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**Note on predation of *Calliophis melanurus* Shaw,  
1802 (Serpents: Elapidae) by *Scolopendra* sp.**

The genus *Calliophis* Gray, 1834 is represented by four species in India, namely *C. beddomei*, *C. bibroni*, *C. melanurus* and *C. nigrescens* (Whitaker and Captain, 2004). Of these, *Calliophis melanurus* (Shaw, 1802) probably occurs in most of Peninsular India (except the extreme north-west), with definite records from Gujarat, Maharashtra, Karnataka, Kerela, Tamil Nadu and West Bengal (Whitaker and Captain, 2004); there is a single record from Dhar, Madhya Pradesh (Vyas and Vyas, 1981). Throughout its range, *C. melanurus* remains poorly known in terms of its natural history. Here, we take the opportunity to add data based on several individuals observed in Mumbai.

A total of 14 individuals were rescued from Marol Police Camp, Mumbai (19°7'31"N–72°52'76"E), between 2003–2007, around October to January between 1730–0730 h., indicating its nocturnal habits. The snakes were often found around human settlements or inside houses. Some individuals were found under boulders, amongst leaf litter with sympatric species such as *Lygosoma lineata* which probably forms a part of its diet. *Calliophis melanurus* is an active little elapid, attaining a maximum length of 380 mm. When disturbed, the snake curls its tail displaying its coral red belly and blue caudal scales. A timid snake in disposition, not inclined to bite when handled. Bites cause slight swelling and itching (Whitaker and Captain, 2004). However, an individual received five bites in Mumbai (due to an accidental breakage of the snake's tail) with no evident symptoms.

On 16 December, 2007 at ca. 2345 h., our attention was drawn towards a rustling movement in the leaf litter inside a garden in Powai, Mumbai (19°7'53"N–72°55'13"E). On closer observation, we discovered that the sound was coming from a *Scolopendra* sp. which was dragging a *Calliophis melanurus* held between its mandibles. The snake's head was chewed and was badly damaged. The tail was curled up, dis-

playing the prominent coral red ventral scales and vermilion caudals and was twitching. We observed the phenomenon for about 7 min., after which the centipede dragged the snakes in a crevice of a stone wall. The centipede measured ca. 130 mm. and the snake, ca. 160 mm.

Scolopendrans are voracious nocturnal predatory arthropods. They are even known to overcome and feed upon significantly larger vertebrate prey including Microchiropteran bats (Molinari et al., 2005) and mice. The report on the predation of *Calliophis melanurus* by *Scolopendra* sp. is noteworthy.

We would like to thank Ketan for drawing our attention towards the snake and Gavin Desouza for recording the coordinates.

**Literature cited**

- MOLINARI, J., E. E. GUTIERREZ, A. A. DE ASCENCAO, J. M. NASSAR, A. ARENDS & R. J. MARQUEZ. 2005. Predation by Giant Centipedes, *Scolopendra gigantea*, on three species of bat in Venezuelan cave. Caribbean Journal of Science 41(2):340–346.
- WHITAKER, R. & A. CAPTAIN. 2004. Snakes of India, the field guide. Draco Books, Chennai. xiv + 481 pp.

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### Preliminary Observations on the Diet of the Cane Turtle (*Vijayachelys silvatica*)

(with two text-figures)

The cane turtle (*Vijayachelys silvatica*) is a cryptic species, endemic to the Western Ghats, India (Vijaya, 1982; Groombridge et al., 1983; Moll et al., 1986). They are omnivorous and reported to feed on fruits, leaves, molluscs, beetles and millipedes (Moll et al., 1986). However, the ecology of the species is poorly documented. The only published report on the diet of the species by Moll et al. (1986), stated that 20–70% of their diet was composed of animal material.

Field surveys are being carried out in Indira Gandhi Wildlife Sanctuary (IGWS), Tamil Nadu and Parambikulam Wildlife Sanctuary, Kerala, both sites are located in southern India. Eighteen different individual cane turtles were encountered in 97 man hours of search from February 2006 to January 2008 in the study areas (Table 1). Usually when cane turtles are handled, they defecate (Moll et al., 1986). Hence, the feces of individual turtles were thus collected and dried under a 40 W incandescent lamp. The dried material was then examined using a 10X hand-held

lens and separated into diet components of: molluscs, insects, millipedes, seeds, plant materials (other than seeds) and sand. Components of diet in individual faecal samples were scored as 1 – low, 2 – medium and 3 – high, based on the relative quantity of dried material found in each faecal sample. Whenever possible, direct observations were also made on the feeding of the turtles. Thirteen faecal samples collected from 11 individuals comprising six males and five females were examined, in which one male and one female were captured twice and they defecated during both the captures (Table 1). All faecal samples contained at least one identifiable prey item; 85% had insect remains and plant matter; 77% had sand; 69% had mollusc remains; 38% had millipede remains and 15% had seeds; 85% had unidentified remains. All dietary categories were found in both males and females, except millipedes, which were found only in males (Fig. 1). This is probably an artifact of small samples. Millipede remains are reported in the diet based on faecal examination made from one female cane turtle (Moll et al., 1986). The presence of sand in the faecal matter is probably due to accidental ingestion and/or feeding on earthworms, the remains of which would not be detected in dried faeces.

Direct observations were made on three (one male #9 and two females #5-6) radio-tagged individuals after locating them on the forest floor. *Ad-libitum* observations were made by a single observer located 8–10 m away from the animal so that it was not disturbed. At Karian Shola, IGWLS, on 27 November 2006 at 1430 h, an individual *Indrella ampulla* snail was found on the forest floor with froth covering its body, and about a foot away, male cane turtle #7 was observed. *Indrella ampulla* is a large terrestrial snail of the family Zonotidae, endemic to the Western

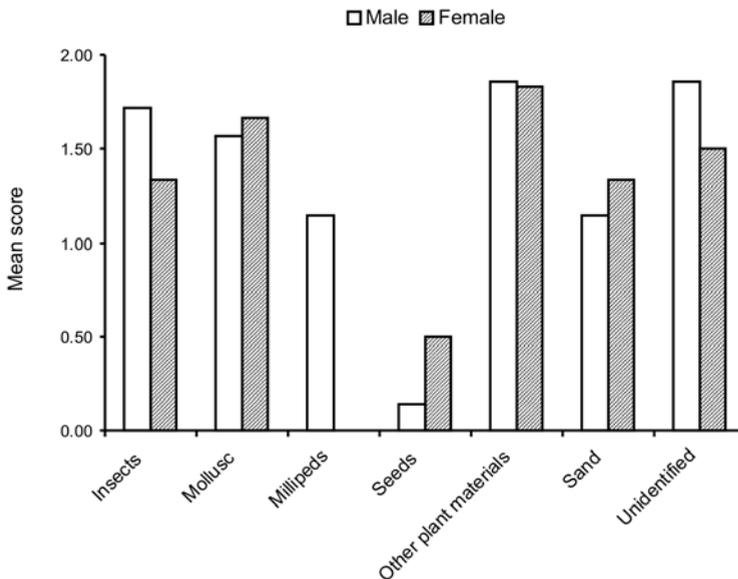


Figure 1. Mean score of different food items in the droppings collected from *Vijayachelys silvatica* from six males and five females.

**Table 1.** Details on individual cane turtles captured from different parts of the study area and their faecal samples used for the diet analysis. M = Male; F = Female; J = Juvenile; Y = Yes; N = No.

S.no	Turtle ID	Category	Date (dd.mm.yy)	Time	Locality	Elevation (m)	Faecal sample (Y/N)
1	1	M	02.06.06	11:10	Karian shola	770	Y
2	1	F	25.07.06	17:50	Anaikundhi shola	760	Y
3	2	M	09.08.06	14:45	Karian shola	770	N
4	3	M	09.08.06	14:52	Karian shola	770	Y
5	4	M	22.08.06	13:40	Anaikundhi shola	760	Y
6	5	M	29.08.06	18:00	Varagaliar shola	660	N
7	6	M	14.10.06	11:30	Karian shola	770	Y
8	2	F	07.11.06	16:35	Anaikundhi shola	760	Y
9	3	F	25.11.06	12:00	Karian shola	853	Y
10	7	M	26.11.06	14:30	Karian shola	770	Y
11	4	F	06.12.06	12:44	Karian shola	770	N
12	8	M	14.01.07	15:12	Karian shola	689	N
13	9	M	19.07.07	14:35	Karian shola	770	Y
14	5	F	31.07.07	18:35	Karian shola	770	Y
15	1	J	07.09.07	17:20	Karian shola	770	N
16	6	F	28.09.07	11:40	Karian shola	770	Y
17	2	J	30.09.07	09:15	Karian shola	770	N
18	10	M	15.01.08	15:30	Karian shola	770	N
19	9	M	17.02.08	11:00	Karian shola	771	Y
20	6	F	23.03.08	11:10	Karian shola	771	Y

Ghats (Blanford and Godwin-Austen, 1908). The turtle was immobile and had soil and litter stuck on the anterior part of its body. Upon close examination, it was observed that the carapace, head, forelimb and neck of the male turtle had sticky froth from the snail. It was inferred that the turtle had attempted to feed on the snail, and in response the snail produced an adhesive frothy secretion that stuck to the head, neck and limbs of the turtle. The mobility of the turtle was temporarily impaired. Other observations corroborating the fact that *Indrella ampulla* formed an important component of cane turtle diet were made on three different occasions. At Karian Shola, IGWLS, on 26 July 2007 at 1350 h and on 10 November 2007 at 1630 h male #9 was located with fragments of the land snail shell and froth within 10 cm from the turtle. On 12 February 2008 at 0945 h, female #6 fed on the land snail at the base of a tree trunk (Fig. 2). It was inferred that the froth secreted by the land snail was in defense from predation by the cane

turtle. Production of sticky mucous as a defense against predators is well known in molluscs (e.g., Eisner and Wilson, 1970; Parkarinen, 1994; Mair and Port, 2002). The snails' mucous primarily helps them in navigation, surviving desiccation, providing structural support and locomotion (Denny, 1989). These observations confirm that *Indrella ampulla* is part of the cane turtle diet. It also suggests that *Indrella ampulla*

**Figure 2.** *Vijayachelys silvatica* preying upon *Indrella ampulla* snail on the base of a tree trunk.

has a unique mechanism that can deter predators, such as the cane turtle

Additional feeding observations were made on 2 August 2007 at 1230 h, female cane turtle (# 5) was observed feeding on *Diospyros buxifolia* fruits. It spent four days feeding under this fruit tree. On 12 October 2007 1040 h, female cane turtle (#6) was observed feeding on earthworm. Cane turtles are known to feed on fallen fruits in the wild (Vijaya, 1982) and on vegetables and fruits in captivity (Henderson, 1912; Vijaya, 1982).

