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THE BRITISH HERPETOLOGICAL SOCIETY

BULLETIN

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Spring 1993

THE BRITISH HERPETOLOGICAL SOCIETY

c/o Zoological Society of London
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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 and 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 fulfill 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	£5	(Receive YHC Newsletter)
Bulletin Membership	£10	(Receive Newsletter and Bulletin)
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
John Pickett and Simon Townson and Neill Clark.
Contributions and correspondence arising from the Bulletin should be sent to:
Neill Clark, 15 Rivenhall End, Welwyn Garden City, Herts AL7 2PJ.

FRONT COVER
Red-Knecked Keelback, *Rhabdophis subminiatus* – see *Snakes of Java with Special Reference to East Java Province*, by Rick Hodges, p. 15.

BHS REMAINING MEETINGS FOR 1993

All Members are welcome to attend the meetings outlined below, further details of which will appear n the Bulletin in due course. Reserve these dates in your diary!

July 3rd	Birkbeck College, Malet Street, London WC1. 2.30-5.30 pm. Vet Mark Geach will give a talk on the veterinary aspects of acclimatising and caring for wild caught and captive bred animals – advice on controlling parasitic burdens in reptiles and amphibians, dietary requirements, reducing stress, microscope use, etc.
September 25th	Birkbeck College, London WC1. 2.30-5.30 pm. HENK ZWARTEPOORTR, Curator of Reptiles at Rotterdam Zoo, on Breeding Reptiles and Amphibians in captivity.
October 16th	Birkbeck College, London WC1. 2.30-5.30 pm. Three talks: Long-term studies: the role of the amateur in herpetology, by LEIGH GILLETT. Round Island's reptiles under new management, by DAVID BULLOCK. The thermal ecology of lacertid lizards, by ROGER MEEK.
October 31st or November 7th	CAPTIVE BREEDING COMMITTEE OPEN MEETING. Details to be announced.
December 4th	RESEARCH COMMITTEE MEETING Details to be announced.

HERPETOLOGICAL JOURNAL REPORT 1992

In 1992 the number of papers submitted to the *Herpetological Journal* increased by nearly 30%, representing the highest number of submissions for eight years. Papers originated from some sixteen countries, which continues to reflect the journal's international profile. Processing these manuscripts involved the effort of sixty referees, to whom the editor is grateful for maintaining high scientific standards. Despite the increase in submissions, quarterly publication allowed more papers to be published and the rejection rate fell slightly to 32%. The year also saw the transition to in-house typesetting using desktop publishing. This should actually improve the appearance of the journal while reducing production costs by at least a half. The time lag between papers being accepted and published started to fall in the later issues, and in 1993 most papers should appear within 6-9 months of acceptance, fullfilling the journal's aim of providing a vehicle for the rapid publication of topical herpetological science. The society owes a debt of gratitude to Peter Curry for setting up the desktop publishing system, and to Tracey Marshall for secretarial support, both of whom have freely provided their services on a voluntary basis.

Richard Griffiths

DEPARTMENT OF THE ENVIRONMENT
NEWS RELEASE

1 December 1992

CHANGES TO WILDLIFE TRADE CONTROLS ANNOUNCED

Changes to controls on the wildlife trade and a review of the operation of all wildlife sales controls were announced today by David Maclean, Minister of State for the Environment and Countryside.

In answer to a written Parliamentary Question from Dr. Ian Twinn MP (Edmonton), Mr Maclean said:

"The main controls on the wildlife trade will remain unaltered but the establishment of the Single Market will make it impractical to retain controls on some imports and exports. We propose to compensate for this by strengthening controls within the United Kingdom."

"There are controls throughout the European Community on trade in species protected by the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). These cover imports from and exports to non-EC countries of all species listed on the CITES Appendices and also include prohibitions on the sale of specimens of endangered species. They are supported by systems of permits and certificates issued and recognised by all Member States. This system will remain fully operational on 1 January."

"Within the United Kingdom, we have an extensive system of controls to restrict sales of specimens of native species. Within Great Britain, this was strengthened in October to include a further 90 species and will remain unchanged from 1 January next year."

"At present, we also control the import and export of many species not listed on CITES, under the Endangered Species (Import and Export) Act 1976 (ESA). From 1 January, it will no longer be possible to retain these controls in relation to trade within the European Community."

"Given the future freedom of movement within the Community, we have looked carefully at whether we should continue to control trade in non-CITES species with non-EC countries. We have concluded that it is only sensible to do so where most other Member States have similar controls, because otherwise our restrictions could be evaded very easily by routing trade through our EC neighbours. This means that from 1 January 1993 controls under the Endangered Species (Import and Export) Act 1976 will apply only to the import of the skins of harp and hooded seal pups. We are writing to traders giving details of the species which will not require import and export licences."

"We are determined that these changes should not result in any significant loss of protection for species which require it. We urged the European Commission last year to bring forward proposals to strengthen EC-wide controls and this they have done. We have made good progress during our Presidency of the European Community

towards achieving agreement on a new Regulation which would extend EC controls on the wildlife trade to more species than are covered at present by the 1976 Act.- We expect this regulation to be adopted next year."

"Further, freedom of movement within the Community will make it particulary important to have effective controls within Manager States and the Environment Council on 20 October took the view that a good deal of discretion on these should continue to rest with individual countries. We therefore propose to strengthen controls applied within this country. As a first step, we propose to extend sales controls to some 200 species formerly protected by import and export restrictions and which our scientific advisors, the Joint Nature Conservation Committee (JNCC), consider would otherwise be at risk from trade. We propsoe too to review how the operation of all our wildlife sales controls may be made more effective. We are consulting interested organisations about the scope of the review which will be undertaken over the course of the next year."

NOTES FOR EDITORS

Import and export Controls:

1. The import and export of wild plants and animals, including parts and derivatives, is currently controlled in the UK through a system of permits. In addition to controlling trade in the species listed on the Appendices to CITES, the UK also controls the import and export of a large number of non-CITES species.

2. CITES was originally implemented in the UK through the ESA 1976. The Act also listed a large number of additional species which the UK wanted to control. In 1984, the provisions of the Act were largely superseded by EC Regulation 3626/ 82 which implemented the Convention throughout the EC, and was directly applicable in each Member State. The UK has continued to operate its separate ESA controls on non-CITES species.

3. Over 24,000 species (2,869 animals and 21,457 plants) are listed on the CITES Appendices. Import and export controls on the species will remain throughout the European Community.

Sales Controls:

4. Under EC Regulation 3626/82 all Member States control the sales of specimens (including parts and derivatives) of about 800 species (570 animals and 228 plants) listed on Appendix 1 of CITES and a further 690 species (583 animals and 106 plants). Under the Wildlife and Countryside Act 1982, sales of all native wild birds in Great Britain are strictly controlled, together with sales of specimens (including parts and derivatives) of 128 other animals and 165 species of plants. The species subject to controls were renewed this year by a Statutory Instrument which entered into force on 29 October. There are simliar controls in Northern Ireland.

5. The ESA may also be used to subject specimens of designated species to licensing control. The 200 species to be made subject to these controls in 1993 have been identified by the JNCC as likely to be at risk from those covered by the Bern Convention, proposed for listing in the most endangered category of the new EC Wildlife Trade Regulation (see below) or for which import permits have been refused in the past.

Proposed EC Regulation:

6. The EC published proposals in February for a new Regulation of the Trade in, and possession of, wildlife. This would replace and extend EC Regulation 3626/82. The Commission proposed covering over 60,000 species and significant strengthening of internal and external controls.

7. Negotiation of the Regulation has been a priority for the UK's Presidency of the EC but has not yet been agreed. One of the main issues for resolution is the extent to which there should be common EC system for contols within Member States. In the meantime, Regulation 3626/82 will remain in effect and applies only to species covered by CITES. Any sales or similar controls on Non-CITES species will therefore remain for the time being for individual Member States to decide.

Proposed Review:

8. The Department is writing to interested organisations and traders informing them of the changes and seeking their views on those aspects of present controls which should be investigated. The review is expected to take most of 1993 to complete.

Press Enquiries: 071 276 0929 (Out of Hours: 071 873 1966)
Public Enquiries Unit: 071 276 0900

NEW IMPORT AND TRADE REGULATIONS FOR LIVE REPTILES AND AMPHIBIANS FROM 1 JANUARY 1993

Substantial changes were made in U.K. controls of the international trade in reptiles and amphibians on 1 January 1993, as a result of the "Single Market", and subsequent changes in Customs controls, between European Community member states.

An explanation of the new controls was given in a letter issued by the Department of the Environment on 1 December, 1992. This letter, and the accompanying list of reptiles and amphibians affected by new sales controls, is reproduced below in full. This is followed by a full copy of a Department of the Environment press release relating to the new controls.

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1 December 1992

Department of the Environment
Traded, Registered & Exotic Wildlife Division
Room 907
Tollgate House
Houlton Street BISTOL BS2 9DJ

WILDLIFE TRADE CONTROLS FROM 1 JANUARY 1993

1. This letter alerts you to important changes to be made to this Department's wildlife trade controls on 1 January next year to take account of the introduction of the Single Market. From that date, Customs surveillance of the movement of goods between European Community Member States will no longer be a matter of course, but will instead be limited to intelligence-based checks. This will have the following implications:

- **no change** to permits and certificates issued under EC Regulation 3626-82 for species covered by the Convention on International Trade in Endangered Species (CITES);
- **the end of requirements for**
  - import and export permits for trade with EC and other countries in non-CITES species except imports of harp and hooded seal pup skins from outside the Community;
  - import and export permits for trade with EC countries in certain CITES species.
- **new requirements for** licences to sell specimens (including parts and derivatives) of 200 species within this country.

2. Details of these changes are set out below, together with informaton about a review we propose to carry out to see what improvements may be needed to controls within this country.

3. The present EC-wide controls on imports from and exports to non-EC countries of all species listed on the CITES appendices will remain. EC-wide prohibitions on the sale of specimens of certain species (unless exemptions have been granted) will also remain.

4. For movement of CITES species within the EC, Customs will no longer be making routine checks of permits and certificates at the borders. The authorities in Member States will, however, continue to check the origins of some specimens, particularly at the time of sale but also at other times. Traders are therefore advised to continue to apply for EC CITES certificates or to ensure that specimens are accompanied by copies of import permits, certificates, or other relevant documents.

5. Import and export permits are currently required for trade within the EC in:

- articles made wholly or party from vicuna;
- birds' plumage,
- collections of birds' eggs;
- diurnal birds of prey; and
- certain species of cacti.

