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THE BRITISH HERPETOLOGICAL SOCIETY

BULLETIN

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

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

Ordinary Members	£20	(Receive Bulletin only)
Full Members	£25	(Receive Bulletin and Journal)
Family Members	£30/£37.50	(Without/with Journal) Family members with children also receive the YHC Newsletter
Student Members	£18	(Receive Bulletin and Journal)
Institutional rates	£36	(Receive Bulletin and Journal)
YHC (Age 9-18):		
Basic Membership	£6	
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
Rana hosei, a small forest frog (42-98 mm) in Malaysia, whose relative abundance is highest in primary forest. (Photographed in Belum Forest Reserve, Perak, March 1994, by C H Diong). See article on on P.2 by Heang et al.

REMAINING BRITISH HERPETOLOGICAL SOCIETY MEETINGS FOR 1996

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

November 10th Annual BHS Captive Breeding Stock Sale and Meeting. New Denham Community Centre, Bucks (off M40, J1), 2-5 pm. Privately-bred captive stock will be available from BHS members, plus herpetological society displays and trade stands (dry goods, vivaria equipment, books, etc). Applications for tables are available from John Spence, 23 Chase Side Avenue, Enfield, Middx, EN2 6JN (tel. 0181 366 8127).

December 7th Research meeting – Birkbeck College, 11.00-16.00. See flyer.

BHS NORTH WEST MEETINGS 1996

December 3rd Christmas Social

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.

BRITISH HERPETOLOGISTS

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

Beddome, Richard Henry (1830-1911): need portrait
Blandford, William Thomas (1832-1905): need biography
Catesby, Mark (1683-1749): need portrait and signature
Cott, Hugh Bamford 91900-1987): need portrait and biography
Fayrer, Joseph (1824-1907): need biography
Flower, Stanley Smyth (1871-1946): need biography
Fox, Harold Munro (1889-portrait, signature, and biography
Gadow, Hans Friedrich (1855-1928): need biography
Huxley, Thomas Henry (1825-1895): need biography
Ionides, Constantine John Philip (1900-1968): need portrait and biography
Jerdon, Thomas Claverhill (1811-1872): need signature and biography
O'Shaughnessy, Arthur W. E. (1844-1881): need portait and biography
Owen, Richard (1804-1892): need biography
Procter, Joan Beauchamp (1897-1931): need biography
Ray, John (1627-1705): need signature and biography
Theobald, William (1829-1908): need portrait and biography
Topsell, Edward (1572-1625 or 1638): need portrait and biography
Tyson, Edward (1650-1708): need portrait and signature
Watson, David Meredith Seares (1886-1973): need biography
Needed materials are indicated above. Any materials or leads to materials would be appreciated (and acknowledged in the book). Current addresses of family member descendents are also solicited. **Prof. Kraig Adler, Cornell University, Division of Biological Sciences, Seeley G. Mudd Hall, Ithaca, New York 14853-2702, USA.** *(telephone: 607-254-4392, fax: 607-254-4308, e-mail: kka4@cornell.edu).*

ERRATUM: In: "Baker, J and Gibson, R. (1995). The precarious status of *Rana dalmatina* on Jersey. *British Herpetological Society Bulletin* **54**, 34-36", the photograph of *Rana dalmatina* should have been credited to Robert Guyétant.

TO DETERMINE THE EFFECTS OF LOGGING AND TIMBER EXTRACTION, AND CONVERSION OF PRIMARY FOREST TO TREE CROP PLANTATIONS, ON HERPETOFAUNAL DIVERSITY IN PENINSULAR MALAYSIA

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INTRODUCTION

Malaysia comprises the eleven states of Peninsular Malaysia, Sabah and Sarawak, and forms a crescent over 1000 miles (1609 km) long between latitudes 10° and 7° N. and longitudes 100° and 119° E. Peninsular Malaysia abuts the Thai border in the north, and extends from the isthmus of Kra to the Singapore Strait, with the South China Sea on the east coast and the Straits of Malacca on the west. The climate is tropical with the year commonly divided into the south-west and north-west monsoon seasons. The Federation of Malaya became an independent member of the Commonwealth in 1957, and, as Malaysia, acceded also Sabah (formerly British North Borneo) and Sarawak from 1963. Kuala Lumpur, the capital, was proclaimed Federal Territory from 1974. Bahasa Malaysia (Malay) is the official language, but English, various dialects of Chinese, and Tamil are also widely spoken.

As the result of discussions prompted by the Tropical Forest Forum with the British Government's Department of the Environment, concern was expressed on the impact of logging activities on faunal and floral diversity in pristine habitats that the world's primary rain forests represent, including those of Malaysia. A consequence of this was the signing of a Memorandum of Understanding between the Governments of Malaysia and the United Kingdom in May 1992 for a joint five-year programme on Conservation, Management and Development of Forest Resources. Respective ecological and economic aspects of the programme were defined by two sub-programmes:

A. Conservation of biodiversity and sustainable use of forest genetic resources, and
B. Valuation of the costs and benefits of non-timber forest products and services.

The initially thirteen projects (now twelve) of sub-programme A included A9: "Comparative studies of the biodiversity of amphibian and reptilian fauna in various forest types and tree crop plantations", which was one of the Malaysian contributions to the sub-programme, with the University of Malaya as Participating Institution.

Following a brief visit, mainly to the east coast of Malaysia, during a week's stop-over in Singapore, 23-29 October 1988, a second official visit to Malaysia was made by M.R.K. Lambert, 26 February-26 March 1995. The main objective of the assignment was to initiate a work programme and enable Malaysian herpetologists, Drs Kiew Bong Heang (Department of Zoology, University of Malaya) and Lim Boo Liat (Council member, Malayan Nature Society - formerly of the Institute of Medical Research, Malaysia, and

WHO), to become involved and be provided with funds for the project's ecological studies. The project was to be managed officially by FRIM (the Forest Research Institute Malaysia), Kepong, situated some 12 km outside Kuala Lumpur.

To gain appreciation of the problems associated with working in primary rain forest, compared with tree crop plantations, and thus assist with project design and methodology, Lambert had the opportunity to stay for a few days at the Pasoh Forest Reserve, near Simpang Pertang (Negeri Sembilan), south-east of and some 160 km by road from Kuala Lumpur.

THE PROJECT

Discussions between the authors and Dr Chan Hung Tuck (senior researcher in the Environmental Sciences Division, FRIM, responsible for the UK-Malaysia programme), resulted in the following research plan:-

a. Comparison of the diversity of amphibians (especially important in pristine forest and highly sensitive to habitat change) in primary rain forest before and in relation to time after logging - pre-logging survey to be conducted May/July 1995 in the Serting Forest Reserve Extension (some 18 km west-south-west of Pasoh Forest Reserve) for which a licence will allow timber extraction in August/September 1995. Further surveys would subsequently be conducted in parallel with Phases I and II after logging has taken place.

b. Phase I. Comparison of herpetofaunal diversity of primary rain forest with that in oil palm, rubber and forest tree plantations from early 1996. [The last plantation type was included because it was believed by some that biodiversity in forest tree plantations does not differ from that of primary forests].

c. Phase II. Changes of herpetofaunal, especially amphibian, diversity in logged forest in relation to method of timber extraction and time after logging, with surveys in 1997.

A list of expected species in forests and plantations of Malaysia was prepared by Kiew B.H. (Appendix 1), while provisional lists of anurans and reptiles were compiled specifically for the Pasoh Forest Reserve area (Tables 1 and 2) based on information provided by Kiew B.H. and Lim B.L., and species recorded by Lambert in March 1995.

With his specialised knowledge of the Malaysian amphibian fauna, as well as reptiles, and with zoology students in his University department for use as field assistants (the study would constitute part of their formal course of tuition), the project was to be led by Kiew B.H.

The aim of this article, therefore, is to provide, during an early stage of the project, provisional information on forest herpetofaunal diversity in Peninsular Malaysia which could form an initial work of reference for further studies.

Table 1

Amphibians and reptiles recorded in Pasoh Forest area, near Simpang Pertang (Negeri Sembilan), Malaysia, March 1995, including those observed outside primary forest previously. Figures in parentheses based on verbal reports only. 1 - Primary forest; 2 - secondary forest; 3 - Rest House area (within secondary forest) and other human dwellings, and 4 - oil palm plantation with riparian valley vegetation.

Species	1	2	3	4	Comments
AMPHIBIA					
Anura					
Bufonidae					
Bufo melanostictus [1]	-	-	8	-	
Leptophryne borbonica	1	-	-	-	
Ranidae					
Occidozyga laevis	-	-	(5)	-	
Rana chalconota [2]	25 (larvae)	-	2	-	In small pool at 1
Rana erythraea [1]	-	-	25	-	
Rana glandulosa	-	-	+	-	At 3 by Kiew (1978)
Rana hosei [2]	-	-	(1)	-	
Rana limnocharis [1]	-	-	11	4	
Rhacophoridae					
Nyctixalus pictus	-	-	2	-	
Polypedates leucomystax	-	-	13	-	Includes two foam nests
Microhylidae					
Kaloula pulchra	-	1	2	-	
Microhyla butleri [1]	-	3	-	-	
Microhyla heymonsi	-	-	5	-	
REPTILIA					
Chelonia					
Emydidae					
Cuora amboinensis	-	1	-	-	In pond
Heosemys spinosa	-	-	(1)	-	During heavy rain
Sauria					
Agamidae					
Bronchocela cristatella	-	-	(1)	-	
Draco volans	-	-	(3)	-	
Gekkonidae					
Gekko smithi	4	1	3	2	All but one (at 3) heard only
Hemidactylus frenatus	-	-	5	-	
Scincidae					
Mabuya multifasciata	1	2	-	1	
Varanidae					
Varanus nebulosa	2	-	-	7	
Varanus salvator	-	1(?)	-	-	
Serpentes					
Boidae					
Python reticulatus	(1)	-	-	-	180mm diameter
Colubridae					
Boiga dendrophila	-	-	(3)	-	
Gonyosoma oxycephala	(3)	-	-	-	
Macrophisthodon rhodomelas	2	-	-	-	
Elapidae					
Naja sumatrana	-	-	-	1	

[1]Indicator species of man-changed habitat
[2]Forest species - absent from plantations

Table 2

Records of amphibians in primary forest of Pasoh Forest Reserve, near Simpang Pertang (Negeri Sembilan), Malaysia.