Our findings are consistent with previous observations on cane turtle feeding habits reported by Moll et al. (1986), highlighting the importance of forest floor macro-invertebrates in the diet of the species.

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#### Literature cited

- BLANFORD, W. T & H. H. GODWIN-AUSTEN. 1908.** The Fauna of British India including Ceylon and Burma, Mollusca: Testacellidae and Zonotidae. pp:48–50. C. T. Bingham (Ed). Taylor & Francis, London.
- DENNY, M. W. 1989.** Invertebrate mucous secretions: functional alternatives to vertebrate paradigms. *Symposia of the Society for Experimental Biology* 43:337–66.
- EISNER, T. & E. O. WILSON. 1970.** Defensive liquid discharge in Florida tree snails (*Liguus fasciatus*). *The Nautilus* 84(1):14–15.
- GROOMBRIDGE, B., E. O. MOLL & J. VIJAYA. 1983.** Rediscovery of a rare Indian turtle. *Oryx* 17:30–34.
- HENDERSON, J. R. 1912.** Preliminary note on a new tortoise from south India. *Records of the Indian Museum*. 7:217–218.
- MAIR, J & G. R. PORT. 2002.** The Influence of mucus production by the slug, *Deroceras reticulatum*, on predation by *Pterostichus madidus* and *Nebria brevicollis* (Coleoptera: Carabidae). *Biocontrol Science and Technology* 12(3):325–335.
- MOLL, E. O., B. GROOMBRIDGE & J. VIJAYA. 1986.** Rediscovery of the cane turtle with notes on its natural history and classification. *Journal of Bombay Natural History Society* 83:112–126.
- PARKARINEN, E. 1994.** The importance of mucus as a defense against carabid beetles by the slugs *Arion fasciatus* and *Deroceras reticulatum*. *Journal of Molluscan Studies* 60:149–155.
- VIJAYA, J. 1982.** Rediscovery of the forest cane turtle (*Heosemys silvatica*) of Kerala. *Hamadryad* 7:2–3.

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#### **New data on the poorly known snake, *Xenelaphis ellipsifer* Boulenger 1900 (Squamata: Colubridae)**

(with five text-figures)

Two species are known in the genus *Xenelaphis*—the relatively common Malaysian Brown Snake (*X. hexagonotus*) and the apparently rare Ornate Brown Snake (*X. ellipsifer*). The former species is found in a much wider geographic range, i.e. from Myanmar across continental south-east Asia, to the Greater Sundas (Sumatra, Java and Borneo) than *X. ellipsifer* which so far has been recorded from Borneo, Sumatra and West Malaysia (Malkmus et al., 2002).

Over a hundred years ago, Boulenger (1900) described *Xenelaphis ellipsifer* from “Pangkalan Ampat”, in the head waters of the Sarawak River, based on one specimen captured in a fish trap (Fig. 1). The holotype is currently in The Natural History Museum, London (BMNH 1946.1.7.38). Since then, few authors have reported on the species. De Haas (1950) reported this species only from Borneo and Sumatra, and according to Stuebing and Inger (1999),

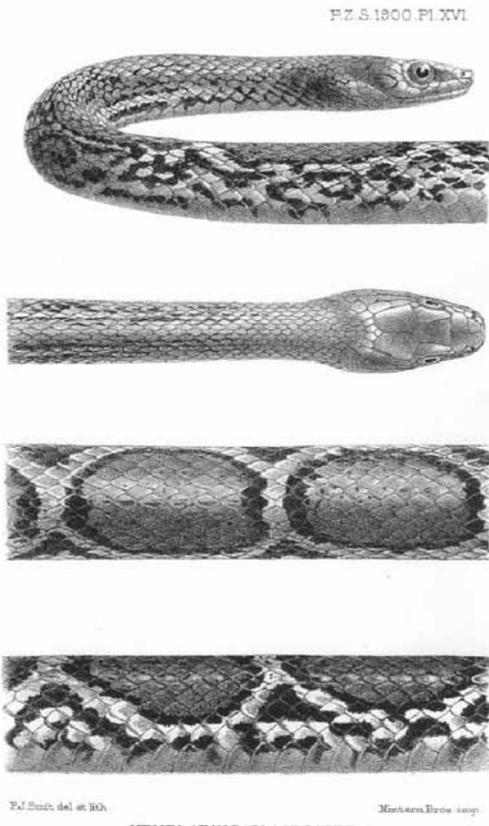


Figure 1. *Xenelaphis ellipsifer* illustrated in Boulenger (1900: Plate 16).



Figure 2. The rare *Xenelaphis ellipsifer* recorded in Gombak, Selangor, Peninsular Malaysia.



Figure 3. Lateral head view of *Xenelaphis ellipsifer*. Note the large eye and the square-like loreal scale.



Figure 4. Dorsal head view of *Xenelaphis ellipsifer*. Note the reddish brown colour and the protruding eyes.



Figure 5. Colour pattern of lateral body of *Xenelaphis ellipsifer*. Note the inverted “Y” pattern and compare with Figure 1.

confirmed records for Borneo only refer to Sarawak. Tweedie (1953) only listed *Xenelaphis hexagonotus* native to the “Malay Peninsula”, however in his third edition of this work, Tweedie (1983) stated that only six specimens have been recorded in Peninsular Malaysia.

This short note reports an additional record of *Xenelaphis ellipsifer* from Peninsular Malaysia, with new data on altitudinal range, morphometry, behaviour and presumably illustrates first photographs of the species.

Observations were made on 19 December 2007, between 2000–2100 h in the Gombak

**Table 1.** Comparison on morphometry, scalation and colour pattern from the holotype description of *Xenelaphis ellipsifer*, and the new specimen record from Gombak River.

	Boulenger (1900)	Gombak River specimen
Eye size	2x longer than distance to edge of mouth	yes, or less than twice distance from anterior eye to snout-tip (Fig.3)
Rostral	visible from above	only slightly visible from above
Internasals	almost equal length as prefrontals	slightly shorter than prefrontals (Fig. 4)
Frontal	1 and 2/5 long as broad, as long as its distance from snout-end and shorter than parietals	about same length as internasals and prefrontals together and longest distance approximately equal to widest distance of each parietal (Fig. 4)
Loreal	slightly longer than deep	almost squarish (Fig. 3)
No. preoculars	one, between 3rd and 4th supralabials	one large, below another smaller preocular, which resembles a subocular and fused with 3rd and 4th or 3rd and 5th supralabials (Fig. 3)
No. suboculars	two: one (large) below preocular, 1 (elongate) separating eye from 5th and 6th supralabials	two: a smaller one below preocular, another (elongate) which can either separate 5th and 6th, or 6th and 7th supralabials from orbit (Fig. 3)
No. postoculars	two	two, a "third" is located half in position of a postocular, but resembles subocular (Fig. 3)
No. supralabials	8	8
No. temporals	2+2	3+3, 2+3
Supralabials in contact with orbit	1	1, either 4th or 5th
No. infralabials	-	9–10
No. infralabials in contact with anterior chin shields	5; anterior chin shields shorter than posterior	5; anterior chin shields shorter than posterior
Colour pattern (head and neck)	pale brown, supralabials uniform yellow; neck with black longitudinal but interrupted markings	dorsal head more reddish than brown; supralabials yellowish with black markings, whitish infralabials without such markings (Fig. 3)
Colour pattern (dorsal body)	18 large elliptic, black edged brown areas separated by cream coloured, narrow interspaces	dorsally black framed (1–2 scale rows) brown areas elliptic to square-like in shape (Fig. 2)
Colour pattern (lateral body)	between and below the brown areas, cream-coloured, spotted or marbled with black	cream-coloured areas reflect a black framed inverted "Y" or "V"(Fig. 5)
Colour pattern (tail)	base like the body, second half uniform brown above with black lateral streak	second half not uniform brown, dorsally reflects elliptic olive brown areas framed by a thin dark line; streaks regularly interrupted; posterior sides and venter pinkish

River, ca. one hour north-west from Kuala Lumpur, in a primary forest enclave locked between roads and intersected by the Gombak River.

While scanning the river with torchlight, a long snake was detected, lying motionless in ca. 50 cm deep water. The current of this 10–12 m wide river stretch was relatively strong. When the snake was illuminated by the torchlight, it moved slowly towards the dark shelter of the overhanging roots at the edge of the river. The snake was secured, and measured 2.51 cm in total length, which exceeds published total length record of 2.32 m by Tweedie (1983). Images of

this specimen are provided here (Figs. 2–5). To the authors' knowledge, no photos of this species have ever been published. Table 1 compares morphometric features, head scalation and colour pattern, with those provided by Boulenger (1900).

The specimen was recorded at ca. 150 m altitude, resembling a lowland forest habitat, rather than foothill or submontane forest habitats at 800 m and 1,000 m altitude, as was reported by Stuebing and Inger (1999) and Malkmus et al. (2002), thus representing a new altitude record for this species. Additionally, the specimen was detected active at night, and may therefore be

active at night, however, it cannot be proven if the specimen did not descend into the river due to our approach and may or may not have been active before. The exceptional large eye diameter may indicate crepuscular and nocturnal activity in a round-pupilled colubrid species. The specimen was released at its capture site.

The authors express their sincere thanks to Lim Boo Liat for his assistance in compiling the historical collection data.

#### Literature cited

- BOULENGER, G. A. 1900.** Description of new reptiles and batrachiens from Borneo. Proceedings of the Zoological Society of London 1900:182–187.
- DE HAAS, C. P. J. 1950.** Checklist of the snakes of the Indo-Australian Archipelago (Reptilia: Ophidia). Treubia 20:511–625.
- MALKMUS, R., U. MANTHEY, G. VOGEL, P. HOFFMANN & J. KOSUCH. 2002.** Amphibians and reptiles of Mount Kinabalu (North Borneo). A.R.G. Gantner Verlag K. G., Rugell. 424 pp
- STUEBING, R. B. & R. F. INGER. 1999.** A field guide to the snakes of Borneo. Natural History Publications (Borneo) Sdn. Bhd., Kota Kinabalu. 254 pp.
- TWEEDIE, M. W. F. 1953.** The snakes of Malaya. Government Printing Office, Singapore. 139 pp.
- \_\_\_\_\_. 1983. The snakes of Malaya. Third edition. Singapore National Printers, Singapore. 167 pp.

