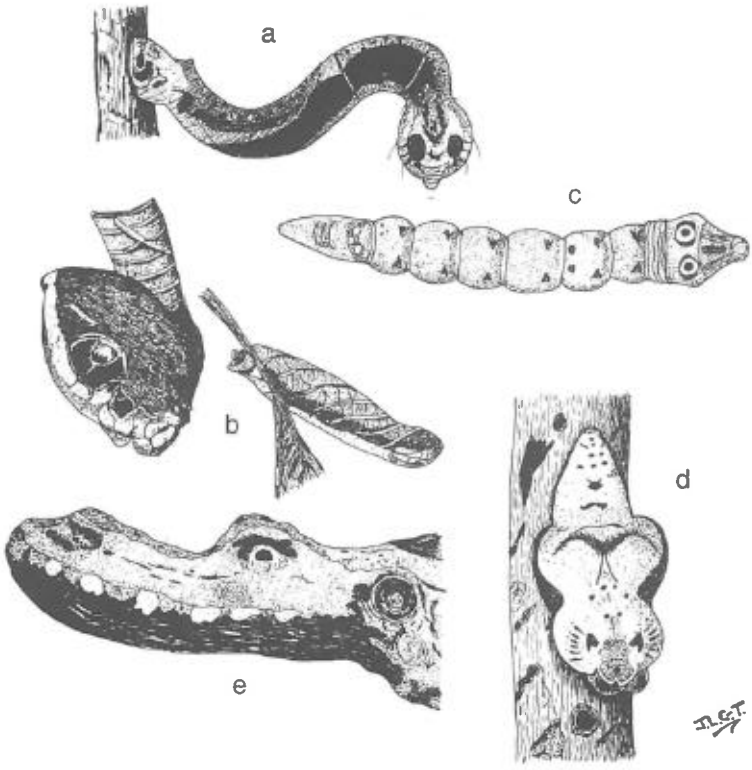

Fig. 1
Insects that display a general resemblance to reptiles. (a) *Leucothampha ornatus* (larva), (b) *Hemeroplanes triptolemus* (larva), (c) *Deilephila porcellus* (larva), (d) *Dynastor darius* (pupa), (e) *Laternaria lucifera* (head). (Not to scale).
(From Cloudsley-Thompson, 1994)

The apparent mimicry of reptiles by birds, insects, and other animals may, in fact, be merely deimatic display. For instance, the hisses of a chameleon, a painted snipe, or a wryneck, could be equally well interpreted either as snake mimicry or in terms of general bluff. A sudden hiss is startling without necessarily making one think of a snake! Both chameleons and kittens distend themselves and hiss savagely in harmless bluff, whereas the rattle of a rattlesnake is a genuine warning. Should the hiss of a grass snake be interpreted as deimatic, as mimicry of the hiss of a viper, or as warning of the evil-smelling defensive fluid that the snake can emit?

On the other hand, the head of a fulgorid bug could also be a case of true mimicry. A high proportion of insect-eating birds hunt by the method of 'rapid peering'. They peer at objects from several different angles in rapid succession because their binocular vision is so narrow as to be of little practical use for judging distance or estimating size. The perception of solidarity and distance has, therefore, to be gained by evoking parallex. The apparent distance of a familiar object is determined by the size of its image on the retina of the eye: rapid peering means that, from time to time, a bird will suddenly have a close up frontal view of one of these bugs and mistake it for the head of a caiman. Under such circumstances, it would probably not wait to peer from a different angle to assess the size, but would immediately fly away (Hinton, 1973). Even if the bug is not mistaken for an alligator or caiman, the appearance of a row of formidable teeth, may, in itself, prove to be a deterrent to further investigation. Since other large bugs, such as cicadas, are relished by monkeys as well as by birds, there may have been heavy selection in favour of a crocodilian appearance. Without careful experimentation, it will not be possible to know which hypothesis is correct.