This requirement will cease at the end of this year, although it may be advisable to obtain an EC CITES certificate (see para 4 above).

NON-CITES SPECIES

6. The import and export of many species not listed on CITES is currently controlled under the Endangered Species (Import and Export) Act 1976. From 1 January it will no longer be possible to retain these controls in relation to trade within the Community. Further, for trade in non-CITES species with non-EC countries, Ministers have decided that it is only sensible to retain controls operated by most other Member States, given the future freedom of movement within the Community. This means that, from 1 January, controls on imports and exports under the 1976 Act will apply only to imports of harp and hooded seal pup skins from non-EC countries.

SALES

7. The present extensive controls on sales of wildlife specimens and their products and derivatives under both EC Regulation 3626-82 and domestic legislation will remain.

8. Further, we are extending sales controls under the Endangered Species (Import and Export) Act 1976 to around 200 species hitherto protected by import and export controls and which our scientific advisors, the Joint Nature Conservation Committee, consider would otherwise be at risk. A list of these species is attached. It will be an offence to sell, offer or expose for sale, possess or transport for the purposes of sale and specimens of these species, or their parts or derivatives, except in accordance with a licence issued by the Secretary of State.

REVIEW OF INTERNAL CONTROLS

9. Freedom of movement in the Community wil make it particularly important to have effective controls within Member States. Negotiations are currently taking place on a new EC Regulation on the wildlife trade and these are likely to lead to substantially stronger controls at the Community's borders and some further harmonisation of controls within them. The Environment Council in October took the view, however, that a good deal of discretion on internal controls should continue to rest with individual Member States. During 1993 we therefore propose to undertake a thorough review of the operation of wildlife sales controls in this country. We should welcome any ideas you may have now on the scope of this review, so that

we can prepare a formal consultation document for wide circulation next year.

ENQUIRIES

10. The Department's Notices to Importers and Exporters are being revised and will contain full guidance on the new arrangements. In the meantime, please contact staff here with any queries as follows:

General policy and the proposed review:	Jane Withey	Tel. 0272 218524
Reptiles:	Felicity Chapman	Tel. 0272 218691
Mammals and plants:	Alastair Grant	Tel. 0272 218688
Birds and fish:	Adrian Thrift	Tel. 0272 218749

11. In order to inform as many people as possible of these changes, we are sending this letter both to recipients of our regular CITES newsletter and to known traders. I am sorry if this means you receive two copies.

SUSAN CARTER
Head of Division

SUGGESTED LIST OF ANIMALS SPECIES FOR SALES CONTROLS UNDER S.4/SCH.4 OF THE ENDANGERED SPECIES (IMPORT & EXPORT) ACT

TESTUDINES	
Emydidae	
Callague borneoensis[1]	Painted terrapin
Cuora pani[2] (inc. chriskarannarum)	Pan's box turtle
Graptemys flavimaculata[2]	Yellow-blotched map turtle
SAURIA	
Gekkonidae	
Eublepharis kuroiwae[2]	Ryukyu panther gecko
Phyllodactylus europaeus[1]	European leaf-toed gecko
Phyllodactylus heterurus[2]	
Chamaeloenidae	
Brookesia nasus[2]	
Brookesia tuberculata[2]	
Iguanidae	
Anolis roosevelti[3]	Colubra Island giant anole
Gambelia silus[3]	San Joaquin leopard lizard
Liolaemus constanzae[2]	
Liolaemus gravenhorstii[2]	Striped ground iguana
Liolaemus leopardinus[2]	Leopard ground iguana
Liolaemus lorenzmuelleri[2]	
Liolaemus nitidus[2]	Greenish ground iguana
Liolaemus paulinae[2]	Chilean ground iguana
Tropidurus tarapacensis[2]	

Tropidurus theresioides[2]	
Lacertidae	
Algyroides marchi[1]	Spanish algyroides
Lacerta monticola[1]	Iberian rock lizard
Lacerta bedriagae[1]	Bedriaga's rock lizard
Podarcis filfolensis[1]	Maltese wall lizard
Teiidae	
Callopistes palluma[2]	
Scincidae	
Ateuchosaurus pellopleurus[3]	Japanese ateuchosaurus
Chalcides occidentalis[1]	
Eumeces kishinouyei[2]	
Amphiglossus splendidus[2]	
OPHIDIA	
Colubridae	
Alluaudina bellyi[2]	Chilean ground snake
Dromicus chamissonis[2]	
Langaha alluaudi[2]	
Langaha nasuta[2]	
Liophidium rhodogaster[2]	
Lycodryas arctifasciatus[2]	
Pseudoxyrhopus heterurus[2]	
Viperidae	
Trimeresurus wiroti[3]	
Vipera lebetina[1]	Blunt-nosed viper
AMPHIBIANS	
CAUDATA	
Salamandridae	
Salamandra luschani[1]	Luschan's salamander
Chioglossa lusitanica[1]	Golden-striped salamander
Euproctus montanus[1]	Corsican brook salamander
Euproctus platycephalus[1]	Sardinian brook salamander
Tylotriton kweichowensis[2]	
Plethodontidae	
Hydromantes genei[1]	Sardinian cave salamander
Hydromantes falvus[1]	
Hydromantes supramontes[1]	
Hydromantes imperialis[1]	
Hydromantes italicus[1]	Italian cave salamander
Proteidae	
Proteus anguinus[1]	Olm

ANURA	
Discoglossidae	
Discoglossus pictus[1]	Painted frog
Discoglossus jeanneae[1]	
Alytes muletensis[1]	Balearic midwife toad
Pelobatidae	
Pelobates fuscus[1]	Common spadefoot
Bufonidae	
Ansonia mcgregori[2]	Mcgregor's toad
Ansonia tiomanica[2]	
Bufo atacamensis[2]	Atacama toad
Bufo chilensis[2]	Chilean toad
Bufo periglenes[3]	Golden toad
Leptodactylidae	
Alsodes barrioi[2]	
Alsodes laevis[2]	
Alsodes montanus[2]	
Alsodes nodosus[2]	
Atelognathus grandisonae[2]	
Caudiverbera caudiverbera[2]	Gay's frog
Eupsophus insularis[2]	
Eupsophus migueli[2]	
Insuetophyrynus acarpicus[2]	
Telmatobius halli[2]	
Telmatobius pefauri[2]	
Telmatobius peruvianus[2]	
Telmatobufo australis[2]	
Telmatobufo venustus[2]	
Hylidae	
Hyla helenae[2]	
Hyla kanaima[2]	
Phyllodytes auratus[2]	
Rhinodermatidae	
Rhinoderma spp.[2]	Darwin's frog
Ranidae	
Conraua goliath[3]	Goliath frog
Mantidactylus eiselti[2]	
Rana latastei[1]	Italian agile frog

[1] Bern Apendix II species which are globally threatened and whose import or sale is not already regulated by the Wildlife & Countryside Act 1981 or EC Regulation 3626/82.

[2] Species whose import has been prohibited in the past under the Endangered Species (Import & Export) Act 1976.

[3] Non-CITES species suggestesd for Annex A of the proposed new EC Wildlife Trade Regulation.

THE PROPAGATION AND HUSBANDRY OF *ELAPHE FLAVIRUFA PARDALINA* (PETERS) INCLUDING NOTES ON NATURAL HISTORY

JOHN WEIR

65 Smithy Carr Lane, Brighouse, W. Yorks. HD6 4BG

INTRODUCTION

Elaphe flavirufa pardalina is one of four currently recognised subspecies of the Neotropical Ratsnake, *Elaphe flavirufa*. An additional subspecies, *Elaphe flavirufa polystichta*, was proposed in 1966, based on the close examination of a preserved specimen held in the British Museum (Smith, Williams 1966). This specimen was taken on Isla Ruatan, Islas de La Bahia, Honduras, around 1893. This subspecies *E.f. polystichta* shows only very minor differences from the mainland population of *E.f. pardalina*, having a slightly higher number of dorsal scale rows and also a higher posterior minimum. The two subspecies are identical in colour and pattern type.

I particularly mention *E.f. polystichta* as my own stock were captive bred from wild-caught adults from *Isla de Ruatan*. Wilson and Hahn (1973) heavily criticised the status of *E.f. polystichta*, suggesting that *E.f. polystichta* (Smith and Williams) should be relegated to the synonymy of *E.f. pardalina*.

The four currently accepted subspecies of *Elaphe flavirufa* (see Dowling 1952) also have their critics and it is clear that a great deal of work has yet to be done to stabilise the taxonomic status of this fascinating species.

The range for *E.f. pardalina* includes the Caribbean coastal regions of Guatemala, Honduras (incl. Islas de la Bahia) into Nicaragua (incl. Corn Island).

Reliable climatic statistics for the Caribbean coastal plain of Honduras have proved difficult to locate, although very useful information is given by Wilson and Meyer in their book *The Snakes of Honduras*. They state that in Honduras *Elaphe flavirufa* is only known from below 100 metres in the tropical moist forest and tropical dry forest formations. The climate of the tropical moist forest is given as having a high mean annual temperature (24°C) and high annual precipitation (2000-4000mm). The precipitation is spread throughout the year with no month receiving less than 50mm. The heaviest precipitation however appears to occur between the months of October and January.

The climate of the tropical dry forest is given as having a relatively high mean annual temperature (24°C) and receiving between 1000 and 2000mm of precipitation annually. During part of the year precipitation falls below 50mm per month and there are three to four months when precipitation is negligible.

Wilson and Meyer (1985) also include some excellent habitat photographs which give the keeper a very real insight into the natural habitat in which *E.f. pardalina* is found. *Elaphe flavirufa* may be at some risk from continued habitat destruction; Wilson and Meyer mention this as a very real threat to the rich and diverse amphibian and reptile population of Honduras. The Phillips Illustrated Atlas of the World (1984) gives some detailed information on habitat destruction in Honduras indicating that the aromatic pine forests of the East are being consumed by new paper mills on the hot rain soaked Caribbean coast. The lower alluvium filled valleys of the rivers draining into the Caribbean have also been reclaimed and the forest replaced by orderly banana plantations.

E.f. pardalina is a large (up to 1600mm), slenderly built colubrid with a relatively thin neck, distinct head, large eyes and a long tail. (See Plate 1 for a typically marked specimen).

Elaphe flavirufa is an aboreal and nocturnal snake and these behaviour patterns should be catered for when considering an appropriate vivarium design i.e. climbing and secure hide facilities.