Species	Kiew (1978)	Lim (in prep.)1	% (n = 65)
Pelobatidae			
Leptobrachium hendricksoni	+	4	6.2
Leptobrachium nigrops	+	2	3.1
Megophrys nasuta	+	2	3.1
Bufonidae			
Leptophryne borbonica	-	- (+ 1[2])	1.5
Bufo asper	+	7	10.8
Bufo parvus	+	9	13.8
Ranidae			
Occidozyga laevis	+	2	3.1
Rana blythi	+	9	13.8
Rana chalconota	+	12 (+ 1[2])	20.0
Rana glandulosa	+	2	3.1
Rana hosei	+	-	0
Rana laticeps	+	1	1.5
Rana paramacrodon	+	-	0
Rana stignata	+	2	3.1
Rhacophoridae			
Polypedates colletti	+	1	1.5
Rhacophorus appendiculatus	+	-	0
Rhacophorus bimaculatus	+	3	4.6
Rhacophorus nigropalmatus	+	-	0
Rhacophorus promianus	-	2	3.1
Microhylidae			
Chaperina fusca	+	1	1.5
Microhyla inornata	+	3	4.6
Microhyla superciliaris (? = *palmatus*)	-	1	1.5
Kalophrynus pleurostigmata	+	-	0

[1]List of Lim Boo Liat compiled from incidental collections on 10-19.i.1968, 13-22.v.1969, 2-12.xii.1972 and FRIM Sains Alam Sekitar 1989-91 (identifications by P.Y. Berry, pers. comm., after Berry, 1975)

[2]Recorded by Lambert, 7 and 14-19.iii.1995

RESEARCH PROGRAMME

Background literature

The earliest works published on the amphibians and reptiles of Peninsular Malaysia were by Flower (1896, 1899), Boulenger (1912) and Smith (1931). With further papers on the reptiles, especially snakes (e.g. Kopstein, 1938), Tweedie (1961) published his work on the snakes of Malaysia which he subsequently revised (Tweedie, 1983) using further

information, most of it provided by Lim B.L., additional to that in papers published by Lim in the Malayan Nature Journal (1956-1975). With useful photographs of many of the snake species to be found in Peninsular Malaysia included with Lim & Lee (1989), and venomous snakes having medical significance, Lim (1991) was published subsequently. Montane amphibians and reptiles in Pahang were examined by Grandison (1972) and in northern Trengganu by Dring (1979). Grandison (1978) also covered the snakes of western Malaysia and Singapore island. Following a bibliography on the ectothermic vertebrate groups by Berry (1973), a definitive work by her on the amphibians of Peninsular Malaysia was prepared subsequently (Berry, 1975). The snakes and lizards of Singapore island, all of which occur also on mainland Peninsular Malaysia, were respectively listed by Sworder (1923, 1925), and a useful field guide with colour photographs of both amphibian and reptile species was produced by Lim & Lim (1992). With such works as Inger (1979, 1980) to hand, the conservation status of respectively amphibians and chelonians in Malaysia was given in species listings by Kiew (1984a, 1984b), who also produced a small educational booklet on Malaysian frogs (Kiew, 1989). A booklet on the Leatherback Turtle and its conservation for educational and publicity purposes was also published by Chan & Liew (1989), whose work is ongoing (Chan & Liew, 1995; Liew et al., 1995), together with conservation and management work on freshwater species (Sharma, 1995). There is no comprehensive listing to date of the crocodilians and lizards of Peninsular Malaysia, and one, especially for the latter group, is urgently required.

Aims

The aims of the research programme were to compare diversity in primary forest before and in relation to method of timber extraction and time after logging, and with diversity in forest converted to oil palm, rubber and forest tree plantations. Species surveys were therefore to be conducted in primary forest for direct comparison with each of the tree crop plantation types, and in secondary forest of known logging history.

In addition to the pre-logging survey in the Serting Forest Reserve Extension not far from Pasoh Forest Reserve, a survey would be conducted in primary forest within a 50-ha study plot that has been established at Pasoh. A list of the amphibians expected there had been prepared by Kiew (1978) for the International Biological Programme, and numbers observed incidental to investigations on vertebrates generally were also recorded by Lim (in prep.) and M.R.K. Lambert (Tables 1 and 2). The list provides useful preliminary information on species richness (composition and frequency) and relative abundance.

Three constituents to the programme were drawn up to address these aims:-

1. To compare amphibian diversity (species composition, percent frequency and relative density as numbers ha-1) in primary forest before and after logging, and in relation to post-logging changes/recovery with time.

2. Phase I. Comparison of herpetofaunal diversity in primary forest with that in forest converted to oil palm, rubber and forest tree plantations (static diversity).

3. Phase II. Record changes in herpetofaunal diversity in logged forest in relation to method of timber extraction and time since logging activities took place (dynamic diversity).

Surveying precepts

1. Primary rain forest with trees of up to 30 or 35 m is a habitat type with a strong vertical component compared with oil palm, rubber and forest tree plantations, which represent generally similar habitats in a more horizontal plane.

2. Forest tree plantation should be included with surveys of other plantation types, for it is believed by some that this vegetation type and habitat differs little from that of primary or secondary forest, which can therefore be replaced with little ecological damage.

3. Secondary forest results from the logging of primary forest. Timber extraction can range from the selection only of economic species and removal by animal traction to the wholesale removal in recent years of all sizeable trunks with very destructive mechanical methods of extraction. Thus extraction method as well as time since logging has last occurred needs to be taken into account.

4. Primary forest yields a high number of species, especially amphibians, at low density while plantations yield a lower number of species (a greater proportion of reptiles) at higher densities.

5. Because amphibians, representing the main herpetofaunal component in primary forest, are primarily active at night,surveys must be conducted during the first two or three hours of darkness, as well as during the day. For purposes of comparison, night surveys must also be undertaken in plantation habitats with the aim to spend equal proportions of surveying time in daylight and darkness.

6. Diurnal reptiles in primary forest emerge to bask and hunt during the hottest two or three hours of the day, when the sun is vertically overhead and can penetrate the canopy layer to some parts of the ground litter surface. In plantations, reptiles emerge during the morning when sunshine has become warm about 2 hours after sunrise or after emerging from cloud later in the day.

7. With distinct dry and wetter periods of the year, behaviour and population structure of forest amphibians are subject to seasonal change.

8. Because amphibians tend to congregate at pond and stream edges in primary forest, especially at night, species recording is facilitated, although a correction factor may have to be introduced for the size of catchment area represented.

9. Because amphibians are an important herpetofaunal component in primary rain forest, high competence in species recognition is required during surveys. Ability to recognise amphibians in plantations is less acute. Reptile species recognition in both habitats is also required. Ability to recognise tadpole species is also needed in forest streams and pools.
10. Oil palm plantations occur on drained soil, usually on slopes intersected by stream valleys, supporting riparian vegetation. Surveys must include riparian habitat.

11. Surveys in plantation types need to take distance from primary and logged forest into account, since forest habitat provides a harbour from which species to varying degrees of ability can invade.

12. To yield sufficient numbers for statistical purposes, the survey area in primary forest will need to be five, ten or more times that in plantation habitats, in which 2 or 4 ha should suffice. An area of 50 ha, with a proportionally greater surveying period may be required in primary forest in order to yield a cumulative number of 300 records desired for statistical comparisons.

Surveying methodology

1. Primary and secondary forest: To ensure that sufficient numbers of amphibians in particular are recorded, 50-ha plots would be subdivided into one-hectare plots. Five field assistants trained in amphibian identification will walk in straight lines through each plot with 10 m separating observers. Each assistant would therefore be responsible for 5 m either side. The basic method will be visual encounter survey at night, supplemented by aural census for animals identified by their calls but not seen [Note that unidentifiable calls can be tape recorded]. Position relative to any nearby breeding site or water body will be noted. The date and time of each survey, weather conditions, phase of the moon, temperature and relative humidity will be recorded at each study site. The team would cover five 1-ha plots per night for 10 nights. Night surveys will be supplemented by 2-3 hour day surveys between 08.00 and 11.00 h, depending on sunshine, in order to record also diurnal species and basking reptiles. Bodies of water will be examined by day or night for the presence and abundance of amphibian larvae and eggs - number of larvae and eggs to be estimated (giving an indication of the number of adult females laying them). Identification will be carried out in the field wherever possible. If tadpoles or adults cannot be identified, samples will be collected and brought back to the laboratory for identification (voucher specimens of unidentified material to be preserved). Tadpoles may also be reared in the laboratory for positive species identification.

2 Oil palm, rubber and forest tree plantations: One to four or five randomly selected 1-ha subplots within a 10-ha plot in each plantation type would be equal-effort sampled initially. For direct comparison with forest species, the same surveying method during the night and day would be carried out as in forests. The number of sub-plots in plantation types will be increased if numbers of animals sighted remain low.

3. Timing: To account for seasonal and weather changes, surveys covering wet and dry seasons would be carried out during four different times of the year.

4. Species richness: From species and the numbers recorded in each of the habitats, the aim would be to determine species composition, percentage frequency and relative density (no. ha-1) in order to make direct comparisons. It may also be possible to compare the data for present day assemblages with those of similar forest habitats recorded by Inger (e.g. 1980) some 30 years ago.

5. Surveying Serting Forest Reserve Extension: A herpetofaunal survey of primary forest in the Serting Forest Reserve Extension may have two options. One may simply involve following the river course through the length of the forest during the hours of darkness and daylight recording species visually and by call. The other may be to record species in three or four 100-m transects established to include forest on either side of the river.

HERPETOFAUNA OBSERVED DURING VISITS TO MALAYSIA (BY M.R.K. LAMBERT)

A number of amphibians and reptiles were observed by Lambert during journeys through Peninsular Malaysia and Singapore. Since locality records and other general information may be useful in future distribution studies, sightings are recorded here of species likely to be seen during cursory visits to a range of locations.

1969

A first visit only to Singapore was made 16-20 September 1969. An observation of a skink photographed in mangrove vegetation just outside the town (18.ix) was included with Lambert (1985). From a photograph in Lim & Lim (1992), the correct identification is the Mangrove Skink *Emoia atrocostata,* not to be confused with *Mabuya multifasciata* (Common Sun Skink), another rather more widespread species with which it is sympatric in Singapore and whose immature stages resemble it.

1988

A further visit to Malaysia was made during another stop-over at Singapore, 22-29 October 1988. A journey by bus from Singapore town in the morning of 23 October crossed the Causeway to Johor Bahru at the southern end of Malaysia, and followed a route through secondary forest, oil palm and rubber tree plantation mosaic to make first contact with the South China Sea at Mersing. Continuing north up the east coast with overnight halts at Cherating and Marang, the journey ended at Kota Bahru having passed through Kuantan, capital town of Pahang, and Kuala Terengganu, capital of Terengganu State. Leaving Kuala Dungun on 25 October, a big Monitor Lizard, *Varanus salvator* (a large species commonly seen throughout the Peninsula), ponderously crossed the road (13.13 h) at a point 68 km S. of Kuala Terengganu, and made its way through an agriculturally developed area with many kampung houses on stilts interspersed amongst coconut palms. Called iguanas by people locally, this impressive monitor is typically seen in areas of human interference, often scavenging at rubbish tips. The island of Pulau Kapas was opposite Marang, and travellers who had stayed on other of Terengganu State's offshore islands reported that their nights' sleep on the beaches were often disturbed by large monitors scavenging for food nearby. The road also passed Rantau Abang with its famous turtle breeding beach and Information Centre. Further details on the turtle conservation programme at this location is given in the booklet of Chan & Liew (1989). Northern Terengganu state was also Dring's (1979) study area. The return journey, via Kuala Lumpur and Melaka, ended back at Singapore on 29 October.

1995

Quite a number of amphibians and reptiles were observed during a further visit to Malaysia, 26 February-26 March 1995, in addition to those at the Pasoh Forest Reserve area (Table 1).

Kuala Lumpur: Being the capital of Malaysia and a built-up area, few species of herpetofauna were expected in the general vicinity of Kuala Lumpur. House Geckos, *Cosymbote platyurus,* with flattened tail (commoner than *Hemidactylus frenataus* with rounded tail) were frequently seen on inside and outside walls of town buildings (1-2.iii). Once in the afternoon (9.iii), beside a small partially vegetated mud island at the edge of the discoloured fast-flowing water of the Sungai Kelang in the city centre, and just

downriver of the confluence with the Sungai Gombak, a terrapin was observed to climb slowly out of the water, cross the mud island, re-enter the water and remain suspended over a shallow. The carapace was approximately 200 mm long, uniform black and the vertebral scutes each bore a midline ridge. It could have been one of two or three species, but compared well with *Siebenrockiella crassicollis,* the Black Marsh or Pond Terrapin, which according to Lim & Lim (1992) is found in canals, ponds and reservoirs in forest and agricultural land, and may be seen for sale in fish markets. It is also a species observed in temples in Malaysia, and is frequently purchased mainly for release, which is common Taoist and Buddhist practice (Kiew, 1984b).