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BREEDING BOIDS IN CAPTIVITY

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(Presented at the BHS Scottish Symposium 1994)

My snake collection is housed in two rooms within the house and is space heated by the central heating system. The temperature of the rooms is controlled by a Landis and Gyr (rev 10) thermostat which will select different temperatures at different times of day, however I only use one day and one night temperature. In summer the temperature is 28° C by day falling to 25° by night. Commencing in September this is lowered progressively 1°C monthly until the winter temperature of 25° by day and 22° by night is achieved in December. At the beginning of January I begin to raise the temperature. At the same time I give the animals a photoperiod which is the same as the daylength outside. In most of the cages humidity is quite low (40-50%) with the exception of a cage holding Emerald Tree Boas *(Corallus caninus)* where a humidifier which creates a humidity of 80-95% at night. By day it is the same as with the other animals.

The cage units are homemade from 18mm plywood and painted with non-toxic acrylic paint. The bottoms of the units are covered with cat-litter which is made from compressed wooden pellets, to absorb the large volume of fluid boids produce when defecating.

Before I started to keep pythons, I wanted to have some experiences with incubating eggs. For this purpose I kept two species of *Elaphe*. But the only thing I learned from this was that eggs from pythons cannot be compared with eggs of *Elaphe*. Even from one python species to another species the eggs can be very different. For instance you can spray *Python molurus* eggs with water, but eggs from *Chondropython* will die if sprayed.

I obtained a female Yellow Rat Snake *(Elaphe obsoleta quadrivittata)* from a friend and a male from the Rotterdam Zoo; this animal had been found on the street! After a couple of months the female had her first clutch of eggs but the quality was very poor. It was her first clutch and none of them hatched. The eggs were incubated by the au-bain-marie method in an aquarium with 5 cm of water, heated by an aquarium heater.

After a couple of months she had her second clutch and after that she gave two clutches a year, each containing over 40 eggs. This time I used a very simple incubation method; I put the eggs in plastic boxes on wet tissue and covered them with wet tissues and closed the boxes. I just left them in the snake-room at various temperatures and 100% of them hatched. I checked the eggs for humidity and gave them fresh air every two days. Sometimes I opened an egg to look what was in it but I always got over 40 young because in some eggs were twins; this seems to be common for this species. But 80 to 90 young each year from only one pair is too many so after three years I gave the animals to a friend.

I also kept Corn Snakes *(Elaphe guttata)*. I kept the normal coloured animals (not albinos) which in my opinion are the nicest and when the animals were nine months old I got the first clutch. Maybe I fed these captive bred animals too much. From her first clutch all the eggs hatched and after this she gave three clutches a year. The eggs were incubated by the same method as the eggs from *Elaphe obsoleta quadrivittata*. I also gave these animals to a friend because nobody wants the young.

In 1986 I started keeping Macklots Pythons. These were captive born animals and I bred them for four successive years. First I got eggs when they were three years old in 1989. I prefer parental incubation and with this female I never had any problems. She always incubated the eggs by herself in a large, inverted flowerpot. I put the male and the female together in January and they start copulating in March. After the female develops the follicles she stops feeding till the eggs hatch. I keep the humidity at 80% by putting some soaked towels around the flower pot. After exactly two months the eggs hatch and as soon as I see the first young I take the female from the eggs.

I put the female in another terrarium and she usually eats the same day; sometimes the next day. The young animals stay another 24 hours in the egg to absorb the yolk. After the first slough I try to feed them with pink mice and if they don't accept this I try mice with the smell of chicks or pieces of chick or chicken legs. They are also cannibalistic. On one occasion one hatchling ate another, this happened 15 minutes after they were fed and they had already calmed down. I put them in one terrarium and when I came back in the room after 15 minutes one had swallowed the other completely. After massaging, the swallowed animal was regurgitated and both animals survived and became healthy animals. But I also heard from someone whose adult female swallowed the (smaller) male without any inducement. At the time the animals were not being fed so maybe we can conclude that this species is cannibalistic.

Using the regime described in the first two paragraphs I bred Boa Constrictors and in the period 1980-1990 approximately 450 young were born and none of them gave any problems feeding. The young were very big (over 50 cm long) and very heavy (120 to 150 gms). This was also the reason for the small litters. The biggest litter was 26 young but a litter of 10 was normal. The young ate adult mice after the first slough.