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#### Life History Traits of Three Sri Lankan Scincidae, With Special Reference to the Reproductive Seasonality of *Lankascincus fallax*

The Scincidae of Sri Lanka is represented by 32 species belonging to eight genera, of which 24 species and the genera *Chalcidoseps* (Günther, 1872), *Lankascincus* Greer, 1991 and *Nessia* Gray, 1839 are endemic to the island (Wickramasinghe et al., 2007; Batuwita and Pethiyagoda, 2008). The most unique are the nine relict taxa that belong to the subfamily Scinciinae: *Chalcidoseps* and *Nessia* (Greer, 1970). Because of the fossorial habits of these species, their ecology is poorly understood. Species of *Lankascincus* (subfamily: Lygosominae) are commonly found in leaf litter and under stones and logs. Majority of the studies on Sri Lankan skinks relate to taxonomy and distribution (Taylor, 1950; Greer, 1991; Gans, 1995). Few studies have reported the reproductive habits of *Eutropis carinata lankae* (Deraniyagala, 1953), *E. macularia* (Blyth, 1853), *Dasia haliana* (Haly in Nevill, 1887), *Lankascincus taprobanensis* (Kelaart, 1852), *Lygosoma punctata* (Linnaeus, 1758), *Lygosoma singha* Taylor, 1950, *Nessia bipes* Smith, 1935, *Nessia burtonii* Gray, 1839 and *Nessia layardi* (Kelaart, 1853) (de Silva et al., 2005a; de Silva et al., 2005b; Deraniyagala, 1953; Taylor, 1950; Smith, 1935). The present communication deals with the reproductive habits of *L. fallax*, *L. deignani* and *N. monodactylus*. *L. fallax* and *L. deignani* are litter dwelling species. *L. fallax* is distributed throughout Sri Lanka, except at the highest elevations (> 1,000 m). However, *L. deignani* is a wet zone species whose distribution extends to the highest elevations. Both species are common in their ranges and do well in anthropogenic habitats. *N. monodactylus* is a limbless burrowing species which is distributed mainly at mid-elevations (300–1,000 m).

Gravid females were collected from the field and kept in captivity until they laid eggs. They were identified using diagnosis and descriptions given by Deraniyagala (1953), Taylor (1950) and Greer (1991). Lizards were kept in 29 x 21 x 13 cm plastic boxes supplied with a 5 cm thick

layer of humus and water was sprayed at regular intervals to avoid desiccation. The skinks were fed with termites and earthworms. Measurements were taken using a vernier caliper to the nearest 0.1 mm (error  $\pm 0.05$  mm). Eggs collected from the field were kept until hatching, at room temperature (24–27°C). All females and hatchlings were released after taking measurements.

In order to assess the reproductive period of *Lankascincus fallax*, a survey was carried out from April 2005 to March 2006, in a 3-acre plot of land, situated in Ampitiya (550 m asl, Kandy District, Central Province). This site is an estate consisting of a mixture of Cocoa (*Theobroma cacao*), Nutmeg (*Myristica fragrans*), Cloves (*Syzygium aromaticum*), Pepper (*Piper nigrum*) and Coconut (*Cocos nucifera*). The site has both shady areas as well as open areas. The study site has thick leaf litter layer ranging from 3–6 cm. Once a month, *Lankascincus fallax* lizards were captured by hand through active searching within the study area during a 3-hour period and a number of gravid females in the sample was recovered. Gravid females with mature ova can be easily observed by external examination. Specimens of *L. deignani* were collected from Gannoruwa Forest Reserve (07°16'56.7"N, 80°35'54.0"E). The site consists of a dry mixed evergreen forest habitat with a thick leaf litter cover ranging from 4–6 cm.

#### *Lankascincus fallax* (Peters, 1860)

Gravid females were observed throughout the year except in January and February. High

numbers were observed from May to July, the highest being in July.

The snout to vent length of 14 gravid females ranged from 39.0–43.6 mm. While all gravid females had a white coloured throat, adult males had a black coloured throat with white spots. The clutch size consistently numbered two and the eggs laid in loose moist soil or under stones, logs or bricks about 2 cm below the surface. The eggs are chalky white and ellipsoid in shape. In a single clutch, the two eggs are buried in two different places. The mean length and width of 18 eggs were 9.67 mm and 5.23 mm, respectively (Table 1). The incubation period of 18 eggs belonging to nine clutches ranged from 39–45 days (mean 42.3). The snout to vent length of 15 hatchlings ranged from 14.5 mm to 17.3 mm (mean 15.8 mm).

#### *Lankascincus deignani* (Taylor, 1950)

Three gravid females measuring 46.3 mm, 45.8 mm and 46.4 mm from snout to vent were collected from Gannoruwa Forest Reserve (Central Province, Kandy District) in June 2006. All of them laid two chalky white, ellipsoid eggs (8.9–9.3 x 5.3–5.6 mm) in the soil, ca. 2.5 cm under the surface. The eggs hatched after 42–46 days. The six hatchlings ranged in snout to vent length from 17.8–18.2 mm (Table 1).

#### *Nessia monodactylus* (Gray, 1839)

A female gravid *Nessia monodactylus* measuring 91 mm from snout to vent was collected from Gannoruwa Forest Reserve (Central Province) on 26 June 2006. It laid an elongated, pinkish-white egg, measuring 15.5 x 6.7 mm,

**Table 1.** Female size, egg size, hatchling size, and incubation period in some Sri Lankan skinks. See text for details.

Species	Mean female SVL (mm) $\pm$ SD	Clutch size	Mean egg size		Mean incubation period (days) $\pm$ SD	Mean hatchling size	
			Length $\pm$ SD	Width $\pm$ SD		SVL $\pm$ SD	TL $\pm$ SD
<i>Lankascincus fallax</i>	41.69 $\pm$ 1.36 (n = 14)	2	9.67 $\pm$ 1.86	5.46 $\pm$ 0.66	42.27 $\pm$ 2.08	15.84 $\pm$ 0.95	–
<i>Lankascincus deignani</i>	46.16 (n = 3)	2	9.07 $\pm$ 0.14	5.41 $\pm$ 0.11	44.50 $\pm$ 0.54	17.96 $\pm$ 0.16	21.01 $\pm$ 1.18
<i>Nessia monodactylus</i>	91 (n = 1)	1	15.5	6.7	42	46.0	19.0

on 19 July 2006, at a depth of ca. 3.5 cm from the soil surface. The egg hatched on 31 August 2006 and the hatchling was 65 mm in length.

The two species of *Lankascincus* studied show similar life history traits, dissimilar to that displayed in *Nessia monodactylus*. In the *Lankascincus* species, the clutch size was two. The eggs were incubated in room temperature between 24–29°C. This temperature range might not have an effect on the incubation period, given that the temperature of the microhabitat itself is also very close to these values. In any case, there were no sources to compare these values. However, in all three species studied, the incubation period ranged between 42 to 44 days. The average snout to vent length of gravid *L. fallax* was smaller than that of *L. deignani*. The average egg size of *L. fallax* was greater than that of *L. deignani*. According to Deraniyagala (1953), the eggs of *L. taprobanensis*, which is a montane species, are about 12.5 x 7 mm and eggshells have numerous fine longitudinal granular pleats. However, the average sizes of the eggs of *L. fallax* and *L. deignani* in the present study were much smaller. Nevertheless, the total length of the newly hatched young was 40 mm, which corresponds well to the values obtained in this study. The observation that the two eggs in the clutch of *L. fallax* and *L. deignani* are laid in two different places can have an adaptive significance and it has not been recorded in other skinks or other lizards before. This behaviour might be related to reducing mortality due to egg predation and/or other physical damage.

The periodic variation of the number of gravid females of *L. fallax* encountered strongly correlate with the seasonality of rainfall. The highest number of gravid females was encountered from May to August, which is also the time when the area receives rain from the Southwest monsoons. There is a complete absence of gravid females in January and February, which are the driest months. The reproductive cycles of tropical lizards can be continuous or seasonal, depending on a variety of factors, some of which are historical. In temperate areas, lizard reproduction is seasonal with mating and egg-laying often occurring from spring to summer (Fitch, 1970). However, tropical lizard species reproduce continuously in some areas (Inger and Greenberg, 1966) and seasonally in

other areas where rainfall is seasonal (Clark and Alford, 1993). Lizards in Australian seasonal tropics show at least three patterns: (1) reproductive activity concentrated in the wet season, (2) reproductive activity concentrated in the dry season and (3) continuous reproduction (James and Shine, 1985). The results on the oviposition period obtained in this study show a close relationship with seasonal rainfall patterns in the study area. However, it is not adequate to confirm the relationship of egg laying period with the seasonality of rainfall for which the study should be extended over a longer period. Furthermore, reproductive period of *L. fallax* living in the dry zone can differ from this given that the seasonality of rainfall is different from that of the wet zone.

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#### Literature cited

- BATUWITA, S. & R. PETHIYAGODA. 2008.** Description of a new species of Sri Lankan litter skink (Squamata: Scincidae: *Lankascincus*). Ceylon Journal of Science (Biological Sciences) 36(2):80–87.
- CLARK, R. B. & R. A. ALFORD. 1993.** Reproductive biology of four species of tropical Australian lizards and comments on the factors regulating lizard reproductive cycles. Journal of Herpetology 27:400–406.
- DERANIYAGALA, P. E. P. 1953.** A coloured atlas of some vertebrates from Ceylon. Volume 2. Tetrapod Reptilia, Ceylon National Museum, Colombo. 101 pp.
- DE SILVA, A. 1994.** An introduction to the herpetofauna of Sri Lanka. Lyriocephalus 1(1&2):3–19.
- \_\_\_\_\_, **A. M. BAUER, C. C. AUSTIN, S. GOONEWARDENE, J. DRAKE & P. DE SILVA. 2005a.** *Chalcidoseps twaitesii* (Günther, 1872) (Reptilia: Scincidae), Four-toed snake skink: preliminary observation, Lyriocephalus Special Issue 6(1&2):103–111.
- \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_, **J. BALASUBRAMANIAM, C. RAJENDRAN, V. PATHMADEVAN, M. FERNANDO & K. SURESHKUMAR. 2005b.** Notes on *Nessia* species inhabiting the Knuckles massif

with special reference to *Nessia bipes* Smith, 1935 (Reptilia: Scincidae): the dominant snake skink, *Lyriocephalus* Special Issue 6(1&2):115–123.

