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NOTES ON THE HERPETOFAUNA OF PANAON AND SÁMAR, EAST VISAYANS, PHILIPPINES

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(with one plate)

ABSTRACT: The first herpetological collection from Panaon consists of three frog species, seven lizard species, and one snake. Four frog species, ten lizard species and four snake species are recorded from Sámar for the first time. The occurrence of some species which are not included in recent faunal records and the taxonomic status of two snake species from Sámar is discussed.

The validity of the species status of *Draco ornatus* (Gray, 1845), which is newly recorded on both islands, is confirmed.

KEY WORDS: Herpetofauna, inventory, Panaon, Sámar, Philippines.

INTRODUCTION

The Philippines archipelago can be separated into several faunistic units (Dickerson, 1928; Inger, 1954; Leviton, 1963a; Brown and Alcala, 1970, 1980). The East Visayan region (Bohol, Sámar, Leyte, and several smaller associated islands) is one such unit, which is closely related to the Mindanao region. Both areas were connected until the late Pleistocene, as the submarine topography indicates. However, herpetofaunal confirmation for this affinity is incomplete, since the herpetofaunas of Leyte, and especially Sámar are poorly known (Leviton, 1963a; Ross and Lazell, 1990). A large number of additional records can be expected especially from Sámar, which still has large areas of unexplored primary forest.

In 1990 and 1992 small numbers of preserved amphibians and reptiles reached the Forschungsinstitut Senckenberg in Frankfurt/Main, Germany. Their origin was Taft (Eastern Sámar) and Panaon, a small member of the East Visayan group that lie off the coast of southern Leyte. This material was identified, as was the older Sámar collection in the herpetological section of the same institution and a small private collection (Th. Borromeo). In addition to yielding the first herpetological records for Panaon, the examination resulted in several new distribution records for Sámar. The old collections also revealed some species which were listed by Boettger (1893, 1897, 1898), but are omitted in more recent publications on the distribution of Philippine amphibians and reptiles (e.g., Taylor, 1922a, 1922b; Leviton, 1963a; Welch, 1988; Welch, *et al.*, 1990).

In April 1992 the author spent a week with a coal-mining company working near Hinabangan (Western Sámar). Herpetological observations and collections were made in the undisturbed primary forest around the mining area (293 m above msl), and along a mountain stream (167 m above msl).

MATERIAL AND METHODS

The specimens from Sámar and Panaon were examined and determined, following Taylor (1920), Inger (1954) and Frost (1985) for frogs, Taylor (1922b) and Ross and Lazell (1990) for agamids, Brown and Alcala (1978) and Kluge (1991) for geckos, Brown and Alcala (1980) for skinks, and Taylor (1922a), Mertens (1968), Leviton (1963a, 1963b, 1965, 1970) and Wüster and Thorpe (1991) for snakes. Distribution data in the text are from these publications.

The species are listed alphabetically by family within orders under the islands, and discussed if taxonomic or biogeographic questions arise. If known, the exact locality is given.

ISLAND LISTS
PANAON ISLAND

Panaon is a small island with a land area of around 260 sq km. It is separated from Southern Leyte by the narrow Uloan Strait. Since Panaon was not collected previously, all listed species present new distribution records. Most of the species were previously known from Sámar and/or Leyte.

RANIDAE

Platymantis corrugatus (A. Duméril, 1853); SMF 74607
Platymantis guentheri (Boulenger, 1882); SMF 74608-9
Rana erythraea (Schlegel, 1837); SMF 74463

R. erythraea was not recorded from the East Visayans before, but is known from the Central Visayans. Within its range it is abundant, being typically found in rice fields. This facilitates dispersal, and it probably will also be found in agricultural areas of Sámar and Leyte.

AGAMIDAE

Bronchocela cristatella (Kuhl, 1820); SMF 74441-2

The *B. cristatella* specimens from Panaon have much higher nuchal crests than specimens from other Philippine localities that I have examined (e.g., from the Sulu Archipelago and the Calamian Island group), showing a similarity to *B. marmorata* (Gray, 1845). However, unlike in *B. marmorata*, there is a distinct interruption between nuchal and dorsal crests, and the dorsal crests are low (in SMF 74442 only a row of slightly enlarged dorsal scales).

Taylor (1922b) mentioned that some *B. cristatella* from Palawan have unusually high nuchal crests. My data suggest that this feature has evolved independently in different populations.

Draco lineatus bimaculatus Günther, 1863; SMF 74603
Draco ornatus (Gray, 1845); SMF 74604

The taxonomy of the Philippine flying lizards is confused (see also Ross and Lazell, 1990), and in need of revision. Because the identification may be incorrect, distribution records from the literature are not always reliable.

D. ornatus (Gray, 1845) was reported by Taylor (1922b) from Luzon, Negros, Dinagat, and Mindanao Islands. Hennig (1936) and Musters (1983) synonymized it with *D. spilopterus* (Wiegmann, 1834), basing on Werner's assumption (1910) that the specimens named *D. ornatus* are in fact the females of *D. spilopterus*. Inger (1983) synonymized *D. ornatus* with *D. volans* Linnaeus, 1758.

As discussed in Ross and Lazell (1990), *D. ornatus* is a valid species. Besides other characteristics (see Ross and Lazell, 1990) it is easily recognizable by the large black patch at the outer margin of the patagia, which includes several bright white spots (Plate 1). This striking colouration, which remains clearly visible in preserved specimens, occurs in males and females of *D. ornatus*, but in no other *Draco* species.

As the record of this species on the East Visayan Islands show (see below), its range is significantly wider than previously thought.

