

# BRITISH JOURNAL OF HERPETOLOGY

Vol. 4 No. 6

June 1970

Published by  
THE BRITISH HERPETOLOGICAL SOCIETY

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The British Journal of Herpetology is published twice a year and is issued free to members. Application to purchase copies, and/or for details of membership to the Society should be made to the Hon. Secretary, British Herpetological Society, c/o The Zoological Society of London, Regents Park, London, N.W.1.

Contributions should be addressed to the Editor, Dr. Harold Fox, Department of Zoology, University College, Gower Street, London, W.C.1. Articles should be typed in double spacing on *one side* of the paper only. Figures should be drawn in Indian ink on plain white paper, or preferably Bristol Board and suitably lettered for publication.

NOTES ON A COLLECTION AND OBSERVATIONS OF AMPHIBIANS AND  
REPTILES FROM S.W. TURKEY

By

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(Received 25/2/69)

This investigation covers the Vilayet (Province) of Mugla, situated on the extreme south-west coast of Turkey, near the offshore Greek islands of Rhodes, Kos and others in the Aegean Sea, which make up the Dodecanese. Collections were made in late July and August, 1968 on the coast around Bodrum (Halicarnassus), Fethiye (Telmessus) and Gökova at the apex of Kerme Körfezi (Ceramic Gulf). Inland specimens were taken from near the town of Mugla, and in the Taurus mountains from Cal Dag and the Girdev Gölü (Eren Dag), north and east of Fethiye respectively (Fig. 1).

Compilations of the herpetofauna of Turkey have been carried out by Bird (1936), Bodenheimer (1944) and Mertens (1952). Eiselt (1965) described an expedition in 1964 to S.W. Anatolia, including Mugla; Eiselt and Spitzenberger (1967) described the testudines of Turkey, including records for Mugla; Wettstein-Westersheimb (1967) discussed the forms and distribution of *Lacerta danfordi*, mainly occurring in S.W. Turkey. Peters (1964) also investigated the taxonomy and ecology of the eastern species, *Lacerta trilineata*.

Bodenheimer (1944) lists 88 species and subspecies (18 Amphibia) of the Turkish herpetofauna, and Mertens (1952) comments on 70 (11 Amphibia). Since then listed species have been clarified taxonomically. In the present work the total for Mugla was 15 species (3 Amphibia), although this total is not comprehensive. The majority are Mediterranean in their geographical distribution, although some naturally penetrate further east towards Iran, and *Bufo v. viridis* ranges from northern Europe south to the Sahara and east to Tibet and Mongolia in central Asia.

The climate of this part of Turkey is Mediterranean; hot in summer, accentuated by the enclosed nature of the Ceramic Gulf; and inland cold in winter, as the result of biting north-easterly winds from the Russian land mass, while the coastal climate is very mild. The geology is mainly limestone.

The nomenclature is based on Mertens (1952, 1960) unless otherwise mentioned. The material collected is now in the British Museum (Natural History), London.

## AMPHIBIA:

## Bufonidae:

1. *Bufo v. viridis* Laurenti:

1 ♀, Mugla, 660 m., 30/7/68. In main square of built-up area of houses and large gardens.

1 ♂, 1 ♀, Fethiye, 7/8/68, alive. On town sea-promenade near hillside of broken-up limestone and dry scrub.

Several seen, Nif, 600 m., S. of Cal Dag, 30 km. N. of Fethiye, Carian Taurus, 9/8/68. Near buildings in scrubland.

Metamorphosed juveniles seen in swarms, Girdev Gölü (Eren Dag), 1,780 m., Lycian Taurus, 11/8/68. On damp, grassland, lake plain, with grazing.

1 ♀ seen, Bodrum, just E., 14/8/68, 10 m. from sea edge on dry beachland.

The species was frequently seen in built-up areas near scrubland. The colour pattern is similar to those from northern Europe. The overall range of distribution includes the whole of Turkey.

## Hylidae:

2. *Hyla arborea* L.:

Single specimen seen and photographed, Girdev Gölü (Eren Dag), 1,780 m., Lycian Taurus, 11/8/68. On tree in lake plainland.

Several, metamorphosed juveniles seen, same locality, 11/8/68. On damp, grazed pastureland of lake plain.

In terms of geography, these specimens are probably either the subspecies *H.a. kretensis* Ahl, which occurs on larger Mediterranean islands and extends through S. Turkey eastwards, or *H.a. arborea*. This species was observed only in this isolated locality in the Taurus range. Eiselt (1969) has collected it in the lowlands near the coast.

## Ranidae:

3. *Rana r. ridibunda* Pallas:

3 ♂, 4 ♀, Gökova, 18 km. S. of Mugla, 30/7/68. Marshland at sea level in ditches with saline water and in running, fresh-water stream.

Many seen, Fethiye, 8/8/68. In wet ditches in cultivated, flat land just above sea level.

Many seen and photographed, half-grown, Girdev Gölü (Eren Dag), 1,780 m., Lycian Taurus, 11/8/68. In running water in ditches adjacent to lake on flat, agricultural plain.

The colour pattern varied in the presence or absence of a mid-dorsal yellow line. In the latter, the dorsal surface was of irregular, darkened green patches. The adult frogs in coastal marshland were seen in brackish water. The juveniles in the Taurus mountains spent the hotter part of the day basking in the sun on the sides of ditches. When feeding in water they remained suspended on the surface, half submerged, until flies alighted on floating vegetation to drink; these were rapidly and deftly engulfed.

## REPTILIA:

## Emydidae:

4. *Clemmys (Mauremys) caspica rivulata* (Valenciennes):

Many adults and half-grown seen Gökova, 18 km. S. of Mugla, 30/7/68. Marshland at sea level in ditches with saline water and adults in a fast-running, fresh-water stream.

Several, adults and half-grown seen, Milas to Mugla road, 13/8/68. In and by the side of a small, muddy river running by the road.

Many adults seen, Fethiye, 8/8/68. In wet ditches in cultivated, flat land just above sea level.

The distinction between this subspecies and *C.c. caspica* Gmelin is primarily in the uniformly black plastron and bridge. There are further distinctions in head colouration (Pritchard, 1966). The distribution of *rivulata* is mainly in the Balkan peninsular, but it enters south-west Turkey, and just extends into Syria eastwards, where further east the species is represented by *caspica* (Pritchard, 1966; Eiselt and Spitzenberger, 1967). The terrapins in the lowlands show a preference for running fresh water, although mainly half-grown specimens were seen in slow moving or brackish water. The subspecies *C.c. caspica* is known from the highlands.

## Testudinidae:

5. *Testuda graeca* L.:

1 ♀ seen, Gökova, 18 km. S. of Mugla, 30/7/68. Marshland at sea-level basking in early morning sun on sand by clump of rush-like vegetation.

1 ♀ seen, Mugla, 1 km. W., 6/8/68. Complete carapace remains by edge of dry, cultivated field in open, sun-exposed area.

On geographical evidence these tortoises were *T.g. ibera* Pallas. The subspecies differs conspicuously from *T.g. terrestris* Forskal, which just enters Mediterranean Turkey from Syria, in the colouration of the head which is pale yellow on the top and front as against black (Eiselt and Spitzenberger, 1967). The presence of a carapace only at Mugla, was probably the result of desiccation by the sun.

## Gekkonidae:

6. *Hemidaectylus t. turcicus* (L.):

Single juvenile seen, Fethiye, 8/8/68. In hotel bedroom at night.

Single adult seen, Fethiye, 8/8/68. On limestone rock face among loose rocks and dry, low scrubland.

These were the only geckoes of this species seen in Mugla, although other species are known in this area.

## Agamidae:

7. *Agama s. stellio* (L.):

1 juvenile, Bardakci, 1 km. W. of Bodrum, 5/8/68. Near buildings by sea.

Single adult seen Gökova, 18 km. S. of Mugla, 30/7/68. From under dead tree trunk in dry, scrubby pastureland.

2 adults seen, Fethiye, 8/8/68. In dry-stone wall crevice and on limestone rock face among loose rocks and dry, low scrubland.

Several adults and half-grown seen, Bodrum, 10/8/68. On boulders around base of Casile walls, seaward facing fortifications.

Single adult seen, Bodrum, 1 km. E., 14/8/68. In dry scrubland and rocks near disused building.

Single adult seen, Milas, 2 km. N., 16/8/68. On dry rockface.

This active species was frequently noticed running over stony areas during the hottest hours of the day, often near habitation. It occurs on the islands and E. Mediterranean countries from Greece to Egypt.

## Scincidae:

8. *Ablepharus k. kitaibeli* Bibron and Bory:

1 ♂, 1 ♀, 2 half-grown, 1 juvenile, Bodrum, 15/8/68. Castle walls' foundations, among plant bases (Limonium) on wasteland by sea.

The only siting, the skinks were seen burrowing among plant bases, wriggling quickly and they possess minute limb vestiges. E. Mediterranean in distribution.

9. *Chalcides o. ocellatus* (Forsk.):

Single adult seen, Kara Ada (Black Island), N. side, 5 km., off-shore from Bodrum, 4/8/68. Dry hillside in maquis-type vegetation under heather bush.

This skink was seen briefly only; from comparison with material in the British Museum, it is almost certainly correctly named. Subspecies occur on some Mediterranean islands, including Rhodes and Kos, and in North Africa.

## Lacertidae:

10. *Lacerta d. danfordi* Günther:

1 ♀, Girdev Gölü (Eren Dag), 1,780 m., Lycian Taurus, 11/8/68. alive. Dry scrubland on edge of lake plain, near mountain slope.

Single adult seen, Gökova, 18 km. S. of Mugla, 30/7/68. On rocks of dry hillside, sparsely forested with pine trees, exposed to the south.

Several seen, adults and half-grown, Fethiye, 8/8/68. On dry-stone wall, seeking refuge in crevices.

Wettstein-Westersheimb (1968) has illustrated its colour pattern variation and distribution. The specimen from the Taurus mountains can be compared with one from Gök Tepe (Guichard col., British Museum; Wettstein-Westersheimb, Plate 1, Fig. 5, opp. 356). The lizard's dorsal surface is fawn-brown in colour, paler dorso-laterally, and descending to a mottled pale and dark brown pattern; the tail is fawn and the underside cream. Those seen at Gökova and Fethiye on the coast were

strikingly different in colour pattern, comparable to those collected from Fethiye and Kaya (Eiselt col., Naturhistorisches Museum, Vienna; Wettstein-Westersheimb. Plate 2, Figs. 1 and 2, opp. 356). The dorsal surface is dark brown in colour, sub-uniform, with dorso-lateral lines of cream, while the underside is also cream, with the tail becoming blue-green towards the tip. The species is very active during the warmer hours of the day. The main stations for *L. danfordi* in S.W. Turkey (Wettstein-Westersheimb, 1967) stretch from Mugla, through the Vilayets of Antalya, Burdur, Isparta into Konya and the other constitutes the eastern part of Konya and parts of Adana, Mersin and Nigde. Remaining records are scattered throughout W. Turkey.

11. *Lacerta trilineata* Bedriaga:

1 half-grown ♀ Fethiye, 8/8/68, alive. Wasteland at sea-level among scrub and bushes.

The species is a member of the *L. viridis* group, and *L. trilineata* is essentially eastern in distribution. From evidence of the geographical distribution of the subspecies (Peters, 1964), this lizard is *L. t. cariensis* G. Peters. Dorsally the surface is olive-brown, with dorso-lateral yellow lines extending from behind the head to the tail base. There are light-blue patches on the sides of the neck. The underside of the body is yellow, causing the animal, although only half-grown, to appear livid. The colours dull with age.