At the moment I only keep *Boa constrictor occidentalis* which I bred this year (1994) for the first time. In July 18 young were born and these animals are completely different from other Boa Constrictors. If they are not kept on a heatmat they stop feeding or regurgitate the prey after one or two days. They need the heat for the digesting of the prey. But when you keep them on a heatmat they have problems sloughing. So I tried to wean them off the heatmat by slowly moving their cages so that the heated area became progressively smaller. It took about six months to get them off the heatmat and since then they are doing fine.

I also bred Rosy Boas *(Lichanura trivirgata rosefusca)* but I was not very successful with them. I put them into hibernation from mid November till mid February at 15°C after that I returned them to normal temperatures and they started to feed. From March till May they copulated several times but the female did not stop feeding. I also could not see that she was gravid. Normally they give birth to the young in September or October. When nothing happened in these months I stopped feeding and put them in hibernation in November again. After two weeks I checked the animals every two days. I found five young of which four had died. The only surviving baby and the mother were brought back to normal temperature, but it was already too late. The female died after a couple of days, the young after a couple of months and as I could not buy another female, I sold the male.

In 1988 I started keeping *Chondrophython viridis* and in 1990 I bred them for the first time. I bought three adults of the lowland morph from Papua New Guinea. In January I put the male in the female's cage and they copulated the same night. Again with this species I prefer parental incubation and I left the female to incubate the eggs by herself under the same circumstances as the Macklots Python. From the first clutch I kept four animals for myself and now after four years they all look different. I have one animal that looks the

same as the mother which had a lot of blue colour. One is light green and the two still have some immature markings. From these animals two have been gravid this year for the first time. One had a clutch of 19 eggs of which only two were fertilised. These two eggs died after three weeks in an incubator. The other animal had 26 eggs of which 15 were fertilised. She did not want to incubate the eggs and after 65 days I opened the eggs and found a half developed deformed snake in all of them. Normally the incubation time for these eggs is 45 to 50 days, which is short because the female keeps the eggs inside her a longer time than other pythons.

Sometimes the female refuses to incubate her eggs and then I have to put them in an incubator. I tried several incubators and I think the best is an ex-hospital incubator but I was not very lucky with the one I had. The thermostat was broken and gave an alarm signal when the temperature was 34°C so I could switch it off. This happened a couple of times and then I made an incubator from an aquarium with 5 cm of water and an aquarium heater. But the best incubator at the moment is the incubator I made from polystyrene sheets which I glued together. On the rear I mounted a heatmat which is connected to a thermostat from an incubator for bird eggs and which I can control to 0.1°C exactly. In this incubator I put a plant propagator filled with 3 to 4 cm of water which will maintain a humidity of about 80%. The eggs I put on dry tissue and they hatch after 45-50 days at a temperature of 29°C. But when the female incubates the eggs 90-95% hatch but when I incubate them in an incubator only 60-70% hatch. That is the reason I prefer parental incubation.

The young animals start to change colour after about 6 months. The complete change takes about 2 years but a friend of mine had a *Chondropython* that changed colour in one day. In the morning he left his house while the snake was yellow and when he came home in the evening it was green.

At the moment I have another two projects. I built a new terrarium in which I keep all of my Emerald Tree Boas together. Before that I kept them in separate cages but in the last few years I was not successful with breeding this species. Last year I put them together but it was already too late in the season. But I found strings of semen so I am hopeful for next year.

In the new terrarium I mounted a pipe system with holes in the pipes which lie on top of the terrarium. This pipe system is connected to a humidifier, outside the terrarium, which is switched on for one hour each night. As soon as it is switched on the animals become active and hopefully they will start to copulate in March or April.

My last project is the *Python curtus breitenstieni* from Borneo. I have two juvenile pairs. I bought these animals as wild-caught hatchlings which were about 15 cms long. They all started to feed in the first week. They are housed separately and each cage has a hide box available which they use all the time. I never see the animals except in the hide box, looking for food. I feed them once in two weeks an adult rat and the more they grow the more aggressive they become.