At FRIM, near Kepong, some 12 km from Kuala Lumpur centre, a number of species were observed in the grounds of the institute buildings. At a pool formed by a dam, containing a large number of carp-like fish, terrapins emerged to bask in sunshine on the pool bank (27.ii). They were unmistakably Red-Eared Sliders, *Trachemys scripta elegans,* an introduced species from North America which is sold in thousands as hatchlings in local pet shops and, surviving into adulthood, are often released into the wild (Lim & Lim, 1992). Such feral animals could pose a danger to native species by being more vigorous and out-competing them. Beside the gecko, *Cosymbote platyurus* on inside and outside walls of FRIM buildings, two or three Variable Lizards, *Calotes versicolor,* were observed on and by cut hedges (27.ii, 20.iii). On 20.iii, an adult monitor, *Varanus nebulosa* was observed basking in the morning (08.10 h) on a lawn and seeking refuge in a drainage channel upon disturbance. All three of these reptile species are commonly associated with man-disturbed habitats.

Penang: The opportunity was taken to visit Penang Island, 10-12 March. Arriving by overnight bus at Georgetown and continuing to Teluk Bahang in the north-west of the island, a scattering of several geckos, *Cosymbote platyurus* greeted my entry into a guest house bedroom; the species was seen on village buildings everywhere. With two heads each poking out of drainage holes at the edge of a concrete-lined ditch (10.iii) in the morning, and two more basking in morning sunshine (10.00 h) at the edge of a bridge over a stream (11.iii), immature *Varanus nebulosa* were present in the village vicinity. I also saw an adult (10.iii) in the middle of the day (ca. 13.00 h) lazily picking at food waste on a rubbish tip by a polluted-looking stream at the end of a garden. A brightly coloured adult Sun Skink, *Mabuya multifasciata* was observed basking on the edge of a concrete-lined drain (10.iii), and a drab brown sub-adult was sighted walking in morning sunshine (10.00 h) along a metal pipe above a drainage ditch (11.iii). A Variable Lizard *Calotes versicolor* was seen by a bush on a wire-mesh fence (10.iii) and another (11.iii) basking in morning sunshine (10.00 h) on the tap-scarred trunk of a rubber tree. A much larger individual of this species was also observed sunning itself on a garden wall (10.iii) in another part of the village. That evening, about an hour after sunset at approximately 19.30 h, frogs were heard croaking (29^{o}C; 85% R.H.) from the edge of a stream flowing through the village; only *Rana limnocharis* would be expected to survive in this disturbed habitat. In a room of the guest house still later (22.45 h), a toad *Bufo melanostictus* was found hopping across the polished concrete floor, inevitably foraging for termites or flying ants, which in Malaysia's tropical conditions may enter human dwellings. None of the species seen was unexpected, for all are associated with, and therefore indicators of human-changed habitats.

In the morning of 12 March, an 8-km return trek was made from Teluk Bahang to the lighthouse on Muka Head, the north-westernmost point of the island, which involved following a rough track through a coastal forest reserve. Setting off at 10.00 h, the scramble over rocks and through the undergrowth was disturbed by crashing branches as

Plate 1. *Rana chalconota,* a small forest frog (32-60 mm) in Malaysia whose relative abundance is increased by selective timber extraction. (Photographed in Belum Forest Reserve, Perak, March 1994, by C H Diong).

Plate 2. *Rana blythi,* a forest frog (c. 100 mm), whose relative abundance in Malaysia is highest in forests, but is also found in tree crop plantations in Malaysia. (Photographed in Belum Forest Reserve, Perak, March 1994, by C H Diong).

Plate 3. *Cyrtodactylus quadrivirgatus*, a gecko not uncommon in forests of Malaysia, and found in forest tree and rubber plantations, but not in oil palm plantations. (Photographed in Belum Forest Reserve, Perak, March 1994, by C H Diong).

Plate 4. Primary rain forest habitat, Pasoh Forest Reserve, Negeri Sembilan, Malaysia. (Photographed 14 March 1995 by M.R.K. Lambert).

two large monitors, *Varanus salvator* (known as the Water Monitor - found along sea shores and rivers) on the outward journey, and two different individuals on the return, made their presence known. Passing the Marine Field Station of the University of Malaya, the next beach was Mermaid Beach, popular for barbecues. Tapped spring water was provided in a forestry building. Two *Calotes versicolor* were perched on coconut palm trunks. On the last kilometre climb up to Muka Head and return from the lighthouse to Teluk Bahang (5 km), seven *Mabuya multifasciata* were recorded in 100 min between 11.45 h and 13.25 h (4.2 per man-h). The first was photographed. Finally, just before re-entering the village, a snake, followed a few minutes later by another, slid through grass tufts and leaf litter at the edge of the track. Both had black and yellow dorso-lateral bands with reddish-brown in between and compared with the photograph of the Painted Bronzeback, *Dendrelaphis pictus* in Lim & Lee (1989). This species is found in forest and from agricultural to urban areas (Lim & Lim, 1992).

Pasoh Forest Reserve area, Negeri Sembilan: A list of the species observed in the Pasoh Forest Reserve area was prepared (Table 1).

Pasoh primary forest: In a small pool deep in primary forest on 7 March morning, there was a shoal of orange coloured tadpoles the product from spawn of a single female of *Rana chalconata,* a species whose relative abundance is enhanced by selective timber extraction from primary forest. Returning to Pasoh a few days later, the orange-coloured tadpoles of *Rana chalconota* had increased somewhat in size since last seen 8 days before, and 25 were counted. A small snake of ca. 50 cm, reddish coloured dorsally with an ash-grey neck laterally, quietly slid across the partially obscured track in the densely-vegetated 50-ha plot of primary forest in the morning of 15 March (10.00 h; 24.5°C; 96% R.H.). Without much difficulty, it was identified as the Blue-Necked Keelback, *Macrophisthodon rhodomelas,* a back-fang which proudly bared its teeth upon capture. That afternoon (14.30 h; 28°C; 85% R.H.), an immature monitor, *Varanus salvator* (nostril near end of the nose) was photographed basking in a sunny patch on a fallen log. Subsequent to heavy rain overnight (17 March), and shortly after hearing the characteristic bark of a *Gekko smithi,* a small toad was spotted at just midday (12.00h; 25.5°C; 96% R.H.) resting on a buttress at the trunk base of a tall dipterocarp, tag-labelled *Shorea maxwelliana,* in the 50-ha plot. The thin relatively long hind limbs had mid-brown bars, and there was a double dark spot between the eyes; it remained quite still for a long-exposure photograph and was identified as *Leptophryne borbonica,* not previously recorded at Pasoh. Beams of sunshine penetrated the canopy foliage of the forest at noon the next day (18 March) enabling an immature *Mabuya multifasciata* basking on a sunny leaf patch (27.5°C; 82% R.H.) to be photographed.

Oil palm plantation, Pasoh: Starting a search in oil palm plantation adjacent to logged forest in the late morning of 16 March (11.27 h; 28.5°C; 75% R.H.), four *Rana limnocharis* were seen on dried fronds on the ground, two *Varanus nebulosa* were disturbed basking, and the black coils of a large snake moved sinuously under a dipterocarp log and protruded the head briefly to give itself away as the Sumatran Cobra, *Naja sumatrana,* an active predator of plantation rats. Just at the end of the search (13.18 h - 111 min; 29.5°C; 72% R.H.), a 2 m-long monitor not far from a stream which at that size must be *Varanus nebulosa* crossed the dirt track just in front and re-entered the secondary forest. The following afternoon (15.07-15.31 h), another *Varanus nebulosa* was disturbed, shortly after hearing the bark of *Gekko smithi,* and an immature skink *Mabuya multifasciata* moved along the stem of a palm frond (31.5°C; 67% R.H.). Travelling through the oil palm plantation in a vehicle along the main dirt track from Pasoh Forest Reserve to the main road, *Varanus nebulosa* were frequently seen plodding across the track's surface.

Pasoh secondary forest: After passing through oil palm plantation, the main track to Pasoh Forest Reserve went through secondary forest (selective timber removal by animal traction in the 1950s) and ended at the Office and Rest House area. During the late afternoon of 6 March (18.00 h; 28.5°C; 85% R.H.), a newly metamorphosed frog, *Kaloula pulchra,* was recorded on the track - pale brown dorsally with an hour-glass pattern and dark sides. With sunshine (12.30 h; 27.5°C; 89% R.H.) on 7 March, basking on a rotten stump back in secondary forest was a dark-coloured adult of the Sun Skink, *Mabuya multifasciata.* The mainly wooden buildings of the Rest House bungalows all teemed with geckos, *Hemidactylus frenatus,* and the barks were frequently heard, and individuals occasionally seen, of giant geckos, *Gekko smithi.* A foam nest with eggs of *Polypedates leucomystax* was attached under a beam above water in an external butt of a rest house bungalow; a common species indicative of human-disturbed habitat. After rain during early morning hours of darkness (17 March), two rhacophorid frogs were seen on the porch of a building at 11.30 that night (24°C, 92% R.H.): *Polypedates leucomystax* (three), with a foam nest on the grass, and *Nyctixalus pictus* (two). An immature *Mabuya multifasciata* was seen scuttling rapidly through grass at the edge of the track, and basking on branches of a fallen tree drooping into a pond, a terrapin with yellow lines on the neck and head, almost certainly *Cuora amboinensis,* plopped rapidly into the water upon disturbance. A number of other species were recorded by two American forest researchers who had been staying at the Rest House for some days during March (Table 1); in particular several Flying Lizards *Draco volans* were often seen chasing each other up trunks and amongst branches of trees at the edge of the residential area.

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Editorial Note: A list of amphibians and reptiles in forests of Peninsular Malaysia, and their relative abundance, has not been prepared previously, and this is the first published check list for lizards.

APPENDIX

Checklist, with relative abundance, of expected amphibian and reptile fauna in primary (PF) and logged-over (secondary) forests (LF), and forest - Acasisa or Pinus (FP), rubber estate (RU) and oil palm plantations (OP) in Peninsular Malaysia. Prepared by Kiew Bong Heang, March 1995. Key:-

0	-	Not likely to be present at all.
1	-	Rare; Not likely to be encountered owing to behaviour, low numbers and/or distribution.
2	-	Number is extremely low, estimated at 1 per 50 hectares; Chance of encounter in a day/night search is negligible.
3	-	Number low, estimated at 1 per 10 hectares; Chance of encounter in a day/night search is slight.
4	-	Number poor, estimated at 1 per 5 hectares; Chance of encounter in a day/night search is poor.
5	-	Number high, estimated at 1 or more per hectare; Chance of encounter in a day/night search is good.