12. *Ophisops elegans ehrenbergii* (Wiegmann):

1 half-grown, Gökova, 12 km. W., 22 km. S.W. of Mugla, 28/7/68. In maquis-type scrubland on coast.

1 half-grown, Bardakei, 1 km. W. of Bodrum, 5/8/68. On dry hillside by coast.

1 ♂, 1 half-grown, Mugla, 1 km. W., 6/8/68. Among rock piles on dry, cultivated and semi-cultivated land.

1 half-grown, Bodrum, 1 km. E., 14/8/68. In maquis-type scrubland on coast.

2 half-grown seen, Gökova, 18 km. S. of Mugla, 30/7/68. Dry, semi-cultivated pastureland

1 adult, 1 half-grown seen, Kara Ada (Black Island), N. side, 5 km. off-shore from Bodrum, 4/8/68. In maquis-type vegetation on dry hillside.

Single half-grown seen, Nif, 600 m., S. of Cal Dag, 30 km. N. of Fethiye, Carian Taurus, 9/8/68. On dry cultivated land.

Several seen, Bodrum, 15/8/68. On waste land with sparse, scrubby vegetation and among rocks at base of Castle walls fortifications.

*O.e. ehrenbergii* differs from other subspecies in Turkey by having fewer scales around the rump. It is widely distributed along the coast of W. Turkey to the south-east part of the Balkan peninsular in the north, and into Syria, Jordan and N. Iraq. It forms a transition with the eastern subspecies *O.e. elegans* Ménériés in S. Turkey, before giving way to it in the east (Bodenheimer, 1944). Mertens (1952) has shown a gradation in the number of rump scales in subspecies extending from the west to those further east in Turkey. It is surprising that this abundant, widely distributed lizard, preferring dry conditions, was not seen at Fethiye, although Eiselt (1969) has collected it there.

Colubridae:

13. *Natrix n. persa* (Pallas):

2 ♂, Gökova, 18 km. S. of Mugla, 30/7/68. Coastal marshland, in and near ditches with slightly brackish water.

Single half-grown seen, Gökova, as above, 30/7/68. Swimming in a fast fresh-water stream passing through coastal marshland.

Single skin remains, Girdev Gölü (Eren Dag), 1,780 m., Lycian Taurus, 11/8/68. On damp plain of grazed pastureland by lake. Most probably of this species.

It is widely distributed throughout Turkey, the Near East and the Balkans. The colour variations have caused some taxonomic controversy. In the localities where

snakes are seen, they feed primarily on frogs and toads. It is possible that the skin remains seen in the mountains were of *Natrix t. tessellata* (Laurenti).

14. *Coluber najadum* (Eichwald):

Single specimen seen, Gökova, 18 km. S. of Mugla, 30/7/68. Dry pastureland near coast by heap of rocks, retreating rapidly out of sight.

This snake, unfortunately unobtainable, possessed a long, tapering body and tail (head not seen) that was dark fawn in colour. Knowing its range of distribution, it would be expected to occur in this area.

15. *Coluber jugularis* L.:

Single specimen seen, Bodrum, 3 km. E., 15/8/68. Cultivated and built-on area on coast, proceeding across a path and secreting itself under a concrete slab.

The dorsal surface was olive-brown with a faint vertebral line and dark bands laterally. It has previously been recorded from Bodrum by Boulenger (Bodenheimer, 1944), and is distributed in S. Turkey, Rhodes, Cyprus and the Near East.

HABITAT DISPERSAL OF SPECIES:

All species were present in lowland conditions (below 1,000m.), except *Hyla arborea*, which was sighted only in one area; the Girdev Gölü in the highlands (above 1,000m.). It was expected in the lowlands for Eiselt (1969) has collected it there. All of the three amphibians seen were in wet highland conditions (juveniles only of *Bufo viridis*); only *Rana ridibunda* was seen in the wet lowlands. Adults of *B. viridis* were common at night in dry, lowland conditions, but knowing the species' overall distribution, it is likely to be ubiquitous. The localised *Lacerta danfordi* was found in dry conditions varying in pattern and colour to an extent with altitude (see Wettstein-Westersheimb, 1967). *Natrix n. persa* is similar in distribution, but lives near water; although only its skin remains were seen by the Girdev Gölü and these could have been of another species. *Clemmys caspica rivulata* was evident in lowland waters only, although in suitable conditions, is probably seen in the highlands as well. The remaining species were found only in dry, lowland habitats.

CONCLUSION:

Owing to the area, apart from the mountains, being dry and arid in mid-summer there was little evidence of species except for a few in some localities. *Ophisops elegans ehrenbergii* was the most widespread lizard seen in dry conditions, and *Bufo viridis* was common at night. Where there was water, *Clemmys caspica rivulata* and *Rana ridibunda* were abundant. The remaining species were seen only occasionally, although *Agama stellio* was conspicuous on account of its activity. Fewer animals were to be seen in the Vilayet of Mugla than in some other parts of Turkey or even the Balkans further to the north.

ACKNOWLEDGEMENTS

I am indebted to Mr. E. N. Arnold (British Museum [Natural History], London) for identifying the lacertids and confirming other identifications. Thanks are also due to Mrs. A. Walpole (Anti-Locust Research Centre) for preparing the illustrations.

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NOTES ON FOUR LIZARD SPECIES FROM THE PELOPONNESE, GREECE:  
*Algyroides moreoticus* (BIBRON & BORY), *Anguis fragilis peloponnesiacus* (STEPANEK),  
*Ophiomorus punctatissimus* (BIBRON & BORY) and *Ophisaurus apodus* (PALLAS).

By

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(Received 20/1/69)

In two recent papers (Clark and Clark, in press and Clark and Clark, in press), the authors have given detailed attention to the *Lacerta* species found on the Peloponnese. Comments are now made on four more lizard species from the Peloponnese which were not discussed in the above reports.

One species, *Ophisaurus apodus*, is here believed to be recorded from the Peloponnese for the first time. None of the other three—*Algyroides moreoticus*, *Anguis fragilis peloponnesiacus* and *Ophiomorus punctatissimus*—are common here and mention of them in the literature from this part of Greece is scanty, and confined to very few specimens.

Thus the authors' own finds since 1963 are presented, together with details of locality, dates of collection, habitat and brief comments on taxonomy. Height are given in feet ('). Descriptions are as in life.

Readers are referred to Clark and Clark (in press) for a background discussion of the physiography, vegetation and climate of the Peloponnese which constitutes the southern Greek mainland (Morea in older literature).

Part of the material referred to has been deposited in the Senckenberg Museum, Frankfurt, and part in the California Academy of Sciences, San Francisco. A few specimens have been retained by the authors.

#### ALGYROIDES MOREOTICUS (BIBRON & BORY)

Material examined: 13.

Localities: Nafplion to Epidavros, 800'-1,000'. January, March, April and December, 1963-1967 (10); Pelopion (near Olympia), 50', 7/10/65 (1); Gythion to Sparta, 300'-600', 31/3/66 and 2/4/66 (2).

General description: Uniform, often dark brown above and on flanks. Head lighter brown. Sometimes a faint trace of a white dorso-lateral stripe anteriorly, and small white dots round forelimbs and over flanks. Venter white or blue-white. Underside of tail, hindlimbs and base of tail often rust or yellow.

Summary of measurements and pholidose: (R=range,  $\bar{x}$ =arithmetic mean, s=standard deviation, n=number of lizards or series); body length: R=32.0-49.0 mm.,  $\bar{x}$ =44.1, s=3.2, n=13; total length/body length: R=2.73-3.38,  $\bar{x}$ =3.17, s=0.195, n=11; dorsals: R=18-22,  $\bar{x}$ =20.2, s=0.83, n=13 (keeled); ventrals (transverse rows): R=18-23,  $\bar{x}$ =20.3, s=1.81, n=11; collar: R=5-8,  $\bar{x}$ =6.5, s=1.13, n=11; supralabials: R=6-7,  $\bar{x}$ =6.9, s=0.27, n=25; supralabials anterior to subocular: R=3-4,  $\bar{x}$ =3.9, s=0.27, n=26; granules: R=7-11,  $\bar{x}$ =8.9, s=0.99, n=25; masseteric: R=0-3,  $\bar{x}$ =0.93, s=1.13, n=15 (estimate of temporal area occupied, on scale 0=absent to 4=very large); occipital pores: R=1-4,  $\bar{x}$ =2.4, s=1.20, n=10 (determined in relation to interparietal, IP, on scale 1=up to  $\frac{1}{4}$  IP to 4 being equal to IP); postnasals: R=1-2,  $\bar{x}$ =1.5, s=0.50, n=26.

Remarks: This is a small, secretive lizard, inhabiting leaf-covered banks and piles of brushwood, often near water and in rather shady locations.

This species was most commonly seen towards coastal regions, but never in large numbers. The only sight identifications made well inland was near the

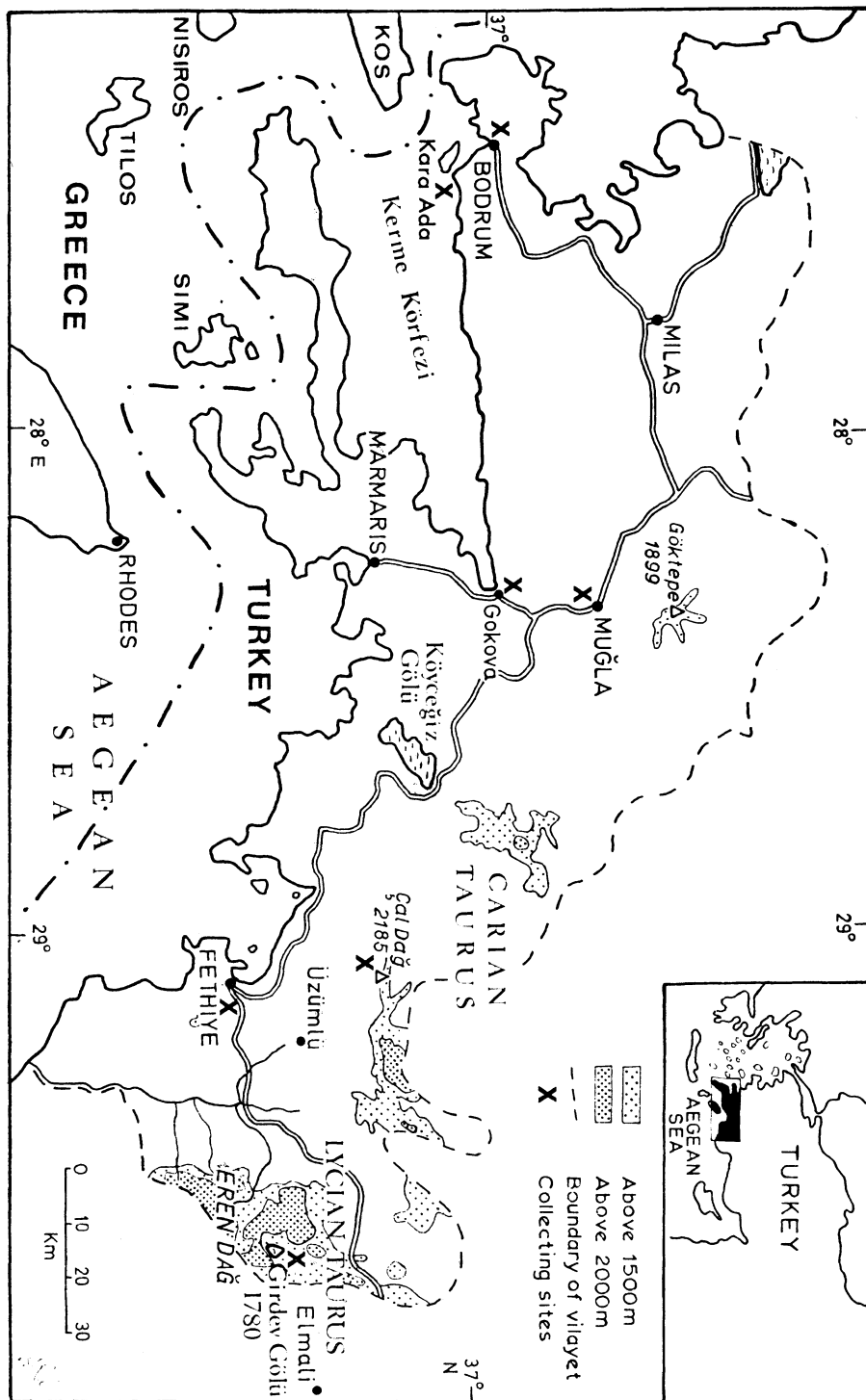


Fig. 1. The Vilayet of Mugla, S.W. Turkey.