GEKKONIDAE

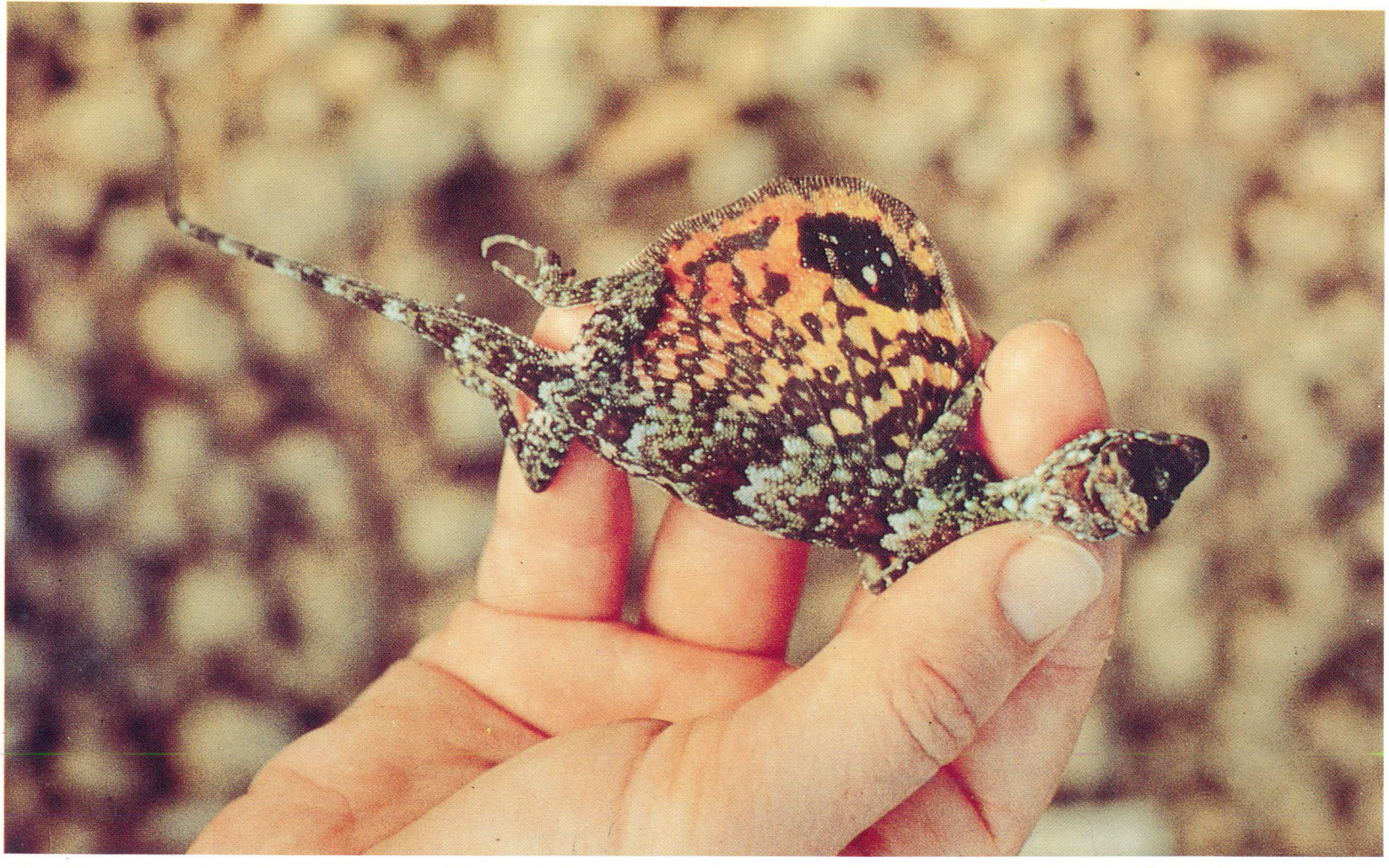
Gonydactylus agusanensis (Taylor, 1915); SMF 74440

SCINCIDAE

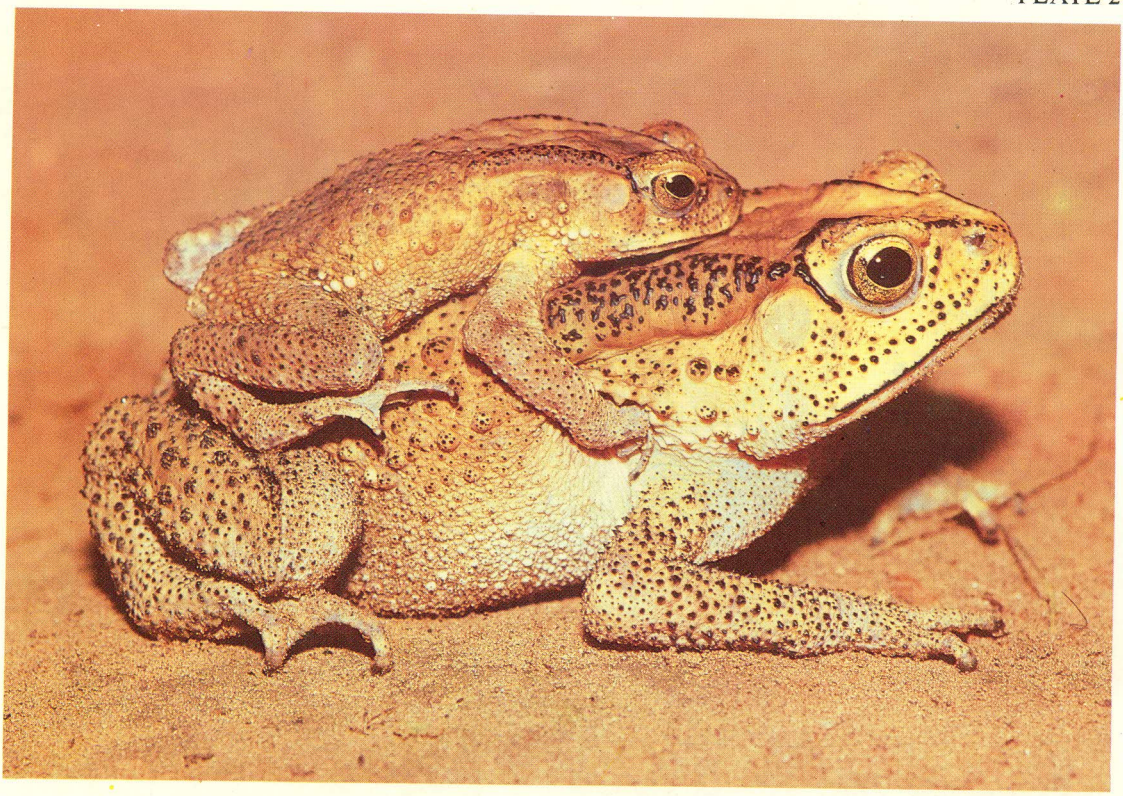
Lipinia pulchella pulchella Gray, 1845; SMF 74451-6
Mabuya multicarinata multicarinata (Gray, 1845); SMF 74457-8
Sphenomorphus jagori jagori (Peters, 1864); SMF 74444

COLUBRIDAE

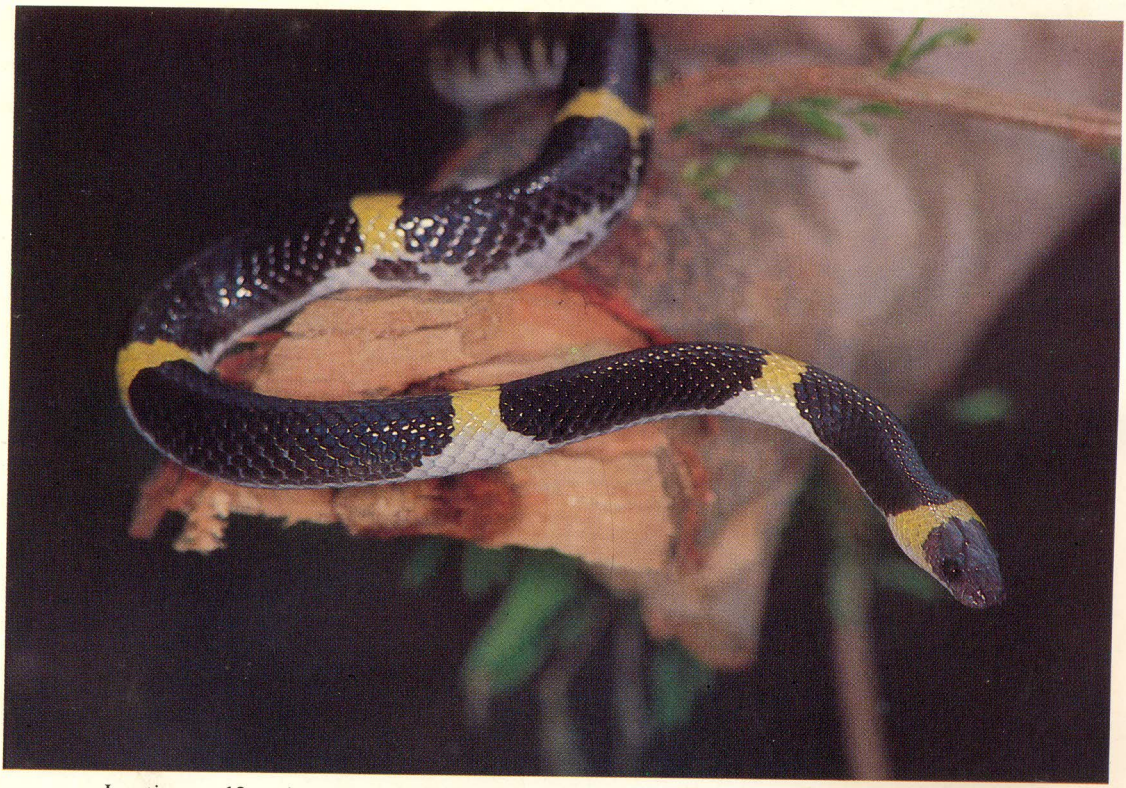
Dendrelaphis caudolineatus terrificus (Peters, 1872); SMF 74606



Female of *Draco ornatus* from Hinabangan, western Sámar. The black patch on the outer edge of the patagium, which includes several white spots, is striking. Photo: Maren Gaulke.