Elaphe flavirufa is poorly represented in collections and its propagation is indeed a rare event. During 1990 I acquired four captive bred hatchlings of *E.f. pardalina* and in 1992 achieved what I believe to be the first U.K. captive breeding of this species. All four hatchlings were from wild caught parents and are unrelated, female 1 (F1) hatched in August 1989 and F2, male 1 (M1) and M2 hatched in August 1990.

Clearly the climate statistics that are available for Honduras give a pointer to certain parameters that must be met for the well being of this species in the vivaria. From my experience temperature and humidity are both extremely important in the adopted regime for the captive care of *E.f. pardalina.* It should be noted that as a tropical species it does not require a period of harsh winter cooling as with the more commonly kept temperate N. American *Elaphe* sp.

The temperature in the vivarium should be stablized at around 25°C through the year. Higher temperatures are tolerated in Summer but these should not be excessive. A very slight cooling period from November to February appears to be beneficial but at no time should the temperature be allowed to fall below 20°C for any length of time. Below 20°C digestion of food items ceases and regurgitation takes place. F1 experienced this problem during an unchecked heater tube failure, although recovery was complete when the recommended temperature was again maintained.

Too dry an environment causes severe problems with sloughing, but this is easily overcome by periodic misting of the vivarium and daily misting of the snake during ecdysis. I now have a large pile of sphagnum moss in each vivarium which is kept permanently damp. My preferred substrate has also been changed from corn cob chips to coir – a peat alternative made from crushed coconut husks. Before making these changes to my husbandry techniques M1 experienced two very bad sloughs in quick succession; no problems have been experienced since. F1 was housed immediately in a small drawer type vivarium, due to her size. F2, M1 and M2 were initially reared in plastic boxes on a rack system, heated by a 45w horticultural cable; they were moved into individual vivaria at 8 months of age.

The vivaria lighting is set at 12 hours on and 12 hours off for the whole year. Expensive UV tubes are not necessary (i.e. True-lite) as, is already mentioned, *Elaphe flavirufa* is nocturnal.

Feeding is unproblematic as all my specimens have a strong feeding response, accepting on a regular basis pre-killed laboratory mice of an appropriate size. Occasionally food items are refused, in particular during the slight cooling period and during the mating season (males only).

In the vivaria each drawer unit is lined with newspaper and in the main compartment climbing branches are provided; fresh drinking water is available at all times.

Behaviour in the vivaria has proved to be very predictable: each snake appears at around 22:00 to climb in the branches and hunt for food. They appear very much to enjoy their arboreal activities and I feel it is very inappropriate to house them in plastic boxes much beyond the hatchling stage. (i.e. up to 8 months). Although not stated in any available literature I feel it is highly probable that in the wild small birds will also be taken.

E. flavirufa is a highly nervous snake and does not react well to being handled, thus they are rarely removed from their vivaria. If handled they are prone to very rapid movements and it is not unusual for a lightning strike to take place.

At the beginning of 1992 I decided that all four snakes had developed sufficiently to consider an attempt at breeding this species.

On the 6/4/92, M1 was introduced into the vivarium of F1 and M2 to F2; at this time F1 was of age 30 months and F2, M1 and M2 of age 18 months. At 22:30 on the same day F2 and M2 were observed clearly coupled high up in the branches of their vivarium. On 8/4/92 F1 and M1 were similarly observed coupled at 22.45 and separated at 23.35. Over the next few days semen stains were found regularly in both vivaria, including the drawer

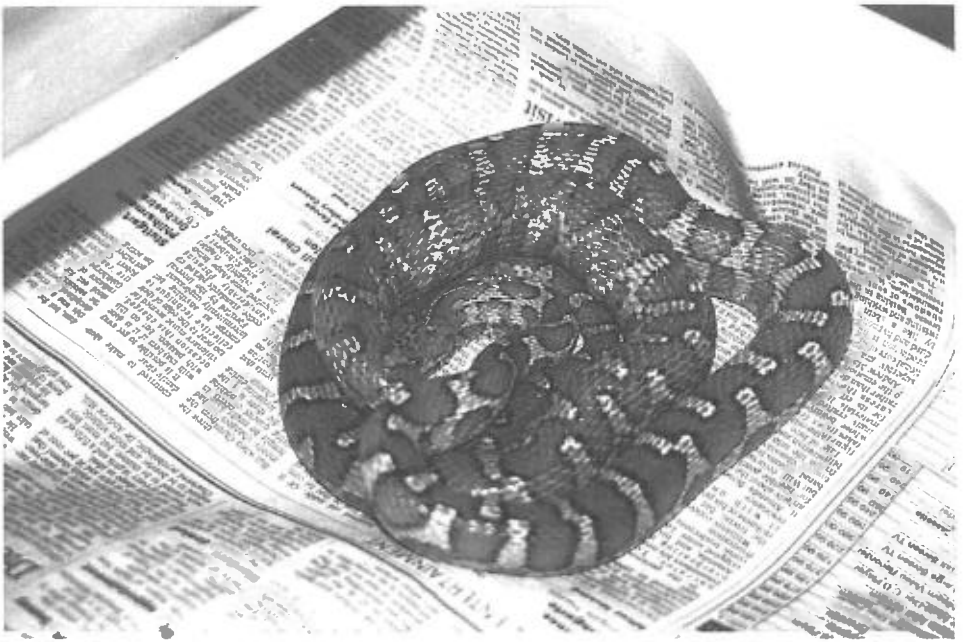

Plate 1. Female *Elaphe flavirufa pardalina*, clearly gravid.

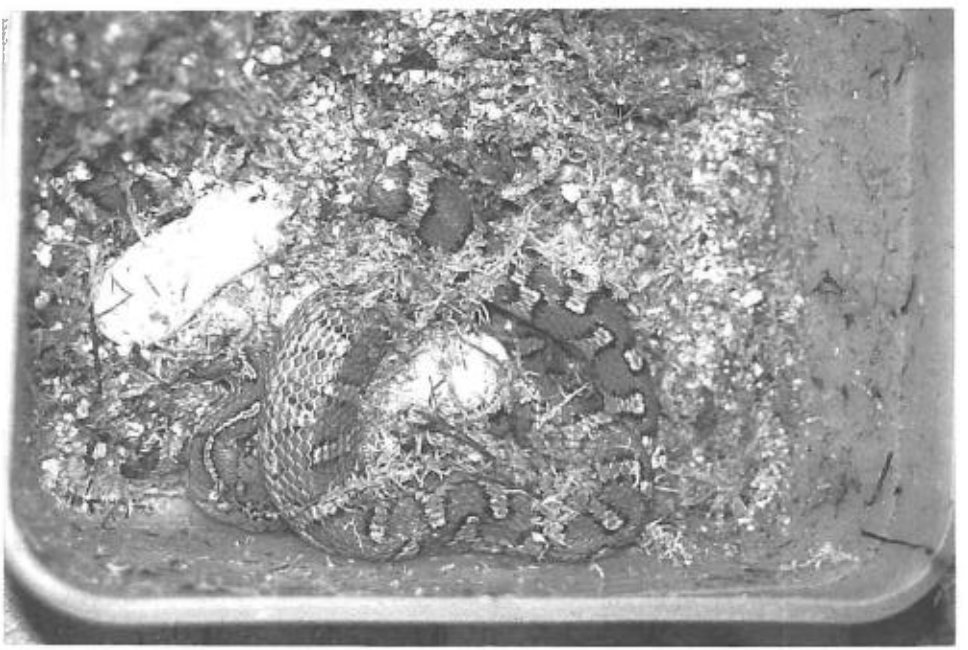

Plate 2. *Elaphe favirufa pardalina* during oviposition.

Table 1. REPRODUCTIVE DATA FOR *ELAPHE FLAVIRUFA PARDALINA*

PAIRINGS	F1/M1	F2/M2
Mating Dates	8/4/92	6. 8. 11/4/92
Pre-Oviposition Slough	28/5/92	25 26/5/92
Date of Oviposition	4/6/92	4/6/92
Gestation Period	57 Days	54-59
Clutch Size	5	4
Incubation Temp. °C	26-30	26-30
Incubation Period	69-70 Days	69
Date of Hatch	12 13/8/92	12/8/92
Fertility	40%	50%

BOTH FEMALES LAID BETWEEN 08.00 AND 16.00

Table 2. EGG AND HATCHLING DATA

FEMALE 1							FEMALE 2						
Egg	L (cm)	W (cm)	Weight (g)	Hatch Date	1st Slough	1st Feed	Egg	L (cm	W (cm)	Weight (g)	Hatch Date	1st Slough	1st Feed
1	6.2	2.7	25.75 = x	12/8	21/8	21/8	1	6.6	3.1	25.38 = x	12/8	21/8	3/9
2	6.85	2.6		*			2	6-7	2-75		12/8	22/8	22/8
3	6	2.3		INF			3	6	2.25		INF		
4	5.9	2.2		INF			4	6.8	2.3		INF		
5	6.8	2.6		13/8	22/8	1/9							

* This Egg went full term but did not hatch naturally. It was opened after 10 further days incubation and was found to contain a live deformed neonate.

units. Both pairs of snakes were returned to individual vivaria on 16/4/92 and within a further two weeks both females were observed to be clearly gravid. (See Plate 1.). Both females fed normally up to the end of April when they began to refuse food items. F2 experienced a very poor pre-oviposition slough (despite misting), and on 26/5/92 I decided to assist her, very much concerned about added stress before egg laying. Fortunately no problems were experienced and both females laid in boxes of damp sphagnum moss. The eggs were surprisingly large when compared to other *Elaphe* sp. I have bred; for detailed reproductive data and egg/hatchling data see Tables 1 and 2. The incubation medium was damp vermiculite (1:1 by weight with water) and the incubation temperature fluctuated between 26°C and 30°C with an average of approximately 28°C. The eggs were inspected on a weekly basis and no extra water was added during incubation. The eggs that proved to be infertile were discarded when appropriate, otherwise incubation was uneventful, although the eggs from F1 became discoloured as incubation progressed. Hatching took place between the 12th and 13th August and the hatchlings were large as expected from such sizeable eggs. They were replicas of their parents, although more brightly coloured. Only the hatchling from egg 5 was measured and weighed to avoid stress. It weighed 22.5g and had a length of 35.2cm.

After their first slough two hatchlings, one from each clutch, fed regularly on week-old pink mice. The other two however were slower and showed a marked preference for pre-thawed pink mice with the nose area cut with a scalpel.

The sex ratio proved to be 3:1, determined by probing.