Stympalea lake, at an altitude of 2,300'. Boulenger (1920) records one specimen from the same area.

This species is basically endemic to the Peloponnese, but has some penetration into the Ionian Islands (Mertens and Wermuth, 1960).

#### ANGUIS FRAGILIS PELOPONNESIACUS STEPANEK

Material examined: 2.

Localities: Psari (between Nemea and Stymphalea), 2,000', 4/10/63 (1); Megalopolis, 1,500', 30/3/66 (1).

Description: Light fawn above with a broken black vertebral stripe starting just behind the head and continuing for about 20 mm. in one, degenerating into spots in the other and then disappearing. Flank zone abruptly darker, nearly black along line of demarcation of dorsum and flanks, otherwise dark grey fawn. The demarcation line broken and wavy for the first 25 mm. Venter nearly or completely black.

Summary of measurements and pholidose: body lengths: 180, 177 mm.; total length/body length: 3.34, \*; scales round mid-body: 33, 30.

Remarks: The specimen from Psari was caught on the gravel road after heavy rain. The other was found under a stone in a grassy field.

Terentev and Chernov (1949) consider this form to be the only valid subspecies of *Anguis fragilis*, being characterised by the larger number of body scales. Specimens from the British Isles have 26 scales round the body (Smith, 1954). Specimens from N.E. Turkey also have a lower number, 24-28 (Eiselt, 1965). However, one of the three specimens caught by the present authors in N.E. Turkey in 1967 had 32.

This subspecies is confined to the Peloponnese. Wettstein (1953) lists three specimens from Kambox at the foot of the Taygetos Range, caught in 1901. It has also been taken near Kalavrita in the N.W. Peloponnese. Thus this species appears widely dispersed over the region, though known from only a few specimens.

#### OPHISAURUS APODUS (PALLAS)

A large specimen was sight-identified near Akladokampos in the central Peloponnese in May 1965, at a height of 1,500'. Although it reappeared a couple of times, it evaded capture, taking refuge in an impenetrable thicket. This is believed to be the first record of this species on the Peloponnese. Evidently it is rare here as no further specimens were seen. Otherwise in Greece it is known from Corfu (Mertens, 1961), Euboia and some islands of the northern and eastern Aegean (Wettstein, 1953).

Outside Greece *O. apodus* has a broad range from the Balkans across Turkey and S.W. Asia, to northern Afghanistan (Smith, 1940), and nearby regions of Soviet Central Asia (Terentev and Chernov, 1949).

#### OPHIOMORUS PUNCTATISSIMUS (BIBRON & BORY)

Material examined: 8.

Locality: Acro-Corinth, 1,500'-1,800', 2/2/67 (2), 14/1/69 (3) and 15/1/69 (3).

General description: Ground—dorsal zone cream or brownish, cream or silver grey on tail; flanks and ventral zone flesh-coloured or greyish. Around whole body each scale with dark fleck made up of aggregate of small dots, which appear as broken dark longitudinal lines. These are fine on dorsum (4 median dorsal lines), absent on the three smallest specimens (except on nape). On tail lines becoming nearly continuous, broader, bolder and as wide as the interspaces. The dorso-lateral lines are the most prominent, and those on the venter clear, with one distinct fleck per scale. On the two juveniles, these dots forming nearly continuous dark stripes on slate-white ground.

Measurements and pholidose are summarised in table 1.

Remarks: All specimens were found under stones on the boulder-strewn hillside within the castle ruins. On the three occasions, the air temperature was about 15.0°C. *O. punctatissimus* was never taken on sloping ground, and always under individual and well-separated stones or rocks. In places where the ground was closely covered with stones and rubble this lizard was not found, but obviously the searching of

large piles of rocks is very difficult. When disclosed, the skinks displayed little activity. Evidently *O. punctatissimus* spends the winter months in this way, little protected from the occasional sharp frost, as under the stones no cavities or holes were present.

Werner (1930) remarks that this is one of the rarest lizards in Greece. In the Peloponnese Werner found it at this identical site, but nowhere else. The present authors' experience is the same and they have collected extensively on the Peloponnese. Werner also mentions it from Larissa (Thessaly) in north Greece. Anderson and Leviton (1966) review the genus *Ophiomorus*. They list the known localities of *O. punctatissimus* and include those mentioned by Werner. In addition, the Taygetos Range in the southern Peloponnese is given, though the exact site is apparently not known. Outside Greece it is on record only from Xanthus in S.W. Turkey.

It is noted in the present authors' material that (i) three specimens are larger than any quoted by Anderson and Leviton in their review (77.0 mm. being their maximum body length) and (ii) they agree with Anderson and Leviton's diagnosis in having, with one exception, 18 scales round the mid-body. A sexual dimorphism was apparent in the number of transverse scale rows.

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TABLE 1. *O. punctatissimus*—summary of measurements and pholidose.

Field number	a.	b.	c.	d.	e.	f.	g.	h.	i.	j.
69/1	♀	94.0	*	20	18	18	115	5	3	5
67/19	*	89.0	*	*	18	*	*	5	3	5
67/18	*	79.5	*	*	18	*	*	5	3	5
69/2	♂	77.0	2.07	20	18	18	107	5	3	5
69/3	♂	73.0	1.97	20	20	18	111	5	3	5
69/4	♀	59.5	(1.86)†	20	18	18	116	5	3	5
69/5	J	41.5	1.86	20	18	18	112	5	3	5
69/6	J	41.5	1.77	20	18	18	107	5	3	5

Lizards are listed in order of size.

\* denotes character not determined; † regenerated tail suspected.

Key to symbols: a. sex, or J=juvenile; b. snout to vent length in mm.; c. total length/body length; d. scales round anterior third of body; e. scales round exact mid body; f. scales round posterior third of body; g. number of transverse scale rows from occiput to tail base; h. supralabials; i. supralabials anterior to subocular; j. sublabials.

Note: (i) limbs entirely absent; (ii) subocular is number 4 supralabial.

NEW USES FOR AN OLD METHOD USED IN  
OPHIDIAN SEX DETERMINATION

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Many workers are concerned with determination of sex in living snakes. Klauber (1956) reviewed much of the literature on ophidian sexual dimorphism in total lengths, tail lengths, squamation, and colour. Schaefer (1934) first noted that a suitable probe could be inserted into either of the inverted hemipenes of male snakes, which open into the posterior side of the cloaca. In females a membrane covers the corresponding region and a probe cannot be inserted without injury.

In preserved specimens a simple method of determining sex is to slit, longitudinally, the ventral side of the tail. The scent glands of the female extend only a short distance posterior to the cloaca and terminate in rounded ends. Hemipenes taper posteriorly and terminate toward the base of the tail (Klauber, *op. cit.*).

In freshly-killed specimens and some live snakes, the hemipenes may be extruded by pressing with the thumb, beginning at the tip of the tail and proceeding forward to the cloaca. Extrusion may also be accomplished by injection of a fluid into the tail. This often is done by injection of formalin during preservation.

The same technique may also be used to determine sex of live specimens, substituting distilled water for preserving fluid.

Ninety-three living reptiles were used to test the water injection technique. 87 snakes, adults and juveniles, and 6 adult lizards of the following species: *Constrictor constrictor* (1), *Arizona elegans* (2), *Chionactis occipitalis* (2), *Elaphe obsoleta* (3), *Hypsiglena torquata* (1), *Lampropeltis getulus* (1), *Masticophis flagellum* (5), *Natrix sipedon* (6), *Pituophis melanoleucus* (11), *Phyllorhynchus decurtatus* (2), *Rhinocheilus lecontei* (3), *Thamnophis elegans* (2), *Thamnophis sirtalis* (5), *Crotalus atrox* (43), *Heloderma suspectum* (6). In initial tests 68 snakes were sexed by use of a probe and the results compared to those obtained by injection of water. Both methods were equally reliable with adults, but the probe method is difficult to use and unreliable with juveniles. A small amount of injected water is sufficient to evert the hemipenes of juveniles; however, male organs may be difficult to distinguish from scent glands of a female. Juvenile scent glands are white and come to a point; while hemipenes are suffused with red and are blunt (Klauber, *op. cit.*).

Nineteen additional snakes and six *Heloderma suspectum* were studied later. The *Heloderma* were included because they are notoriously difficult to sex (Bogert, 1956). When no hemipenes were everted following injection the animals were killed and dissected. In all cases they were females.

In two of five snakes checked for sperm, samples of low density were obtained by rubbing a microscope slide against the sulcus spermaticus and the apex. Helminthes were often found on the surface of the hemipenes (especially in the sulcus). Unfortunately these have not been identified and it is not known if they were parasitic.

The gauge of the needle and syringe size should be commensurate with the size of the specimen. A 28-gauge needle and 5-CC syringe were used on juveniles and small specimens. It is not necessary to apply great pressure or to totally evert the hemipenes, and such should be avoided. Just enough fluid to begin the eversion of the hemipenes is sufficient to determine sex, and the organs invert rapidly. When total eversion is necessary, considerably more time is required for the hemipenes to become inverted. In three instances snakes were decidedly over-injected; blood vessels were ruptured; marked discomfort was shown and the hemipenes required

several hours to invert. The first group of 68 specimens was observed for 14 days following the injections and no obvious effects were noted.

## ACKNOWLEDGEMENTS

I thank Dr. A. E. Dammann, Charles E. Mays and Max Allen's Zoological Gardens for allowing me to examine some of their specimens. The Arizona Game and Fish Department kindly issued permits for the *Heloderma suspectum* from Arizona. Thanks are due to Dr. W. L. Minckley for criticising the manuscript and to Dr. M. J. Fouquette, Jr., for checking the sperm samples.

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THE ACTIVITY PATTERN OF *CAUSUS RHOMBEATUS* (LICHTENSTEIN)  
(VIPERIDAE) IN GHANA

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The night adder *Causus rhombeatus* (Lichtenstein) is the snake most commonly found amongst the herpetofauna of Tafo, Ghana (Leston and Hughes, 1968). During a period of thirteen months, December 1966 to December 1967 inclusive, a bounty was offered for all snakes brought in by the team of labourers employed at the Cocoa Research Institute of Ghana. The area sampled comprised patches of cocoa, some in plantation plots and some in more or less bush plots, bungalows, laboratory and store buildings, food farms and secondary forest but, as described elsewhere (Leston and Hughes, 1968), the majority of the night adders were found around buildings and in compounds. A more or less constant number of workers was employed, at tasks such as harvesting, weeding, ditching, gardening, cleaning, and the sample of snakes brought in is believed to have varied only in relation to the activity of the snakes.