SPECIES	VEGETATION TYPE				
	PF	LF	FP	RU	OP
AMPHIBIA					
Caecilidae					
Caudacaecilia nigroflavus	2	2	0	0	0
Ichthyophis monochrous	2	2	0	0	0
Pelobatidae					
Leptobrachium hendricksoni	4	3	2	3	2
Leptobrachium nigrops	2	2	2	2	0
Megophrys monticola nasuta	3	3	0	0	0
Bufonidae					
Ansonia longidigita	2	2	0	0	0
Ansonia malayana	1	1	0	0	0
Bufo asper	4	4	2	0	0
Bufo biporcatus	2	2	0	0	0
Bufo macrotis	1	1	0	0	0
Bufo melanostictus	0	0	0	3	3
Bufo parvus	4	4	3	3	2
Bufo quadriporcatus	1	1	0	0	0
Leptophryne borbonica	2	2	0	0	0
Pedostibes hosei	3	2	0	0	0
Pelophryne brevipes	1	1	0	0	0

Ranidae					
Occidozyga laevis	3	4	1	1	1
Rana baramica	2	2	0	0	0
Rana blythi	4	4	3	3	3
Rana chalconota	4	4	0	0	0
Rana erythraea	0	2	2	3	3
Rana glandulosa	2	2	2	2	2
Rana hosei	3	2	0	0	0
Rana kuhlii	2	2	0	0	0
Rana laticeps	2	2	0	0	0
Rana limnocharis	0	2	3	4	4
Rana luctuosa	2	2	0	0	0
Rana malesiana	2	2	2	3	1
Rana miopus	2	2	2	2	2
Rana nicrobariensis	2	3	3	2	2
Rana paramacrodon	2	2	0	0	0
Rana plicatella	2	2	0	0	0
Rana stignata	3	2	0	0	0
Staurois larutensis	2	2	0	0	0
Rhacophoridae					
Nyctixalus picta	2	2	0	0	0
Polypedates colletti	2	2	0	0	0
Polypedates leucomystax	0	2	4	4	4
Polypedates linki	0	2	2	2	2
Polypedates macrotis	3	3	0	0	0
Rhacophorus appendiculatus	2	3	0	0	0
Rhacophorus bimaculatus	1	1	0	0	0
Rhacophorus nigropalmatus	1	1	0	0	0
Rhacophorus pardalis	1	1	0	0	0
Rhacophorus promianus	2	2	0	0	0
Rhacophorus reinwardti	1	1	0	0	0
Rhacophorus robinsoni	1	1	0	0	0
Theloderma asper	1	1	0	0	0
Theloderma horridus	1	1	0	0	0
Theloderma leprosa	1	1	0	0	0
Microhylidae					
Calluella volzi	1	1	0	0	0
Chaperina fusca	1	2	0	0	0
Kalophrynus palmatissimus	2	1	0	0	0
Kalophrynus pleurostigma	1	2	0	0	0
Kalophrynus robinsoni	1	1	0	0	0
Kaloula baleata	1	1	0	0	0
Kaloula pulchra	0	0	1	2	2
Microhyla annectens	1	1	0	0	0
Microhyla berdmorei	2	2	0	0	0
Microhyla bornensis	2	2	0	0	0
Microhyla butleri	1	2	3	3	3
Microhyla heymonsi	2	3	3	3	3
Microhyla inornata	1	1	0	0	0
Microhyla ornata	1	1	0	0	0
Microhyla palmipes	1	1	0	0	0
Microhyla superciliaris	1	1	0	0	0

REPTILIA					
Chelonia					
Emydidae					
Cuora amboinensis	1	2	2	2	2
Cyclemys dentata	1	1	1	1	1
Hoesemys spinosa	1	1	0	0	0
Notochelys platynota	2	2	0	0	0
Testudinidae					
Geochelone elongata	1	1	1	1	1
Geochelone emys	1	1	2	2	2
Trionychidae					
Dogania subplana	2	2	1	1	1
Amyda cartilagineus	1	1	1	1	1
Sauria					
Agamidae					
Acanthosaura armata	2	2	0	0	0
Aphaniotis fusca	2	2	0	0	0
Bronchocela cristatella	0	0	1	2	2
Bronchocela emma	0	0	1	1	1
Calotes versicolor	2	2	2	2	2
Draco fimbriatus	1	1	0	0	0
Draco formosus	1	1	0	0	0
Draco maculatus	1	1	0	0	0
Draco maximus	1	1	0	0	0
Draco melanopogon	2	2	1	1	1
Draco volans	3	3	2	2	2
Gonocephalus borneensis	1	1	0	0	0
Gonocephalus grandis	1	1	0	0	0
Gonocephalus herveyi	1	1	0	0	0
Gekkonidae					
Aeruloscalabotes felinus	1	1	0	0	0
Cnemaspis affinis	1	1	0	0	0
Cnemaspis kendalli	1	1	0	0	0
Cosymbotes platyurus	0	0	1	1	1
Cyrtodactylus consobrinus	1	1	0	0	0
Cyrtodactylus malayanus	1	1	0	0	0
Cyrtodactylus pulchellus	1	1	0	0	0
Cyrtodactylus quadrivirgatus	2	2	1	1	0
Gehyra mutilata	0	0	0	1	0
Gekko gecko	0	0	0	1	0
Gekko monarchus	0	0	0	1	0
Gekko smithi	2	2	0	0	0
Hemidactylus brookii	0	0	0	1	0
Hemidactylus frenatus	0	0	0	1	0
Hemidactylus garnotii	0	0	0	1	0
Lepidodactylus lugubris	0	0	0	1	0
Mimetozoon craspedotus	1	1	0	0	0
Ptychozoon horsfieldii	1	1	0	0	0
Ptychozoon kuhli	1	1	0	0	0
Scincidae					
Dasia olivacea	2	2	1	0	0
Emoia atrocostata	2	2	1	0	0

Mabuya longicaudata	1	1	1	1	1
Mabuya multifasciata	2	3	3	3	3
Mabuya rugifera	1	1	1	1	1
Mochlus bowringi	0	0	1	2	2
Sphenomorphus indicus	1	1	0	0	0
Sphenomorphus praesigne	1	1	0	0	0
Sphenomorphus scotophilus	1	1	0	0	0
Sphenomorphus stellatus	2	2	1	0	0
Varanidae					
Varanus nebulosa	1	1	2	2	2
Varanus rudicollis	1	1	1	2	3
Varanus salvator	1	1	1	2	3
Serpentes					
Typhlopidae					
Ramphotyphlops albiceps	1	1	0	0	0
Ramphotyphlops braminus	1	1	1	1	1
Typhlops diardi	1	1	1	1	1
Aniliidae					
Anomochilus leonardi	1	1	1	1	1
Cylindrophis rufus	1	1	1	1	1
Xenopeltidae					
Xenopeltis unicolor	1	1	1	1	1
Boidae					
Python curtus	1	1	1	1	1
Python reticulatus	1	1	1	1	2
Colubridae					
Ahaetulla fasciolata	1	1	1	1	1
Ahaetulla mycterizans	1	1	1	1	1
Ahaetulla prasina	1	1	1	1	1
Amphiesma conspicillata	1	1	1	1	1
Amphiesma peterii	1	1	1	1	1
Aplopeltura boa	1	1	0	0	0
Boiga cynodon	1	1	1	1	1
Boiga dendrophila	1	1	1	1	1
Boiga drapiezii	1	1	1	1	1
Boiga jaspidea	1	1	1	1	1
Calamaria albiventer	1	1	1	1	1
Calamaria pavimentata	1	1	1	1	1
Calamaria schlegeli	1	1	1	1	1
Chrysopelea ornata	1	1	1	1	1
Chrysopelea paradisi	1	1	1	1	1
Chrysopelea pelias	1	1	1	1	1
Dendrelaphis caudolineatus	1	1	1	1	1
Dendrelaphis pictus	1	1	1	1	1
Dendrelaphis formosus	1	1	1	1	1
Dendrelaphis striatus	1	1	1	1	1
Dryocalamus subannulatus	1	1	1	1	1
Dryophiops rubescens	1	1	1	1	1
Elaphe flavolineata	1	1	1	1	1
Elaphe taeniura	1	1	1	1	1
Elaphe radiata	1	1	1	1	1
Elaphe prasina	1	1	1	1	1

Gonyophis margaritatus	1	1	0	0	0
Gonyosoma oxycephalum	1	1	1	1	1
Homalopsis buccata	1	1	1	1	1
Lepturophis borneensis	1	1	1	1	1
Liopeltis baliodeira	1	1	1	1	1
Liopeltis longicauda	1	1	1	1	1
Liopeltis tricolor	1	1	1	1	1
Lycodon aulicus	1	1	1	1	1
Lycodon butleri	1	1	1	1	1
Lycodon effraenis	1	1	1	1	1
Lycodon subcinctus	1	1	1	1	1
Macrophisthodon flaviceps	1	1	1	1	1
Macrophisthodon rhodomelas	1	1	1	1	1
Macropophis maculatus	1	1	1	1	1
Natrix trianguligera	1	1	1	1	1
Oligodon octolineatus	1	1	1	1	1
Oligodon purpurascens	1	1	1	1	1
Oligodon signatus	1	1	1	1	1
Pareas carinatus	1	1	1	1	1
Pareas laevis	1	1	1	1	1
Pareas malaccanus	1	1	1	1	1
Pareas margaritophorus	1	1	1	1	1
Psammodynastes pictus	1	1	1	1	1
Psammodynastes pulverulentus	1	1	1	1	1
Pseudorhabdion longiceps	1	1	1	1	1
Ptyas carinatus	1	1	1	1	1
Ptyas fuscus	1	1	1	1	1
Ptyas korros	1	1	1	1	1
Rhabdophis chrysargus	1	1	1	1	1
Rhabdophis subminiatus	1	1	1	1	1
Sibynophis collaris	1	1	1	1	1
Sibynophis melanocephalus	1	1	1	1	1
Xenelaphis hexagonotus	1	1	1	1	1
Xenochrophis piscator	1	1	1	1	1
Xenodermus javanicus	1	1	1	1	1
Elapidae					
Bungarus candidus	1	1	1	1	1
Bungarus fasciatus	1	1	1	1	1
Bungarus flaviceps	1	1	1	1	1
Calliophis gracilis	1	1	1	1	1
Calliophis maculiceps	1	1	1	1	1
Maticora bivirgata	1	1	1	1	1
Maticora intestinalis	1	1	1	1	1
Naja kaouthia	0	0	0	1	1
Naja sumatrana	1	1	1	1	2
Ophiophagus hannah	1	1	1	1	1
Viperidae					
Agkistrodon rhodostoma	0	0	0	1	1
Trimeresurus hageni	1	1	0	0	0
Trimeresurus puniceus	1	1	0	0	0
Trimeresurus sumatranus	1	1	0	0	0
Trimeresurus wagleri	1	1	0	0	0

AMPHIBIAN REMAINS IDENTIFIED FROM THE GUT OF A GRASS SNAKE AND A POLECAT

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INTRODUCTION

During the preparation of skeletons for comparative osteological collection, the gut contents of a Grass Snake *Natrix natrix* (L.) and a polecat *Mustela putorius* (L.) were separated and examined. The dead Grass Snake was donated by Colin Howes (Doncaster Museum) and was found in the Doncaster area of South Yorkshire in 1994. It measured 826 mm total length, unfortunately its sex was not determined before preparation. The Polecat was found run-over close to the Shropshire border with Powys near Bishops Castle, although it also contained two 22 lead air gun pellets. The enzymic maceration technique used in preparation is described in Bulletin No. 50 (Gleed-Owen, 1994). The vertebrate remains retrieved from the gut of the two animals were examined under low power (x7 - x40) magnification using a binocular microscope. Some bones may have been lost when preparing the polecat as its skeleton was sieved at 500 mm before is was realised that the animal contained evidence of its last meal. Modern comparative specimens and scanning electron microscope photographs from the author's collection were used in the identification of the remains. Some of the features used in identification are described by Holman and Stuart (1991) and by Böhme (1977) but this field remains poorly-described in the literature.