Common Asian toad (*Bufo melanostictus*), Kopen Heat, Great Nicobar, India. Photo: Indraneil Das



Laotian wolf snake (*Lycodon laoensis*), south-east Thailand. Photo: Jennifer Daltry

This specimen shows the typical colour pattern of this subspecies, with black stripes bordering the outer dorsal scale rows, a broad black stripe beginning behind the eyes and continuing some distance on the sides of the neck, and a black zigzag line between the subcaudals.

SÁMAR ISLAND

Sámar is the third largest of the Philippine islands, with a land area of about 13,300 sq km. It lies north-east of Leyte, between Luzon in the north and Mindanao in the south. The highest elevation (Mt. Capotoan) rises only 850 m above msl.

BUFONIDAE

Pelophryne lighti (Taylor, 1920); one species (priv. col.): Taft

This is the first record of a bufonid from Sámar. *P. lighti* is known from Mindanao, Bohol, Leyte (Denzer, *et al.*, in prep.), and Sámar. This small bufonid (less than 20 mm SVL) is easily distinguished from sympatric (e.g., on Mindanao) *P. brevipes* (Peters, 1867) by the ventral colour pattern. While *P. brevipes* has large black spots on a light ground, *P. lighti* has well defined white spots on a brown belly and on the lower sides of the body.

MICROHYLIDAE

Kalophrynus pleurostigma pleurostigma Tschudi, 1838; SMF 4100 SMF 4100 is the type (and only known specimen) of *Calophrynus acutirostris* Boettger, 1897, but was later synonymized with *K. p. pleurostigma.*

PELOBATIDAE

Megophrys montana stejnegeri (Taylor, 1920); SMF 75205: Hinabangan, 75206-7: Taft

RANIDAE

Occidozyga laevis laevis (Günther, 1859); SMF 75202-4: Hinabangan

Platymantis corrugatus (A. Duméril, 1853); SMF 75208, 75211: Taft, SMF 75209: Hinabangan

New record for Sámar. Its occurrence here was expected, since it is also found on the neighbouring islands.

Rana visayana Inger, 1954; SMF 75217-9: Hinabangan

Rana cancrivora cancrivora Gravenhorst, 1829, SMF 74414: Gandara (Western Sámar)

Rana leytensis Boettger, 1893; SMF 75212-6: Hinabangan

Rana signata grandocula Taylor, 1920; SMF 75196-201: Hinabangan

R. s. grandocula, also known from Basilan, Bohol, and Mindanao was first recorded from Samar by Leviton (1955). From Leyte, another subspecies, *R. s. similis* (Günther, 1873), was reported by Inger (1954), which is otherwise known from Luzon and Polillo. Both subspecies are distinguished by size (*R. s. grandocula* is the larger form, *R. s. similis* a small to medium-sized form) and colour pattern (*R. s. grandocula* has only very faint and narrow dorso-lateral stripes and an irregular marbled pattern on its back; *R. s. similis* has well developed light dorso-lateral stripes and an unpatterned back). Leviton (1963a) doubted that *R. s. similis* is indigenous to Leyte. He suspected that the six specimens examined by Inger (1954) were either mislabeled, or accidentally introduced, since it is extremely unlikely that different subspecies occur on both otherwise closely-located islands. *Rana woodworthi* Taylor, 1923; SMF 75220-1: Hinabangan

New record for Sámar. *R. woodworthi* was previously only known from Luzon, Polillo, and Catanduanes, where it is quite common along mountain streams at low elevations. The Sámar specimens were collected at the same type of habitat. *Staurois natator* (Günther, 1858); SMF 75188-94: Hinabangan, SMF 75195: Taft

RHACOPHORIDAE

Philautus leitensis (Peters, 1867); SMF 75210: Taft

New record for Sámar. It was discussed by Brown and Alcala (1963) that *P. acutirostris*, known from Basilan and Mindanao and *P. leitensis* (Boulenger, 1897), known from Leyte

and Biliran, might be conspecific. However, recent investigations prove the validity of both species (Brown and Alcala, in press).

Polypedates leucomystax (Boie, 1829); SMF 6900

AGAMIDAE

Draco mindanensis Stejneger, 1908; 1 species (priv. col.): Taft

New record for Sámar. This species was previously only known from Mindanao and Dinagat islands. It is easily recognizable by the position of the nostrils, which are positioned on top of the snout, directed upward. In all other Philippine flying lizards, the nostrils are positioned laterally, being directed outward.

Draco lineatus bimaculatus Günther, 1863; SMF 75170-2: Hinabangan
Draco ornatus (Gray, 1845); SMF 75015, 75017, 75233: Hinabangan, 75016, 75232: Taft

New record for Sámar. For discussion see Panaon.

Draco sp.; 1 species (priv. col.): Taft

This specimen most probably belongs to an undescribed species. It appears to be related to *D. spilopterus* (Wiegmann, 1834), but differs in features like the colouration of the patagia and scale counts. However, the description of a new species in this taxonomically complicated agamid group cannot be based on a single specimen.

Gonocephalus sp.; 1 species (priv. col.): Taft

New record for Sámar, from which no *Gonocephalus* was recorded previously. Three species of *Gonocephalus* are reported from the Philippines. These are: *G. interruptus* Boulenger, 1885, *G. semperi* (Peters, 1867), and *G. sophiae* (Gray, 1845). They are distinguished by the development of the nuchal and dorsal crest, and the position of enlarged dorsal scales. The specimen from Sámar is juvenile, characteristic features like nuchal and dorsal crest are not yet developed.

Hydrosaurus pustulatus (Eschscholtz, 1829)

New record for Sámar. The specimen sighted at Hinabangan was not collected. However, it cannot be mistaken for any other lizard occurring in the Philippines.

GEKKONIDAE

Cosymbotus platyurus (Schneider, 1792); SMF 75075: Hinabangan

New record for Sámar. Its occurrence here was expected, since it is found on most islands in the Philippines.

Gehyra mutilata Wiegmann, 1834; 1 species (priv. col.): Taft
Gonydactylus annulatus (Taylor, 1915); 1 species (priv. col.): Taft

New record for Sámar. This species has a wide distribution within the Philippines. It was recorded from Leyte previously, therefore the occurrence on Sámar could be expected.

Gonydactylus philippinicus (Steindachner, 1869); SMF 8234

The locality record "Sámar" is given with question mark, indicating that some confusion might have occurred during cataloguing. *G. philippinicus* is reported from Polillo, Luzon, Mindoro, Masbate, Tablas, Borocay and Negros. This wide distribution makes it's occurrence on Sámar not unlikely.