Figure 1 shows the number of night adders caught in the period under review. Three levels were exhibited by these numbers: (1) a range of 0 to 1 per month during the period December to March; (2) a range of 5 to 7 per month during the period April to November except (3) for peaks in July and September.

The principle food of the night adder at Tafo is the African toad, *Bufo regularis* Reuss, which occurs abundantly. This toad practically disappears during the dry season—late November to the end of February—though some individuals turn up following the occasional rains. It is probable that the low activity of the snakes is associated with scarcity of food, at least from December to the end of February, but the mechanism which brings this about is unelucidated. The March lag in resumption of activity was noticeable in 1967 but again the nature of the trigger operating between March and April is unknown.

The activity level between April and November is to be associated with the availability of an abundant food supply: in addition to the African toad various ground frogs abound and these are known to be secondary food sources (Leston and Hughes, 1968).

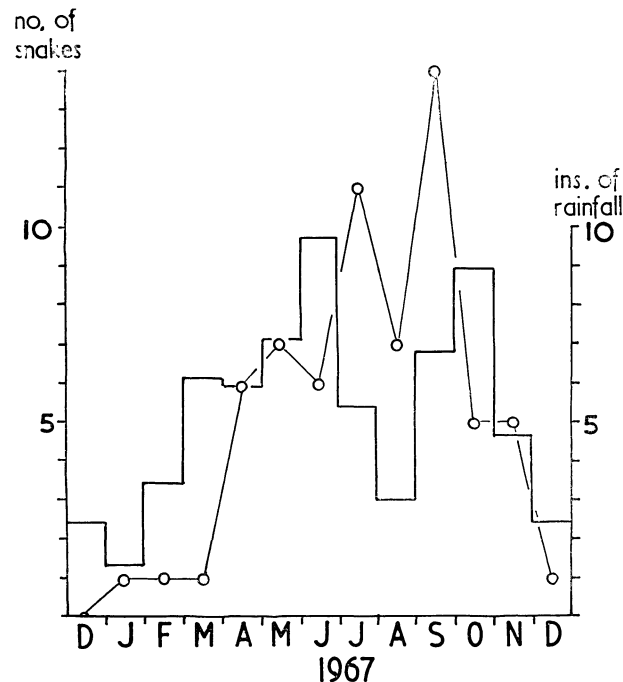


Figure 1. Thirteen months of captures of night adders, *Causus rhombeatus*, (frequency polygon) and rainfall (histogram).

It is tempting to associate the two peaks of activity with additional mobility in searching for mates or oviposition sites. Eggs were reported to be present in females caught during April, May (twice) and July (Leston and Hughes, 1968). Eggs were also present in specimens M308 (July, 1967), M343 (July, 1967) and M374 (captured June, 1967 and kept in captivity with others—oviposited 2 Nov. 1967): the numbers are registration numbers in the University of Ghana's collection. These data, however, cannot be interpreted so as to throw light on mating dates but they do suggest that oviposition is confined to the period from May to early November.

The seasons at Tafo, in the semi-deciduous forest region of West Africa, have recently been re-interpreted (Leston and Gibbs, 1970). Figure 1 shows the monthly rainfall for the period under discussion. Although Leston and Gibbs (1970) use a combination of rainfall and sunshine hours in defining seasons there is little reason to invoke their complex pattern for an understanding of the present data. The night adder clearly has two main levels of activity: a low level associated with shortage of prey and correlated with the dry season; a high level associated with sufficiency of prey and correlated with the rainy season. The dry, dull season, which coincides with August, is sufficiently humid not to cause the disappearance of ranids and bufonids.

#### ACKNOWLEDGEMENTS

This investigation was carried out at Cocoa Research Institute of Ghana, by permission of the Director.

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## SOME SNAKES FROM THE FOREST ZONE OF GHANA

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The food, habitat and activity times of 34 species of snakes—203 specimens—collected at Tafo, Eastern Region, Ghana, have been recorded (Leston and Hughes, 1968). Separate notes have been devoted to the overall prey pattern (Leston, 1970a) and the activity seasons of *Causus rhombeatus* (Lichtenstein), (Leston, 1970b). Tafo is within the forest zone but largely cleared or devoted to cocoa growing: nevertheless its fauna is almost entirely a forest one. The present account gives additional or confirmatory biological information and is based on a sample of 167 snakes captured at Tafo and not hitherto reported together with a few records from other parts of Ghana. Almost no information is available other than in the papers noted above and in Cansdale's book (1961): data from adjacent countries, though large, are entirely taxonomic and distributional.

*Typhlops caecatus* (Jan). Regurgitated by *Miodon acanthias* (see below), 15 Sept., 1967: the previous Tafo example was also from the gut of this species (Leston and Hughes, 1968). These are the only published records for Ghana bearing a precise locality.

*Leptotyphlops bicolor* (Jan). Found in the topsoil of a bungalow garden, 21 July, 1967. Usually said to be a savanna snake—it is reported from Upper Volta by Villiers (1963)—but this confirms that it occurs in large clearings in the forest zone. It has previously been recorded from Tafo and from Obuasi, Ashanti (Leston and Hughes, 1968) whilst the type locality is Butre, Western Region, also forest zone.

*Calabaria reinhardtii* (Schlegel). Further examples have been found amidst houses, 15 Aug., 1967; in leaf litter under cocoa, 3 Oct., 1967; and in a ditch in the open, 5 Dec., 1967. Another was dead on the road at Asiakwa, Eastern Region, an urban area, 11 June, 1967. Thus although a forest snake it is not confined to closed forest and can occur in largely cleared and populated areas. The only published Ghana records are for Oda, Eastern Region (Cansdale, 1961) and Tafo (Leston and Hughes, 1968): at the last eleven specimens have now been captured out of a total of 370 snakes, that is 3 per cent.—it is therefore not rare. Dunger (1966) reports the snake feeds on shrews but how far this is its exclusive diet is unknown.

*Natrix anoscopus* (Cope). A female found at the side of a stream, 1 June, 1967: it contained five eggs each about  $23 \times 13$  mm. and some smaller rudiments, indicating wet season oviposition.

*Natriciteres variegatus* (Peters). The sites of additional captures—2 May, 13 July and 25 Sept., 1967; 19 Jan., 1968—all confirm this is a shade-loving snake with a preference for damp places where its sole prey, frogs, abounds. As with other frog eaters there is no suggestion of reduced activity in the dry season.

*Bothrophthalmus lineatus* (Peters). One caught beside the Tafo Dam, 9 June, 1967, measured 878 (snout-vent)+178 (tail)=1,056 mm. and is bigger than any previously recorded from Tafo: it contained a frog, *Ptychadena* sp. and unidentifiable mammal remains.

*Bouedon virgatum* (Hallowell). Although the majority occurred around buildings or in nearby grassy areas three (out of eleven) were captured under cocoa shade away from compounds. This is a voracious snake: one captured 16 Nov., 1967, contained a mouse 121 mm. long with a 140 mm. long tail and another 70 mm. long with a 16 mm. tail.

*Lycophidion laterale* (Hallowell). One was taken 15 Jan., 1968 in the same circumstances as those previously reported; amidst cocoa leaf litter under heavy shade. The snake reported by Cansdale (1954) from Lawra, Upper Region, a sudan savanna area, was most unlikely to be this species.

*Lycophidion irroratum*. (Leach). The type locality of this is Fantee; that is, the area around Cape Coast, Central Region. *L. guttatus* (Jan), considered a synonym, has type locality Elmina, also Central Region. It is recorded from Oda, Eastern Region (Cansdale, 1954) but was not known to us from Tafo (Leston and Hughes, 1968). Three are now reported from the latter: 20 Oct., 1967, on ground in a shaded cocoa nursery, buildings nearby; 11 Nov., 1967, in grass in a regularly mown area; 5 Jan., 1968, in grass in the laboratory compound. This is not therefore, necessarily confined to heavy shade but the gut contents of the last were the remnants of a *Panaspis breviceps*, a nocturnal forest skink.

*Lycophidion nigromaculatum* (Jan and Sordelli). The type locality of this is Dabocrom, an almost lost town in Western Region. Neither the form nor even the name is mentioned in Laurent's revision of the genus (1968) but the close sympatry of *laterale*, *irroratum* and *nigromaculatum* supports the contention of Leston and Hughes (1968) that all three are valid species. The specimen reported earlier from Tafo had an empty gut but one captured on the ground at 0930 hrs., 25 Oct., 1967, under banana tree debris more or less in the open, contained the tail of a scincid 85 mm. long (probably *Mochlus sundevalli*): this is the first food record for the species.

Of the 370 Tafo snake captures four were *laterale*, three *irroratum* and two *nigromaculatum*: records of any of these from the savanna zone are suspect.

*Mehelya poensis* (Smith). New captures—12 July, 1967, on a road near a farm plot, at 2130 hrs., moonless and overcast; 27 Nov., 1967, in a rotten log in shade, daytime—confirm this as a snake active at night, hiding in rotten wood by day. The first regurgitated a *Mabuya* sp (Scincidae) on capture.

*Philothamus heterodermus* (Hallowell). A further nine from Tafo confirm that this is as much, if not more, a ground snake than an arboreal one. The 29 dated captures of the earlier and present study fall into the months, from January, thus: 3, 4, 2, 0, 3, 7, 2, 2, 0, 3, 1, 2. This does not suggest any marked falling off in activity in the relatively dry months of December, January and February: presumably frogs, on which this species exclusively feeds, are always available (compare *Causus rhombeatus* (Leston, 1970b)). It was noted that oviposition takes place in the last half of the rains (Leston and Hughes, 1968): one captured 17 Nov., 1967, laid three eggs during the night of 12-13 Dec., 1967, thus extending the known laying season into the early dry period. Additional captures include Bunso, Eastern Region, 20 Oct., 1967 (forest zone) and Wegbe, Volta Region, 1 Nov., 1967 (savanna).

*Gastropxyxis smaragdina* (Schlegel). Whereas this was earlier believed to be an uncommon snake—six were recorded by Leston and Hughes (1968)—the period June 1967 to Jan. 1968 saw 15 captured. Agamid and geckonid lizards were previously reported as food: the present sample had as identifiable gut contents *Agama agama*, *Hemidactylus fasciatus* and a tree-frog, *Hyperolius* sp. A female caught 7 Dec., 1967 had two ripe eggs which came out of the abdomen when the animal was killed. Each measured 34 × 11 mm., of yellow colour, without blood supply: this indicates oviposition in the dry season (but there had been rain on the six previous days). A specimen was taken in the Odomi River Forest Reserve, the first to be reported from Volta Region; 4 Nov., 1967.

*Thrasops occidentalis* (Parker). This snake, only described in 1940, was known hitherto from Axim, Western Region (type locality); Dunkwa, Central Region (paratype locality); Kumasi, Ashanti; Sekondi, Western Region, and Oda, Eastern Region (Cansdale, 1949). It was unrecorded for Tafo but two have now been captured: 6 Nov., 1967, and 12 Nov., 1967. Another was found on the road near Nkwanta Forest Reserve, Eastern Region, 8 May, 1966. Thus this is now seen to be a widespread snake in the Ghana forest zone with records from four

Regions. The second Tafo specimen contained a bird, too digested for identification. *Grayia smythi* (Leach). Of two captured, 4 Aug., 1967 and 12 Oct., 1967, the second was 1,270 mm. (snout-vent) + 527 mm. (tail) = 1,797 mm. long and considerably bigger than the previously recorded Tafo specimens. It weighed 2.112 kgs., and was a female, with an empty gut. This snake seems to have a far greater volume of blood than other species of comparable size.