- FITCH, H. S. 1970.** Reproductive cycles in lizards and snakes. Miscellaneous Publications of the Museum of Natural History, University of Kansas 52:1–247.
- GANS, C. 1995.** New records of skinks from Sri Lanka. *Lyriocephalus* 2(1&20):21–24
- GREER, A. E. 1970.** A subfamilial classification of Scincid lizards. *Bulletin of the Museum of Comparative Zoology* 139(3):151–184.
- \_\_\_\_\_. **1991.** *Lankascincus* a new genus of scincid lizards from Sri Lanka, with descriptions of three new species. *Journal of Herpetology* 25(1):59–64.
- INGER R. F. & B. GREENBERG. 1966.** Annual reproductive patterns of lizards from a Bornean rainforest. *Ecology* 47:1007–1021.
- JAMES, C. & R. SHINE. 1985.** The seasonal timing of reproduction: atropical temperate comparison in Australian lizards. *Oecologia*, Berlin 67:464–474.
- SMITH, M. A. 1935.** The fauna of British India, Ceylon and Burma, including the whole of Indo-Chinese Subregion, Reptilia and Amphibia. Volume II. Taylor & Francis, London. xiii + 440 pp + 1 pl.
- TAYLOR, E. H. 1950.** Ceylonese lizards of the family Scincidae. *The University of Kansas Science Bulletin* 33:482–5.
- WICKRAMASINGHE, L. J. M., R. RODRIGO, N. DAYAWANSA & U. L. D. JAYANTHA. 2007.** Two new species of *Lankascincus* (Squamata: Scincidae) from Sripada Sanctuary (Peak Wilderness), in Sri Lanka. *Zootaxa* 1612:1–24.

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**The Rediscovery of *Enhydris pahangensis* Tweedie, 1946**

(with one text-figure)

The rear-fanged water snakes in the family Homalopsidae (Colubroidae) were reviewed by Gyi (1970) and more recently by Murphy (2007). Gyi (1970) recognized 10 genera, containing 34 species, while Murphy (2007) listed 10 genera with 37 species, acknowledging that there are numerous undescribed taxa within this family. The genus *Enhydris* contains 24 species, but is paraphyletic (Alfaro et al., 2008). Two species (*Enhydris enhydris* and *E. plumbea*) are widespread, while the others are restricted to specific bioregions. In Peninsular Malaysia, six species of *Enhydris* are recognized (Das and Norsham, 2007). They are: *Enhydris bocourti*, *E. enhydris*, *E. indica*, *E. pahangensis*, *E. plumbea* and *E. punctata*. Of these, three are commonly found throughout Peninsular Malaysia (*E. bocourti*, *E. enhydris* and *E. plumbea*). *Enhydris indica*, *E. punctata* and *E. pahangensis* are poorly known, and *E. pahangensis* is known only from the type specimen.

*Enhydris pahangensis* was described on the basis of a single juvenile male from Kuala Tahan, Tembeling River, in the state of Pahang at an altitude of ca. 150–300 m, > 112 km from the east coast of Peninsular Malaysia (Tweedie, 1946).

In May 2007, a juvenile female was collected from the east coast of Peninsular Malaysia, in the state of Terengganu. The specimen was collected from a small stream in the Sungai Kura drainage, in the district of Hulu Terengganu (05°13'45.3'N, 102°28'17.5'E'), at an altitude of ca. 300 m. It was collected at night in shallow, murky and stagnant water. The stream had a muddy bed and was ca. 2 m wide. The surrounding area consisted of lowland secondary dipterocarp forests, undisturbed for many years. Tissue samples were taken and the specimen deposited at the herpetological collection of the National University of Malaysia (Catalogue number UKMHC 0923). This constitutes the second record for this species, and represents a



Figure 1. Juvenile female *Enhydris pahangensis* (UKMHC 0923).

new locality record, extending its geographical distribution by over 100 km.

The specimen is a juvenile female, snout-vent-length 215 mm and tail length 50 mm. Eight supralabials, Supralabial IV touching the eye; nine infralabials, five of which are in contact with the anterior chin shields; 25 dorsal scale rows at midbody; 27 rows at neck; 20 rows near vent; 130 ventrals; 52 paired subcaudals and anal plate divided. The body is grey-brown above, with small dark spots over dorsum; a pale yellow stripe runs along each side of the body and covers first four lateral dorsal scale rows anteriorly and three rows posteriorly towards anus; this stripe wider and turns from pale yellow to white on sides of head and extends onto supralabials and rostral scale; lateral stripe bordered above and below by a dark, distinct zig-zag line; a dark median line runs between paired subcaudals; anterior portion of head, supralabials, infralabials and underside of head mottled with dark grey; ventral scales white. In Peninsular Malaysia, *E. pahangensis* differs from all other species of *Enhydris* in having 25 scale rows at midbody with the exception of *E. punctata* which has 23–27 scale rows; *E. pahangensis* can be readily distinguished from *E. punctata* by having eight supralabials while *E. punctata* has 12–14 supralabials.

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### Literature cited

- ALFARO, M. E., D. R. KARNS, H. K. VORIS, C. D. BROCK & B. L. STUART. 2008. Phylogeny, evolutionary history, and biogeography of Oriental-Australian rear-fanged water snakes (Colubroidea: Homalopsidae) inferred from mitochondrial and nuclear DNA sequences. *Molecular Phylogenetics and Evolution* 46:576–593.
- DAS, I. & N. YAAKOB. 2007. Status of knowledge of the Malaysian herpetofauna. In: Status of biological diversity in Malaysia & threat assessment of plant species in Malaysia. pp:31–81. L. S. L. Chua, L. G. Kirton & L. G. Saw (Eds). Forest Research Institute Malaysia, Kepong.
- GYI, K. K. 1970. A revision of colubrid snakes of the subfamily Homalopsinae. University of Kansas Publication, Museum of Natural History 20(2):47–223.
- MANTHEY, U. & W. GROSSMANN. 1997. Amphibien & Reptilien Südostasiens. Natur und Tier-Verlag, Münster. 512 pp.
- MURPHY, J. C. 2007. Homalopsid snakes. Evolution in the mud. Krieger Publishing, Malabar, Florida. 249 pp.
- TWEEDIE, M. W. F. 1946. A new snake from the Malay Peninsula. *Annals and Magazine of Natural History, Series 11*, 13(98):142–144.
- \_\_\_\_\_. 1983. The snakes of Malaya. Third edition. Singapore National Printers (Pte) Ltd., Singapore. 167 pp.

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### ***Python molurus* Predation on a *Macaca nemestrina* in Khao Yai National Park, Thailand**

(with two text-figures)

Pig-tailed Macaque (*Macaca nemestrina*) is one of five species of macaques found in Thailand, usually inhabiting inland evergreen or deciduous forest (Choudhury, 2003), where they can be found solitary or in large groups (McClure, 1964). Group size of this species ranges from 7–22 individuals (Borries et al., 2002). Although predation of primates is rarely observed (Uhde and Sommer, 2002), predation risk has been suggested as one of the major causes for the formation of large social units in most primate species (van Schaik, 1983). Pythons are represented by three species in Thailand, including the Reticulate Python (*Broghammerus reticulatus*), the Blood Python (*P. brongersmai*), and the Burmese Python (*P. molurus*). Burmese Python can be found in the forest plains and hills up to 900 m (Cox et al., 1998) and occasionally, near human habitations. Pythons are among the most commonly observed predators of wild primates, such as gibbons (Uhde and Sommer, 2002), macaques (Shine et al., 1998) and tarsiers (Gursky, 2002). The Burmese Python shows good camouflage, that permit prey to come close without detecting them, while they wait in ambush (Slip and Shine, 1988; Fredriksson, 2005).

In this paper, we describe a predation event by a Burmese Python on a Pig-tailed Macaque

(*Macaca nemestrina*), in Khao Yai National Park (14°26'N, 101°22'E), in north-eastern Thailand, which covers ca. 2,200 km<sup>2</sup>. This area (740 m asl) has mature, seasonally-wet evergreen forest (Brockelman et al., 1998; Kitamura et al., 2004). Pig-tailed Macaques are common at Khao Yai, where they often form large groups (> 30 individuals) along the roads, and near restaurants and camp grounds and near other housing within the Park, begging or stealing food from tourists (Huynen et al., in press). This area experiences heavy vehicular traffic and human movements.

In the afternoon of 11 January 2006, at the 109 Lodge of Khao Yai, 5 m from the main road, which passes through the Park's headquarters, we observed an adult female Pig-tailed Macaque being looped and squeezed by an ca. 2.5 m Burmese Python. At 1200 h, the macaque was squeezed against a small tree (ca. 6 cm diameter) where it presumably died. At 1330 h, the snake began swallowing its prey, head-first (Fig. 1), and it spent 30 min. swallowing this part. Then the python attempted to swallow macaque's shoulders, the widest part of the body (Fig. 2), but was unsuccessful. It then regurgitated the macaque and rotated the prey and started swallowing from the shoulders. It took the python 50 min. to completely swallowing the macaque at 1450 h. The python remained resting in the area for about 20 min., before retreating into a clump of bamboo. During the aforementioned event, there were two macaques walking and sitting on the roof of 109 Lodge, 20 m from the python without giving alarm calls. Several people were also present within 2 m,



**Figure 1.** *Python molurus* (~ 2.5 m) starting to swallow a female *Macaca nemestrina*.



**Figure 2.** *Python molurus* swallows head, shoulders and feet of *Macaca nemestrina*.

which apparently had no effect on the snake's behaviour.