Pseudogekko brevipes (Boettger, 1897); SMF 8988 (Type)

In Welch *et. al.* (1990), the distribution of this species is erroneously given as Luzon. Its currently known range includes Negros, Bohol and Cebu. The type locality is Sámar; however, this record is questionable. Boettger wrote that the type, sent by O. v. Moellendorff, was probably from Sámar. To my knowledge, no other specimen has been found on Sámar since then.

SCINCIDAE

Brachymeles gracilis hilong Brown & Rabor, 1967; SMF 75071-2: Hinabangan

Lipinia pulchella pulchella Gray, 1845; SMF 14592: Samar, 75087: Taft
Mabuya indeprensa Brown & Alcala, 1980; SMF 75073-4: Hinabangan
Sphenomorphus llanosi Taylor, 1919; SMF 75076-81: Hinabangan

This medium sized sphenomorphid skink (Measurements of the new material, n = 6: SVL 6.1 - 9.0 cm, TL 4.3 - 7.3 cm, weight 2.3 - 13.2 g) is only known from Leyte and Sámar Islands. It can easily be distinguished from similar species (like *S. jagori*) by a conspicious light line which extends from the ear region along the upper labials almost to the nostrils.

In April 1992, a large population of this species was observed in a forest stream near Hinabangan. These diurnal skinks move as fast in and underwater as on rocky outcrops along the stream. A few times, these skinks were observed catching small gastropods underwater, which were carried on land for eating. They only swallowed the soft bodies, quickly pulling it out from the shell. Often, they were seen chasing each other, but no actual combat was observed. Losers usually fled into the water, diving, as they did when disturbed by humans.

Sphenomorphus jagori jagori (Peters, 1862); SMF 75084-6: Taft
Sphenomorphus steerei Stejneger, 1908; SMF 75082: Hinabangan

New record for Sámar. Its occurrence here was expected, since it is also found on the neighbouring islands.

Sphenomorphus variegatus (Peters, 1867); SMF 75083: Taft

New record for Sámar. Its occurrence here was expected, since it is also found on the neighbouring islands.

VARANIDAE

Varanus salvator cumingi (Martin, 1838)

This subspecies on Sámar is not as colourful as *V. s. cumingi* from Mindanao. For description, see Gaulke (1991). Two specimens from Gandara are being maintained alive at the time of writing.

COLUBRIDAE

Ahaetulla prasina preocularis (Taylor, 1922); SMF 20534
Boiga angulata (Peters, 1861); SMF 19702: Calbayog (Western Sámar), 75070: Hinabangan

New record for Sámar, even so SMF 19702 is in the collection since 1897. This species has a wide distribution in the country, being recorded from Catanduanes, Leyte, Luzon, Mindanao, Negros and Polillo. It is closely related to *B. d. drapiezii* (Boie, 1827), from which it is distinguished by slight differences in the head scalation and colour pattern of the belly. However, the justification of its species status is under debate (Leviton, 1970).

SMF 75070 was found during the day, sleeping outstretched on a low tree branch at the riverside of a forest stream near Hinabangan.

Boiga dendrophila latifasciata (Boulenger, 1896); SMF 19699
Chrysopelea paradisi variabilis Mertens, 1968; SMF 20281 (Type), 75069: Taft
Cyclocorus nuchalis taylori Leviton, 1965; SMF 17903
Dendrelaphis pictus pictus (Gmelin, 1788); SMF 18636-41
Dryophiops philippina Boulenger, 1896; SMF 20216

This specimen was sent to the Senckenberg Museum in 1897 by O. v. Moellendorff, but the record was never published. Thus, Sámar can be added to its known range which includes Luzon, Mindanao, Mindoro, Negros and Sibuyan.

Elaphe erythrura erythrura (Duméril, Bibron & Duméril, 1854); SMF 18520
Liopeltis philippinus (Boettger, 1897); SMF 19319

This snake, sent to the Senckenberg Museum in 1897, was listed by Boettger (1897, 1898). Taylor (1922a) retained this locality record, although Leviton (1963b) doubted it. This snake is otherwise known only from the Palawan Province, and SMF 19319 is the only record for Sámar, although it may be found on some of the islands

between Palawan and Sámar, when these are surveyed intensively.

Lycodon aulicus capucinus Boie, 1826; 1 species (priv. col.): Taft
Lycodon dumerili (Boulenger, 1893); SMF 18065

This snake was sent to the Senckenberg Museum by O. v. Moellendorff in 1897, and catalogued by Boettger (1898) as *Stegonotus muelleri* Duméril, Bibron and Duméril, 1854, a snake known from Sámar, Leyte, and Mindanao. Reexamination of this specimen raises some questions, which have been discussed here.

A short description of SMF 18065: SVL 64 cm, TL 15 cm (tail tip is missing); 231 ventrals, 78 double series of subcaudals (incomplete); 17 middorsal scale rows; eight supralabials, with numbers IV and V entering orbit; 10 and nine infralabials; two preoculars; two postoculars; one loreal; divided nasals; 2 + 3 + 4 temporals.

Colour in alcohol: Dorsally reddish-brown, with 19 cream bands across the back and nine across the tail. The light bands cover two scales in the middle of the back, and widen to four scales on the sides. The light scales include irregular reddish-brown speckles. Head with a small light parietal spot and a cream coloured band running from the parietal region to the posterior borders of the chin. Underside of the head is light. A cream collar is present. Outer sides of the ventrals reddish-brown, the vertebral cream. Ventrals light-brown posteriorly.

Based on the pholidosis of this specimen, Boettger's (1898) determination is right. The ventral count lies in the range of *S. muelleri* (220-232 ventrals, 81-100 subcaudals; Boulenger, 1893). However, regarding its striking colour pattern, SMF 18065 matches the description of *L. dumerili*, for which a ventral count of 195-221, and a subcaudal count of 111-123 is given (Leviton, 1965). The colour of *S. muelleri* is dark above, with lighter dorsolateral stripes, or with large, broad, dark flecks and a dirty yellowish underside.

Leviton (1965) discussed the Philippine snakes of the genus *Lycodon*. The only distinguishing feature between *Stegonotus* and *Lycodon* he mentioned are minor differences in dentition. *Stegonotus* has a single diastema, whereas *Lycodon* has two diastemata and a stronger arched maxillary bone. Unfortunately, this feature is not discernible in SMF 18065, the head being slightly damaged. Nevertheless, regarding the significant differences in colour pattern via the small differences in scale counts, I determine SMF 18065 as *Lycodon dumerili*. This determination is confirmed by comparison with typical *S. muelleri*, which has a more robust habtus compared to SMF 18065, and other species of *Lycodon*.

L. dumerili is a new record for Sámar.

Macropophis dendrophiops dendrophiops (Günther, 1883); 1 species (priv. col.): Taft

New record for Sámar. This subspecies was only known from Basilan and Mindanao.