AMPHIBIAN REMAINS RETRIEVED

All of the skeletal material contained in the snake and polecat were of small amphibians. The Grass Snake contained the remains of one Common Toad, *Bufo bufo* (L.) and a newt *Triturus* sp. The Polecat contained a Great Crested Newt, *T. cristatus* (Laurenti) and a Common Toad, *B. bufo*. The specific elements identified are listed below.

GRASS SNAKE CONTENTS

Bufo bufo (L.) Common Toad

Material: Five partial or incomplete trunk vertebrae; one sacrum; one urostyle; one partial right humerus; and one right femur; a number of indeterminate appendicular elements and fragments.

Remarks: The bones were badly corroded during digestion and were probably in the lower gut rather than the stomach. It is likely that Grass Snakes eventually completely digest all skeletal material. However, specific identification was still possible in this case and the remains are of a very small toad. Comparison was made with the skeleton of a toad which measured 33 mm snout to vent. The remains are around two-thirds of this size and are probably of a newly-metamorphosed toad measuring about 20 mm in snout to vent length.

Triturus sp Newt
Material: One partial right femur; one left and one right rib.

Remarks: Preservation was poor and as these particular elements are not diagnostic, specific identification was not possible. The bones are not of *T. cristatus* and are either *T. vulgaris* or *T. helveticus*. These are probably the remains of one newt.

Along with the skeletal remains, six variously-disarticulated weevils were found, their chitinous exoskeletons remaining in excellent condition. It is unclear whether the weevils were eaten by the grass snake, or by the toad or newt before they themselves were eaten.

POLECAT CONTENTS

Triturus cristatus (Laurenti) Great Crested Newt

Material: One incomplete premaxilla; one left pterygoid; one left and one right posterior hyoidal cornu; nine trunk vertebrae; three ribs; three caudal vertebrae; one right ulna; one left and one right ilium; one left and two halves of one right femur; one right tibia; one left fibula; a number of metapodials and phalanges.

Remarks: These bones were strongly stained but otherwise in fairly good condition and may not have moved further than the stomach. Some long bones were broken and various elements are missing. The size and numbers of the elements suggest they represent one newt of around 120 mm total length (by comparison with other skeletons).

Rana temporaria (L.) Common Frog

Material: One left and one right fronto-parietal; one left and one right exoccipital; fragments of at least three trunk vertebrae; one urostyle; one omosternum; one right coracoid; one right humerus; one ischium; one left and one right femur; one left and one right tibiofibula; various metapodials and phalanges.

Remarks: This material was more seriously corroded and some long bones were broken but could be refitted. The bones are of one juvenile frog with a snout to vent length of about 30-35 mm.

DISCUSSION

In a previous study of this kind (Gleed-Owen, 1994) a Grass Snake contained a Great Crested Newt and a Common Frog. Frazer (1989) lists the prey of Grass Snakes as newts, fish and frogs, probably taken in the water. Some are known to eat toads, for example in the Isle of Purbeck (opp. cit.) where they constitute the main prey species along with voles and even insects. According to Arnold and Burton (1978), Grass Snakes eat predominantly frogs and toads as well as newts, tadpoles and other small vetebrates. Frazer (1989) suggests that young snakes will take tadpoles and small fish but using the size and age table he provided (opp. cit.: p. 196), this specimen was probably at least eight years old. Smith (1969) suggests that mainly frogs are eaten but also amphibians as well as lizards, birds and mammals. Where necessity dictates, no doubt toads are eaten. However, it is unclear whether Grass Snakes will preferentially avoid toads in other circumstances. Perhaps even if toads are avoided as prey in an area, very young animals would not be rejected. The Common Toad and the three British newts are known from the Doncaster area. This Grass Snake may well have taken its newly-metamorphosed prey close to a water body and probably late this year.

In Britain the polecat is most commonly encountered in Wales where it is known to feed mainly on small mammals and frogs (Macdonald and Barrett, 1993). It would appear

from this example that as well as frogs, newts are also eaten, perhaps even as a primary food source in areas where such species are abundant. Distribution atlas records (Arnold, 1973) are not detailed enough for the Shropshire area to determine whether both prey species are already known from the locality but this example serves as a surrogate method of recording which proves that both species are present in the Bishops Castle area.

ACKNOWLEDGEMENTS

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FROGS BREEDING IN STREAMS

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The British amphibians are almost exclusively found to breed in still, rather than running, water. Surveys for native amphibians generally take the form of pond surveys (e.g. British Herpetological Society Conservation Committee, 1990). However, there are occasional records of native anurans breeding in streams (e.g. Cooke, 1975; Frazer, 1953). The present note reports some observations of Common Frogs (*Rana temporaria*) breeding in streams at sites in England and Wales.

Whilst visiting the Black Mountains in South Wales (1.9.95), we discovered large numbers of Common Frog tadpoles and metamorphs in a stream, Nant y Bwch, flowing off an upland area at 475-490 m altitude (Grid ref: SO 233 333). The tadpoles occurred in a rocky pool and riffle section of the stream, but were not confined to pool areas. They were abundant in flowing water. The tadpoles were very numerous (some several hundred) and well-grown. The stream supported no vegetation, except for algal periphyton growing over the rocks of the stream bed. Although it was possible for the tadpoles to hide away in the many refuges of the rocky bed, there were very conspicuous out in the open, shallow, clear water.

Although Common Frogs have long been noted in this area (Smith, 1964, notes that frogs have been found breeding on the summit of Waun Fâch [811 m]), it was possible that the tadpoles were introduced to the stream, as eggs or larvae, by people. To verify whether spawn was naturally deposited, the site was re-visited the following spring (7.4.96). The upper 1800 m of the stream and one of its tributaries were searched for frog spawn. 14 clumps of spawn were found along a 500 metre section of stream. No spawn was found in the tributary, which was faster flowing due to being on a steeper incline. Three clumps were singly deposited, while the remaining clumps were deposited in communal sites of four and seven clumps. The communal spawning sites were in slow-moving pockets of the stream, where the spawn was protected from the current by large rocks. However, even in these areas the water was not completely still. One clump was found under a flat stone, but it was impossible to tell whether it had been oviposited there, or whether it had been moved by water currents. Of the singly deposited clumps, one was deposited between two rocks, and the other two were deposited in the slower-moving water at the edge of the stream. All of the spawn clumps were recently deposited (none had reached the tail bud stage), which suggests that the search coincided with the early stages of the spawning period, and hence it is likely that not all of the frogs in the locality had spawned by the time of the survey visit.

At the same time (7.4.96), frogs were found to have spawned in a stream in the ancient Blean forest (situated on a dissected London Clay plateau of about 100 m altitude) of Northeast Kent. The River Sarre Penn (c. 65 m altitude) is intermittent, but frequently torrential at this time of year. Heavily shaded, aquatic vegetation is sparse, with some willow moss. The bed is comprised of shingle. Invertebrate predators of amphibians are few, but several fish are present: Three-Spined Stickleback, Minnow, Stone-Loach, Bullhead and Eel. The first four species survive periods of no flow by utilising persistent

pools in the stream bed; Eels are able to migrate. In previous years, frogs had spawned in a permanent pond (Grid Ref: TR 112 602); this contains the same fish species, as well as numerous invertebrate predators and abundant vegetation. On this occasion spawn was found in the adjacent shallow section of the stream, with spawn and tadpoles in a deeper pool below a bridge culvert (Grid Ref: TR 118 603). There was no evidence of spawning having taken place in the pond.

The breeding frogs in these streams raises several questions. First, how frequently do Common Frogs use streams as spawning sites and why do they more commonly seem to avoid breeding in streams? Predation by fish may generally prevent frogs from breeding in streams. Trout are found only in the lower reaches of the Nat y Bwch, which may allow the frogs to exploit the upper sections. Fish numbers in the River Sarre Penn may have been lowered as a consequence of drought, making the stream more attractive as a frog spawning site.

Alternatively, or in addition, it is possible that in most years the flow rate of streams is too unpredictable to allow successful reproduction. Fast flowing stream water may make external fertilisation difficult and may wash tadpoles downstream, into less favourable habitat. We have no quantitative data regarding changes in stream flow over past year, but it is possible that the recent sequence of years of relatively low rainfall may have allowed frogs to exploit streams for successful reproduction. At the Nant y Bwch, the stream flow was certainly not vigorous for the time of year. At the Sarre Penn site, although pond conditions appeared to be identical to previous years, the flow rate of the stream was unusually low, following a prolonged dry spell. Additionally, spawning at the latter site had been delayed by approximately one month, presumably as a result of the long cold winter. The late spring meant that many trees were not in leaf, reducing the shading effect. Low flow and lack of shade would both have contributed to elevated water temperatures, which may also be a reason for the change in behaviour of the frogs.

Are stream breeding sites overlooked by amphibian recorders because they tend to focus their efforts on ponds? Preliminary results from the BHS/Wildlife WATCH Frogwatch survey suggest that such sites may be of some significance. A World Wide Web page, dated 13.4.96, quoted about 100 records of frog spawn in 'flowing water', from a total of 1518 (c. 6.6%). Alternatively, is breeding in flowing water a successful strategy for frogs only in years of low water flow? Sections of streams that are relatively free of predators may be suitable for frog reproduction only in years when water flow is insufficient to either disrupt insemination of the ova, or to wash eggs and larvae into less suitable stretches of water. It would seem prudent for future surveys to consider flowing waters as potential spawning sites for Common Frogs.

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OF ROBINS, RATS AND WALL LIZARDS

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Having nurtured a small population of European Wall Lizards (*Podarcis muralis)* for some 15 years and through several generations, I thought I had encountered and overcome all the likely problems that might threaten their continued well-being or even existence. Early escapes from the outside vivarium were countered by trial and error (there were very few and all were re-caught!), cats were excluded from the beginning with a lid frame of chicken wire, mouse predation (if ever it occurs) was presumably prevented by provided enough brickwork that the lizards could find the narrowest chinks in which to hide while they were cold and immobile at night or through the winter. I even had an invasion of small boys over the garden fence on two consecutive days one July which threatened the whole project, but surprisingly the losses then were finally restricted largely to the destruction of the following generation when all eggs that had been laid were inadvertently trampled. Prompt police interest and my investment in a much more robust and far taller fence capped with barbed wire has so far prevented any repetition.

The colony has had fits and starts, but in early May 1996 numbered 6 adult (and gravid) females, 3 adult males, with 3 males and 3 females hatched in 1994 and installed in the vivarium this spring. In my experience young lizards up to 1+ years old are likely to be eaten by the adults, and must be kept apart until at least this age. During the 15 years of the project no lizard has ever lost its tail, so I was surprised when one of the young males appeared without a tail in the third week of May, but assumed it must have been the work of the dominant male, even though I have never seen tail losses in the many lizard-lizard encounters I have seen. At the beginning of June the dominant male, a large and magnificent animal, disappeared. I have had no escapes since 1981, there have been no epidemics and I am not aware of any mammals larger than mice ever having managed to enter the vivarium. Of course older lizards have finally succumbed, mostly not emerging one spring. In fact I have not had any lizard anaccountably vanishing except following a winter, but in this case, when all appeared normal I still persisted in assuming that this was just a first, if unusual, example of an apparently healthy animal 'missing presumed dead' through unknown but 'normal' causes. In retrospect I should have been more vigilant.