ON THE IDENTIFICATION OF EMYDID *(REPTILIA: TESTUDINES)* SHELL BONES IN THE PLEISTOCENE OF BRITAIN

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INTRODUCTION

Stuart (1979) identified the European pond tortoise *(Emys orbicularis)* in many British Pleistocene localities, mainly on the basis of individual shell bones. But he did not explain how the *E. orbicularis* bones were distinguished from its emydid relative, the striped-necked terrapin, *Mauremys caspica leprosa*. I believe that *M. c. leprosa* could have also existed in the British Pleistocene because it coexists (Escriva, 1987) with the presently exotic British Pleistocene species *Pelodytes punctatus, Hyla arborea, Hyla meridionalis* and *Elaphe longissima* (Holman, 1992, 1993, 1994; Ashton et al., 1994) in eastern Spain.

In 1986, I was able to study many of Stuart's British Pleistocene chelonian specimens in the Zoology Museum at Cambridge and agree that the bones all represent *E. orbicularis*. Nevertheless, I believe it is important to point out characters that distinguish shell bones of these species, especially given the possibility that *Mauremys* bones might be found someday in the British Pleistocene.

In 1992, I was able to study individual shell bones from several specimens of *Emys orbicularis* and *Mauremys caspica leprosa* in the Museo National de Ciencias Naturales, Madrid, Spain. Diagnostic bones were sketched there and form the subject of this paper. Turtle shell bone terminology follows Zangerl (1969) and vernacular and scientific names of the two species follow King and Burke, 1989).

DIAGNOSTIC CARAPACIAL BONES (Fig. 1)

Nuchal bone. The nuchal bone, the most anterior of the median bones of the carapace, is quite diagnostic in dorsal view. In *E. orbicularis* it is wider than long, anteriorly truncated, and has a cervical scute impression that is less than one-third the length of the bone (Fig. 1A). In *M. c. leprosa* it is about as wide as long, not anteriorly truncated, and has a cervical scute impression that is more than one-third the length of the bone (Fig. 1B).

Third and fourth neural bones. In *E. orbicularis,* in dorsal view, the third neural bone is crossed horizontally by the edge of the vertebral scute impression very near the posterior edge of the bone (Fig. 1C). In *M. c. leprosa,* in dorsal view, it is crossed horizontally by the edge of the vertebral scute impression at about the middle of the bone (Fig. 1D). In *E. obicularis* the fourth neural bone is longer than wide (Fig. 1E). In *M. c. leprosa* it is much wider than long (Fig. 1F).

Suprapygal and pygal bones. These are the most posterior median bones of the carapace. In *E. orbicularis,* in dorsal view, the pygal and suprapygal bones are smooth. In *M. c. leprosa,* in dorsal, view, the suprapygal and pygal bones have a wide, irregular keel.

PLASTRAL BONES
(Figs. 2 and 3)

Hinged plastron. A plastral hinge occurs in *E. orbicularis* and is lacking in *M. c. leprosa.* Evidence of the hinge may be seen in the individual hyo and hypoplastral bones of *E. orbicularis* which are smooth and slightly grooved along the hinge line (Fig. 2) rather than having the dove-tailed sutures of *M. c. leprosa.*

Epiplastra. These are the most anterior paired bones of the plastron. In dorsal view, the epiplastral tubercle of *E. orbicularis* (Fig. 3A) is more weakly developed than that of *M. c. leprosa* (Fig. 3B).

Entoplastron. This is the only unpaired bone in the plastra of these turtles and it lies in the anterior one-half of the shell. In dorsal view, in *E. orbicularis* it is rounded and has a long posteriorly extending spike (Fig. 3C), whereas in *M. c. leprosa* the spike is very short and confined to the dorsal surface of the bone (Fig. 3D).

Hypoplastra. In *E. orbicularis,* in dorsal view, the inguinal scute impression is wide and subtriangular (Fig. 3E), whereas in *M. c. leprosa* it is elongate and narrow (Fig. 3F). Moreover, the hypoplastral bone of *E. orbicularis* is wider than in *M. c. leprosa.*

Xiphiplastra. The xiphiplastra are the most posterior paired bones of the plastron. In *E. orbicularis* the articulated xiphiplastra form a shallow xiphiplastral notch (Fig. 3G), whereas in *M. c. leprosa* the articulated xiphiplastra form a deeper xiphiplastral notch (Fig. 3H).