Oligodon ancorus (Girard, 1857); SMF 19219
Oxyrhabdium modestum (Duméril, Bibron & Duméril, 1854); SMF 17857-62, 69014, 75064: Hinabangan
Psammodynastes pulverulentus (Boie, 1827); SMF 20132, 75065-8: Hinabangan
Rhabdophis auriculata auriculata (Günther, 1858); SMF 75062-3: Hinabangan, 75223: Taft
Rhabdophis lineata (Peters, 1861); SMF 75061: Hinabangan

The juvenile snake, caught on a rocky outcrop of a forest stream near Hinabangan, shows following features: SVL 25.8 cm, TL 4.9 cm (tail- tip missing); 133 ventrals; 38 double series of subcaudals; a single anal scale; 19 middorsal scale rows, reducing to 17 around neck and before vent; eight and nine supralabials, with IV and V on the right and IV, V and VI on the left entering the orbit; eight infralabials; three preoculars right and four preoculars left; three postoculars; one loreal; a big vertically divided nasal scale; 1 + 2 temporals on both sides; large eyes with round pupil, dorsal scales keeled.

Colour in life: Dorsally reddish-brown, with a row of dorso-laterally arranged orangish-yellow spots. Between these and across the back are dark speckles. A dark bordered white collar. A whitish stripe runs from the rostral across the upper part

of the supralabials, continuing backwards and downwards to the sixth ventral. The ventral surface is light pink, and a dark zigzag line is present between the subcaudals.

This snake is similar to the juvenile of *R. lineata*, as described in Taylor (1922a). However, in contrast to *R. lineata*, which has one or two preoculars, this specimen has three well- differentiated preocular scales right, and four on the left. Since this might be an individual variation, it is referred to *R. lineata*. However, new material, especially of adult specimens, might prove it to be a new form.

ELAPIDAE

Naja samarensis Peters, 1861; SMF 9385

TYPHLOPIDAE

Typhlops ruber Boettger, 1897; SMF 16616 (Type)

DISCUSSION

Most of the species found on Panaon are rather widespread throughout the Philippines. The only ones showing evidence for the Mindanao - East Visayan connection are *Dendrelaphis c. terrificus* and *Gonydactylus agusanensis*.

About 18 amphibian and reptile species are added to the list from Sámar (the records of *Gonydactylus philippinicus*, *Pseudogekko brevipes* and *Liopeltis philippinus* are doubtful, see under Island list). Remarkable is the increase in agamids. Previously only one species, *Draco lineatus bimaculatus*, was known from Sámar: now six agamid species are recorded.

Of the four newly-recorded frog species, one, *Philautus leitensis*, according to existing knowledge, is confined to the East Visayan region, *Pelophryne lighti* is endemic to the Mindanao and East Visayan region, while *Rana woodworthi* provides evidence for a previous connection between Sámar and the Luzon Dist. (see also Dickerson, 1928; Leviton, 1963a). Of the new lizard records, *Draco mindanensis* and *Sphenomorphus variegatus* are obviously endemic to the Mindanao and East Visayan region, while the others have a rather wide distribution in the Philippines. Even though all the newly-recorded, or for Sámar resurrected, snakes are endemic to the Philippines, only *Macropophis d. dendrophiops* is confined to the Mindanao and East Visayan region. The presently-known scattered distribution of the others may be due to the minimal collecting activities on many islands.

The herpetofaunal list for Sámar (the third largest of the Philippine Islands), previously with 54 species, now with 72 species, is still small compared to other Philippine islands. For example, from Leyte, with a much smaller land area (7,200 sq km against 13,300 sq km for Sámar), 20 skink species are reported, but only 14 are known from Sámar. Even on a comparatively small island like Dinagat (800 sq km), 58 species of amphibians and reptiles have been collected (Ross and Lazell, 1990). One reason for the relatively small numbers of amphibian and reptile species known from here might be the absence of high mountains. However, the number of species which are confined in their distribution to high altitudes is relatively small, and it can be assumed that future, more intensive collections will add considerably to Sámar's herpetofauna.

The amphibians and reptiles from Sámar (compiled from previous and new records) are added as Appendix I.

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Appendix I: Checklist of the herpetofauna of Sámar, compiled from previous and new records (marked with asterisk). Doubtful records are indicated with an interrogation mark.

BUFONIDAE
*Pelophryne lighti**

MICROHYLIDAE
Kalophrynus p. pleurostigma

PELOBATIDAE
Megophrys montana stejnegeri

RANIDAE
Occidozyga l. laevis
*Platymantis corrugatus**
Platymantis dorsalis
Rana visayana
Rana c. cancrivora
Rana leytensis
Rana signata grandocula
*Rana woodworthi**
Staurois natator

RHACOPHORIDAE
*Philautus leitensis**
Polypedates leucomystax
Rhacophorus hecticus

AGAMIDAE
Draco lineatus bimaculatus
*Draco mindanensis**
*Draco ornatus**
Draco sp.*
Gonocephalus sp.*
*Hydrosaurus pustulatus**

GEKKONIDAE
*Cosymbotus platyurus**
*Gonydactylus annulatus**
*Gonydactylus philippinicus** (?)
Gehyra mutilata
Hemiphyllodactylus t.typus
Lepidodactylus aureolineatus
Lepidodactylus planicaudus
Pseudogekko brevipes (?)

SCINCIDAE
Brachymeles gracilis hilong
Brachymeles samarensis
Emoia atrocostata
Lamprolepis smaragdina philippinica
Lipinia p. pulchella
Mabuya indeprensa
Mabuya m. multicarinata
Sphenomorphus acutus
Sphenomorphus c. coxi
Sphenomorphus fasciatus
Sphenomorphus j. jagori
Sphenomorphus llanosi
*Sphenomorphus steerei**
*Sphenomorphus variegatus**

VARANIDAE
Varanus salvator cumingi

TYPHLOPIDAE
Typhlops marxi

BOIDAE
Python reticulata

COLUBRIDAE
Ahaetulla prasina preocularis
*Boiga angulata**
Boiga dendrophila latifasciata
Calamaria vermiformis grayi
Chrysopelea paradisi variabilis
Cyclocorus lineatus nuchalis
Dendrelaphis caudolineatus terrificus
Dendrelaphis p. pictus
*Dryophiops philippina**
Elaphe e. erythrura
Liopeltis philippinus (?)
Lycodon aulicus capucinus
*Lycodon dumerili**
*Macropophis d. dendrophiops**
Oligodon ancorus
Oxyrhabdium modestum
Psammodynastes pulverulentus
Rhabdophis a. auriculata
Rhabdophis lineata

Stegonotus muelleri

VIPERIDAE
Tropidolaemus wagleri

ELAPIDAE
Maticora intestinalis philippina
Naja samarensis

TYPHLOPIDAE
Typhlops olivacea
Typhlops ruber

EMYDIDAE
Cuora a. amboinensis

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A REVISED CHECKLIST AND KEY TO THE AMPHIBIANS OF PAKISTAN

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ABSTRACT: A checklist and dichotomous identification key to the amphibian fauna of Pakistan is presented. At present, the fauna is composed of 17 species in three families: the Bufonidae (seven species), Microhylidae (one species) and Ranidae (nine species).

KEY WORDS: Amphibian, checklist, identification key, Pakistan.

INTRODUCTION

Since the publication of the checklist of amphibians of Pakistan by Khan (1976), reports from different parts of Pakistan (Khan, 1979; 1980; 1982a; 1982b; 1985; 1986; 1987; Khan and Ahmed, 1987; Khan and Baig, 1988; Khan and Tasnim, 1987; 1989; Dubois and Khan, 1979) have added several new species, new records and have brought to light hitherto unknown aspects of the life history of the local amphibians. Thus, a checklist and identification key to the Pakistan, incorporating these new data are desirable.