*Boiga blandingi* (Hallowell). Seven more have been captured: the colour was recorded of six—all were of the black form. Of five dissected all had something in the stomach: *Agama agama*, a fiscal shrike, a young weaver bird and an adult *agama*, a bronze manakin, a further *agama*. Six were found on trees, the seventh was electrocuted on a power line: unlike most other tree snakes this is almost never taken on the ground. *Boiga pulverulenta* (Fischer). One was found crossing a path at 2100 hrs., 9 June, 1967; five others were captured on trees (including one coiled inside a rotten cocoa pod); one occurred amidst old files on an office shelf; another on a five-foot high cocoa tree in a greenhouse. All the captures, and observations on individuals in cages, confirm this as a nocturnally active snake. One was captured in savanna at Golokuati, Volta Region, 5 Nov., 1967.

*Psammophis phillipsi* (Hallowell). Of nine further captures two had recognizable gut contents; mice and *Mabuya blandingi* (Scincidae). The sample, together with the six earlier reported with dates, does not suggest any marked seasonal changes in activity: from one to four have been taken in all months save February (dry season), April and October (wet season).

*Thelotornis kirtlandi* (Hallowell). One was taken at Kibi, Eastern Region, in the forest zone, 10 November, 1967.

*Miodon acanthias* (Reinhardt). Three more of this uncommon snake have been taken: 25 Aug., 1967, 23 Sept., 1967, 15 Nov., 1967. The last two contained respectively the caecilian *Geotrypes seraphini* and a blind-snake, *Typhlops caecatus*. Both these prey have previously been reported (Leston and Hughes, 1968). So far all dated captures have been between April and mid-November, that is, in the rainy season.

*Aparallactus modestus* (Gunther). A further example was captured in mid-afternoon, 23 Jan., 1968: the gut was empty.

*Naja melanoleuca* (Hallowell). Adding the present twelve captures to the six reported earlier with dates shows records for all months except February, April and November: there is no suggestion of a seasonal pattern in activity. Of the new sample nine occurred on the ground, three in trees, but the presence of young snakes in the sample is perhaps responsible for the bias.

*Dendroaspis viridis* (Hallowell). Of thirteen additional captures two were on the ground, nine in trees or shrubs, one in a first floor telephone exchange and one in a ground floor bedroom. Capture dates do not suggest any seasonal variation in activity. Five had gut contents, in each case myomorph rodents.

*Causus lichtensteini* (Jan). Leeson (1950) says of this "no recent record" and it is unknown in the Ivory Coast (Doucet, 1963). One was captured at c. 2,200 feet in the Atewa Range Forest Reserve, Eastern Region, 30 Nov., 1968—this is the first modern record for Ghana and the first to have a precise locality. The snake, a male, regurgitated a frog on capture. Absence from Tafo and the present record indicate it is a snake of undisturbed primary forest with a low light preference. A large foraging party of black driver ants, *Anomma nigricans*, was nearby at the time, 1530 hrs., and may have been responsible for driving the snake from hiding. The rich orange-brown colour made it quite distinctive in life.

*Causus rhombeatus* (Lichtenstein). Elsewhere it is shown that during the dry season this snake exhibits a marked decline in activity (Leston, 1970b). 53 were caught at Tafo between mid-June, 1967 and mid-January, 1968: it is far and away the snake most commonly seen. Despite its vernacular name, night adder, times of capture suggest it is just as active by day as by night—though humidity may be important here—and oviposition was observed of a captive snake between 1130 and 1400 hrs. (seven eggs). Oviposition is probably confined to the wet season.

A white colleague was bitten whilst handling this species: one fang deeply penetrated a finger tip. The wound was sucked and blood pushed out but other than local pain, stiffness and a feeling of bruising no other symptoms appeared and normal use returned to the finger within a week.

*Atheris chlorechis* (Schlegel). Three further examples have been found, all on cocoa trees growing under fairly heavy top shade. It has not been found on trees growing in the open, suggesting it is a true high forest species.

## ACKNOWLEDGEMENT

These observations were made at the Cocoa Research Institute of Ghana whilst the author was in the employ of the International Capsid Research Team. Mr. B. Hughes (University of Ghana) has assisted with determinations of the more critical species: all specimens are now deposited with him in the University's collection.

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NOTES ON THE TOAD (*Bufo bufo*) AT CASTOR HANGLANDS

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(Received 20/2/69)

## INTRODUCTION

Observations have been carried out since 1961 on a colony of the Common Toad (*Bufo bufo*) in a pond on the Castor Hanglands National Nature Reserve. The results have been used for guidance in the management of the aquatic habitats in the Reserve and also to see the effects of such management on this toad colony. The aims of the work were (a) to estimate the toad population, (b) record their presence at the pond, (c) try and locate their hibernation places and (d) obtain data on their size and weight.

The Castor Hanglands Reserve is situated five miles west of Peterborough and two miles north of the village of Ailsworth. The pond, which is 50 feet above sea level and at Grid Ref. TF119016 lies at the eastern end of a grassy peninsular which extends from Ailsworth Heath into Castor Hanglands Wood. The pond is permanent and spring fed and known as the Main Pond and the peninsular as the Pond Leg. During the study period it underwent considerable changes which altered both its size and depth. The outlet was dammed in 1962, then in 1966 the dam was replaced by a more permanent wooden structure and the southern half of the pond dredged out by dragline. In 1967 the rest of the pond was dredged out and a new circular dyke cut at its western side and a small island created. An overflow was incorporated in the new dam so the water level is fairly constant, giving 1,100 square yards of surface. It has a maximum depth of about four feet with six inches of silt on the bed and sloping margins. Readings taken in June 1964 showed an average pH of 7.6 (Figs. 1, 2).

Previous to dredging the dominant aquatic plant was the Stonewort (*Chara hispida*). Since dredging Branched Burr-reed (*Sparganium erectum*) and Broad-leaved Pondweed (*Potamogeton natans*) have been co-dominants in the southern half while in the recently dredged northern half the *Chara hispida* is resuming its previous dominance. Other aquatic plants include Bulrush (*Scirpus lacustris*), Common Water Starwort (*Callitriche stagnalis*), Horned Pondweed (*Zannichellia palustris*) and Common Spike Rush (*Eleocharis palustris*) while marginal species include Fen Rush (*Juncus subnodulosus*), Hard Rush (*Juncus inflexus*) and Lesser Water Parsnip (*Berula erecta*).

The Pond Leg and the immediate surround of the pond are essentially grassland with occasional shrubs and trees and small areas dominated by *Juncus sp.* About 30 yards from the edge of the pond there is woodland on three sides. The outlet runs south-east from the pond and another stream, running west to east, joins it about 20 yards south of the pond. About 300 yards up the latter there is the small Heath Pond. This dries up in most summers. In the Pond Leg itself is a small depression about 5 yards square which holds a few inches of water during the period when the toads are breeding. It is about 200 yards west of the Main Pond. The whole of the Pond Leg is badly drained yielding marshy conditions throughout.

## METHODS

Night visits were used to observe the position and direction of movement of toads away from the pond. During the day catches were made for examination, measuring and marking. A Spring balance, accurate to 0.1 gm. was used for weighing. Body length was taken from the nose to tip of the urostyle. Up to 1965 toe clipping was used as a method of marking, but was discontinued as it was found to result in inflamed and swollen digits.

Estimates of population were made by the capture/recapture method, carried out over several days to increase accuracy. Only the population of males could be estimated in this way as they stay at the pond for most of the breeding season whereas the females soon leave. Thus far more males were handled than females.

By mapping the distribution of individuals found away from the pond it was hoped to locate the hibernation sites. Locating toads at night by torchlight was fairly easy on woodland rides or short grassland but was more difficult for other habitats; the former method was therefore emphasised. As rides and paths are present all around the area the records obtained are considered a reliable indication of the directional movement.

TABLE 1.

## (a) Population estimates and survival

Capture/recapture details in 1962 (males)		
April	Nos. handled	Est. Population
13	45 caught and marked	
14	63 (18 marked)	157
16	20 (14 marked)	129
18	30 (16 marked)	180
19	30 (25 marked)	220
21	41 (20 marked)	227
22	28 (15 marked)	291
23	9 (6 marked)	257
Capture/recapture details in 1963 (males)		
April	Nos. handled	Est. Population
5	5 caught and marked	
11	16 (1 marked)	80
12	45 (3 marked)	300
13	23 (11 marked)	130
15	23 (7 marked)	243

Numbers marked in 1962 .....	172 males	7 females
Numbers marked in 1963 .....	90 males	7 females
Number of males recaptured in 1963 .....	20.	Thus survival of 11%.

The largest catch was made on 13 April 1964 when 248 males and 12 females were handled in one visit.

TABLE 2.

## MEASUREMENTS

Weights and lengths in 1962 (males)					
Dates	Nos.	Av. Wt. (gms.)	S.D.	Av. Lgth. (mm.)	S.D.
13 April	45	24.9	3.4	54.0	2.6
14 April	63	26.2	4.2	54.0	3.2
16 April	20	24.6	4.8	55.0	3.9
18 April	30	25.2	3.5	56.0	3.8
19 April	50	24.8	6.0	56.0	3.2
21 April	41	23.7	3.4	55.0	2.4
22 April	28	22.9	3.1	55.0	2.9
23 April	9	23.7	4.9	54.0	4.2
Totals	286	24.5	4.2	55.0	3.3
Weights and lengths in 1962 (females)					
Dates	Nos.	Av. Wt. (gms.)	S.D.	Av. Lgth. (mm.)	S.D.
13-23 April	8	66.0	9.1	73.0	3.8
Weights and lengths in 1963 (males)					
Dates	Nos.	Av. Wt. (gms.)	S.D.	Av. Lgth. (mm.)	S.D.
5 April	5	29.2	5.0	58.0	3.6
11 April	16	25.8	4.8	56.0	3.6
12 April	45	27.2	3.6	54.0	2.3
13 April	23	27.1	4.1	55.0	2.0
15 April	23	24.4	3.0	53.0	2.1
Totals	112	27.4	4.1	55.0	2.7
Weights and lengths in 1963 (females)					
Dates	Nos.	Av. Wt. (gms.)	S.D.	Av. Lgth. (mm.)	S.D.
5-15 April	7	73.9	18.4	75.0	5.0
				1962	1963
Maximum length in males .....				67 mm.	64 mm.
Maximum weight in males .....				39.3 gms.	40.4 gms.
Maximum length in females .....				77 mm.	81 mm.
Maximum weight in females .....				92.7 gms.	114.0 gms.

N.B. Weights of females have been included for completeness sake only, as they are of course variable depending on how much spawn has been deposited before weighing.

(See also Figs. 3, 4, 5.)

## (c) DISPLACEMENT

At 14.00 hrs. G.M.T. on 27 March, 1964, 25 males were marked and released in a woodland stream 450 yards due south of the Main Pond. The area of release was searched on the 28th but none were found or were ever contacted again. On 28 March, 1964, 25 males were marked and released in the Heath Pond, and were still there five hours later. Only one was subsequently seen, in the Main Pond, ten days later.

## (d) HIBERNATION

Although large numbers of records were obtained on some evenings over 50 individuals were recorded away from the pond, no apparent pattern to indicate any special hibernation source emerged. Rather the maps show a random pattern of dispersal to both grassland and woodland habitats. Some toads were extremely dry indicating very recent emergence but here again no directional pattern could be found. No individuals were located over 350 yards from the pond. Apparently either a wide range of scattered hibernaculae were used; if a few favoured places are used these were not located.