There followed several days of poor weather when I would not expect to see any of the lizards. At the next opportunity when sunshine and spare time at the right time allowed an examination, I was thoroughly alarmed. Just three lizards could be seen, one young female from the 1994 hatch and two adult females, one minus half her tail. I know the behaviour patterns of these lizards and know that in 'good' weather it is normal for most or all to be abroad, active and observable, particularly when sun first strikes in the morning. Despite my families' assurances that all was well, the missing lizards were still about but taken to late rising, or had become far more cautious, I was convinced that a real debacle had occurred. But what, and where was the evidence? The wire lid, though now past its best and needing replacement still serves its purpose and showed no sign of interference. There was no disturbance to the vegetation within the vivarium, such as

might be expected if a blood-crazed cat or fox had managed to enter, and in any case the lizards of course are fast and wary of larger predators. What could possibly have gone wrong to so devastate my lizards?

I still have no positive identification of the cause, although initially I was convinced the losses were the work of a robin. A few years ago I noticed sparrows were dropping into the vivarium to feast on some large field crickets intended for the lizards. The crickets were cold and slow moving and made an easy meal for the birds. However, I could not say that the birds were frequent visitors. During the period leading up to the major lizard loss this year, I had also been working my vegetable patch adjacent to the vivarium. A robin had been attracted by my exertions, or rather the chance of a quick meal revealed as I worked the soil, and I had seen it dropping into the vivarium and taking mealworms during this same period. I wondered whether the robin had learned how to deal with the lizards. They were concentrated in a small area, and would always reappear to bask even after disturbance. At first emergence in the morning they tended to be slower, sometimes lying full out before the sun had yet reached the vivarium, so they were probably fairly easy to pick off by a persistent predator that learnt the necessary tricks. Birds are quick to learn, lizards have a limited capacity by comparison. In natural circumstances these lizards would not be so concentrated, and would probably be more wary - mine are certainly now (or were!) more approachable than wild individuals, while they tended to emerge and lie out in anticipation of the first sun which does not reach the vivarium until around 10.00 am and until then, being cooler, their reactions and flight speed would be relatively slow. In natural situations they would have immediate access to the sun and would reach preferred active temperature rapidly. Lizards are a normal component of the diet of many birds, although it is doubtful if that is so for robins in England. They are not specialist lizard feeders, and lizards are not a conspicuous component of many habitats that robins frequent. I thought this was an example of a robin exploiting an unusual feeding opportunity that it could easily deal with, perhaps initially attracted by the mealworms but discovering that a quick peck at a lizard sometimes, perhaps very early in its attempts, produced results. I did wonder whether a robin could handle, i.e., swallow a mature male wall lizard, but the bird's gape is more than ample. I would think though that the lizard would stretch the capacity of the robin's stomach!

After this episode I covered the chicken wire lid with plastic bird netting as sold for soft fruit protection. The closer mesh of the plastic netting must reduce slightly the sun's intensity beneath but this was the only disadvantage to the new system. There were no further losses for a few weeks, the robin was no longer obvious and I did no see it showing further interest in the vivarium or its content, the severed tail of one of the adults lizards regrew and the two adult females laid their eggs. It seemed that I had indeed solved the puzzle and I relaxed. Then, in July, the female with the regrown tail lost her tail again, and before I had an opportunity to remove the remaining lizards, they all vanished. It was now impossible for birds to enter the vivarium, and again there was absolutely no evidence to suggest a cause.

My final, though tentative, conclusion is that a rat took up residence in the vivarium and destroyed all the lizards. My jogging sons tell me that locally rats have been far more conspicuous this year in nearby Epping Forest, while during the summer two young rats have been killed and left on separate occasions on the lawn by cats - we have not seen this before. I suppose that my arguments given earlier implementing the poor old robin can be equally well applied to rats, although while at optimum temperature I cannot imagine that the lizards would be easy prey. I suspect that they were attacked whilst under cover, although the vivarium is full of nooks and crannies amongst brickwork that

are impossible for a rat to enter, which would have had to learn the strategy of waiting for the re-emergence of the lizards.

Young lizards from the 1995 hatch will eventually be put in the outside vivarium, having first ensured that no rodents are present. In the long term this event is probably just a hiccup, though producing a severe genetic 'bottleneck' in a small population already closely inbred. In the shorter term, my source of eggs is curtailed - I have been studying their 'behaviour' during incubation and now have only a small number this year, and the young males will probably not be mature enough for reproduction next year so there are not likely to be any eggs now until 1998.

While I am a committed conservationist and am pleased to encourage all forms of wildlife, conflicts do occasionally arise and resolving them can be difficult. If birds are involved in predation within vivaria they can easily be excluded, but it is difficult to find alternatives to eradication or rodents if they are involved, unless rodent entry to the vivarium can be totally prevented, which is rather more difficult than for birds. Whatever the cause of predation, it is clear than small lizards housed in high concentration and frequently observed but without disturbance are more applicable, their flight response becomes delayed and the survival advantage of flight is never put to the test. If ever a small predator eg a bird or rat does manage to reach them, they have partially lost their survival capabilities and are in trouble.

NOTES ON KEEPING AND BREEDING *PHELSUMA LATICAUDA* (THE GOLD DUST OR FLAT TAILED DAY GECKO)

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INTRODUCTION

Gold Dust Geckoes are from the Comoros islands off Madagascar, as well as being introduced to other places including Madagascar itself. They are tropical lizards with an insectivorous diet, supplemented by fruit.

During Easter 1995, I obtained three day geckos from a reptile shop in London. I wanted two females and a male but was unfortunately sent two males and a female - this I suspected quite quickly as the fully grown male would not tolerate one of the "females". "She" has now grown and become as big as him, has obvious femoral pores (always much more obvious that on the female) and is definitely a "him".

It is generally recommended that captive-bred reptiles are best as they are tamer and more accustomed to captivity.

DESCRIPTION

In good light they are like living jewels. They have two horizontal bright red stripes across the top of their fairly blunt snouts up to their beautiful blue almost eye-shadowed eyes which do not have eyelids and are licked clean by their long pink tongue. There is often another red bar just behind the eyes. The posterior dorsal surface of the head and anterior half of the back is powdered with a yellowy-gold. Briefly the back is just green and then there are three bright red, "tear drops" which break up posteriorly into numerous small red spots which spread down the yellowy tail with a hint of green. The underside, which is seen through the sides of the vivarium is white; in males the femoral pores can become yellow with chemical secretions. At night and when nervous or otherwise in an emotional state their colouring can very quickly become pale or bright.

They are unusual in being diurnal geckos; most geckos are nocturnal or at least crepuscular. Normally geckos are fairly drab in appearance due to the need to be camouflaged during the daytime while they are hiding and particularly by the lack of need for coloration at dusk/night. Nocturnal geckos are sometimes quite vociferous which is unusual in lizards, but useful at night. Day geckos' coloration serves to camouflage them pretty well and is also useful for courtship rituals. The fact that both sexes are equally colourful indicating a lack in obvious physical sexual dimorphism indicates that other factors play a more major role in courtship and sexual attraction, probably chemical and behavioural. It may also indicate that both males and females compete with each other for partners. Generally males compete for females in animal species when the female looks after the eggs or young; females may compete for males if the males look after the young. The fact that the colour is displayed during courtship must indicate that it is of some importance. Day geckos can vocalise, but it is probably less developed than many non-diurnal day geckos.

Their total length when adult is approximately 13 cm, about half being tail. The females are a little smaller and develop "jowls" (endolymphatic glands) just behind the eyes if fed with enough calcium.

CARE AND FEEDING

In a reasonably warm room the heating and lighting can be turned off at night. If the temperature goes down too low a heater with a thermostat needs arranging. Temperatures of 25-30 ^{o}C for day time and a slight drop at night or 26-32 ^{o}C are recommended. Personally I find a drop to around 15 ^{o}C at night causes no ill effects.

I feed them mainly on crickets and waxworms dusted with calcium and vitamins. They will eat mealworms, but this is not recommended in some books so they are offered only occasionally. I also offer fruit as a treat. I keep a sugar cube with a drop of vitamins on it in the vivaria which the female in particular licks avidly.

Compared to anoles they do not seem to particularly go for bluebottles or flies. They enjoy "sweepings" of spiders from local blackberry bushes. If they escape they seem to be quite fond of the spiders which make their homes in the corner of my study!. I leave cuttle fish bones in the vivaria and put calcium lactate in all the water supply. I also put a drop of reptile vitamins in too.

The young feed well on hatchling crickets, greenfly, sweepings from bramble and holly bushes, and fruit flies. They need vitamin and calcium supplements on their food and exposure to UV light. Calcium lactate should be supplied in all water given (only a small pinch to 1 litre). The one success I have had so far grew extremely rapidly and fed voraciously.

BREEDING

It is recommended that two females to one male is used as the females then have respite from the male's advances.

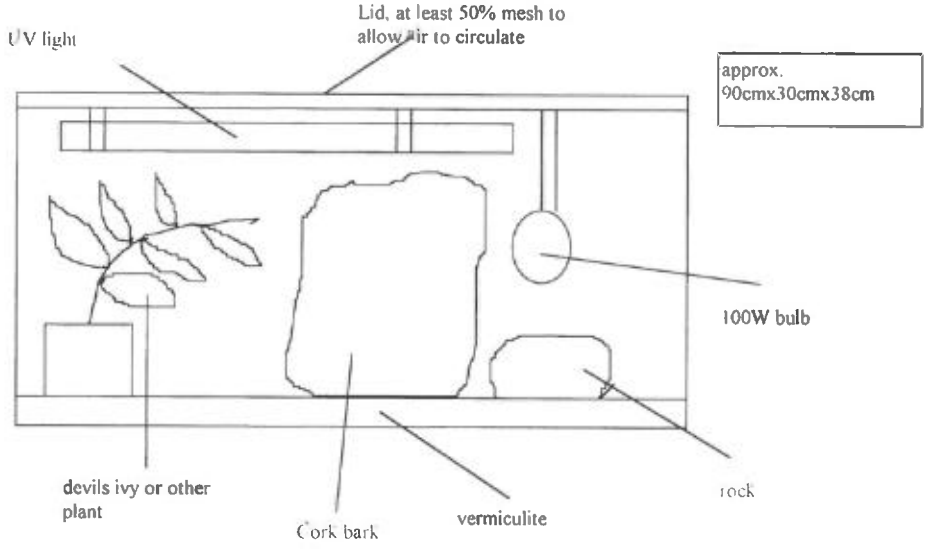

Figure 1. Possible vivarium set-up.

The following however, assumes that there is a 1:1 ratio. I have found that it is very important that the female is in good condition. Before breeding I have found that it is useful to keep the sexes apart so that the female is not accosted and able to get into good condition. She should be feeding well and have had access to good supplies of vitamin D and other vitamins as well as calcium. This leads to a fattened area on either side of the neck with a store of calcium.

The male can then be introduced to the female. It is probably recommended that it is this way round as males are a little bigger and more powerful and it helps the female to feel more secure.