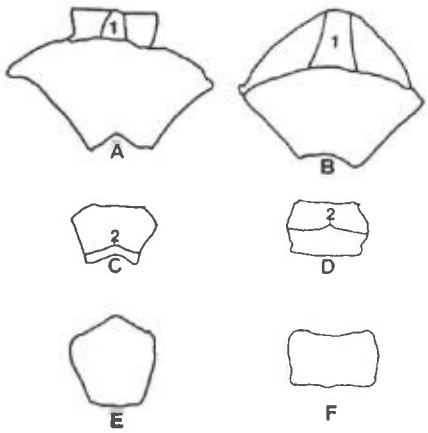

Fig 1. Carapacial bones (in dorsal view) of *Emys orbicularis* and *Mauremys caspica leprosa.* A, nuchal bone of *E. orbicularis;* B, nuchal bone of *M. c. leprosa;* C, third neural bone of *E. orbicularis;* D, third neural bone of *M. c. leprosa;* E fourth neural bone of *E. orbicularis;* F, fourth neural bone of *M. c. leprosa.* Key to numbers: 1, cervical scute impression; 2, edge of vertebral scute impression.

SUMMARY

Pleistocene chelonian remains in Britain mainly occur as individual shell bones. At present, all of these bones appear to represent the European pond tortoise, *Emys orbicularis.* Nevertheless, considering the modern distribution of some exotic British Pleistocene herpetofauna, it seems possible that the Mediterranean pond terrapin, *Mauremys caspica leprosa,* could have occurred in the British Pleistocene. Thus, a discussion of diagnostic shell bones in the two species has been presented.

ACKNOWLEDGEMENTS

I thank A.J. Stuart and J. Clack for allowing me to study British Pleistocene *Emys orbicularis* bones in the Zoology Museum at Cambridge. I am also grateful to B. Sanchiz, C. Martin and J. Gonzales for letting me study skeletons of modern *Emys orbicularis* and *Mauremys caspica leprosa* in the Museo National de Ciencias Naturales, Madrid. Teresa Petersen made the drawing for Fig. 2.

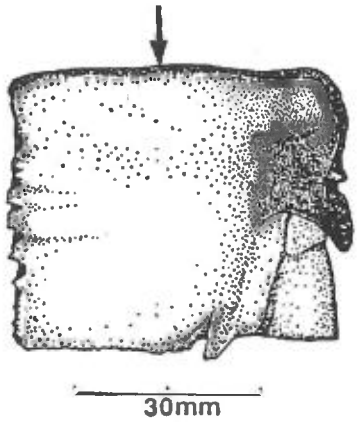

Fig 2. Right hypoplastral bone (in dorsal view) of fossil *Emys orbicularis* from the late Pleistocene of Shropham, England, showing the smooth, slightly grooved surface along the hinge line (end of arrow).

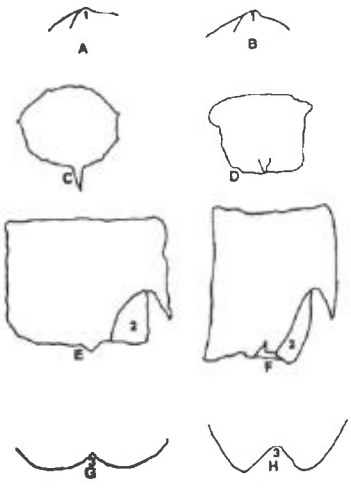

Fig. 3. Plastral bones (in dorsal view) of *Emys orbicularis* and *Mauremys caspica leprosa*. A, tubercular portion of left epiplastron of *E. orbicularis;* B, tubercular portion of left epiplastron of *M. c. leprosa;* C, entoplastron of *E. orbicularis;* D, entoplastron of *M. c. leprosa;* E, right hypoplastron of *E. orbicularis;* F, right hypoplastron of *M. c. leprosa;* G, fused xiphiplastra of *E. orbicularis;* H, fused xiphiplastra of *M. c. leprosa*. Key to numbers: 1, epiplastral tubercle; 2, inguinal scute impression; 3, xiphiplastral notch.

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