Although predation on macaques by the Reticulated Python has been reported before (Nettelbeck, 1995; Shine et al., 1998), this is the first detailed description of a predation event on a Pig-tailed Macaque by the Burmese Python. Overall, such predation events are rarely observed in the wild, and thus their frequency remains largely unknown, as no data are available for either Pig-tailed Macaques (Caldecott, 1986) or Pythons (Standford, 2002; Fredriksson, 2005). However, our observation confirms the existence of predation on Pig-tailed Macaque even in an area highly populated by humans where predation rates are assumed to be low due to the sensitivity of some larger predators to disturbance (Anderson, 1986; Berger, 2007). It is possible that a major distinction can be made between the types of predator in relation to their hunting and feeding behaviour. Primates are known to be preyed by large carnivores, mainly felids (Davies, 1990; Isbell, 2005), for which diurnal primates tend to form large groups to increase the likelihood of detecting such predators (van Schaik and van Hooff, 1983). Complex mobbing behaviour is also a consequence of predator detection and isolation in group-living primates, as known in gibbons (Uhde and Sommer, 2002), White-faced Cebus Monkeys (*Cebus capucinus*) (Chapman, 1986); Spectral Tarsiers (*Tarsius spectrum*) (Gursky, 2002) and Bonnet Macaques (*Macaca radiata*) (Ramakrishna et al., 2005). Our observation also highlights the possibility that grouping is not a successful behaviour for other types of predators, such as large snakes, which are more difficult to detect. Pythons mainly hunt by ambush, relying on their camouflage to remain undetected in close proximity to potential prey. They are often reported to ambush at locations frequently used by wildlife (Slip and Shine, 1988). Under such circumstances, vigilance by large groups may be useless and, due to the large size of the prey, once one group member has been successfully attacked by a predator, additional mobbing is probably irrelevant. This might explain why surprisingly no mobbing was recorded by other macaques present at the predation site, in contrast to observations of smaller primate species such as tarsier, where other group members

kept mobbing a python while it was ingesting its prey (Gursky, 2002). Overall, human presence did not appear to be a deterrent for this type of predator as during the event, a small crowd of people stood around to watch, and the python was not dissuaded from consuming the macaque once it began, unlike larger cats which can be deterred from finishing their prey relatively easily (Kerley et al., 2002).

It is unknown at this time whether pythons are commonly successful at depredating macaques or how the threats from pythons may stimulate anti-predator behaviour in this primate species. Furthermore, while Pig-tailed Macaques are relatively common in the Park (Jenks and Damrongchainarong, 2006) and elsewhere in south-east Asia (Azlan and Lading, 2006), the abundance of pythons is unknown, particularly those of sufficient size to capture an adult macaque. As these macaques may benefit from associating with humans in the park, further examination of predation rates on macaques far away from and adjacent to centres of human activity could be particularly useful for understanding the demographics of macaques in Khao Yai and elsewhere.

### Literature cited

- ANDERSON, C. M. 1986.** Predation and primate evolution. *Primates* 27(1):15–39.
- AZLAN, J. M. & E. LADING. 2006.** Camera trapping and conservation in Lambir Hills National Park. Sarawak. *The Raffles Bulletin of Zoology* 54:469–475.
- BERGER, J. 2007.** Fear, human shields and the redistribution of prey and predators in protected areas. *Biology Letters* 3:620–623.
- BORRIES, C., E. KREETIYUTANONT & A. KOENIG. 2002.** The diurnal primate community in a dry evergreen forest in Phu Khieo wildlife sanctuary, northeast Thailand. *Natural History Bulletin of Siam Society* 50(1):75–88.
- BROCKELMAN, W. Y., U. REICHARD, U. TREESUCON & J. J. RAEMAEKERS. 1998.** Dispersal, pair formation and social structure in gibbons (*Hyllobates lar*). *Behavioral Ecology and Sociobiology* 42:329–339.
- CALDECOTT, J. O. 1986.** An ecological and behavioural study of the Pig-tailed Macaque. In: *Contributions of Primatology* 21:1–257.
- CHAPMAN, C. A. 1986.** *Boa constrictor* Predation

- and group response in White-faced cebus monkeys. *Biotropica* 18(2):171–172.
- CHOUDHURY, A. 2003.** The pig-tailed macaque *Macaca nemestrina* in India- Status and conservation. *Primate Conservation* 19:91–98.
- COX, J. M., P. P. VAN DIJK, J. NABHITABHATA & K. THIRAKHUPT. 1998.** Snakes and other reptiles of Thailand and south-east Asia. Asia Book Co., Ltd., Bangkok. 144 pp.
- DAVIES, R. G. 1990.** Sighting of a clouded leopard (*Neofelis nebulosa*) in a troop of pigtail macaques (*Macaca nemestrina*) in Khao Yai National Park, Thailand. *Natural History Bulletin of the Siam Society* 28:95–96.
- FREDRIKSSON, M. G. 2005.** Predation on sun bears by reticulated python in East Kalimantan, Indonesian Borneo. *The Raffles Bulletin of Zoology* 53(1):165–168.
- GURSKY, S. 2002.** Predation on a wild spectral tarsier (*Tarsius spectrum*) by a snake. *Folia Primatologica* 73:60–62.
- HUYNEN, M.-C., A. LATINNE, H. BERNARD & T. SAVINI.** In press. The question of Pigtail macaques (*Macaca nemestrina*) population density in the Khao Yai National Park, with preliminary data on the ecology of a semi-habituated troop. *Natural History Bulletin of the Siam Society*
- ISBELL, L. A. 2005.** Sudden short-term increase in mortality of vervet monkeys (*Cercopithecus aethiops*) due to leopard predation in Amboseli National Park, Kenya. *American Journal of Primatology* 21: 41–52.
- JENKS, K. E. & K. DAMRONGCHAINARONG. 2006.** Dong Phrayayen-Khao Yai Carnivore Conservation Project: summary project report October 2003 through October 2006. Smithsonian's National Zoological Park, Wildlife Foundation Thailand, and Khao Yai National Park. Report submitted to Department of National Parks, Wildlife, and Plant Conservation, Bangkok. 58 pp.
- KERLEY, L. L., J. M. GOODRICH, D. G. MIQUELLE, E. N. SMIRNOV, I. G. NIKOLAEV, H. B. QUIGLEY & M. G. HORNOCKER. 2002.** Effects of roads and human disturbance on Amur tigers. *Conservation Biology* 16:1–12.
- KITAMURA, S., T. YUMOTO, P. POONSWAD, P. CHUAILUA & K. PLONGMAI. 2004.** Characteristics of hornbill-dispersed fruits in a tropical seasonal forest in Thailand. *Bird Conservation International* 14:81–88.
- NETTELBECK, A. R. 1995.** Predation on barking deer by reticulated python and dholes in Khao Yai National Park. *The Natural History Bulletin of the Siam Society* 43:369–373.
- McCLURE, H. E. 1964.** Some observations of primates in climax dipterocarp forest near Kuala Lumpur, Malaya. *Primates* 5(3–4):39–58.
- RAMAKRISHNA, U., R. G. COSS, J. SCHANK, A. DHARAWAT & S. KIM. 2005.** Snake species discrimination by wild bonnet macaques (*Macaca radiata*). *Ethology* 111(4):337.
- SHINE, R., P. HARLOW, J. KEOGH & BOEADI. 1998.** The influence of sex and body size on food habits of a giant tropical snake, *Python reticulatus*. *Functional Ecology* 12(2):248–258.
- SLIP, D. J. & R. SHINE. 1988.** Feeding habits of the diamond python, *Morelia s. spilota*: ambush predation by a boid snake. *Journal of Herpetology* 22:323–330.
- STANDFORD, C. B. 2002.** Avoiding predators: expectations and evidence in primate antipredator behavior. *International Journal of Primatology* 23(4):741–757.
- UHDE, N. L. & V. SOMMER. 2002.** Antipredatory behaviour in gibbons (*Hylobates lar*, KhaYai/Thailand). Eat or been eaten. Predator, sensitive, foraging among primates. pp:268–291. Miller L.E. Cambridge University Press, Cambridge.
- VAN SCHAİK, C. P. 1983.** Why are diurnal primates living in groups? *Behaviour* 87:120–144.
- \_\_\_\_ & J. A. R. A. M. VAN HOOFF. 1983. On the ultimate causes of primate social systems. *Behaviour* 85:91–117.

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### Yawning in *Python molurus*

Yawning is widespread in many vertebrates, especially among homeotherms (Baenninger, 1987). Factors that reportedly stimulate yawning include psychological and physiological (see Gallup and Gallup, 2007). However, the precise reason and process for yawning is poorly understood. Experimental studies pertaining to yawning have largely been done on homeothermic vertebrates, especially humans. Reports on yawning in reptiles are scanty. In this paper, we report yawning in the free ranging Indian rock python, *Python molurus molurus*, in Keoladeo National Park (KNP), Bharatpur, Rajasthan, northern India.

*Python molurus molurus*, is listed as threatened and consequently protected under the Indian Wildlife (Protection) Act of 1972 (Anon, 2003), and is distributed in most parts of the Indian subcontinent from Pakistan to Bengal, and from the foot hills of the Himalayas to the tip of the Indian Peninsula and Sri Lanka (Smith, 1943). The Sálím Ali Centre for Ornithology and Natural History (SACON) in Coimbatore has been conducting ecological investigations on pythons in KNP since October 2007. In the winter (November-February), ambient temperature of the area falls to a low of 4°C during the night, rising to ca. 23°C by day. Due to the prevailing low temperature, pythons thermoregulate by basking (Bhupathy and Vijayan, 1989; Bhatt and Choudhury, 1993). We monitored the emergence of pythons from burrows, basking duration and their behaviour from 0900–1600 h (Indian Standard Time) from a hide (5 m above ground and 6–7 m from burrow). Individual pythons were identified using dorsal blotch pattern (Bhupathy, 1991) for monitoring and recording behaviour.

On 10 January 2008 at 1340 h, we observed yawning in a ca. 3.7 m female python at KNP. The ambient temperature and humidity during this time were 19.9°C and 48%, respectively. On 30 January 2008 the same python (identified based on dorsal blotch pattern and size) yawned at 1335 h. Temperature and humidity during this observation were 18.6°C and 39%, respective-

ly. On these observation days, the python that yawned emerged from earthen burrow at 1150 and 1120 h and retreated at 1500 and 1440 h, respectively. In both cases yawning occurred about 68–81 min prior to retreat. The yawning python opened its mouth vertically (90°), an action that lasted for 11 and 9 sec, respectively.

In general, yawning is reportedly contagious, but during these observations, two pythons (ca. 1.7 m in length) that were basking adjacently did not show this behaviour. A total of 58 contact hours with various pythons were made from November 2007 to February 2008, but yawning was observed only twice, which indicates the rarity of this behaviour in wild pythons. This particular individual was one of the largest (and presumably oldest) pythons observed during this study, and in general it appeared healthy. The duration of yawning in pythons (9–11 sec) is similar to that reported in humans (10 sec; Daquin et al., 2001). Yawning in the Indian rock python has not been reported earlier either in captivity or the wild.