Hot temperate conditions in the plains of Punjab, Sindh and the dry environs of the Balochistan tableland presumably have had negative effects on the distribution of amphibians (Khan, 1987; in press). However, the recent upsurge in reclamation of arid and barren areas has apparently helped the dispersal of once little-known species (Khan and Tasnim, 1987). Areas of northern Pakistan, at the Himalayan foot-hills appear optimal for amphibians (Khan, 1979), supporting large populations.

Amphibians are represented by three families in Pakistan: Bufonidae by eight species, Microhylidae by one species and Ranidae by eight species. The long-known record of a salamander from the stomach of a *Xenochrophis piscator* from Chitral by Wall (1911) is yet to be verified.

All newly-described amphibian species were found close to the Indian border, in the Himalayan foothills. The present checklist and key will hopefully lead to increased interest in Indian colleagues working in adjoining area, and their collaboration will help delimit the ranges of these species.

CHECKLIST

FAMILY BUFONIDAE

Bufo himalayanus Günther, 1894 (Himalayan toad)

Type locality: "in the Himalayas (in Sikkim and Nepal)".

Distribution: Himalayas of India, Nepal and Pakistan, between 2,000-3,500 m. In Pakistan, it has been recorded from Azad Kashmir and Hazara Division, NWFP.

Bufo latastii Boulenger, 1882 (Ladakh toad)

Type locality: "Ladak" (= Ladakh), India and Pakistan.

Distribution: Recorded from Ladakh (Baltistan) at an elevation of 3,000 m.

Bufo melanostictus Schneider, 1799 (South-east Asian toad)

Type locality: "Ex-India orientalis".

Distribution: Until recently, *Bufo melanostictus* was regarded the common toad of Pakistan. Khan (1972) has shown it to be confined to Hazara District, alpine Punjab and Azad Kashmir. It is common and widely distributed in India, Bangladesh, Nepal, Sri Lanka, extending into south-east Asia.

Bufo olivaceus Blanford, 1874 (Olive toad)

Type locality: "in Gedrosia", Iran.

Distribution: Extreme western Balochistan and adjoining Iran.

Bufo stomaticus Lütken, 1862 (Common Pakistani toad)

Type locality: "Assam", India.

Distribution: Widely distributed in Bangladesh, India, Nepal, Sri Lanka, Pakistan, westwards to Afghanistan, Iran and Muscat.

Bufo surdus Boulenger, 1891 (Iranian toad)

Type locality: "Baluchistan", Pakistan.

Distribution: A little-known species from the Balochistan-Iran border.

Bufo viridis Laurenti, 1768

Pakistani populations of this Palearctic toad represent two subspecies.

Bufo viridis arabicus Heyden, 1827 (Arabian green toad)

Type locality: Arabian peninsula, Sinai.

Distribution: The Arabian peninsula, east to Pakistan, where it has been reported from western Balochistan and Waziristan, between 1,500-2,000 m.

Bufo viridis pseudoraddei Mertens, 1971 (Swati toad)

Type locality: Mingora, Swat, Pakistan.

Distribution: Known only from type locality.

FAMILY MICROHYLIDAE

Microhyla ornata (Duméril & Bibron, 1841) (Ornate narrow-headed frog)

Type locality: "Malabar", India.

Distribution: Pakistan, India, Bangladesh, Nepal, east to Myanmar, Thailand, southern China, Indo-China and Indo-Malaya. Widely distributed in N.W.F.P., Azad Kashmir and Punjab, in Pakistan (Khan, 1974; 1976).

FAMILY RANIDAE

Rana vicina Stoliczka, 1872 (Tibetan frog)

Type locality: From fountain water near Murree, alpine Punjab, Pakistan.

Distribution: One example, assigned to *Rana pleskei* was taken by Mertens (1969) from the border between Pakistan and Azad Kashmir. Dubois (1976) identified the material as *Rana vicina.*

Rana barmoachensis Khan & Tasnim, 1989 (Kashmir torrent frog)

Type locality: "Barmoach, Goi Madan, Azad Kashmir".

Distribution: Known only from type locality.

Rana cyanophlyctis Schneider, 1799 (Skipping frog)

Type locality: "India orientalis".

Distribution: Widely distributed in Asia, from the Arabian peninsula, east through Iran, India, Bangladesh, Nepal and Sri Lanka to Thailand. It occurs throughout Pakistan, below 1,800 m.

Rana hazarensis Dubois & Khan, 1979 (Hazara torrent frog)

Type locality: "near Datta, northern Pakistan (Manshera District, Hazara Division, 34° 15' N 73° 15' E, elevation about 1,200 m."

Distribution: Widely distributed in Hazara District, N.W.F.P.

Rana limnocharis Boie, 1835 (Cricket frog)

Type locality: "Java", Indonesia.

Distribution: Widely distributed in sub-Himalayan Pakistan, descending into the waters of the Potwar tableland. It has also been collected from the northern plains of Punjab. The species extends east through India, Nepal, Bangladesh, to Indo-Malaya.

Rana sternosignata Murray, 1885 (Karez frog)

Type locality: "Mulleer [Malir] near Kurrachee [= Karachi]; Zandra and Quetta, South Afghanistan" (all localities in Balochistan, Pakistan).

Distribution: Abounds around Quetta and Mastug in *karez* (underground channels in Balochistan and Iran, that are sometimes dug up to provide water for drinking and irrigation). Also reported from Afghanistan, at 1,800-2,000 m.

Rana syhadrensis Annandale, 1919 (Southern cricket frog)

Type locality: "Medha and Khandala", Bombay, India.

Distribution: This species is sympatric with *Rana limnocharis* in riparian Punjab, Pakistan. It is widely distributed throughout southern Pakistan and adjoining India.

Rana tigerina Daudin, 1803 (Asian bull frog)

Type locality: Bengal, India/Bangladesh.

Distribution: One of the familiar frog of the Indo-Gangetic plains, including Bangladesh, India, Bhutan and Nepal. Widely distributed in Pakistan, except Balochistan. However, it has been reported from Afghanistan, along the Khaiber Pass.

Tomopterna breviceps (Schneider, 1799) (Burrowing frog)

Type locality: "Indies orientales".

Distribution: Throughout India, Bangladesh, Nepal, Sri Lanka, east to Myanmar. In Pakistan, the species has been reported from the Himalayan foothills, and extends along the Potwar tableland. In Punjab, it has a patchy distribution along riparian environments (Khan, 1985).

IDENTIFICATION KEY

1. Parotid gland present 2
1'. Parotid gland absent 8

2. Head with cranial crests 3
2'. Head without cranial crests 4

3. Only supraorbital crest present; tympanum indistinct . . . . . *Bufo himalayanus*
3'. Canthal, supraorbital, postorbital and orbitotympanic crests present; tympanum distinct . . . . . *Bufo melanostictus*

4. Tympanum distinct 5
4'. Tympanum indistinct . . . . . *Bufo surdus*

5. Tibial gland present 6
5'. Tibial gland absent 7

6. Length of parotid gland equals its width . . . . . *Bufo viridis*
(Dorsum of body with distinct green spots . . . . . *B. v. arabicus*
Dorsum of body uniformly dark green, usually with a distinct thin light vertebral line . . . . . *B. v. pseudoraddei*)
6'. Parotid gland longer than wide . . . . . *Bufo olivaceus*

7. Tarsal fold indicated by a weak spinulated line . . . . . *Bufo stomaticus*
7'. A distinct tarsal fold present . . . . . *Bufo latastii*

8. Pupil round; adults not exceeding 27 mm in snout-vent length . . . . . *Microhyla ornata*
8'. Pupil horizontal; adult size exceeds 27 mm 9