This is an account of some of the courtship rituals I once recorded. "One of my males has in the past 10 minutes been introduced to my female. He has moved towards her in a slow jerky fashion, sticking his tongue out in an almost flag waving gesture. She has reciprocated and has not run off. Now, flattening and tilting his body in front of her, his "offside legs" leaving the surface of the vivarium side, he is showing his gaudy colours to their best advantage. She has moved away, at times stopping and holding one back leg in the air and poking her tongue out too. At present she is not totally impressed and has moved well away from him. He keeps licking the air and the sides of the vivarium. She has turned a little pale in colour while he is close but now she is moving a little distance from him she is turning back to her original glory. Males and females seem to be of equal brilliance regarding colour. Her cloaca is a little distended and he is slowly and deliberately closing in on her again. She is waving her near side foot and he briefly displayed his body as before. Quickly and jerkily he has moved fairly near to her, she has lifted her tail and waved it but then she has jumped down to the floor of the vivarium to escape his ardour. He is now displaying his body again and waving his tail slowly. He is shaking his head sideways in a very jerky manner. The female seems impressed but a little nervous, hiding behind a plant pot and looking round it at her suitor. Now they have both moved onto the same side of the vivarium. He has moved away from her, still facing her, occasionally walking away, waving his tail, then turning round. She is moving up towards him a little. Still moving, she is within fifteen centimetres, occasionally licking her lips. She is also sticking her back right leg in the air."

After mating the eggs become very obvious through the skin of the underside, just above the cloaca at first. Usually there are two eggs and both become visible. After about 1 month the eggs are laid in a secluded position, usually the floor. The day geckos can retain sperm so mating is not necessary before egg laying. I have not had any opportunity to test this as yet.

I tend to move them to incubate them, but this has caused mishaps! Eventually I found a technique of very gently pushing a piece of flat plastic under the eggs a reasonable way of getting them out safely.

I incubate the eggs in an old plastic butter container filled with dampish vermiculite, all placed into a plastic bag which is folded under the container. This is carefully moved to a home-made incubator - basically a smallish aquarium with a 100W light bulb connected to an external aquarium type thermostat. This has worked incubating Giant Day Gecko eggs, Anole eggs and also Ibizan Wall Lizards.

The sex of day geckos is supposed to be determined by the temperature of the incubation. I have incubated eggs at 25ºC to try and encourage females - this led to a female (which died in January 1996). It took 10 weeks to hatch. Obviously this could have just been by chance, a much bigger number would be needed to confirm the sex determining factor.

The eggs I incubated in 1996 were at 28-29ºC and took just 6 weeks to hatch. Whether these were males or females I never found out.

PROBLEMS

1 Moving the eggs is very difficult, they are hard and calcified unlike other lizard species and very delicate. They are less than 1 cm in diameter and a couple of eggs are usually glued together - on no account try and separate them! They must be incubated in the same orientation in which they were laid. It may be best to try and leave them in situ with a plastic container Sellotaped/glued over them. Some references recommend this.

2 After egg laying in January 1996 the female became very subdued in colour and behaviour, having difficulty sloughing and becoming very reluctant to eat. This was, I think, due to two reasons. Firstly she needed a break from the attentions of the male, and secondly I had let them get a little cool while away at Christmas. A baby which I had raised to a length of 4 inches died. Until this point it had been feeding very well and had grown rapidly. Since it was a female I was anticipating a whole colony of day geckos in the near future! I am sure it was the cool snap. Do not let the night time temperature fall below 13-15ºC as they are tropical lizards - and give the female a break from the male. Due to these problems she has lost a little of the ends of a couple of her fingers. I have been supplying her with sugar cubes with drops of reptile vitamins and keeping her separate. She has been eating and behaving healthily for a couple of months (it is now September 1996) or so now and is nice and plump. The males have not lost condition at all despite being kept in similar conditions to the female. I must assume that the stress of the continual presence of the male and the egg laying caused her loss of condition. The nearly adult offspring was in a vivarium which lost all its heating while I was away.

3 Do not put males together - they fight!

COMMENTS

Gold Dust Day Geckos are fairly easy to keep, not needing much humidity so long as they receive a spraying of water each day which can then evaporate leaving the vivarium fairly dry. The males seem to be a little more confident than females, but both seem quite robust and not very shy if healthy. I have kept the male Day Geckos in very good condition in the same vivaria with Green Anoles and even with Ibizan Wall Lizards. They seem to co-exist quite happily with the other species for much of the year, pretty well ignoring each other. At present I have no Anoles and I cool off the Wall Lizards from October to January so the Day Geckos will be alone then.

HERPETOLOGY IN JERSEY: A REPORT OF THE 1996 VISIT TO JERSEY ORGANISED BY THE CONSERVATION COMMITTEE

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The fourth annual meeting for BHS members on a conservation theme was held on the 4th and 5th, May, 1996 on the island of Jersey. The meeting had two main themes. First, a visit to the Herpetology Department at Jersey Wildlife Preservation Trust and Zoo, which enabled BHS members to see round the facilities and learn about the Trust's wildlife conservation and protection programmes for threatened herpetofauna; second, a visit by members to several of Jersey's herpetological sites and conservation areas to gain some insight into the status and threats facing the native herpetofauna.

VISIT TO THE JERSEY WILDLIFE PRESERVATION TRUST AND ZOO

Arriving at Jersey Zoo in time for lunch, we were met by Quentin Bloxam, General Curator, who promptly ushered us towards the Zoo's excellent restaurant, the Dodo. An appointment immediately afterwards was made with Richard Gibson, Herpetology Department Head, who was to show us round the collection, and behind the scenes, in the Gaherty Reptile Breeding Centre.

In terraria outside the House, there were enclosures containing hardy European species, primarily for exhibition purposes. Two or three old favourites such as the European Pond Tortoise *Emys orbicularis* and the Spanish terrapin *Mauremys leprosa* basked in the sunshine, despite the cold wind, at the concrete edges of pools. Three pairs of Marginated Tortoises, *Testudo marginata* steadily plodded across their enclosure, stopping intermittently to take bites from herbaceous plants growing on the ground, and moving their heads to survey the crowd observing them. There was another enclosure for endangered Jersey Agile Frogs *Rana dalmatina* although there was no obvious activity, but we were assured of their existence. They are being used in a captive breeding programme for release into specially chosen sites on the island to offset the decline and possible extinction of the species on Jersey and their tadpoles and some juveniles were shown to us in the "cool" room behind the scenes.

Once in the warmth of the reptile house itself, rare tropical species were evident, being bred for relocation and other purposes. First, there was a fine pair of Rhinoceros Iguanas, *Cyclura cornuta*, perched on logs in a delightfully presented terrarium, shared with a small colony of Antiguan Anoles, *Anolis wattsi*. Next to each other, but in separate cages for the moment "to make the heart grow stronger" and increase mating success, there was a pair of the very threatened *Iguana delicatissima* from the Lesser Antilles in the Caribbean. These iguanas are so closely related to green iguanas that one of the most significant threats to their survival is hybridisation with the introduced latter species.

In the centre of the exhibition area there were two humid vivaria planted with self-sustaining bromeliads, mosses, ferns and orchids. One contained the highly endangered

Blue Poison-Dart Frog, *Dendrobates azureus* and the miniscule *Dendrobates reticulatus*, and the other housed *Dendrobates auratus*, mottled iridescent turquoise and black in colour, and another small brown frog in the Dendrobatid family, *Colostethus trinitatis*, whose food was invisible to the naked eye. There were also some huge 'homeless' captive bred Burmese Pythons, *Python molurus bivittatus* in a large cage, that having outgrown their owners, had been relinquished by them and given to the zoo. They were on display primarily for exhibition and educational purposes, for the species is not endangered in the wild and breeds very readily in captivity. Next, a fine pair of Basilisk Lizards, *Basiliscus plumifrons* (family Iguanidae) was perched on branches in their cage, while on the ground in the same cage was a pair of South American Red-Footed Tortoises, *Geochelone carbonaria*. This pair of tortoises had inadvertently been allowed to mate and the female to lay eggs, and there were eight 2-month old hatchlings in an open vivarium behind the scenes.

At this point, Lee Durrell, Honorary Director, and Quentin Bloxam joined us as a few additional features about the collection were pointed out. There was a single hatchling of the Madagascan Flat-Tailed Tortoise, *Pyxis planicauda* - it was the first time the species had bred in captivity outside Madagascar, and was growing well in its cage next to the eight *G. carbonaria* hatchlings. In another enclosure, there were captive bred juveniles and adults of one of the world's smallest tortoise species, *Testudo kleinmanni*, and near the ground, a large female specimen of so-called *Testudo whitei* from Algeria which is much larger than the more widespread North African *Testudo graeca*. "Tortoiseville", a long indoor tortoise enclosure, was alive with twenty-seven baby marginated tortoises, all fighting over food and the best basking spots. Further along the corridor, there was a room devoted to Round Island Geckos from Mauritius, *Phelsuma guentheri*. The Zoo population of this species had crashed for a reason that was not entirely clear, but two years later, the population was building up again. The Round Island Skink, *Leiolopisma telfairii* has also been bred at Jersey Zoo, but the gecko now takes priority.

Among the snakes breeding successfully are the Round Island Boa, *Casarea dussumieri*, the Jamaican Boa, *Epicrates subflavus*, for which Richard Gibson carried out an island wide survey in October last year, and also an unusually coloured garter snake *Thamnophis sirtalis tetrataenia*, a subspecies from San Fransisco, confined to a tiny strip of land between two urbanised areas, which had blue and red, instead of yellow, dorso-lateral stripes. Finally, in partnership with Fauna & Flora International, the Government of Antigua and other locally based organizations on Antigua in the north-eastern Caribbean, there was one of the world's rarest snakes, a gentle, small, grey-coloured snake, the Antiguan Racer, *Alsophis antiguae*, in specially constructed vivaria. The species' last refuge is on Great Bird Island, off Antigua, where even there it was threatened by rats that had colonised from tourist boats until these unwelcome rodents were eradicated in December 1995. The racer was eliminated on Antigua by the Indian mongoose, which were introduced in 1899 to control rats in sugar cane plantations. If captive breeding is successful, hatchlings will be flown straight back to other islands on which rats and mongoose have been cleared, possibly even before sloughing or feeding, to establish a second island population and increase their chance of survival in the wild.

All in all, the visit was much enjoyed by the BHS party, and Richard Gibson's highly articulate exposition made the picture very much clearer. The environments inside the terraria were among the best one would ever see, and were the result of sensitive response and constant adaptation by Richard and his assistant Kevin Buley to improve the animals' needs. There was even a nesting box high up on a windowsill to improve the chances of successful nesting as one species of iguana consistently chose to perch on a branch prior to oviposition, and kept laying its eggs in mid air. This behaviour has now

been linked to substrate temperature and has been accommodated for by the provision of the "arboreal" nest site where ambient temperatures are much higher.

There was only time for a relatively small fraction of the work being done at the Centre to be covered during the visit. There was a lot more "unseen", and much of the work is conducted overseas in animals' natural habitats.