Reasons for yawning in the python are not clear. In certain species yawning can serve as a warning signal (Tinbergen, 1952). But this may not be true in the present case, as no humans or animals were near the yawning python on both occasions. It is reported that in reptiles, some other activities may appear like yawning, such as the adjustment of jaw joints and bones after the dislocation due to the engulfing larger prey or consumption of slime-coated prey, such as fish, amphibians and snails (Kaplan, 2002). This may not be applicable in the present case as the python that yawned had no sign of previously consumed prey.

It is reported that yawning has a thermoregulatory function that evolved to promote or maintain optimal mental efficiency and homeostasis (see Gallup and Gallup, 2007). It is also reported that yawning may serve as a compensatory cooling mechanism when regulatory mechanisms fail to operate favourably. Low oxygen level in lungs may stimulate yawning, which involves opening the mouth involuntarily while taking a long deep breath of air. It is commonly believed that people yawn as a result of drowsiness or weariness or lack of sufficient oxygen. However, the function of a yawn to increase oxygen in the blood is found to be incorrect

(Provine et al., 1987). Yawning is commonly accompanied by stretching and occurs most frequently before sleep and after waking and may be associated with boredom. Robinson (1981) reported that yawning is significantly associated with head scratching in the black skimmer, *Rynchops niger*. Reasons for yawning in wild pythons, and for reptiles in general, remain unknown and merit further investigation.

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### Literature cited

- ANON.** 2003. The Indian Wildlife (Protection) Act, 1972. Professional Book Publishers, New Delhi. 102 pp.
- BAENNINGER, R.** 1987. Some comparative aspects of yawning in *Betta splendens*, *Homo sapiens*, *Panthera leo* and *Papio sphinx*. Journal of Comparative Psychology 101:349–354.
- BHATT, K. & B. C. CHOUDHURY.** 1993. The diel activity pattern of Indian python (*Python molurus molurus* Linn.) at the Keoladeo National Park, Bharatpur, Rajasthan. Journal of the Bombay Natural History Society 90:394–403.
- BHUPATHY, S.** 1991. Blotch structure in individual identification of the Indian python (*Python molurus molurus*) and its possible usage in population estimation. Journal of the Bombay Natural History Society 87:399–404.
- \_\_\_\_ & **V. S. VIJAYAN.** 1989. Status, distribution and general ecology of the Indian python (*Python molurus molurus*) in Keoladeo National Park, Bharatpur, Rajasthan. Journal of the Bombay Natural History Society 86:381–387.
- DAQUIN, G., J. MICALLEF & O. BLIN.** 2001. Yawning. Sleep Medicine Review 5:299–312.
- GALLUP, A. C. & G. G. GALLUP, Jr.** 2007. Yawning as a brain cooling mechanism: Nasal breathing and forehead cooling diminish the incidence of contagious yawning. www.epjournal.net 5(1):92–101.
- KAPLAN, M.** 2002. Sneezing and yawning. www.anapsid.org/sneeze.html. Accessed on 28<sup>th</sup> May 2008.
- PROVINE, R. R., B. C. TATE & L. L. GELDMACHER.** 1987. Yawning: no effect of 3–5% CO<sub>2</sub>, 100% O<sub>2</sub>, and exercise. Behavioral Neural Biology 48:382–393.
- ROBINSON, S. R.** 1981. Head scratching and yawning in black skimmers. Journal of Field Ornithology 52(1):59–60.
- SMITH, M. A.** 1943. The fauna of British India, Ceylon and Burma, including the whole of the Indo-Chinese region. Reptilia and Amphibia. Vol. III. Serpentes. Taylor and Francis, London. xii +583 pp +1 map.
- TINBERGEN, N.** 1952. Derived activities: their causation, biological significance, origin and emancipation during evolution. Quarterly Review of Biology 27:1–32.

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### A Mishmi Belief Concerning *Bufo cyphosus* from North-east India

(with one text-figure)

On 16 March 2005, I was on a trip to Mehao Wildlife Sanctuary, Lower Dibang Valley, Arunachal Pradesh, north-eastern India. The Sanctuary is within the Mishmi Hill Range. The local tribal people of the area are the Mishmis.

On that day, I was accompanied by Sito Mimi, my field assistant-cum-local guide. Sito (age ca. 46 years) belongs to Mishmi community and is a resident of Koronu village at the fringe of Mehao Sanctuary. We were turning over rocks, leaf litter and logs by the side of a forest trail near Koronu village, and at around 1230 h, I found a specimen of *Bufo cyphosus* Ye, 1977 (Fig. 1; specimen preserved in the Mu-



**Figure 1.** *Bufo cyphosus* Ye, 1977 (AVC A.0940) from Mehao Wildlife Sanctuary, Lower Dibang Valley, Arunachal Pradesh, north-eastern India.

seum of Arya Vidyapeeth College, Guwahati, Assam India, AVC A.0940), under a rotten log in a bamboo-dominated patch (GPS reading: 28°06'04.8"N, 95°54'29.2"E; elevation 350 m asl). As I collected the specimen and started to examine it, Sito Mimi burst out laughing, and after a while, stopped as suddenly.

Initially, I thought the reason for his merriment was my overt curiosity on the specimen. As soon as he stopped laughing, I asked him the reason for his exuberance. His reply was that, according to the Mishmis, one needs to laugh for a few moments (it should be loud enough for the *Bufo* to hear) when they come across any “*Pacapra*” (Mishmi for *Bufo*), as they believe God created this quirky creature to amuse us. He thus suggested me to enjoy this creature when I find it next!

I thank Annemarie Ohler for identification of the specimen.

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### Notes on sexual size dimorphism and reproduction in the Asian Sand Snake, *Psammophis condanarus* (Psammophiidae)

Psammophiid snakes (comprising 7 recognised genera and ~50 extant species) are widespread and conspicuous members of the herpetofauna of Africa, southern Europe, the Middle East, and much of Asia (Schleich et al., 1996; Branch, 1998; Spawls et al., 2002; Khan, 2002; Kelly et al., 2008). Species belonging to the clade exhibit certain ecological characteristics considered uncommon among snakes in general (e.g., Dowling and Savage, 1960; de Haan, 2003; Shine et al., 2006; Cottone and Bauer, 2008a) and occur chiefly in regions of the world where few ecological studies of snakes have been conducted (Greene, 1997). The genus *Psammophis* (Sand Snakes) comprises approximately 60% of all species diversity within the family and these snakes are easily recognised throughout their distribution by their characteristic “whipsnake” morphology and behaviours (Schleich et al., 1996; Branch, 1998; Spawls et al., 2002).

As part of a broader study investigating sexual size dimorphism (SSD) in psammophiids, we dissected and measured specimens of the South and Southeast Asian species *Psammophis condanarus* (n = 27) from the collection of the California Academy of Sciences (CAS). This species occurs through Pakistan, India and Sri Lanka, extending northward to Nepal and eastward through Myanmar and Indochina into Indonesia (Ineich and Deuve, 1990; Prasad, 1992; Brandstätter, 1996; Ingle, 2004). Most information about the ecology of *P. condanarus* is based on general statements from regional works (e.g., Minton, 1966; Khan, 2002; Schleich and Kästle, 2002; Sharma, 2003; Whitaker and Captain, 2004) and little, if any, quantitative information currently exists on this topic.

Two subspecies are recognised, the nominotypical form from the area west of the Ganges Delta and *P. c. indochinensis* from southern Myanmar, through mainland south-east Asia, to Indonesia (Smith, 1943; Brandstätter, 1996). The validity of the subspecific division of the species has not been critically assessed, so we have

**Table 1.** Descriptive statistics and results of two-tailed *t*-tests across sex in mean body traits for *Psammophis condanarus*. Data for body mass were ln transformed in order to meet the assumption homogeneity of variances, but unaltered means and standard errors are presented in the table.

	n: ♂, ♀	♂ mean ± s.e.	♀ mean ± s.e.	t	DF	P
SVL (mm)	21, 6	691 ± 4.3	560 ± 3.3	-1.591	25	0.124
Tail length (mm)	17, 5	206 ± 1.34	182 ± 2.48	-0.866	20	0.397
Head length (mm)	21, 6	24.5 ± 0.88	21.9 ± 1.65	-1.41	25	0.171
Head width (mm)	21, 6	11.5 ± 0.50	9.81 ± 0.93	-1.580	25	0.127
Eye diameter (mm)	21, 6	3.97 ± 0.15	3.82 ± 0.28	-0.481	25	0.634
Body width (mm)	21, 6	14.1 ± 0.82	11.2 ± 1.53	-1.678	25	0.106
Body mass (g)	21, 6	116 ± 15.5	46.5 ± 29.0	-1.718	25	0.096

pooled the individuals examined here, most of which derive from Myanmar.

We recorded SVL, tail length, head length (from the posterior margin of the retroarticular process of the jaw to the tip of the snout), head width (at the widest point), body width (diameter at mid-body), eye diameter, and body mass (after draining and blotting to remove excess ethanol, e.g., Greene and Rodríguez-Robles, 2003) for each specimen. SVL and tail length measurements were taken to the nearest 1 mm with a string and metre rule, and all other measurements were taken to the nearest 0.1 mm with digital callipers. Analysis of tail length was based only on complete and unbroken specimens, which is especially relevant because psammophiids can autotomise their tails (Loveridge, 1940; Broadley, 1987; Akani et al., 2002; Cottone and Bauer, 2008b).

We used two-tailed *t*-tests to assess SSD in mean body traits and single factor ANCOVAs (with sex as the factor in each test) to assess differences in overall body shape across sex. All statistical analyses in this study were performed using JMP 4.0.2 (SAS) and SPSS (15.0). Data

for body mass were ln transformed in order to meet the assumption homogeneity of variances. Our data show that males and females displayed no significant SSD in either mean body measurements (Table 1). ANCOVAs showed that there were no allometric differences across sex (Table 2).

The SSD index, which is negative if males are the larger sex (Gibbons and Lovich, 1990), was calculated to evaluate SSD patterns for *P. condanarus* within the context of its allopatric congeners. The SSD index for this species was -0.234.

Sex and reproductive status of snakes were determined by visual inspection of the gonads (located ~ 30–40 ventral scutes anterior to the cloaca). Of the 27 individuals sampled, 22% were female and 78% were male. All females examined (*n* = 6) were classed as mature because they displayed thickened muscular oviducts, and one with vitellogenic follicles was considered sexually active at the time of collection (CAS 222752, collected in January from Myanmar). None of the females examined had oviductal eggs.