## (e) BREEDING SITES

Most of the spawn was laid amongst the aquatic vegetation in the Main Pond, particularly on the shallow sides at depths less than one foot six inches. From its distribution some places seemed more favoured than others. Thus in certain sites the water is black with ribbons of spawn but others are devoid of any. Two plants seem to be connected with spawn distribution *Juncus subnodulosus* and *Sparganium erectum*. A few toads spawned at the very end of the season in the Heath Pond and the small depression.

## (f) BREEDING TIMES

The males were first seen or heard between 23 March and 9 April except for 1966 when the males and females bred early at the pond on 3 March. This was a long breeding season and included periods of inactivity when the temperature dropped low enough to form ice on the pond. Females were still laying spawn after tadpoles had hatched from the first batches of eggs. The last female laying in that year was recorded on 10 April.

## PREDATION

Grass snakes (*Natrix natrix*) have been seen eating toads although not many snakes visit the pond until the toads have finished breeding. Herons (*Ardea cinerea*) and Brown Rat (*Rattus norvegicus*) have also been seen taking small numbers of the adult toads. In several instances a dead female was found in the middle of a large number of males (in one case no less than 22 males). Periodically these 'bundles' on animals were separated for it is believed that the males kill the female.

## BEHAVIOUR

If it becomes particularly cold breeding toads cease croaking and bury themselves in the silt at the bottom of the pond or on its margins. They can also be stimulated to bury themselves by disturbing the water although sometimes this action has the effect, particularly at night, of stimulating the male who in some way perhaps associates the disturbance with the arrival of a female.

Reaction to a torch beam varies considerably; some retreat backwards into corners while others sit upright and can easily be seen as their white throats show up clearly.

Some males were found with brick-red blotches up to half-inch diameter on various parts of the skin; Dr. E. Elkan (personal communication) has suggested that this could well be either bacterial or fungal infection.

The alterations to the pond had no apparent effect on the breeding pattern apart from causing spawn to be deposited in different situations, possibly influenced by the change in plant distribution.

## OTHER SPECIES

During the study the following species were recorded:

- Grass snake (*Natrix natrix*). Common, frequently swims.
- Smooth newt (*Triturus vulgaris*). Frequent.
- Palmate Newt (*Triturus helveticus*). Occasional.
- Crested Newt (*Triturus cristatus*). Very rare.

## DISCUSSION

The main investigation on toad weight, length and population took place in the spring of 1962 and 1963 when the winter was the severest for a considerable number of years. The weights and lengths of toads caught in 1963 after the winter are slightly higher than those caught in 1962 (Table 2). This could indicate a greater survival of the larger and thus presumably older individuals. It was of particular interest to find a survival value of 11 per cent. which is similar to that recorded by other workers.

It would appear that the hibernation areas provide adequate protection against such severe conditions.

The male population is probably around 300 whilst the number of females handled were not sufficient to give comparable figures there is an indication that the male-female ratio is unusually high (4:1). The females found dead in 'bundles' might also suggest a high sex ratio as my visits to ponds in other areas have not indicated this type of mortality.

My own observations at other ponds suggest that toads migrate to the breeding site in one direction leading from the hibernation area but at Castor Hanglands however, there is an even scatter of incoming toads from all directions. It seemed likely that hibernation occurred in a variety of habitats including woodland, grassland and conifer plantation.

From the data of 1962 and 1963 there is no suggestion that toads move to the pond in different age groups, if one assumes that there is a direct relationship between age and size.

## ACKNOWLEDGEMENTS

I should like to thank Mr. I. Prestt for his very helpful suggestions with the draft copy.

## SUMMARY

- (a) Observations on the Toad (*Bufo bufo*) were carried out from 1961 to 1968 in a pond at Castor Hanglands National Nature Reserve.
- (b) The population of males is estimated to be about 300 individuals.
- (c) Less data was obtained on the females but the sex ratio was probably about 4 males to 1 female.
- (d) Survival rate of males between 1962 and 1963 was 11 per cent.
- (e) The severe winter of 1962/63 did not affect the breeding cycle although probably a higher proportion of older individuals survived.
- (f) No communal hibernation place was located and it appears toads hibernate individually in a variety of habitats around the pond.
- (g) Two experimental releases of 50 males yielded only one recovery.
- (h) Alterations to the pond merely led to a change in the place where spawn was deposited, possibly due to a change in plant distribution.

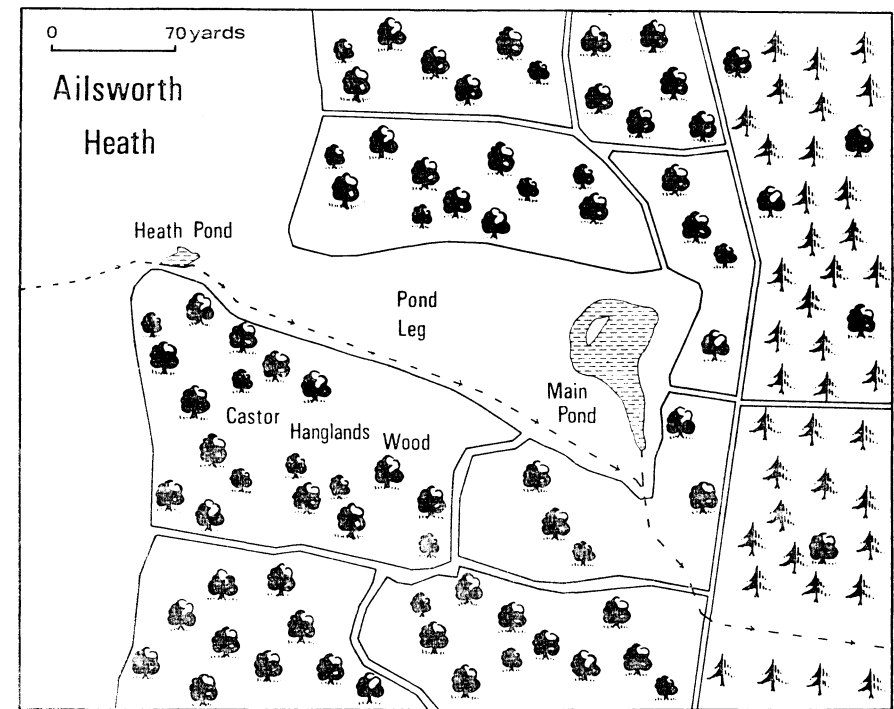


Fig. 1. Castor Hanglands National Nature Reserve.



Fig. 2. Castor Hanglands, Main Pond, 1969. Looking west up pond leg, showing newly formed island.

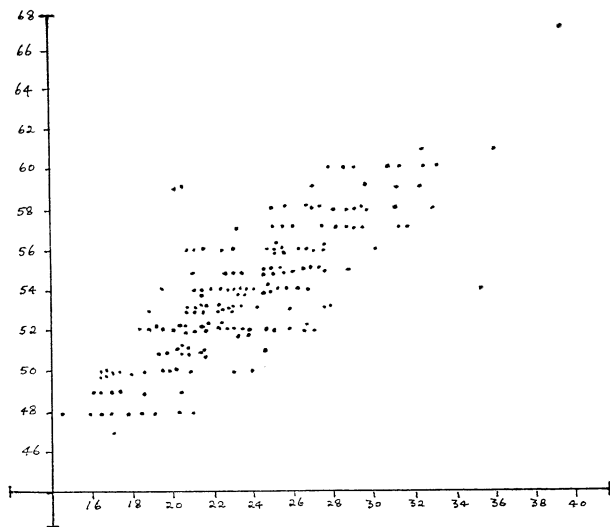


Fig. 3. *Bufo bufo* at Castor Hanglands. Weight/Length ratio of males.  
Ordinate: Length (mm.).  
Abcissa: Wht. (gms.).

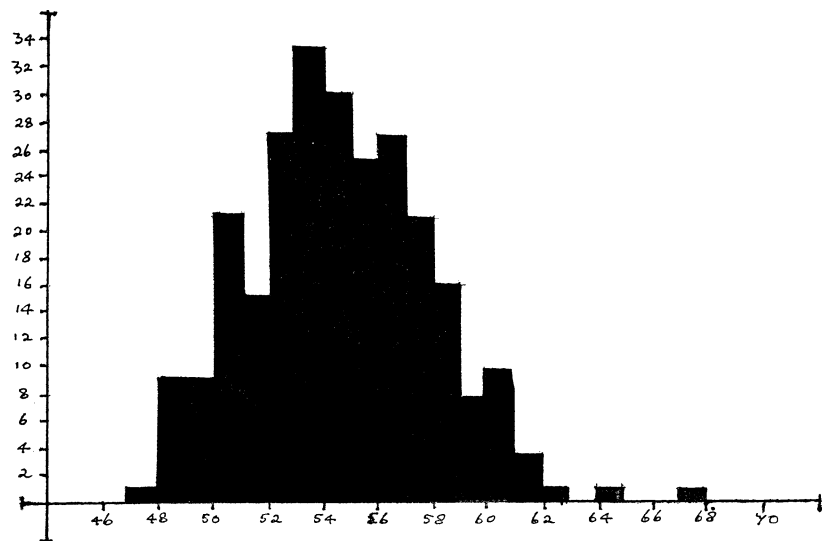


Fig. 4. Frequency distribution. Length. Sample of 262 *Bufo* males in 1962 and 1963.  
Ordinate: Number of individuals.  
Abcissa: Length (mm.).

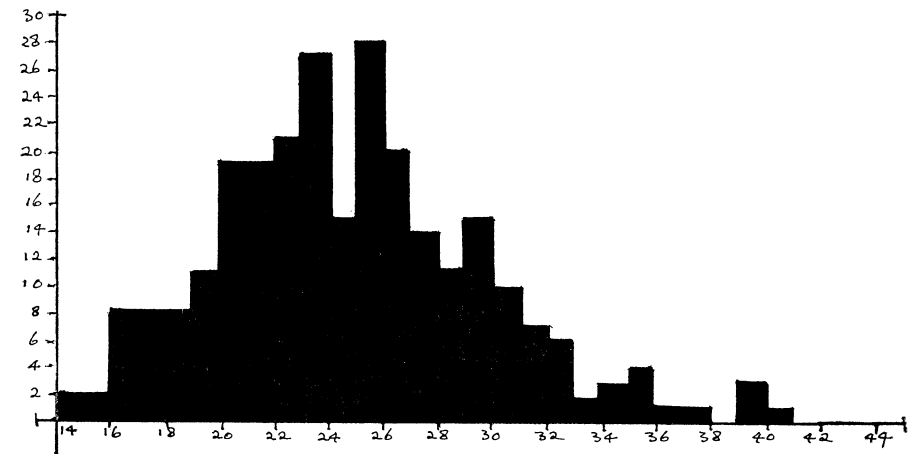


Fig. 5. Frequency distribution. Weight. Sample of 262 *Bufo* males in 1962 and 1963.  
Ordinate: Number of individuals.  
Abcissa: Wht. (gms.).

#### STUDIES ON THE BIOLOGY OF TWO SELECTED LIZARDS OF TIRUPATI

By

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The Ecophysiology of two lizards, *Sitana ponticeriana*, and *Calotes nemoricola*, was studied during the years 1964 to 1966 under natural conditions at Kapilathirtham, University campus and in the laboratory at Sri Venkateswara University, Tirupati, Andhra Pradesh, India.

#### ENVIRONMENT

The entire field area was found to be scattered with small rocks, stones and pebbles of quartzite. The predominant shrubs found in the area were *Barleria noctiflora* and *Randia dumatorum* and the predominant herbs were *Zornia diphylla*.