Elaphe flavirufa is indeed a very beautiful ratsnake worthy of inclusion in any collection, although it should only be considered by the more experienced hobbyist who can provide the necessary conditions to ensure it's well-being. It's reproductive biology is relatively straightforward and it makes a fascinating vivarium subject.

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SNAKES OF JAVA WITH SPECIAL REFERENCE TO EAST JAVA PROVINCE*

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The name of Java conjures mystery and romance. This wonderful tropical island, albeit the most densely populated in the world, with 800 people/km^2, lies a few degrees south of the equator. During a spell of four years working on rice storage problems in Indonesia I had the opportunity to survey the snake species of East Java. As many of Java's snakes are threatened by industrial pollution, the extensive use and over-use of pesticides, loss of habitat and over-collecting for skins, it seemed a good idea to attempt an inventory of species before many disappear. The snakes of West Java are relatively well known from the works of the Dutch colonial herpetologists, in particular, De Rooij, De Haas and Kopstein. However, Central and East Java have attracted rather less attention, the latter being of some interest as it has a more seasonal climate and would therefore be expected to show some faunal variations.

Java lies at the southern reaches of the zoogeographical region called Sundaland which includes the Malay Peninsular and the islands of Sumatra and Borneo. The boundary between Sundaland and continental Asia is at the Isthmus of Kra in peninsular Thailand (Fig. 1). Many Sundaland snakes are endemic while others also have extensive distributions in continental Asia. East Java is well supplied with species of both types which, despite the increasing pressure of the human population, may be encountered in a wide range of habitats. These include the surrounding sea and associated estuaries, mud banks and mangrove swamps, lowland fish ponds, paddy fields, savannah and both natural and cultivated forests. The geography of the province is organised in three broad east-west bands. In the north there are alluvial plains and foothills

Figure 1 – Map of Java and surrounding territory

where all natural forest has been felled and in parts is replaced by large teak plantations. Centrally, the province has a spine of volcanoes (Fig. 2) rising to a little more than 3500 metres, which offer cool environments in forest, agricultural land and, at the highest elevations, exposed habitats with little cover. The volcanic peaks are separated by extensive, gently sloping lowlands. Small areas of seasonal monsoon forest remain, especially in the extreme north-east of the province in the Baluran Volcano Nature Reserve; sub-montane/montane forest can be found around the Ijen complex, and the southern slopes of the Tengger complex have the best examples of montane forest in East Java. Finally, in the south there are dissected plateaux, almost all of which lie below 500m, where little forest remains except in nature reserves such as Meru Betiri (Fig. 2) which still has extensive lowland rain forest, mangrove, lowland swamp and beach forest.

Field collecting in East Java presented some problems as except for common paddy field species most 'interesting' snakes appear to be secretive, localised, nocturnal or all three. My first taste of Javanese snakes came from daily travel to work along an 8km stretch of motorway on the western edge of Surabaya City. This afforded an opportunity to collect the traffic victims from the night before and sometimes live specimens. However, to obtain a reasonable sample from the province as a whole, it was essential to develop a network of collectors in a range of different habitats. This was, at least in theory, not going to be too difficult as there is a substantial trade in snakes.

My first attempts to recruit collectors involved a deal with the Chinese owner of a snake-restaurant. The restaurant served fried cobra meat as well as blood and bile mixed with brandy as a cure for all sorts of diseases. After the necessary polite formalities, a meal of fried cobra meat and whole fried eggs dipped in chilli sauce, I became the owner's chauffeur on trips to pick up his snakes from local suppliers. The introductions gained from this were useful but tended to be with dealers whose interest was in supplying cobras for restaurants and other large species for skins. I eventually abandoned this approach after one long day of visits which involved returning home with exactly 101 ill-secured Spitting Cobras in the back of my car.

* A check list of East Java species with locality records is available from the author on request.

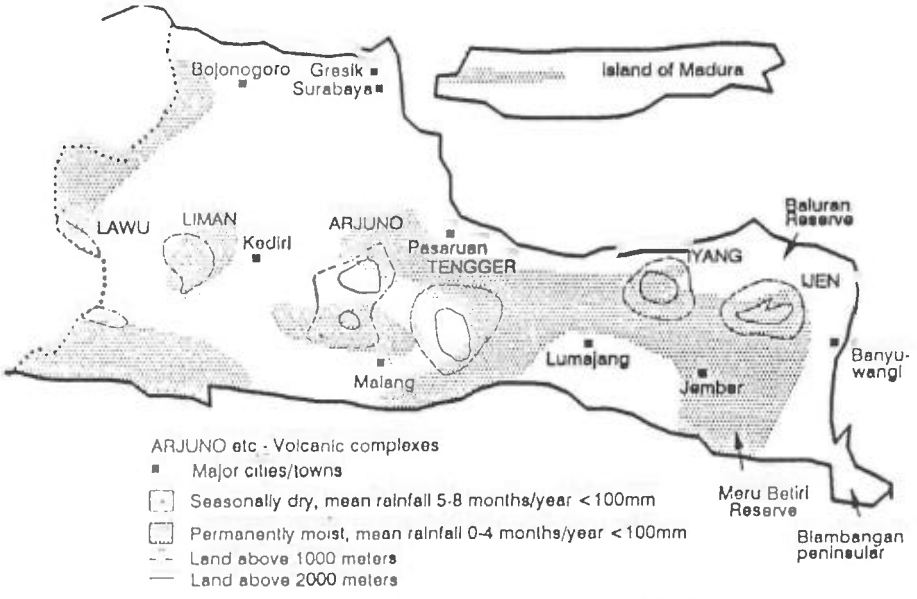

Figure 2 – Physical features and climatic zones of East Java

My next step in building the network was with the aid of a local pawang (magic man). His forte was the cure of snakebite and on the side he ran a dance troupe called the Cobra Putih (White Cobra). He actually really liked snakes despite the fact that some of the dance antics can hardly have been beneficial to them. On my first visit to his house I spotted, in a dimly lit corner, a small snake in a bottle half filled with water. I asked him where it had come from and he explained that it was from the caldera of the famous volcano, Bromo, and had been captured at night during an animist ceremony in which bronze effigies are cast into the crater. The snake was later identified as East Java endemic *Tetralepis frustorferi*, a species confined to high altitude and known from only a few specimens in the Netherlands. As a local celebrity and Javanese speaker, the pawang was able to arrange all sorts of introductions and we soon had a group of collectors, mostly woodsmen and farmers, who would collect especially for us. They were given a small reward for each species captured which was increased if the snake was undamaged. No reward was given for repeat species and a special reward given for anything unusual. The collectors generally proved skilled at snake catching and most of their captures showed no signs of harm and could be released. Careful records were kept of capture sites and associated altitudes. A sample of most species caught was deposited at the Ecology Centre (Pusat Lingkungan Hidup), Trawas, East Java and in certain cases also the British Museum (Natural History).

NEW DISTRIBUTION RECORDS AND OTHER OBSERVATIONS

During the survey 49 species of snake were collected, of which eleven were apparently new records of East Java (Table 1). It is rather strange that a number of common species, particularly *Acrochordus javanicus, Enhydris enhydris, Cerebus rynchops, Naja sputatrix* and *Trimeresurus albolabris* seem to have avoided earlier detection. Below are notes on some of the new records and other species. This is followed by a wider consideration of the distribution and the future of Javanese species.

The Burmese Python *(Python molurus bivittatus)*
This species is relatively common in lowland areas of East Java although neither De Rooij (1917) nor the Bogor Museum of Zoology have records of it from this province. Local snake collectors say that this species is not common in West Java and that most specimens encountered for sale there may well have originated in East Java. These pythons were very prone to bite even when captive from birth.

P. molurus bivittatus is the dark race of the Indian python and is found in S. China, Java and Sulawesi. *P. molurus molurus* and this sub-species may interbreed and produce offspring of intermediate form (Townson, 1980).

Collared Snake *(Sibynophis geminatus)*
This gentle and attractive species is found in East Java at altitudes of over 1000m and may well be widespread at this altitude although current records are only from the Tengger Mountains. It would seem that in Java *S. geminatus* may sometimes have a series of black bars or spots within the light dorso-lateral streaks that run the length of the body (De Rooij, 1917). Kopstein collected specimens with bars from both East and West Java. I have observed only two specimens in East Java and also one from Bali, and none had this character.

It has been suggested that *S. geminatus* and *Sibynophis melanocephalus* are one and the same species (De Haas, 1950) although Tweedie (1983) suggested that the species are distinct and that both may be found in Java. However, in more recent correspondence he considered that *S. melanocephalus* may not be a Javanese species. The status of these two needs clarification.

Shiny Mountain Snake *(Elapoides fuscus)*
This small dark brown snake, confined to Java and Sumatra, is typically found at high elevation. In this survey only a single specimen was collected, at 1200m. In one habitat in the highlands of West Java (900-1200m), with very high humidity and frequent rain, it was the most frequently captured snake with some 800 specimens taken in the course of a year (De Haas, 1941). While

TABLE 1

The Geographical Distribution of Javanese Snakes

	Java			Limit of
	East	Central	West	Distribution
TYPHLOPHIDAE				
Ramphotyphlops braminus	x+	x	x	C. Asia
Ramphotyphlops lineatus	x(1)	x	x	C. Asia
Typhlops ater	x(2)	–	x(2)	C. Asia
Typhlops bisubocularis	–	–	x	Sundaland
BOIDAE				
Python molurus	x*	–	x(3)	C. Asia
Python reticulatus	x+	x	x	C. Asia
ANILIIDAE				
Cylindrophis rufus	x+	x	x	C. Asia
XENOPELTIDAE				
Xenopeltis unicolor	x+	x	x	C. Asia
ACHROCHORDIDAE				
Acrochordus granulatus	x+	x	x	C. Asia
Acrochordus javanicus	x*	–	x	C. Asia
COLUBRIDAE				
Colubrinae				
Sibynophis geminatus	x+	x	x	Sundaland
Elapoides fuscus	x+	x	x	Sundaland
Lycodon capucinus	x+	x	x	C. Asia
Lycodon subcinctus	x+	x	x	C. Asia
Oligodon bitorquatus	x+	x	x	Sundaland
Oligodon octolineatus	x*	–	x	Sundaland
Oligodon propinquus	?	?	?	Sundaland
Oligodon purpurascens	x	–	x(3)	Sundaland
Liopeltis baliodirus	x+	x	x	(C. Asia)
Liopeltis longicauda	–	–	x	Sundaland
Liopeltis tricolor	x	–	x	(C. Asia)
Tetralepis fruhstorferi	x*	–	–	Sundaland
Calamaria bicolor	?	?	?	Sundaland
Calamaria javanica	?	?	?	Sundaland
Calamaria lateralis	?	?	?	Sundaland
Calamaria leucogaster	?	?	?	Sundaland
Calamaria linnaei	x+	x	x	Sundaland
Calamaria lowi	?	?	?	Sundaland
Calamaria lumbricoidea	–	x	x	C. Asia
Calamaria modesta	x*	x	x	Sundaland
Calamaria schlegeli	x	x	x	Sundaland
Calamaria virgulata	–	–	x	Sundaland

* A key to symbols is given at the end of the table.