Among those animals unseen, the St. Lucia Whiptail, *Cnemidophorus vanzoi*, is confined to only two tiny islets, Maria Major and Maria Minor, off the coast of St. Lucia. Though the island is protected and no introduced predators are present, the lizard is considered extremely vulnerable due to its limited distribution. In 1993 another island, Praslin (not to be confused with that in the Seychelles group, Indian Ocean), was selected for a translocation project and the rat population eradicated. In 1995, 2 years later, after significant vegetation regeneration and the return of nesting birds to the island, 40 whiptails were removed from the source population (1500 or more individuals) on Maria Major, sampled for DNA, and released on Praslin. After an initial scare with a stray mongoose (which was quickly trapped), the lizards soon settled into their new home and were breeding only a few weeks later. Staff from JWPT have visited the new population again in 1996 to continue monitoring the success of the introduced population. Preliminary results suggest that there are now more than one hundred lizards on the island. The colours of the male are similar to the country's national colours depicted on the flag, and this lizard species has been taken up as the country's national emblem. A success story indeed!

The following species projects should also be mentioned. There is a large herd of Radiated Tortoises, *Geochelone radiata* occupying half of the outdoor paddock area. This species has bred in Jersey a number of times despite the cool climate.

Work has recently begun on the Prehensile-Tailed Skinks, *Corucia zebrata* from the Solomon Islands. The Zoo has two groups of these unique lizards. Although they are well known, and have been widely kept, only recently has their conservation status come to light as the Solomon islands are logged in a devastating way at an ever increasing rate, and the skinks' exploitation for the pet trade continues un-checked.

There is a whole room full of baby Jamaican Boas, a species mentioned earlier. The snake has been bred at the Trust since 1977, and field work has been carried out on two occasions. Based on work, and at the recommendation of Richard Gibson, this species has recently been reassessed as Vulnerable in the IUCN Red Data book, and is likely to be raised to an EEP programme in the next year.

Two endangered chelonian species are part of a cooperative breeding programme with the American Zoo Association. The Coahuilan Box-Turtle, *Terrapene coahuila* is restricted to a single small region of marshland in Coahuila County, Mexico, and the Hispaniolan Slider, *Trachemys decorata* has declined drastically over the past decade, and is the subject of a reintroduction programme coordinated by Zoo Dominica in the Dominican Republic.

The Mallorcan Midwife Toad, *Alytes muletensis*, known as a fossil, but only "re-discovered" in 1980, has been the subject of a Jersey breeding programme since 1986. The Zoo's offspring have been used to found other captive populations in Britain and Europe, and also for reintroduction to selected sites in Majorca. This project has successfully established five new populations in the wild so far, and further releases are

planned along with a cooperative programme of education and research, and habitat protection, reclamation and creation.

Fourteen baby Madagascan Iguanas, *Oplurus cuvieri* were running around two huge communal enclosures. This species is being used as a model species with which to learn and develop husbandry and breeding protocol for the closely related and endangered sub-species from the Comoros Islands.

The Zoo has a whole room devoted to the rearing of young freshwater turtles. Species currently in residence there included the Coahuilan Box-Turtles and European Pond Terrapins, species mentioned earlier.

There is also the Trust's well known work to conserve by captive breeding the Angonoka or Ploughshare Tortoise, *Geochelone yniphora* on Madagascar, which is being conducted by Don Read. The centre established at Madagascar recently suffered a theft (May 1996) of some 60 tortoises (mostly juveniles, but two females were included by the thieves for good measure). This was a very serious matter, which has rightly been much publicised among the world's herpetological community.

Now what about the staff themselves! The Herpetology office enjoys the comfort of air conditioning, while the rest of the building is set at around 30 °C, but not for the staff. The cooler air is for highly endangered colonies of Partula snails, many species of which are extinct in the wild, having been exterminated by introduced predatory snails. The remaining snails exist only in captivity, with sometimes as few as half a dozen individuals. Jersey was the first zoo to begin keeping these difficult creatures in 1982 at the request of Nottingham and Virginia universities. The captive breeding programme since then has gone from strength to strength, with around twenty collections now holding colonies in Britain, Europe and the USA. Releases into specially built snail reserves in their native home, Moorea in the Pacific, have taken place in 1994 and 1996. Results are encouraging and further releases are planned. The subjects, although not exactly herpetofaunal, enjoy the atmosphere conducive to amphibians and reptiles, or rather their minders!

The captive breeding work on many of the world's rarest species of amphibians and reptiles being done at the Zoo, and by the Jersey Wildlife Preservation Trust generally, is very valuable, making a substantial contribution both to our knowledge of rare species' biology and to conservation. Although already fairly well known, the enterprise deserves wider publicity within the world's herpetological community. A presentation will hopefully be made on the work of the Zoo's reptile house in both the form of a poster, and verbal account by Richard Gibson, at the 3rd World Congress of Herpetology in Prague, Czech Republic, 2-10 August 1997.

HERPETOFAUNA OF JERSEY

Compared to mainland Britain, the herpetofauna of Jersey is insular and small, and only supports three amphibian species and four reptile species. A former BHS President was first to produce an annotated inventory for the Channel Island group (Frazer, 1949). Three of the species on Jersey, however, never reached the rest of Britain naturally, namely the Agile Frog, *Rana dalmatina*, Wall Lizard, *Podarcis muralis* and Green Lizard, *Lacerta viridis*. The first two species are common in adjacent areas of France.

The island of Jersey covers 45 square miles, but the herpetofauna today, are mainly confined to the less urbanised coastal areas where there are heathland and sand dune

ecosystems. The interior of the island is intensively farmed for growing Jersey new potatoes and rearing Jersey cows on lush meadowland. Natural 'wildlife' areas are a rarity, except for garden ponds which are readily colonised by Common Toads, *Bufo bufo*.

An evening visit to ponds by the ruins of the Castle at Grosnez Point in the north west area of the island revealed the presence of toad tadpoles and Palmate Newts, *Triturus helveticus,* the latter surfacing intermittently for air. There is concern that Common Toads are less abundant than in the past, and contamination of ground water by agrochemicals may be a significant factor. Extensive use of fertilisers has raised the levels of nitrate and nitrite ions in the breeding ponds, and what could be traces of an arsenic based pesticide used in the early fifties has been detected in one of the ponds.

Regrettably we did not have the chance to see Jersey's third amphibian, the Agile Frog, because its status in the wild is cause for concern. Monitoring of all the known breeding ponds in 1995 and 1996 revealed no adults or spawn. The Jersey Environmental Services together with the Jersey Wildlife Preservation Trust are involved in a captive breeding programme with subsequent release of frogs into private ponds around the island to increase the captive population. We visited one pond where a number of tadpoles had been released, and their progress is being carefully monitored. The pond in question has been incorporated in an enclosure to prevent people and animals gaining access, and over twenty air-surfacing Palmate Newts were observed from the perimeter fencing. On a positive note, Palmate Newts are abundant in Jersey, but are often mistaken by the local people for lizards in their terrestrial phase.

The second day we visited Ouaisné Common which is one of the best herpetofauna sites on the island. This gorse heathland lies behind a sandy bay, Ouaisné Bay, and separates it from Noirmont. Both here and between La Pulente and Corbiere, where sadly no lizards were sighted between 16 and 17.00 h that afternoon, there are healthy Green Lizard populations. Simon Tonge, in his paper on the herpetofauna of Jersey reported that Ouaisné supported populations of all the Jersey herptiles, except the Wall Lizard (Tonge, 1986). Unfortunately in the ten interceding years, Agile Frogs are now presumed to have become extinct, and the size of the colony of Grass Snakes, *Natrix natrix* has greatly decreased which corresponds with the declining amphibian populations and increased contamination of freshwater by agrochemicals. Several Green Lizards, including adults and juveniles, were observed during our visit, basking in the morning sunshine in spots sheltered from the cold wind or actively foraging for invertebrate prey between tussocks of dune marram grass and gorse clumps.

The large male of the first lizards observed (12.08 h), a basking pair, was about 40 cm long, dark olive-green, speckled with brilliant bright green spots. It had almost the negative pigmentation of adjacent mainland *L. viridis*, which are grass-green and spotted, with a fine peppering of black dots. Is the darker colouration of the Jersey Green Lizards an adaptation to living at the extreme of its northerly range with the darker ground colour facilitating heat absorption? A young male Green Lizard, about two-thirds the size of the first animal was the next lizard to be observed. This individual was a uniform bright green with turquoise-coloured throat. An adult female observed was bright green with four white longitudinal stripes and a few black blotches. This was in contrast to French Green Lizard females, which are frequently brown. The juveniles observed were predominantly darker coloured and extremely fast moving, diving into grass tussocks and gorse bushes. Part of Ouaisné Common has just been purchased by the States of Jersey and, with the cooperation of the Tenants of the rest of the common, is being managed as protected area through positive conservation measures, for the area also

Plate 1. Ouaisné Common, Jersey. (Photograph by Frank Bowles).

supports a number of locally rare plants, such as the cross-leaved heath, and animals such as the Dartford warbler. With a satisfactory morning of lizard sightings behind us, we lunched at the nearby Smugglers Inn.

One of the best places on Jersey to see Wall Lizards is on the walls of Mont Orgueil Castle above Gorey Harbour in the east of the island. The colony ranges from the rocks on the beach to the castle keep where the south facing walls have not been rendered. Over thirty lizards were observed basking, scampering along the walls or with their heads peeping out of holes and crevasses. These Jersey Wall Lizards appeared to be a more colourful brownish and olive green than the greyer French Wall Lizards in Brittany. It is rumoured that the Wall Lizards at Mont Orgeil Castle where introduced by British soldiers, and if this is the case, it would be interesting to know from where they originally came. The colony appears to be thriving despite the fact that local cats from the harbour below the castle make it their hunting ground. One young lizard, with a missing tail was no doubt a casualty of such an encounter.

The first systematic survey of Jersey lizards was carried out by Frances Le Sueur (1976), who mapped their distribution based on sightings made after 1965. A subsequent survey carried out in 1986-7 by Chris Perkins into lizard distribution and abundance confirmed many of Le Sueur's records, with new sightings for Green Lizards (believed to have been due to a more intensive search) and a few losses due to site urbanisation. Green Lizard distribution is closely associated with the distribution of coastal heathland and dunes

concentrated in the south-west of the island. The distribution of Wall Lizards in Jersey has apparently always been restricted to the north and northeast coasts. The reasons for this are unknown. Were the animals deliberately introduced at some time in the past (as suspected at Mont Orgeil castle) or is their presence in the north due to an adaptation related to living at the extreme edge of their range?

In conclusion, it seems that the reptiles are not so much in decline as the amphibians on the Island. Amphibians with their permeable skins and larval gill membranes, and living in both aquatic and terrestrial habitats, may make them more vulnerable to the toxic effects of pesticides and other agrochemicals compared to reptiles. However, bioconcentration of insecticide residues must threaten both phyla, and may also endanger other forms of predatory wildlife higher up the food chain.

Jersey has its own Statutory Wild Life Law (1947) which prohibits removal of native herpetofauna for sale in pet shops on the Island and some degree of habitat protection was achieved by the Island Planning Law (1983). Alternatives to intensive farming could be further encouraged, but pressure on the land as a result of increased leisure activities by the thousands of visitors every year is also cause for concern. Finally, on a more positive note, it is reassuring to see that the conservation of the herpetofauna of Jersey is being taken seriously by Jersey Environmental Services, and that all possible measures are being taken to maintain, and even improve, their present status on the island.

Green Lizard *(Lacerta vividis)* from Jersey.
(Photograph by Chris Perkins and reproduced by permission).

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Mike Freeman, States Ecologist, and Chris Perkins took time and trouble to show us sites of herpetofaunal interest on the Island of Jersey, and shared their knowledge with us.

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