**Table 2.** Allometric trends in *Psammophis condanarus*. Differences across sex were first evaluated by testing for homogeneity of slopes and then by single-factor ANCOVAs. Sex was used as the factor in all analyses.

Trait	Covariate	Homogeneity of slopes			ANCOVA		
		F	DF	P	F	DF	P
Tail length	SVL	0.055	1, 18	0.818	0.08	1, 19	0.928
Head length	SVL	0.022	1, 23	0.884	0.077	1, 24	0.784
Head width	Head length	1.580	1, 23	0.221	0.453	1, 24	0.507
Eye diameter	Head length	0.109	1, 23	0.745	0.589	1, 24	0.450
Body mass	SVL	0.100	1, 23	0.754	0.475	1, 24	0.497

All males examined ( $n = 21$ ) were classified as mature and producing sperm at the time of collection, as testes were thick, enlarged, and turgid (as opposed to flat and ribbon-like) and for one specimen (collected in January from Myanmar) efferent ducts were also white and thickened (indicating presence of sperm). Finally, small incisions ( $\sim 15$  mm) were made at three different locations along the alimentary tract to check for prey items; none were detected for this sample.

While the sample size for this study is small, it is comparable to samples from other studies on psammophiids quantifying similar ecological parameters (e.g., Shine et al., 2006). According to these data, *P. condanarus* displays little sexual dimorphism in body size and shape, a pattern also seen in several psammophiids from Africa and Europe (Corti et al., 2001; Shine et al., 2006; Cottone and Bauer, 2009). Males do tend to have larger mean body traits, but the differences are not statistically distinguishable and may be misleading considering the skewed sex ratio of our sample. Moreover, sex ratios above 70% (male) have been reported in samples of other psammophiids (Shine et al., 2006) and may reflect underlying behavioral differences affecting capture frequencies.

Of the 13 congeners where SSD indices are known (Shine et al., 2006; Cottone and Bauer, in press, in press), *P. condanarus* is the most heavily male-biased of all, yet there were no statistically significant differences in mean size and shape here (Table 1 and 2); however, it is possible larger, more robust samples in the future may reveal otherwise. Interestingly, females have previously been reported to grow to larger sizes than males (Smith, 1943) and also account for the largest specimen measured for the species. These discrepancies highlight the importance of obtaining representative samples, especially since many psammophiids have widespread distributions and have been documented to exhibit geographic variation in several ecological traits (e.g., Marx, 1988; Kark et al., 1997; Cottone, 2007). Eighty-five percent ( $n = 23$ ) of the specimens examined in this study were collected in Myanmar. Of the rest, one was collected in India, a second from Thailand, and two more from unknown localities. *Psammophis condanarus* occurs over a hetero-

geneous habitat, ranging from the arid deserts of Pakistan to the tropical monsoon climate of Myanmar and Indonesia (Brandstätter, 1996). It is likely that different habitats favor different ecological strategies and a more comprehensive investigation of *P. condanarus* could potentially reveal such differences.

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### Literature cited

- AKANI, G. C., L. LUISELLI, S. M. WARIBOKO, L. UDE & F. M. ANGELICI. 2002.** Frequency of tail autotomy in the African olive grass snake, *Psammophis 'phillipsi'* from three habitats in southern Nigeria. *Journal of Herpetology* 51(2):143–146.
- BRANCH, W. R. 1998.** A field guide to snakes and other reptiles of southern Africa. Struik Publishers, Cape Town. 399 pp.
- BRANDSTÄTTER, F. 1996.** Die Sandrennattern. Westarp Wissenschaften, Magdeburg. 142 pp.
- BROADLEY, D. G. 1987.** Caudal autonomy in African snakes of the genera *Natriciteres* Loveridge and *Psammophis* Boie. *Journal of the Herpetology Association of Africa* 33:18–19.
- CORTI, C., L. LUISELLI & M. A. ZUFFI. 2001.** Observations on the natural history and morphometrics of the Montpellier snake *Malpolon monspessulanus*, on Lampedusa Island (Mediterranean Sea). *Herpetological Journal* 11:79–82.
- COTTONE, A. M. 2007.** Ecological investigations of the Psammophiidae (Squamata: Serpentes). Unpublished M.S. thesis, Villanova University, Villanova, PA. xiv + 163 pp.
- \_\_\_\_ & A. M. BAUER. 2008a. Prey excavation by *Psammophylax rhombeatus rhombeatus* (Colubridae: Psammophiinae) from South Africa. *Herpetological Bulletin* 103(2):11–15.
- \_\_\_\_ & \_\_\_\_\_. 2008b. *Psammophylax r. rhombeatus* (Linnaeus, 1758) and *Psammophis* spp. Rhombic skaapsteker and sand snakes. Tail autotomy. *African Herp News* (44):18–19.
- \_\_\_\_ & \_\_\_\_\_. 2009. Sexual size dimorphism, diet,

- and reproductive biology of the Afro-Asian Sand Snake, *Psammophis schokari* (Psammophiidae). *Amphibia-Reptilia* 30:331-340.
- \_\_\_\_ & \_\_\_\_\_. In Press. Ecological notes on two sympatric *Psammophis* species from East Africa. *African Journal of Herpetology*.
- DE HAAN, C. C. 2003.** Extrabuccal infralabial secretion outlets in *Dromophis*, *Mimophis*, and *Psammophis* species (Serpentes, Colubridae, Psammophiini). A probable substitute for "self rubbing" and cloacal scent gland functions, and a cue for a taxonomic account. *Comptus Rendus Biologie* 36:275-286.
- DOWLING, H. G. & J. M. SAVAGE. 1960.** A guide to the snake hemipenis: a survey of basic structure and systematic characteristics. *Zoologica*, New York 45:17-28.
- GIBBONS, J. W. & J. E. LOVICH. 1990.** Sexual dimorphism in turtles with emphasis on the slider turtle (*Trachemys scripta*). *Herpetological Monographs* 4:1-29.
- GREENE, H. W. 1997.** Snakes — The evolution of mystery in nature. University of California Press, Berkeley. 351 pp.
- \_\_\_\_ & **J. A. RODRIGUEZ-ROBLES. 2003.** Feeding ecology of the California Mountain kingsnake, *Lampropeltis zonata* (Colubridae), *Copeia* 2003:308-314.
- INEICH, I. & J. DEUVE. 1990.** *Psammophis condanarus* (Asian sand snake). *Herpetological Review* 21(1): 23.
- INGLE, M. 2004.** Ophio-fauna of Ujjain and certain areas of Malwi region (Madhya Pradesh). *Records of the Zoological Survey of India* 103:17-31.
- KARK, S., I. WARBURG & Y. L. WERNER. 1997.** Polymorphism in the snake *Psammophis schokari* on both sides of the desert edge in Israel and Sinai. *Journal of Arid Environments* 37:513-527.
- KELLY, C. M. R., N. P. BARKER, M. H. VILLET, D. G. BROADLEY & W. R. BRANCH. 2008.** The snake family Psammophiidae (Reptilia: Serpentes): Phylogenetics and species delimitation in the African sand snakes (*Psammophis* Boie, 1825) and allied genera. *Molecular Phylogenetics and Evolution* 47:1045-1060.
- KHAN, M. S. 2002.** A guide to the snakes of Pakistan. Edition Chimaira, Frankfurt am Main. 265 pp.
- LOVERIDGE, A. 1940.** Revision of the African snakes of the genera *Dromophis* and *Psammophis*. *Bulletin of the Museum of Comparative Zoology* 87:1-16.
- MARX, H. 1988.** The colubrid snake, *Psammophis schokari*, from the Arabian Peninsula. *Fieldiana Zoology* 40:1-16.
- MINTON, S. A. 1966.** A contribution to the herpetology of West Pakistan. *Bulletin of the American Museum of Natural History* 134:27-184.
- PRASAD, J. N. 1992.** Review of the distribution of the condanarous sandsnake *Psammophis condanarus* (Merrem). *Journal of the Bombay Natural History Society* 89(3):382.
- SCHLEICH, H. H. & W. KÄSTLE (Eds). 2002.** Amphibians and reptiles of Nepal. Koeltz Scientific Books, Koenigstein. 1,201 pp.
- \_\_\_\_, \_\_\_\_ & **K. KABISCH. 1996.** Amphibians and reptiles of North Africa. Koeltz Scientific Books, Koenigstein. 630 pp.
- SHARMA, R. C. 2003.** Handbook. Indian snakes. *Zoological Survey of India, Kolkata*. xxvi + 410 pp.
- SHINE, R., W. R. BRANCH, P. S. HARLOW, J. K. WEBB & T. SHINE. 2006.** Sexual dimorphism, reproductive biology, and dietary habits of psammophiine snakes (Colubridae) from southern Africa. *Copeia* 2006:650-664.
- SMITH, M. A. 1943.** The fauna of British India. Reptilia and Amphibia, Vol. III.—Serpentes. Taylor and Francis, London. xii + 583 pp.
- SPAWLS, S., K. HOWELL, R. DREWES & J. ASHE. 2002.** A field guide to the reptiles of East Africa. Academic Press, San Diego. 543 pp.
- WHITAKER, R. & A. CAPTAIN. 2004.** Snakes of India, the field guide. Draco Books, Chennai. 481pp.

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**Field Observation of a Large Prey Item  
 Consumed by a Small *Cylindrophis ruffus*  
 (Laurenti, 1768) (Serpentes: Cylindrophiidae)**

(with one text-figure)

*Cylindrophis ruffus* is a semi-fossorial, nocturnal and relatively common snake, widely distributed in the lowlands of south-east Asia. It is frequently found in the vicinity of rice paddies, ditches, canals, and gardens, will swim readily, and is reported to prey principally upon snakes and eels (Tweedie, 1954; Taylor, 1965; Saint Girons, 1972). Snakes of the families Cylindrophiidae and Aniliidae are among the most morphologically primitive of extant snake species, and feed almost exclusively on elongate lower vertebrates, which are sometimes heavy relative to the snakes (Greene, 1983). The diet and feeding habits of these snakes is of particular interest in the evolution of snake feeding mechanisms for large prey, yet there are few dietary observations from wild individuals, and most available data are from museum specimens and captive individuals. Here, I report a field observation of the consumption of a relatively large and heavy prey item, a swamp eel *Monopterus albus* (Zuiew, 1793), by a small individual of *C. ruffus*. I follow Adler et al. (1993) in using the specific spelling *ruffus* instead of the unjustified emendation *rufus*.