Pareas carinatus	x+	x	x	C. Asia
Pareas laevis	–	x(4)	x	Sundaland
Aplopeltura boa	x+	–	x	(C. Asia)
Xenodermus javanicus	–	x	x	(C. Asia)
Boiga cynodon	x+	x	x	C. Asia
Boiga dendrophila	x*	x	x	C. Asia
Boiga drapiezii	–	–	x	(C. Asia)
Boiga jaspidea	–	–	x(5,6)	(C. Asia)
Boiga multimaculata	x+	x	x	C. Asia
Boiga nigriceps	x*	–	x	(C. Asia)
Psammodynastes pictus	?	?	?(8)	Sundaland
Psammodynastes pulverulentus	x	x	x	C. Asia
Psammophis condanarus	x(9)	–	–	C. Asia
Chrysopelea paradisi	x+	–	x	C. Asia
Ahaetulla mycterizans	x+	x	x	(C. Asia)
Ahaetulla prasina	x+	x	x	C. Asia
Dryophiops rubescens	x	–	x(3)	Sundaland
Dendralaphis formosus	x	x	x	Sundaland
Dendralaphis pictus	x+	x	x	C. Asia
Gonyosoma oxycephala	x	x	x	C. Asia
Elaphe flavolineata	x+	x	x	(C. Asia)
Elaphe radiata	x+	x	x	C. Asia
Ptyas korros	x+	x	x	C. Asia
Ptyas mucosus	x+	x	x	C. Asia
Zaocys carinatus	x*	–	x	C. Asia
Xenalaphis hexagonotus	–	–	x	C. Asia
Homolpsinae				
Enhydris alternans	–	–	x(7)	Sundaland
Enhydris enhydris	x*	x	x	C. Asia
Enhydris plumbea	x+	x	x	C. Asia
Homolopsis buccata	x+	x	x	C. Asia
Cerebus rynchops	x*	x	x	C. Asia
Fordonia leucobalia	–	x	x	C. Asia
Natricinae				
Rhabdophis chrysargoides	–	–	x	Sundaland
Rhabdophis chrysargus	x+	x	x	C. Asia
Rhabdophis subminiatus	x+	x	x	C. Asia
Macropisthodon rhodomelas	?	?	?	(C. Asia)
Pseudoxenodon inornatus	?	?	?	Sundaland
Xenochrophis piscator	x+	x	x	C. Asia
Xenochrophis vittatus	x+	x	x	Sundaland
Sinonatrix trianguligera	x	x	x	(C. Asia)
ELAPIDAE				
Bungarus candidus	x+	x	x	C. Asia
Bungarus fasciatus	x+	x	x	C.Asia
Bungarus javanicus	x	–	x	Sundaland
Bungarus flaviceps	?	?	?	C. Asia
Naja sputatrix	x*	x	x	Sundaland
Ophiophagus hannah	x*	x	x	C. Asia

Plate 1. Collared Snake, *Sibynophis geminatus,* is found in East Java at altitudes over 1000m. The species may sometimes have black bars or spots in the orange dorso-lateral streaks.

Plate 2. The presence of Russell's Viper, *Vipera russelli siamensis,* in Java was only confirmed in the 1930's. Its distribution in Java is limited to a few sites on the western edge of Surabaya City.

Plate 3. Malayan Pit Viper, *Callosellasma rhodostoma* (juvenile), this species is common in the dry forested areas in the north west of East Java.

Plate 4. White-lipped Pit Viper, *Trimeresurus albolabris*, is a very common cause of snakebite in lowland East Java, victims appear to be bitten only at night.

Maticora bivirgata	x	–	x(5)	Sundaland
Maticora intestinalis	x+	x	x	Sundaland
VIPERIDAE				
Calloselasma rhodostoma	x+	–	x	C. Asia
Trimeresurus albolabris	x*	x	x	C. Asia
Trimeresurus puniceus	x+	x	x	Sundaland
Vipera russelli	x+	–	–	C. Asia

x	**Species present**
–	**Species yet not found**
?	**Species recorded but with no precise locality**
*	New distribution record for East Java
+	**Species reconfirmed during this survey**
(C. Asia)	**A Sundaland species, extending only a short distance into continental Asia**

1) Bogor Museum, Indonesia
2) Brongersma (1934)
3) Kopstein (1930)
4) Jong de (1930)
5) Haas de (1941)
6) Kopstein (1929)
7) Gyi Ko Ko (1970)
8) Rasmussen (1975)
9) Mertens (1957b)

in another habitat with a similar altitude, but seasonally dry climate, the species was relatively scarce. East Java habitats with dense populations of this species have not yet been encountered; they may be generally too dry.

Javanese Kukri Snake *(Oligodon bitorquatus)*
This species is fairly common at 400-1000m and has been found as high as 1600m. It is probably endemic to Java. The most westerly record is from Panaitan Island just off the coast of Java (Mertens, 1957a). An old record from the eastern island of Ambon reported in De Rooij (1917) may well be in error.

This snake has a seemingly gentle disposition but if handled may eventually grasp some flesh in its mouth and drag its blade like teeth back through the skin, making a series of parallel razor cuts up to a centimetre long. This action is very slow and deliberate and gives the impression that the snake is using its teeth like a can-opener.

Fruhstorfer's Mountain Snake *(Tetralepis fruhstorferi)*
This species is endemic to East Java and occurs only at high altitude, almost certainly no lower than 1000m. All records to date have been from the Tengger Mts and apparently from the drier western side (Fig. 2); it apparently has a preference for a cool, seasonal climate. These conditions occur in a few other East Java localities (Fig. 2) so it is possible that, in due course, a wider distribution may be recorded. The species may be quite common in the Bromo caldera since three expatriates, visiting the area on separate occasions during daylight, reported seeing snakes that would fit the description of this species – slow moving, small and pinkish-brown.

Javanese Reed Snake *(Calamaria linnaei)*
This species is abundant at and above 700m. Most specimens taken in this study had white bellies patched with black quadrangles. However, two out of seventeen specimens had red bellies. Van Hoesel (1959) considered that red bellies were the norm while Inger and Marx (1965) make no mention of this character. Another species, *Calamaria modesta* was identified by Dr Colin McCarthy from a single damaged specimen; this was the first East Java record for this species.

Specimens of *C. linnaei* could be maintained for some weeks in captivity in upland areas but if brought down to sea level either with no precautions or in an insulated box, to a drier hotter climate, they died within 24 hours. It would seem that they are very prone to the stress inflicted by travel and/or climatic change.

Indo-Chinese Rat Snake *(Ptyas korros)*
P. korros is extremely common in a wide variety of habitats throughout East Java. This species is considered normally to have either two or three loreal scales in Malaya (Tweedie, 1983), the Asian region (Smith, 1943) and Java (De Rooij, 1917). However, in half of the East Java specimens examined there was only a single loreal, all others had two.

Oriental Rat Snake *(Ptyas mucosus)*
This common speies is prized by snake collectors for its skin. It is apparently much less common in West Java and there seems to be only a single record from Sumatra. This would seem to be a good example of a continental Asian species that thrives in East Java.

Red-necked Keelback *(Rhabdophis subminiatus)*
R. subminiatus is rarely encountered on coastal plains but may be quite common in wooded areas up to at least 500m and in West Java is common at 700-1200m (De Haas, 1941). This is the only species of keelback known to be dangerously poisonous to man. There is one documented record of serious poisoning by a specimen apparently originating from Thailand. I have also met a somewhat eccentric butterfly collector, Scipio Pariwono, from Bogor (West Java), who had been hospitalised after a bite from this species. He had photographed both the snake and his symptoms, which included very widespread bruising.

Checkered Keelback *(Xenochrophis piscator melanozostus)*
This species is very common in lowland areas throughout East Java. The subspecies *X. piscator melanozostus*, probably found only in Java and Sumatra, is dimorphic having either 5 (4 on the neck) rows of black spots or stripes running the whole or part of the length of the body. The two forms are equally common and may have bright red flanks. Three other subspecies, which occur elsewhere, have only spots (Smith, 1943).

Striped Keelback *(Xenochrophis vittatus)*
The Striped Keelback is very common in paddy fields and gardens. Until recently it was only recorded from Java and Sumatra but it now appears to have found its way to Singapore, possibly through the pet trade. A snake dealer in West Java, who exports this species under the name 'SE Asian Garter Snake', has maintained large numbers together and noticed them to be very prone to density dependant mortality.

Indo-Chinese Sand Snake *(Psammophis condanarus indochinensis)*
There is only one record of this species from Indonesia (Mertens, 1957b). The specimen in question was a road traffic victim in Gresik, an area with a particularly dry climate. Elsewhere it is found in Thailand and Burma at elevations up to 2000m (Smith, 1943). In view of the fact that only one specimen has ever been collected, Liong (1958) suggested that it may have been introduced accidentally by trade. If the species was/is genuinely established in East Java then it may share the same unusual, discontinuous distribution shown by *Vipera russelli siamensis* (see below). In 1991, I could find no local snake collectors who recognised this species; a likely and as yet largely unchecked habitat for *P. condanarus* are the foothills and associated teak forests in the north west of the province.

Russell's Viper *(Viper russelli siamensis)*
Only during the 1930s was it confirmed that *V. russelli* occurred in Java (Neuhaus, 1935). Recent detailed study of the population systematics of *V. russelli* by Wüster *et al.* (1991) has shown Javanese specimens to be typical of the Burma/Thailand population, *V. russelli siamensis*, and distinct from *V. russelli limitis* found in the Lesser Sunda Islands eg. Flores, Komodo.