The particle size, pH, and conductivity of the soil were noted. The soil, substratum, rock and air temperatures were recorded to the nearest 0.1°C with a sensitive mercurial thermometer. Maximum and minimum air temperatures, humidity, rainfall and the velocity of wind were observed during 1964 to 1966. The intensity of light was recorded with a light meter.

#### LIZARD ACTIVITY

All size groups of *S. ponticeriana* are most common in the Kapilathirtham field area because of the presence of many bushes there. Juvenile and adult *C. nemoricola*

act as ecologically separate populations because of different habitats, i.e., living in bushes and on small trees in gardens respectively.

The activity cycle of both species are found to be dominated and controlled by thermoregulatory needs, and are interrupted by periods of rain. Both species of lizards are diurnal. *Sitana* and juvenile *Calotes* appear to occupy closely similar ecological niches but their activity periods are slightly different because of their different thermal tolerances. Adult *Calotes* starts its activity more or less at the same time but always a few minutes later than *Sitana*. No activity is observed during the night in both species of the lizards.

The sleeping or resting habits were observed in both *Sitana* and *Calotes*. *Sitana* selected the base of a bush to sleep whereas *Calotes* preferred tree trunks and branches.

The ground and garden lizards are true heliothermic baskers. The lizards can absorb sufficient solar radiation to raise their body temperatures (34.25-34.5°C) far above air temperatures (32.6-33.0°C); but the body temperature (27.8°C) is almost equal to air temperature (27.5°C) during the night. Size, surface area, amount of radiation, orientation, cooling, effects of wind etc., are among the many variables affecting rate of heat absorption from the sun.

*Sitana* and *Calotes* do not have higher thermal preferences. The various thermal categories are determined on the basis of temperature records and no differences between sexes are found. The preferred temperatures in *Sitana* and *Calotes* are 35.5° and 36.5°C respectively. The critical maximum and lethal temperatures in *Sitana* are 46.5° and 47°C respectively; in *Calotes* they are 45° and 45.5°C respectively.

Both lizards tend to be solitary in habits. There is no centre of activity. The lizard movement is found to be restricted to still smaller areas (20-200 square feet). A few of them shifted more than once and several moved back to the same place.

The ground and garden lizards have quadrupedal locomotion, but the ground lizard sometimes takes to bipedal running. Generally, males seemed to be more active and run faster than females.

The ground and garden lizards depend chiefly upon sight in finding food. They swallow the food without chewing or macerating. *Sitana* feeds mostly on white ants and *Calotes* on black ants. The size of the prey is within the limits of the gape of the mouth. However, there is no direct intergeneric competition for food due to their different types of food.

All the lizards mature at the age of one year or less.

#### REPRODUCTION

The breeding season in both lizards is mostly during April to September.

The mating behaviour and egg-laying were observed in *Sitana* and *Calotes*. Though the manner of egg-laying is the same in both lizards, the diameter and depth of their holes are different.

Increase in weight and size of the egg from the first to the thirtieth day was seen in both genera. The time taken from breaking the egg to independent movement in *S. ponticeriana* is 4 hours 20 minutes; in *C. nemoricola* it is 5 hours 32 minutes.

#### POPULATIONS

Density estimates made over a period of three years indicated that populations did not remain constant owing to drought in 1964 and 1966. The density of juvenile *Sitana* varied from 9.5 to 10.5 per hectare/year. The same area supported adult male and female populations of 11.3 to 16.4 and 11.3 to 14.2 per hectare/year respectively. The total ground lizard population is not constant. The same is the case in *Calotes* but the density of juveniles varied from 13 to 17 per hectare/year and the adult males and females is 18 to 22 and 23 to 32 per hectare/year respectively.

The average sex ratios of *Sitana* are roughly 1:1 but males seemed to be greater in number in an individual sample of one year. In *Calotes* in contrast the females are greater in number than males.

*Sitana* but not *Calotes* was found to be infected with ectoparasites like red mites, the trombiculoid mites. Endoparasitic trematodes and nematodes are recorded in *Calotes* but not in *Sitana*.

The common predators in ground and garden lizards are snakes, rats and birds. In addition the ground lizard has predators like garden lizards and skinks.

Both species of lizards are not allopatric. Inter specific competition is observed.

A clear cut locomotor activity rhythm has been described in *S. ponticeriana* and *C. nemoricola* with the active phase appearing between 4.00 and 5.00 a.m. that lasts for about 12 hours. The rhythm is truly monophasic with only a single period of activity in a cycle of 24 hours. The rhythm persists for more than 10 days in the laboratory, when exposed to natural day and night variations in the experimental chamber. In continuous dark and light conditions, the locomotor activity becomes arrhythmic. Under dark: light; 12:12 conditions in synchrony with the natural day-night pattern, the locomotor rhythm remains unaltered. But when subjected to reversed dark-light conditions, i.e., artificial light being provided during night and vice versa, the locomotor rhythm also gets reversed with the active phase confined to the light period. This provides conclusive evidence for the fact that the light is a master synchroniser or phase setting factor in the absence of other conspicuous daily variations. Increased temperature is found to have an accelerating effect upon locomotor activity.

The respiratory rhythm in both species of lizards follows nearly the same time course as that of the locomotor rhythm with a higher rate of oxygen consumption in majority of the cases, extending between 8.00 a.m. and 8.00 p.m. An adaptive significance of this rhythm of respiratory activity is suggested.

#### ACKNOWLEDGEMENT

I am deeply indebted to Dr. B. S. Rajabai, Department of Zoology, S. V. University, for suggesting this problem and for valuable guidance.

#### SUMMARY

The present investigation examined the habits such as basking, mating, egg day, hatching, resting or sleeping, and rhythmic, adaptive variations in the metabolic activity as reflected by the respiratory and locomotor activity in both the tropical ground and garden lizards, *Sitana ponticeriana* and *Calotes nemoricola*. All these processes more or less synchronize with each other. This suggests the existence of a number of 'clocks' in the organisms.

It is inferred that these 'clocks' are interdependent and mutually inter-related. A consideration of their sequence should reveal the possible way in which they are related and the nature of the control which they exercise on each other.

A perusal of the schematic representation of activities studied showing their time relationships (Fig. 1) suggest the possibility of there being a series of events operating in a definite sequence. So, it can be said that in these two tropical lizards activities like movement, capturing prey, basking, mating and egg laying synchronize with monophasic locomotor activity and with increased respiratory rate. Resting finds its correlation with decreased locomotor activity and reduced metabolism, whereas sleeping synchronises with almost no locomotor activity and least oxygen uptake of the respiratory rhythm.

The habits and the rhythms fluctuate depending upon environmental factors like temperature, light, humidity, wind velocity and rainfall, in different seasons and different years.

Thus the various activities studied may be placed in sequence based on the time of their appearance and their possible significance in relation to the daily-life of these animals.

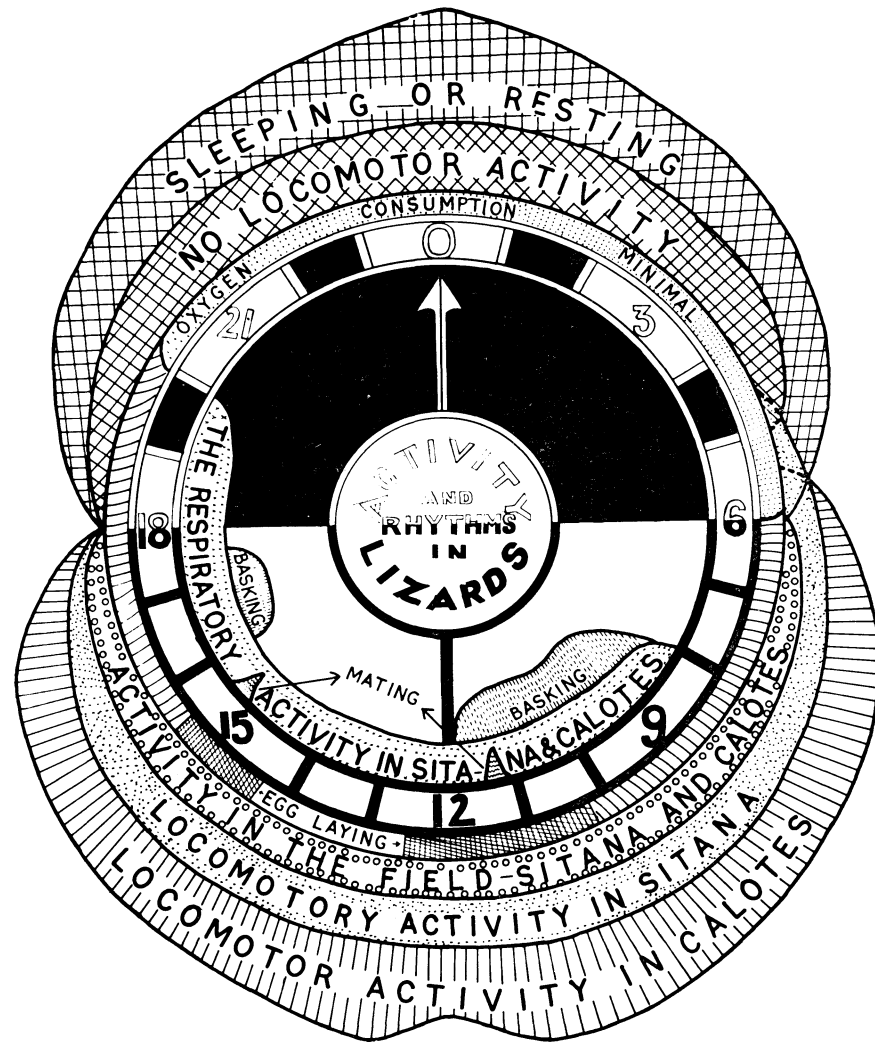


Fig. 1. A Biological Clock. Diagrammatic representation of different activities of *Sitana ponticeriana*, the ground lizard and *Calotes nemoricola*, the garden lizard, in relation to the time of the day.

#### EPIDERMAL ULCERS IN FROGS

Frogs and toads kept in cages are subject to the development of patches of skin ulceration. The agile types (*Rana*) injure their foreheads, toads develop ulcerations on the palms of their feet and even tree frogs are not immune from this kind of skin trouble. It does not look as if lesions of this kind cause the frogs a great deal of pain, because even severely affected specimens continue to feed. The skin of frogs however, has a notoriously bad healing power and even a small defect will

eventually act as an entry for bacteria which, once they get into the bloodstream, will kill the patient. This process can most typically be followed in *Xenopus*. They get very excited at feeding time, and if kept too crowded, are apt to bite their neighbour's toes instead of the food. The small injuries caused by these bites serve as entries for cold-water mycobacteria which, very slowly spread up the leg, to the urinary bladder and eventually to the kidney. Once more than half the kidney is destroyed by tuberculosis the toad dies. It has practically no defence against the infection. Matters are not quite so serious if only other than mycobacteria are involved and treatment, in the medical sense is not even always necessary as shown in the case of the specimen of *Hyla cinerea* (Figs. 1 and 2). When the frog was first seen it had a large blister in the fronto-parietal region. The frog was transferred to a small, well heated cage, furnished with a leafy plant (*Tradescantia*) and fed with blow flies (*Lucilia*). After three days the blister burst and revealed a round ulcer of 5 mm. diameter. The frog was kept at 25-30°C in the day and 15-20°C at night. It kept on feeding but spent much more time adhering to the wall of the glass cage than on the plant. The ulcer took three months to heal and the scar it left behind is grey. Apparently the chromatophores have taken no part in the healing process. The frog is perfectly well and continues feeding on flies. It shows no interest in mealworms, indeed it probably would not even see them since it never returns to the ground. It cannot be said that this ulcer would have healed quicker if the healing process had been assisted by the application of antibiotics or antiseptics. Nor, since the frog arrived by post in a tin and since nothing is known about its previous accommodation, can it be asserted that the move to another cage was all that was required to effect a cure. All this short history shows is that dermal ulcers will heal spontaneously if they are given a chance to do so.