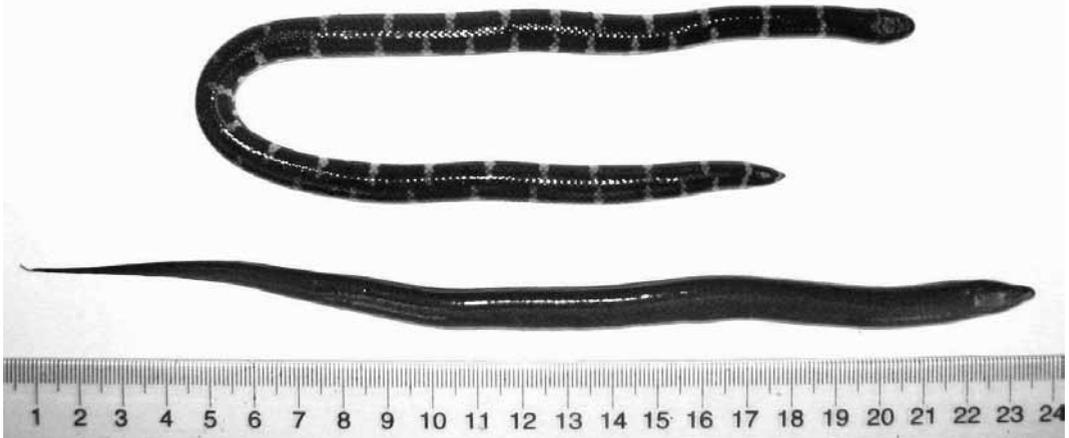
On 13 July 2006 at 1920 h, I observed and caught a juvenile *C. ruffus* on a path among rice paddies and scrub in a suburban district of Vientiane, the capital of Lao People's Democratic Republic (hereafter 'Laos'), and made the following measurements of this individual: female (ascertained by the absence of hemipenes), total length (TL) 293 mm, snout-vent length (SVL) 284 mm, head width (to the commissure of the jaws) 7 mm, mass 15.0 gm (measured with a Pesola 50 gm balance to 0.5 gm, after regurgitation of the eel), capture locality, 17°58'N, 102°36'E, elevation 165 m. This individual conformed to the description of Taylor (1965) for *C. ruffus* in having a cylindrical body of nearly equal diameter throughout, smooth scales, ventrals feebly enlarged, body scales small, imbricating and

subequal, nasals in contact behind the rostral, and loreal and preoculars absent. It possessed the iridescent colouration distinctive of hatching and juvenile *C. ruffus*. Upon capture the snake pressed its tail tip against my hand and flashed its red subcaudal scales (the latter is a common defensive reaction of *C. ruffus*: Campden-Main, 1970; David and Vogel, 1996).

Within five minutes of capture the snake regurgitated an eel, *M. albus*, with TL 240 mm, mid-body width 8 mm and mass 10.0 gm. The eel was visibly large compared to the snake (Fig. 1) and was equivalent to 67% of the snake's mass and 85% of its SVL. The eel was disgorged tail first, indicating it had been swallowed head first (consistent with feeding behaviour previously documented in *C. ruffus*: Greene, 1983; Cundall, 1995; Kupfer et al., 2003). The eel was identified by the absence of scales and pectoral and dorsal fins, features distinctive to this species (Kottelat, 2001).

This record is consistent with other published records that indicate *C. ruffus* consumes heavy vertebrate prey relative to individual snake mass. Three ratios help express size relationships between snakes and their prey: weight ratio (prey mass/predator mass) and ingestion ratio (prey diameter/snake's head diameter) (Greene, 1983), and length ratio (TL of prey/SVL of snake) (Jackson et al., 2004). Few published data are available for *C. ruffus* for any of these measures.

In the present record, the weight, ingestion and length ratios between the *C. ruffus* and eel were 0.67, 1.1 and 0.85, respectively. Values of 1.0 or greater indicate the prey item is equal to or greater than the snake's weight, head width or SVL respectively. By comparison, weight ratios of 0.01–0.83 (mean 0.24) were documented for nine *Cylindrophis* and their prey by Greene (1983), and values of 0.48 and 0.45 were recorded for two *C. ruffus* which had caught caecilians (Kupfer et al., 2003). These are the only other published weight ratios I am aware of for the genus *Cylindrophis*. The present value 0.67 is at the higher end of this range and reflects the large mass of the eel compared with the relatively small mass of the *C. ruffus*; in Greene's sample, the low values indicate that large *Cylindrophis* also consume small prey. In the case of *C. ruffus* and the eel *M. albus*, which attain maximum



**Figure 1.** Juvenile *Cylindrophis ruffus* (SVL 284 mm, mass 15.0 gm) with recently disgorged eel *Monopterus albus* (TL 240 mm, mass 10.0 gm), Vientiane, Laos.

lengths of 870 mm (David and Vogel, 1996) and 875 mm (Kottelat, 2001) respectively, it seems likely that both juvenile and adult *C. ruffus* will consume small and large eels.

The present ingestion ratio 1.1 is low (reflecting the elongate shape of the eel compared with the snake's gape) and the length ratio 0.85 is high (reflecting the eel's long TL compared with the snake's SVL). This length ratio is similar to the highest length ratio (0.88) measured for *C. ruffus* by Greene (1983), in which the prey item was also an eel. Cundall (1995) observed an unsuccessful attempt by a captive *C. ruffus* to eat a snake longer than itself (i.e., weight and length ratios > 1.0). It is unknown whether *C. ruffus* is able to ingest prey with weight or length ratios > 1.0.

By comparison, weight and/or length ratios > 1.0 have been documented in macrostomate snakes, including elapids and viperids, in which snakes consume prey heavier than themselves or longer than the length between their mouth and cloaca, and employ mechanical strategies to do so (Greene, 1983; Jackson et al., 2004 and references therein).

The choice of prey consumed in the present record, an eel, is consistent with other field data on the diet of *C. ruffus*. Greene (1983) examined museum specimens and also summarized published dietary records for *Cylindrophis* up to the early 1980s. He found that snakes and eels were the dominant prey items in the stomach contents

of 30 specimens of *C. ruffus* collected from localities across south-east Asia.

An historical field record not cited by Greene (1983) is that of Smith (1921:196–197), who observed a *C. ruffus* consuming a *Xenochrophis piscator*, and noted 'it was firmly caught by the neck.. So tightly was it held that it required considerable force to extract it'.. [*C. ruffus*] 'feeds, as far as I know, upon eels and other snakes, and several specimens that have been sent me have disgorged meals, nearly as thick as, and several inches longer than, themselves'. Dietary field records subsequent to Greene (1983) are from Thailand, where Kupfer et al. (2003) observed two *C. ruffus* preying upon caecilians *Ichthyophis* cf. *kohtaoensis*, and Karns et al. (2005) documented snake-feeding by *C. ruffus* among semi-aquatic snake communities (but provided no other details). Voris and Murphy (2002) noted that ophiophagous snakes such as *C. ruffus* are important predators of homalopsid snakes. Captive *C. ruffus* have been observed to consume snakes, salamanders, fish and small mice (Green, 1983; Cundall, 1995).

Much of central and southern Laos, including Vientiane, is located on large floodplains of the Mekong River and supports degraded suburban wetland habitats and rice paddies, where *C. ruffus* is common (Deuve, 1970; M. Bezuijen, unpubl. data) as is the eel *M. albus* (R. Mollot, pers. comm.). Given the similarity of these floodplain habitats with contiguous areas of north-east Thailand and Cambodia, it seems

likely that *C. ruffus* on Laos floodplains share similar dietary characteristics with these other regions of the Lower Mekong Basin.

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### Literature cited

- ADLER, K., E. ZHAO & I. S. DAREVSKY. 1993.** First records of the Pipe Snake (*Cylindrophis*) in China. *Asiatic Herpetological Research* 4:37–41.
- CAMPDEN-MAIN, S. M. 1970.** A field guide to the snakes of South Vietnam. Smithsonian Institution, Washington, D.C. 114 pp.
- CUNDALL, D. 1995.** Feeding behaviour in *Cylindrophis* and its bearing on the evolution of alethinophidian snakes. *Journal of Zoology*, London 237:353–376.
- DAVID, P. & G. VOGEL. 1996.** The snakes of Sumatra. Edition Chimaira, Frankfurt. 260 pp.
- DEUVE, J. 1970.** Serpents du Laos. *Mémoires O.R.S.T.O.M.* 39:1–251.
- GREENE, H. 1983.** Dietary correlates of the origin and radiation of snakes. *American Zoologist* 23:431–441.
- JACKSON, K., N. J. KLEY & E. L. BRAINERD. 2004.** How snakes eat snakes: the biomechanical challenges of ophiophagy for the California kingsnake, *Lampropeltis getula californiae* (Serpentes: Colubridae). *Zoology* 107:191–200.
- KARNS, D. R., J. C. MURPHY, H. K. VORIS & J. S. SUDDETH. 2005.** Comparison of semi-aquatic snake communities associated with the Khorat Basin, Thailand. *The Natural History Journal of Chulalongkorn University* 5:73–90.
- KOTTELAT, M. 2001.** Fishes of Laos. WHT Publications (Pte) Ltd, Colombo. 198 pp.
- KUPFER, A., D. J. GOWER & W. HIMSTEDT. 2003.** Field observations on the predation of the caecilian amphibian, genus *Ichthyophis* (Fitzinger, 1826), by the red-tailed pipe snake *Cylindrophis ruffus* (Laurenti, 1768). *Amphibia-Reptilia* 24:212–215.
- SAINT GIRONS, H. 1972.** Les serpents du Cambodge. *Mémoires du Muséum National d'Histoire Naturelle. Nouvelle Serie A, Zoologie* 74:1–170.
- SMITH, M. A. 1921.** Earth snake eating a grass snake. *Natural History Bulletin of the Siam Society* 4:196–197.
- TAYLOR, E. H. 1965.** The serpents of Thailand and adjacent waters. *The University of Kansas Science Bulletin* 45:609–1096.
- TWEEDIE, M. W. F. 1954.** The snakes of Malaya. Government Printing Office, Singapore. 139 pp.
- VORIS, H. K. & J. C. MURPHY. 2002.** The prey and predators of homalopsine snakes. *Journal of Natural History* 36:1621–1632.

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