9. Toes half webbed . . . . *Rana limnocharis*
9'. Toes more than half webbed 10

10. Tympanum indistinct . . . . *Rana vicina*
10'. Tympanum distinct 11

11. Toes half webbed 12
11'. Toes extensively webbed 13

12. Habitus toad-like; inner metatarsal tubercle shovel-shaped . . . . . *Tomopterna breviceps*
12'. Habitus frog-like; inner metatarsal tubercle elongate . . . . . *Rana syhadrensis*

13. Dorsum of body pustulate 14
13'. Dorsum of body with broken longitudinal folds . . . . . *Rana tigerina*

14. Dorsal pustules tipped with spines; male with nuptial spines on inner finger 15
14'. Dorsal pustules spineless; no nuptial spines . . . . . *Rana cyanophlyctis*

15. Pustules large; multispinulate; belly spiny . . . . . *Rana sternosignata*
15'. Pustules small, unispinulate 16

16. Spinules on longitudinal ridges . . . . . *Rana hazarensis*
16'. Spinules on pustules . . . . . *Rana barmoachensis*

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THE REPTILES OF SOUTH ASIA: CHECKLIST AND DISTRIBUTIONAL SUMMARY

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(with one text-figure)

ABSTRACT: A checklist of species and subspecies of reptiles recorded from south Asia is presented. In all, 632 species have been recorded, in 185 genera and 25 families. Endemicity is high, 305 species being restricted to a single physiographic zone and an additional 98 species to more than one zone within the region but not extralimitally. The total endemicity of 403 (63.7%) is high for a chiefly continental landmass.

KEY WORDS: Reptiles, checklist, distribution, endemicity, south Asia.

INTRODUCTION

South Asia (composed of Bangladesh, Bhutan, India, Maldives, Nepal, Pakistan and Sri Lanka), also referred to as the Indo-Pakistan subcontinent, the Indian subcontinent and the Indian region, is home to one of tropical Asia's areas of greatest herpetological diversities. The half-century-old monographs of Smith (1931; 1935; 1943) continue to be the authoritative sources for identification of the region's reptiles. Many species have been described since. The present list has been largely compiled from the literature, from material personally examined in various museums in America, Asia and Europe, as well as printouts of the holdings of several North American collections, where important material, such as range extensions, have been recently examined by colleagues. The cut-off date for literature search and museum work was the end of August, 1994.

The following works have been followed for nomenclatural use: Crocodilians and turtles: King and Burke (1989) and Das (1991). Lizards: Kluge (1991) for gekkonids, Moody (1980) for agamids, Arnold (1989) for lacertids. Snakes: Gans (1966) for uropeltids, Kluge (1993) for erycines, Gyi (1970), Lazell *et. al.* (1991), Savage (1952), Malnate (1960), Malnate and Underwood (1988), among others, for colubrids; and Kharin (1984) for hydrophiids.

A synopsis of the reptiles of the south Asian region, comprising valid names, synonymy, information on primary types, distribution and references is in preparation and a biogeographic summary of the fauna can be found in Das (in press). Physiographic units (see Fig. 1) include: AN (Andaman Islands), DC (Deccan), EG (Eastern Ghats), HM (Himalayas), NI (Nicobar Islands), NE (Northeast), NW (Northwest), TH (Trans-Himalayas), WG (Western Ghats) and SL (Sri Lanka). Estuarine and marine species have not been linked to any physiographic units. Species marked with a single asterisk are believed to be locally extinct; those with double asterisk are taxa from politically disputed regions. For the two species marked with a triple asterisk (*Cnemaspis boiei* and *Typhlops loveridgei*), the type locality in the original description is not precise, and have been considered restricted to a single physiographic unit.

CHECKLIST OF REPTILES

CROCODYLIA

CROCODYLIDAE

1. *Crocodylus palustris* Lesson, 1831:
Distribution: Bangladesh*, India, Nepal, Pakistan, Sri Lanka. (DC, EG, HM, NE, NW, SL, WG).
2. *Crocodylus porosus* Schneider, 1801:
Distribution: Bangladesh, India, Sri Lanka. (estuarine).

GAVIALIIDAE

3. *Gavialis gangeticus* (Gmelin, 1789):
Distribution: Bangladesh, Bhutan*, India, Nepal, Pakistan. (EG, HM, NE, NW).

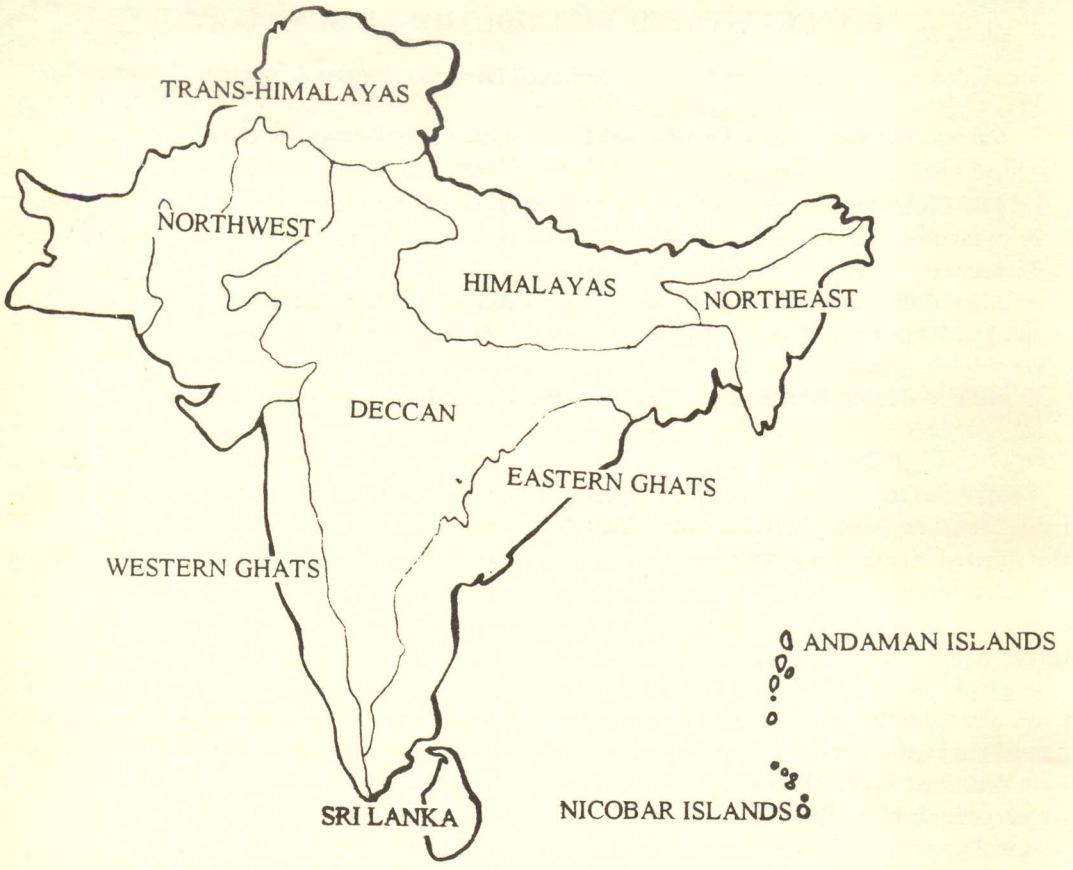

FIGURE 1: Physiographic units in south Asia.