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#### EMBALMING FROGS

However well you look after your frogs, casualties will occur, often for reasons beyond control. The casualties may represent very rare species. You might like to preserve them for purposes of documentation or demonstration. To start a private collection of museum jars is not everybody's choice. The jars are expensive and they take up a lot of room. A method which allows the keeping of frog specimens in the dry state and which is neither complicated nor expensive, might be of interest. The steps of the operation are as follows:

On receiving the specimen place it into the optimal position in which you want to preserve it. In the case of frogs, legs adducted, toes spread out, mouth, if so desired, open, etc. You cannot change the position later on.

Next inject the frog with 10 per cent. formaldehyde and leave it in this same solution for 5-10 days, according to the size of the frog.

When the specimen is thoroughly fixed prepare a thick, creamy mixture of either finely sieved Plaster of Paris (Alabastine) or 'Polyfilla' and inject the frog with the aid of a large-bore needle until it appears rather somewhat bulkier than normal. It is necessary to do this because the specimen will shrink later on. Return the frog to the formaldehyde solution and repeat the injection the next day and after that until you are satisfied that no large pockets of air or fluid are left to be filled.

When this stage has been reached, remove the frog from the formaldehyde, dry it with a cloth and prepare a bowl, the bottom of which is filled with a layer of 'Lankroline.' Wrap the frog in surgical gauze, soaked in 'Lankroline' and place it into the bowl. Leave the specimen undisturbed for 1-2 weeks according to the

size of the frog. During the latter half of the period put the bowl on a radiator or into a 37° C oven. The water contained in the frog evaporates and the Lankroline a tanning substance, takes its place. When no further Lankroline is being absorbed dry the frog and keep it on the radiator for a few more days. Finally spray it with an aerosol containing clear varnish. This takes a few days to dry, after which time a label can be attached to the frog which is now ready for storing.

Lankroline for the tanning of skins (Mahoney 1966) can be obtained (1 gallon 8s. 4d.) from Messrs. Lankro Chemicals Ltd., Bentcliffe Works, P.O. Box No. 1, Eccles, Manchester M30 0BH.

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Fig. 1. *Hyla cinerea*. Vesicular epidermal blister of unknown origin.



Fig. 2. *Hyla cinerea*. Ulcerative stage.

A BRIEF NOTE ON THE ASIATIC NEWT—*Triturus pyrrhogaster*

Two *Triturus pyrrhogaster* specimens were obtained in early June 1968. As it was relatively late in the year it was assumed that the courtship behaviour had occurred in the wild prior to capture.

The toes of one animal were noticeably longer than those of the other and the skin less granular, but there was no suggestion of a black stripe on the tail of either, as indicated by Noble (1931).

On 13 June two newly laid eggs were observed in the aquatic vegetation, it was noted that the eggs were not totally wrapped in the leaves and not individually placed as is usual in the British species (Smith, 1951); both eggs were in contact. The eggs were some 3 mm. in diameter with the nucleus about 1 mm. The capsule was greenish-white with the embryo brown in colour, this coloration merged with the surroundings.

On 19 June the assumed female was observed motionless in the water in an almost vertical position; she then changed her position to a horizontal one. At this time the female's cloaca appeared swollen and an egg was extruded. The female's hind feet were clasped with the toes interlocked and holding a leaf. The feet movements coincided with the laying of the egg and the leaf was brought forward to meet the egg which became attached to the leaf. The eggs laid on the 13th showed a distinctly shaped embryo at this time. The eggs hatched between 10 and 14 days later. Development was normal and metamorphosis occurred at 89 days. The young then averaged 33 mm.

The carmine underside of the young was paler than that of the adults and it has been suggested that the type of food is directly responsible for the density of colour (Noble, 1931).

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## BOOK REVIEW

BIOLOGY OF THE REPTILIA, Volume 1, Morphology A, Ed. Gans, Bellairs and Parsons, Academic Press, London & New York, £4.

As far as I am aware there has been no work comparable to this in any language; the nearest approach has been Hochstetter's volume in Bronn's "Tierreich" published about 80 years ago. The reptile sections of "Handbuch der Zoologie" (ed. Kükenthal and Krumbach) have not yet been completed and the reptile volume of "Traité de Zoologie" (ed. Grassé) has still to appear. From this point of view therefore this work is enormously welcome. There are many areas about which any one student cannot realistically hope to inform himself simply because of the labour of tracing scattered references and the dearth of reviews to lead into the subject. As for investigators, interested in making comparative studies of vertebrates, who had no prior familiarity with reptiles they had little to guide them in making a choice of material and their account of the "reptilian condition" was likely to be based on whatever animal was readily available from a local dealer. The aims of this work and the need that it is designed to meet are admirably set forth in the preface by the general editor Dr. Carl Gans.

This first volume has six contributions: two each from the U.S.A. and Canada and one each from France and Uganda. The forthcoming volumes already announced indicate a further wide geographical range of contributors. R. L. Carroll surveys the origin of reptiles. It is evident that there has been considerable recent progress in this field. *Seymouria*, that used to be the oldest known reptile and then passed through a phase in which A. S. Romer and D. M. S. Watson agreed that it should be a reptile and an amphibian in alternate weeks, seems now ever more surely to be an amphibian somewhat off the main line of reptilian descent. A group of anthracosaurian amphibians, *Solenodonsaurus* and its relatives, now look like the ancestral stock that gave rise to the first reptiles, that were of course the first amniotes. The particular ancestry of the surviving groups of reptiles is also discussed.

D. H. Enlow on the bone of reptiles opens a field about which I neither knew anything nor even suspected that there was much to be known. The various types of bone are described and figured and then their distribution in the different groups of reptiles is surveyed. I was interested to learn that the histology of the bone of lizards and snakes differs from that of other reptile groups.

R. Wheeler Haines surveys epiphyses and sesamoid bones. He explains that epiphyses have to furnish functional articulations for the long bones and at the same time to permit their growth in length. Here we find that the snakes resemble the crocodylians and chelonians more than they do their near relatives lizards and *Sphenodon*.

A. G. Edmund on dentition brings together, with many new observations, a survey of a subject on which much has been written. With a wealth of diagrams and figures the intricate subject of tooth replacement is lucidly explained. Functional modifications and ontogenetic changes are discussed and there is a family by family survey. One curious piece of information that struck me is that the waves of tooth

replacement in the sea-snakes (Hydrophiidae) proceed in the opposite direction to other reptiles in general and the terrestrial Elapidae in particular.

The vertebrae and ribs, treated by R. Hoffstetter and J-P. Gasc, is another subject on which much has been written; again there has been little prior review of the subject from the point of view of reptilian systematics. This account has given me the courage to start examining snake vertebrae, a subject that I had previously neglected despite its manifest importance. The morphology of ribs and vertebrae is described and the possible systematic usefulness of many characters is discussed.

Finally the turtle shell is a feature so peculiar that it has a section to itself by R. Zangerl. The relation of the shell to the rest of the skeleton and the relation between horny scales and bony plates is fully described. The evolution of the shell is discussed. Here I discovered that I had not appreciated that in the leathery turtle, *Dermodochelys*, the little polygonal plates of bone beneath the skin are formed external to the usual bony plates of the shell which latter are in fact extremely reduced.

The volume is very well produced with a multitude of diagrams, line figures and half-tone illustrations. It requires careful reading to appreciate the editorial labours that have gone into its production. Names have been conscientiously brought to date. In 370 pages I noticed only one spelling mistake and only one error in the references; I have not been able to fault the author and subject indices. In conclusion I venture to suggest that this series of volumes will when complete so advance the study of reptiles as to make the supporters of some other groups of animals envious.

GARTH UNDERWOOD

## ENCYCLOPEDIA OF PALEOHERPETOLOGY

This year sees the appearance of two parts of Professor Oskar Kuhn's special brainchild "Handbuch der Paläoherpetologie/Encyclopedia of Paleoherpétology" published by Gustar Fischer Verlag, Stuttgart and Portland, U.S.A., in both English and German. There are 19 authors, 5 British, 4 German, 3 Russian, 3 Canadian, 2 U.S.A., one Pole and one Czech. Each of the 19 projected volumes will cover a major group of the Amphibia or Reptilia. And if the first two parts that have appeared are anything to go by, then this series will be by far the most useful tool for palaeoherpetologists that has yet appeared.

Rodney Steel's "Ornithischia" will rank as an important source book for anyone with more than a passing interest in dinosaurs. This is not just a catalogue but a critical appraisal of all known genera, including the recently recognized heterodont dinosaurs of which fragments were described as long ago as 1911 although not recognized as such until 1962.

Oskar Kuhn's part "Proganosauria, Bolosauria, Placodontia, Araeoscelidia, Trilophosauria, Weigeltisauria, Millerosauria, Rhynchocephalia, Protosauria," is more difficult to assess. This is the "bits and pieces" volume. There is certainly no consensus on the classification of these groups and Kuhn's strongest supporter on this matter happens to be the reviewer! Suffice it to say that Kuhn's compilation is exceedingly valuable from any standpoint.

This Encyclopedia is a landmark in vertebrate palaeontology which will fill a long felt need. Professor Kuhn is to be congratulated in having succeeded in launching this most worthy venture. Unfortunately the cost of these volumes is quite prohibitive (Kuhn, 74 pp. RM. 48; Steel, 84 pp. DM. 76); Steel's part on the Ornithischia is more expensive than Romer's "Osteology of the Reptiles." Such high prices will reduce the distribution of these volumes to a mere handful and this is a pity.

L. B. HALSTEAD

LETTER TO THE EDITOR

COLOUR PHASES OF SLOW-WORM

A black slow-worm has been seen here from time to time this summer, under a piece of corrugated iron, in company with two normal examples. The colour is reddish-black, which could perhaps be described as a dark mahogany. It is very dark indeed and entirely different from any other slow-worm I have ever seen. It looks like a year-old slow-worm, about 9—10 inches long.

Mr. Christopher Webber has just told me that about four years ago he found a white slow-worm in Plymouth. It had pink eyes and a pink tongue, so was a true albino.

H. G. HURRELL,  
Moorgate,  
Wrangaton,  
South Brent,  
S. Devon.  
28/7/69

ANNOUNCEMENTS

HERPETOLOGICAL REPRINTS. The Society for the Study of Amphibians and Reptiles announces two new facsimile reprints: *Anatome Testudinis Europaeae*, by L. H. Bojanus; 250 pages, 41 plates (folio); introduction by Alfred S. Romer. To be published winter 1969-1970; pre-publication prices \$18.00 paper, \$20.00 cloth (\$5 off to S.S.A.R. members).

*Herpetologia Mexicana*, by A. F. A. Wiegmann; 80 pages, 10 plates (folio); introduction by Edward H. Taylor gives details of Wiegmann's types, type localities and field collectors. Published summer 1969; price \$6.00.

Send orders to Henri C. Seibert, Publ. Secy., S.S.A.R., Department of Zoology, Ohio University, Athens, Ohio 45701, U.S.A.; a list of other *Facsimile Reprints in Herpetology* may be obtained on request.