The *V. russelli* population in Java appears to be confined to two sites west of Surabaya City. Reports from farmers and snake catchers suggest that it may also be encountered in the dry teak plantations around Gresik and Bojonogoro although there may be some confusion with *Calloselasma rhodostoma*. During three years I obtained six records of *V. russelli*, all specimens killed by cars on the motorway running close to a military cemetery (Kembang Kuning). It is quite possible that a nearby wooded area, preserved because it houses an ammunition dump, provides the necessary cover in an otherwise heavily cultivated area. Specimens were only ever collected in July or August, which is in the middle of the dry season and about three months to the onset of the rains. It would seem probable that mating occurs at this time of the year, especially as in one instance specimens were taken as a pair.

It is believed that the current distribution of *V. russelli* (and probably *P. condanarus)* has resulted from climate change in the recent past. As sea levels fell during the ice ages the sea floor (Sunda shelf) became a plain stretching from Thailand to eastern Sumatra and Java. This plain incorporated a corridor, with a seasonally dry climate, along which species favoured by these conditions might spread (Morley and Flenley, 1987). Subsequent rises in sea levels and the return of a more humid climate to several areas probably eliminated these species from all but those places retaining a seasonal climate, such as East Java (Wüster *et al.* 1992). However, the very limited distribution of *V. russelli* in Java, to just a few areas close to Surabaya rather than more widely in the dry northern coastal strip, is still unexplained. The same phenomenon is noticed elsewhere, as in continental Asia its distribution is said to be capricious (Smith, 1943).

Malayan Pit Viper *(Calloselasma rhodostoma)*
C. rhodostoma appears to prefer dry forested areas and is locally quite common, especially in the north west of the province although there are records from other locations up to 1600m. Tweedie (1983) suggested that *C. rhodostoma* prefers a climate with a distinct wet and dry season, so that East Java would appear to be a particularly suitable place although its distribution within the province is clearly very patchy.

White-lipped Pit Viper *(Trimeresurus albolabris)*
This species is very common in lowland areas and is often encountered in Surabaya gardens. During the day time snake collectors handle this viper with no precaution although they say that at night time it must be treated with respect. The pawang who accompanied me collecting and who specialised in the magic treatment of snakebite said that this species was the most common source of bites in and around Surabaya and that most people bitten would come to him, rather than go to hospital for fear that the afflicted part might be amputated. He claimed a 100% success rate in cure suggesting that the venom of this species is of rather low toxicity. In West Java, De Haas (1941) found this species to be very common in coffee and tea plantations at 700-1200m but bites to be very rare. Presumably, this is because plantation workers are generally not exposed to this species at night time.

Another species *Trimeresurus puniceus,* the Flat-nosed Pit Viper, occurs in East Java but has only been found at altitudes above 1500m. This species has been referred to as a 'hill variety' of *T. albolabris* (De Haas, 1941) despite great differences in the shape of the head and colour pattern.

Javanese Krait *(Bungarus javanicus)*
This species was first recorded from Cirebon in West Java and is said to be confined to the north coast of the island. Two specimens received by the Bogor Museum of Zoology were taken from a traditional medicine man in Surabaya. I have never met East Javanese who knew it and so conclude that the species is probably rather uncommon.

King Cobra *(Ophiophagus hannah)*
Specimens of this species are frequently on display in snake restaurants and are for sale at £30-£40. Judging by the numbers that I have seen it must still be fairly common, at least locally. In East Java, I have been informed that most specimens come from the forested slopes around Mt Semeru in the Tengger Mts.

Southern Spitting Cobra *(Naja sputatrix)*
This species has provisionally been re-established from the sub-species *Naja naja sputatrix* (Wüster and Thorpe, 1989) and is restricted to Java and the Lesser Sunda Islands. Further study is required to clarify its relationship with cobras in Sulawesi.

In East Java this is one of the most common snakes. In West Java, De Haas (1941) considers that it probably does not reach elevations above 700m; a similar limit would seem to obtain in East Java. Colour variation is considerable and with some geographical trends. Specimens from Malang and eastward, as far as Lumajang (see Fig. 2), tend to be black or dark brown. Further east they become lighter in colour and in and around Banyuwangi whitish specimens are common. Freshly captured specimens will readily spit venom but after a short while in captivity are generally reluctant to do so. When spitting, the venom stream breaks up soon after discharge to produce a spray rather than the accurate jet of venom typical of the African 'spitters'.

DISTRIBUTION OF JAVANESE SNAKES

Snake distribution between the provinces of Java and an indication of those species also found in continental Asia is given on Table 1; most records come from Brongersma (1929) or Tweedie (1983); others are referred to in Table 1. As long ago as 1929, Dammerman noted that the fauna of Java was not as rich as that in other areas of Sundaland and that the number of species declines from west to east. Data gathered on snakes since 1929 have not changed this view (Table 2). Other areas of Sundaland still have more species, mostly *Calamaria* and rarer montane forms, and East Java has 12% and Central Java has 30% fewer records than West Java. Perhaps records from the Central province would receive a boost from more intensive study.

TABLE 2

Numbers of snake species recorded in the component areas of Sundaland

Geographical location	Number of Species	Source
Sumatra	131	De Haas (1950)
Borneo	133	Haile (1958)
Malaya	117	Tweedie (1983)
Java	84	
	Java Provinces West Central East 71 49 62	

Of the 84 recorded land snakes of Java, half are species that occur only in Sundaland and half are also well established in continental Asia. East Java is well supplied with species typical of continental Asia. It would appear likely that two, *Ptyas mucosus* and *Python molurus*, are probably more abundant in East Java than elsewhere on the island and that two other species, *Vipera russelli* and *Psammophis condanarus*, are found only in this province and are probably confined to very restricted localities.

It is interesting to note that many species recorded as common in lowland habitats in Malaya by Tweedie (1983) appear to be confined to the middle of higher zones in East, and to some extent also West Java. Specific examples are *Maticora bivirgata, Maticora intestinalis, Pareas carinatus, Psammodynastes pulverulentus, Rhabdophis chrysargus, Lycodon subcinctus* and *Sinonatrix trianguligera*. This may result from the virtual absence of evergreen lowland forest and a generally less favourable lowland climate where competition from species more tolerant of the prolonged dry season confines the others to higher ground. It is also possible that some species may be recorded from lower altitude, once the moister forested areas that still remain, in particular those adjacent to the south coast, have been more thoroughly investigated. Table 3 shows the altitude ranges of species found in East Java according to their limits of distribution in continental Asia or Sundaland. To prepare this table an assessment was made of the likely altitude ranges of those species for which sufficient data exist (60). It is clear that in East Java the majority of species limited to Sundaland occur on higher ground with 33% not found below 1000m (Table 3). Continental Asian species appear to be far more tolerant of hotter drier conditions as they are better represented in the lower and middle elevations and have 35% of species able to exist over the widest altitude range, sea-level to above 1000m. Only a single Sundaland species, *X. vittatus*, is this versatile. However, despite this trend two of the species believed to be endemic to Java, *Tetralepis fruhstorferi* and *Bungarus javanicus* are also apparently restricted to areas with a seasonal climate, *B. javanicus* to the north coast and *T. fruhstorferi* to an area of the Tengger Mountains. It is assumed that they have evolved to occupy an environment with a seasonal climate and that their limited range is a reflection of this.

TABLE 3

Numbers of East Java snake species (%) found at various altitude ranges reflecting the limit of species distribution to Sundaland or continental Asia

	Distribution limit	
Altitude range	Sundaland	C. Asia
Only above 1000m	8 (33)	0 (0)
500m to above 1000m	9 (37)	7 (19)
Sea level to above 1000m	1 (4)	14 (39)
Sea level to 1000m	4 (17)	6 (17)
Sea level to 500m	2 (8)	9 (25)

THE FUTURE FOR THE SNAKES OF EAST JAVA

The need to conserve snakes in Java is not widely recognised despite the ever increasing threat of Java's industrialisation and burgeoning human population. However, although it may have to be accepted that, outside park areas, many of the more sensitive species may in the long term be doomed, there is still much that could be done to help maintain the diversity of the snake species that can survive the onslaught of intensive agriculture. The Indonesian public have no access to even simple literature on their native species; there are apparently no organisations actively promoting the well being of Javanese reptiles at large and there are no programmes, unlike say in Thailand, to educate farmers about the advantages of protecting rodent predators. Over the last few years farmers have become increasingly aware of rodent damage to their crops, yet to date there has been no effort to educate people in rural areas that this problem would be greatly reduced if they were to avoid the indiscriminate killing of those harmless snakes which eat rodents. Instead, they are encouraged to pay for rodenticides which they can ill afford and which are at best only partially effective. Further. the trade in skins flourishes.

The first steps in the conservation of these creatures must be through education. The dissemination of cheap and simple but attractive literature would be of great benefit. So also would assistance to the Deaprtment of Agriculture so that it can mount simple farmer education programmes.

Over many years huge numbers of certain species, particularly cobras *(N. sputatrix)* and rat snakes *(Ptyas* spp), have been collected and killed for their skins but these species seem very robust and it is likely that while there is sufficient food and suitable habitat there is no immediate danger to their survival. However, special conservation measures are needed for several species. The pythons *P. reticulatus* and *P. molurus bivittatus* and the King Cobra *(O. hannah)* are very vulnerable as their high value in trade means that even when numbers have seriously declined the search for them will be relentless. In more immediate danger is *V. russelli siamensis* which is confined to small areas west of Surabaya and which may be lost as Surabaya expands. Fortunately, one site that it occupies, a wooded ammunition dump (Kembang Kuning), could easily be preserved and with it a species that is one of the clues to Java's geological past. The endemic *T. fruhstorferi* is also a species of special interest occuring in a limited area which fortunately includes the Luat Pasir Tengger Nature Reserve (3800 ha) and the Bromo Tengger Semeru National Park (53200 ha). It is important to establish the current status of the species over its small range and, if necessary, to implement measures to secure its future.

Plate 5. Javanese Kukri Snake, *Oligodon bitorquatus*, is probably endemic to Java and in the eastern province is common at 400-1000m.

Plate 6. Frustorfer's Mountain Snake, *Tetralepis frustorferi*, is endemic to East Java and has so far only been recorded from the drier western side of the Tengger Mountains, at altitudes well above 1000m.

Plate 7. Red-knecked Keelback, *Rhabdophis subminiatus*, is common in wooded areas at altitudes up to 500m. Humans bitten by this species may suffer serious symptoms.

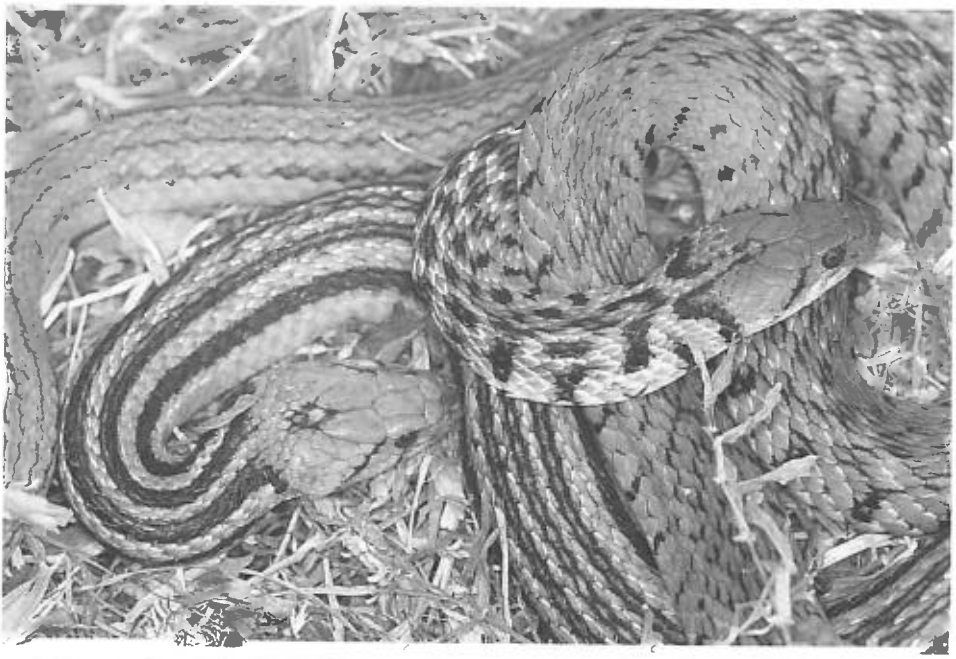

Plate 8. Checkered Keelback, *Xenochrophis piscator melanozostus*, is a common paddy field species and this particular subspecies has as striped and spotted form.

Plate 9. Striped Keelback, *Xenochrophis vittatus*, sometimes known as the 'SE Asian Garter Snake' is a very common species found at sea-level up to at least 1000m.

Plate 10. Flat-nosed Pit Viper *Trimeresurus puniceus*, is relatively uncommon and occurs at high altitude in East Java.

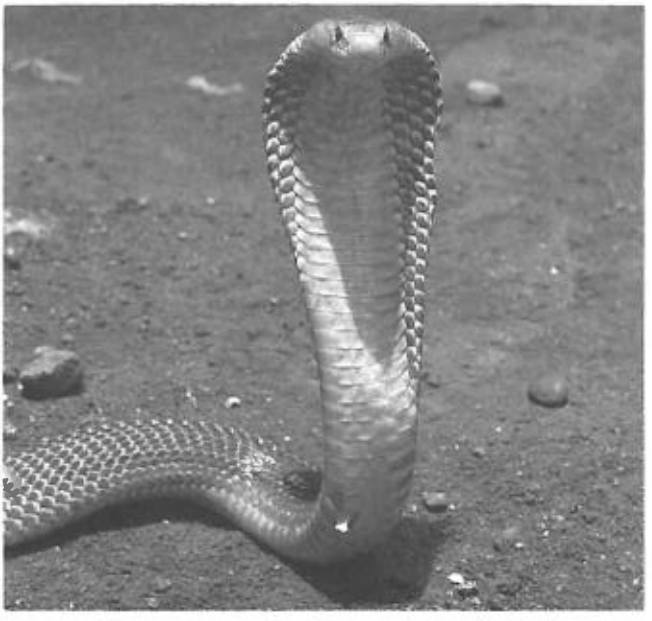

Plate 11. A light coloured specimen of Southern Spitting Cobra, *Naja sputatrix*, from Banyuwangi, East Java. This species ejects a diffuse spray of venom rather than accurate jets.

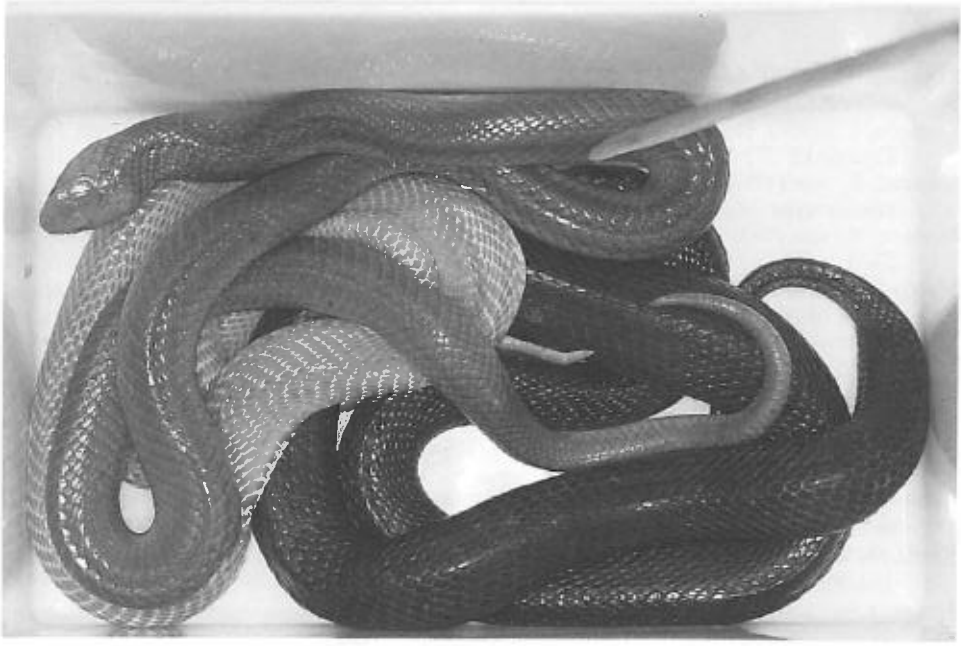

Plate 12. Southern Spitting Cobras, *Naja sputatrix*, showing the range of colour variation encountered in East Java, from black to light brown. Within East Java specimens tend to be lighter coloured from the more easterly locations.

ACKNOWLEDGEMENT

Thanks are due to the many people who helped with this study, in particular Vincen Khartono and members of the Cobra Putih dance troop, Prof. M.W.F. Tweedie, Dr Boeadi (Bogor Museum of Zoology), Dr Colin McCarthy (BMNH) and Dr Rinus Hoogmoed (Natural History Museum, Leiden). Finally, my wife accepted many snakes around the house, rescued escapees and put up with weekends disrupted by collecting.

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HERPTILES FROM THE TYPE HOXNIAN (MIDDLE PLEISTOCENE INTERGLACIAL STAGE) AT HOXNE, SUFFOLK

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INTRODUCTION

The type site for the Middle Pleistocene Hoxnian Interglacial Stage occurs at Hoxne (pronounced "Hoxen"), Suffolk. The site consists of organic lake deposits overlain by a series of stream, lake and solifluction deposits, all of which occupy a basin in the older Anglian Glacial Stage Chalky Boulder Clay (Stuart, 1982).

Hoxnian Interglacial Stage herpetofaunas are of considerable interest, in general, because they may be made up of as many as 50% exotic continental species (Holman, Stuart and Clayden, 1990). Stuart (1982) has listed ". . . frog and/or toad bones . . . " from the type site at Hoxne, but other than this notation, no other herptiles have been reported from this locality.

In the summer of 1990, I was able to study the herpetological material from the site at Hoxne at the Natural History Museum, London, and this short paper is the result of this work. Aside from a small number of herptile bones, the Hoxne site contains fossil fishes, birds and extinct and extant mammalian species; as well as flint blades, cores, flakes, scrapers and Acheulian hand axes. The Hoxne site contains fossil evidence of vegetational changes from oak forest to more open herbaceous communities, as well as changes from warmer to somewhat cooler climates.

SYSTEMATIC PALAEONTOLOGY

Numbers are of the Natural History Museum, London.

Class Amphibia

Order Anura

Family Bufonidae

Bufo bufo (Linnaeus)

Material. — R-12269, right ilium (Fig. 1a); R-12270, right ilium (Fig. 1b) and distal portion of left humerus.

Remarks. — Characters for distinguishing the ilia of European species of *Bufo* species have been given by Holman (1989). The two above ilia come from different individuals. Ilium R-12269 has a low, rounded dorsal prominence and a number of perforations around the acetabular area (Fig. 1a). These characters are typical of young individuals. Ilium R-12270 has a higher, more well-developed dorsal prominence and fewer perforations around the acetabular area (Fig. 1b). This is typical of somewhat older individuals. The humerus represents a male, as it has the dorsal tendinal flange well-developed.

Bufo sp. indet.

Material. — R-12271, right scapula.

Remarks. — The scapulae of *Bufo* may be separated from those of *Rana* on the basis that *Bufo* lacks the ridge on the dorsomedial side of the bone that occurs in *Rana* (see Hallock et al., 1990, Fig. 4). I was unable to identify this element to the specific level.

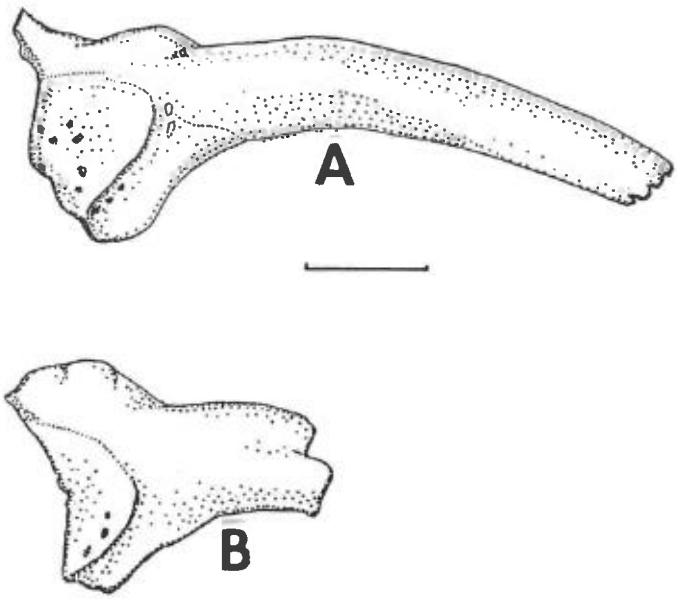

Fig. 1. Right ilia of *Bufo bufo* from the Hoxonian type site at Hoxne, Suffolk. A, R-12269; B. R-12270. The line equals 2 mm and applies to both figures

Class Reptilia

Order Squamata

Family Colubridae

Natrix natrix (Linnaeus)

Material. — R-12272, trunk vertebra.

Remarks. — The vertebra has the end of the hypapophysis blunt rather than acute as in *Natrix maura* and *Natrix tessellata* (Szyndlar, 1984).

Natrix sp. indet.

Material. — R-12273, two small, fragmentary trunk vertebrae; R-12274, one fragmentary caudal vertebra.

Remarks. — These fragmentary vertebrae represent *Natrix*, but do not have specifically diagnostic parts.

COMMENT

The small sample of amphibian and reptile bones found at the type Hoxnian site at Hoxne is surprising in the light of the large assemblage of amphibians and reptiles that was recovered from the Cudmore Grove Hoxnian Site, Mersea Island, Essex (Holman, Stuart and Clayden, 1990). The Cudmore Grove Site yielded 14 herpetological species, half of which were exotic continental forms. The lack of exotic species at Hoxne is also somewhat surprising, as collectively, previously studied Hoxnian sites in Britain have yielded 46.5% exotic species (Holman, 1993).

The two common herptiles, *Bufo bufo* and *Natrix natrix*, do not tell us much about the climate or environment of the type Hoxnian site, as both species occur in interglacial as well as some glacial sites in Britain (Holman, 1993). Both animals, however, could have existed near the lakes or slow-moving streams indicated by the sediments at the site, utilizing these aquatic situations for breeding purposes (*Bufo bufo*), or for hunting prey (*Natrix natrix*).

ACKNOWLEDGEMENTS

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DIVERSITY AND ECOLOGICAL ANALOGUES AMONG DESERT REPTILES

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INTRODUCTION

Diversity is often regarded as a measure of the richness of species in a faunal region or biome. This concept provides a more useful measurement of the characteristics of a community when it is combined with an assessment of the relative abundance of the various species present. It does not, however, take into account the variety of morphological forms in the area – cursorial, fossorial, aquatic, arboreal and so on. Moreover related groups or taxa of smaller animals may not only be represented by more species than there are in taxa of larger animals in the same habitat, but they also contain more individuals of each species. There are naturally many more micro-environments in the same region than there are major habitats and, consequently, both more species and more individuals in them. Furthermore, it is a matter of opinion whether diversity should be reckoned in terms of the numbers of species present, or in the genetic variability within each of these species. More homogeneous environments must, obviously, contain fewer species than do less homogeneous environments, while the most numerous species occupy extensive habitats such as wide expanses of grassland or, in the desert biome, a sea of sand dunes rather than, say, a single tuft of perennial grass.

The diversity of reptiles lies not so much in their diversity of form as in the number of times that a particular shape or physiological adaptation has been evolved independently in different taxonomic groups. These often respond to environmental factors in remarkably similar ways. When quite unrelated species come to look alike as a result of parallel evolution in different geographical regions, they may be known as 'ecological equivalents' or, more precisely, as 'ecological analogues'. Some of the best known mammalian examples are the Fennec Fox of the Sahara, which has a number of adaptive characters that parallel those of Nearctic Kit Foxes, and the Kangaroo Rats of the North American deserts which closely resemble the Jerboas of the Palaearctic realm. Reptilian examples include the Australian Thorny Devil *Moloch horridus* (Agamidae) and its approximate analogue *Phrynosoma platyrhinos* (Iguanidae), the Horned Lizard of the North American deserts, both of which exploit a diet of ants. Analysis demonstrates that these two species are morphologically closer to one another than is either to any other species of its *own* lizard taxon. No lizard of any other desert region of the world has adopted a similar life style (Pianka, 1985, 1986).

Another well-known reptilian example of ecological analogues is provided by the North American Sidewinder *(Crotalus cerastes)* (Crotalinae) and its Palaearctic counterpart, the Saharan Sand Viper *(Cerastes cerastes)* (Viperinae). Both these snakes move by throwing lateral loops forward, and hide themselves by flattening their bodies and shovelling sand over their backs. They are so much alike in general appearance that, were it not for the rattle of *Crotalus cerastes* and the pits between its eyes and nostrils, the two might easily be confused (Cloudsley-Thompson, 1991).

In his analysis of the ecological niche and community structure of the lizard faunas of the North American Kalahari and Australian deserts, Pianka (1985, 1986) pointed out that both North America and Australia have long-legged species that frequent the open spaces between plants – the iguanid *Calisaurus draconoides* and *Amphibolurus* (= *Ctenophorus*) spp. (Agamidae) respectively – while each region has a medium-sized lizard-eating species *(Crotaphytus wislizeni* (Iguanidae) in North America, and *Varanus eremius* (Varanidae) in Australia. A few Kalahari – Australia species pairs are also roughly equivalent e.g. the subterranean skinks *Typhlosaurus* and *Lerista* spp. (Scincidae) and the semi-arboreal *Agama hispida* and *Amphibolurus* (= *Pogona) minor* (Agamidae).

In addition to the examples already mentioned, other members of the Agamidae frequently occupy similar or analagous ecological niches to those of Iguanidae. Examples include *Uromastix* spp. (Agamidae) of the Great Palaeractic desert and North American *Sauromalus* and *Cachryx* spp. (Iguanidae). The south-east Asian agamids *Leiolepis spp.* resemble North American iguanids such as *Dipsosaurus dorsalis* and the Australian *Amphibolurus pictus* (Agamidae) while the Iranian agamid *Phrynocephalus mystaceus* and the African gecko *Geckonia chazaliae* may also have many characters in common. Despite this, Pianka (1985, 1986) concluded that the differences between the ecologies of most lizard species in the three continental deserts that he studied, are much more striking than are the similarities. 'It is easy to make too much out of convergence, and one must always be wary of imposing it upon the system under consideration'.

Neverthless, recognition of convergence is an important factor in the understanding of natural selection. (Another example of convergence upon which I do not intend to elaborate here, is provided by the adaptive coloration of desert animals, including reptiles, which almost always match the sandy hues of their environment, or else are black (Cloudsley-Thompson, 1979). It is almost a tautology to state that a particular biome, such as the desert, should engender comparable adaptations in its fauna in different zoogeographical realms of the world. Pianka (1986) provides an excellent example based on scorpion predation. While scorpions are solitary prey items, they are extremely large and nutritious, thereby presumably facilitating the evolution of dietary specialization. In the Kalahari they are preyed on by *Nucras tessellata* (Lacertidae) and in Australia by *Pygopus nigriceps* (Pygopodidae). The diurnal *N. tessellata* forages widely to capture these animals in their daytime retreats, whereas the nocturnal *P. nigriceps* sits and waits for scorpions moving at night, above ground, during their normal period of activity. No North American desert lizard specializes on a diet of scorpions, but the small snake *Chionactis occipitalis* (Colubridae) appears to have usurped this ecological role.

Whereas some lizards have evolved as dietary specialists, rather more are generalists. *Moloch horridus* and *Phrynosoma* spp. eat essentially nothing but ants. The Kalahari lizards *Mesalina lugubris* (Lacertidae) and *Typhlosaurus* spp. (Scincidae) feed entirely on termites as do the Australian nocturnal geckos *Diplodactylus conspicilatus* and *Rhynchoedura* spp. as well as some day-active *Ctenotus* spp. (Scincidae) (Pianka, 1986). Dietary diversity occurs in many species of lizards which eat almost everything they can catch and overcome. Variations in diet also occur within the same species, both from time to time and from place to place, as opportunities present themselves and the abundance of particular prey species fluctuates.

The existence of ecological analogues and convergence among reptiles is more evident in a comparatively homogeneous biome, such as desert, than it is in more complex environments. Nevertheless it often becomes apparent in specialized ecological niches everywhere.

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REVIEW

A Short History of British Reptile Keeping. C.H. Keeling. 1992. Clam Publications, 27pp. £4.50 from C.H. Keeling, Pound Place, Shalford, Guildford, Surrey.

If you think that a book which describes the history of reptiles in captivity from the Aztecs to the present day is a little out of the ordinary, even for the herpetologist, you'd be right. But then Clam Publications is no ordinary publisher. Founded by Clinton Keeling (a noted naturalist and zoo historian) in 1983, to publish the books that the author wanted to write rather than books that commercial publishers wanted written, Clam Publications boasts some sixteen titles, all concerned with the history of zoological collections or animal husbandry in general.

This short, but extremely well-researched book, is a delight to read. The author describes how reptile keeping has progressed from the days of William Laud, the one-time Archbishop of Canterbury who owned a spur-thighed tortoise and in doing so became Britain's first reptile keeper. In taking the story through to the present day the author presents a host of fascinating facts and figures. Did you know that the Tower of London menagerie once had a collection of over 100 rattlesnakes? Or that the first notes on the captive maintenance of chameleons were made by Sir Robert Heron MP as long ago as 1820? Or that Kennington Underground Station was once the site of a zoo with a collection of boas and pythons?

The history of the three reptile houses at London Zoo are dealt with in some detail. The second reptile house built in 1883 still stands today as the bird house, and the outlines of the orignal crocodile pools can still be seen on the floor. Although serious captive-breeding is generally seen as a development of the 1980s and 1990s, Keeling highlights some impressive records from years ago. By 1880 London Zoo had bred a wide range of species, including painted terrapins, rattlesnakes, boas and pythons, and most impressive of all, all three species of British snake (a feat which has not been repeated, or indeed attempted, in more recent times). The well-known story of Stewart Girling, the drunken keeper who died after mishandling a cobra, is described in graphic detail.

The author points out that until the 1960s, reptile-keeping was always a minority occupation even by serious zoologists. At about this time came, what Keeling calls "the reptile revolution". Indeed, the book ends on a note of some concern, as Keeling describes the present level of private reptile keeping as nothing more than a "craze" which can do no good for herpetology as a whole. He applauds the work done by the serious private keeper in the name of science, conservation or education, but expresses some concern that such activities may be overshadowed by those of less-serious and poorly informed individuals.

Like other Clam Publications *A Short History of British Reptile Keeping* is home-produced in typescript, run-off on a photocopier, and loosely bound, with a few line drawings and photos. Keeling writes with authority, verve and enthusiasm, however, and does not shy away from controversy. This book is a fascinating insight into herpetology of bygone days, and is a delightful departure from the current crop of more conventional titles.

Richard Griffiths

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THE CARE AND BREEDING OF CAPTIVE REPTILES

Edited by: S. Townson, N.J. Millichamp, D.G.D. Lucas and A.J. Millwood

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