TESTUDINES

DERMOCHELYIDAE

4. *Dermochelys coriacea* (Vandelli, 1761):
Distribution: Bangladesh, India, Pakistan, Sri Lanka. (marine).

CHELONIIDAE

5. *Caretta caretta* (Linnaeus, 1758):
Distribution: Bangladesh, India, Maldives, Pakistan, Sri Lanka. (marine).
6. *Chelonia mydas* (Linnaeus, 1758):
Distribution: Bangladesh, India, Maldives, Pakistan, Sri Lanka. (marine).
7. *Eretmochelys imbricata* (Linnaeus, 1766):
Distribution: Bangladesh, India, Maldives, Sri Lanka. (marine).
8. *Lepidochelys olivacea* (Eschscholtz, 1829):
Distribution: Bangladesh, India, Maldives, Pakistan, Sri Lanka. (marine).

BATAGURIDAE

9. *Batagur baska* (Gray, 1831):
Batagur baska baska (Gray, 1831):
Distribution: Bangladesh, India. (estuarine).
10. *Cuora amboinensis* (Daudin, 1801)
Cuora amboinensis kamaroma Rummler & Fritz, 1991:
Distribution: Bangladesh, India. (NE, NI)
11. *Cyclemys dentata* (Gray, 1831):
Distribution: Bangladesh, India. (HM, NE)

12. *Geoclemys hamiltonii* (Gray, 1831):

Distribution: Bangladesh, India, Pakistan. (HM, NE, NW). Endemic to south Asia.

13. *Geoemyda silvatica* Henderson, 1912:

Distribution: India. (WG). Endemic to south Asia.

14. *Hardella thurjii* (Gray, 1831)

Hardella thurjii thurjii (Gray, 1831):

Distribution: Bangladesh, India, Nepal. (HM, NE). Endemic to south Asia.

Hardella thurjii indi (Gray, 1870):

Distribution: Pakistan. (NW). Endemic to south Asia.

15. *Kachuga dhongoka* (Gray, 1834):

Distribution: Bangladesh, India, Nepal. (HM, NE). Endemic to south Asia.

16. *Kachuga kachuga* (Gray, 1831):

Distribution: Bangladesh, India, Nepal. (HM). Endemic to south Asia.

17. *Kachuga smithii* (Gray, 1863)

Kachuga smithii smithii (Gray, 1863):

Distribution: Bangladesh, India, Pakistan. (HM, NE, NW). Endemic to south Asia.

Kachuga smithii pallidipes Moll, 1987:

Distribution: India, Nepal. (HM). Endemic to south Asia.

18. *Kachuga sylhetensis* (Jerdon, 1870):

Distribution: Bangladesh, India. (NE). Endemic to south Asia.

19. *Kachuga tecta* (Gray, 1831):

Distribution: Bangladesh, India, Nepal, Pakistan. (HM, NE, NW). Endemic to south Asia.

20. *Kachuga tentoria* (Gray, 1834)

Kachuga tentoria tentoria (Gray, 1834):

Distribution: India. (EG). Endemic to south Asia.

Kachuga tentoria circumdata (Mertens, 1969):

Distribution: India. (HM). Endemic to south Asia.

Kachuga tentoria flaviventer (Günther, 1864):

Distribution: Bangladesh, India. (HM). Endemic to south Asia.

21. *Melanochelys tricarinata* (Blyth, 1856):

Distribution: Bangladesh, India, Nepal. (HM, NE). Endemic to south Asia.

22. *Melanochelys trijuga* (Schweigger, 1812)

Melanochelys trijuga trijuga (Schweigger, 1812):

Distribution: India. (DC, EG, WG). Endemic to south Asia.

Melanochelys trijuga coronata (Anderson, 1879):

Distribution: India. (WG). Endemic to south Asia.

Melanochelys trijuga indopeninsularis (Annandale, 1913):

Distribution: Bangladesh, India, Nepal. (HM, NE). Endemic to south Asia.

Melanochelys trijuga parkeri Deraniyagala, 1939:

Distribution: Sri Lanka. (SL). Endemic to south Asia.

Melanochelys trijuga thermalis (Lesson, 1830):

Distribution: India, Maldives, Sri Lanka. (DC, SL). Endemic to south Asia.

23. *Morenia petersi* (Anderson, 1879):

Distribution: Bangladesh, India. (HM, NE). Endemic to south Asia.

24. *Pyxidea mouhotii* (Gray, 1862):

Distribution: India. (NE).

TESTUDINIDAE

25. *Geochelone elegans* (Schoepff, 1795):

Distribution: India, Pakistan, Sri Lanka. (DC, EG, NW, SL). Endemic to south Asia.

26. *Indotestudo elongata* (Blyth, 1853):

Distribution: Bangladesh, India, Nepal (EG, HM, NE).

27. *Indotestudo forstenii* (Schlegel & Müller, 1844):

Distribution: India. Endemic to south Asia. (WG). A population of this species has been introduced into some of the islands of eastern Indonesia.

28. *Manouria emys* (Schlegel & Müller, 1840)

Manouria emys phayrei (Blyth, 1853):

Distribution: Bangladesh, India (NE).

29. *Testudo horsfieldii* Gray, 1844

Testudo horsfieldii horsfieldii Gray, 1844:

Distribution: Pakistan (TH).

TRIONYCHIDAE

30. *Aspideretes gangeticus* (Cuvier, 1825):

Distribution: Bangladesh, India, Nepal, Pakistan. (EG, HM, NE, NW). Endemic to south Asia.

31. *Aspideretes hurum* (Gray, 1831):

Distribution: Bangladesh, India. (HM, NE). Endemic to south Asia.

32. *Aspideretes leithii* (Gray, 1872):

Distribution: India. (EG, DC, WG). Endemic to south Asia.

33. *Aspideretes nigricans* (Anderson, 1875):

Distribution: Bangladesh. (NE). Endemic to south Asia.

34. *Chitra indica* (Gray, 1831):

Distribution: Bangladesh, India, Nepal, Pakistan. (DC, EG, HM, NW). Endemic to south Asia.

35. *Lissemys punctata* (Lacépède, 1788)

Lissemys punctata punctata (Lacépède, 1788):

Distribution: India, Sri Lanka. (DC, SL, WG). Endemic to south Asia.

Lissemys punctata andersoni Webb, 1980:

Distribution: Bangladesh, India, Nepal, Pakistan. (EG, HM, NE, NW). Endemic to south Asia.

36. *Pelochelys bibroni* (Owen, 1853):

Distribution: Bangladesh, India. (estuarine).

LACERTILIA

GEKKONIDAE

37. *Agamura femoralis* Smith, 1933:

Distribution: Pakistan. (NW). Endemic to south Asia.

38. *Agamura misonnei* (Whitte, 1973):

Distribution: Pakistan. (NW). Endemic to south Asia.

39. *Agamura persica* (Duméril, 1856):

Distribution: Pakistan. (NW). Endemic to south Asia.

40. *Alsophylax boehmi* Szczerbak, 1991:

Distribution: India/Pakistan**. (TH). Endemic to south Asia.

41. *Asiocolotes depressus* (Minton & Anderson, 1965):

Distribution: Pakistan. (NW). Endemic to south Asia.

42. *Bunopus tuberculatus* Blanford, 1874:

Distribution: Pakistan. (NW).

43. *Calodactylodes aureus* (Beddome, 1870):

Distribution: India. (EG). Endemic to south Asia.

44. *Calodactylodes illingworthi* Deraniyagala, 1953:

Distribution: Sri Lanka. (SL). Endemic to south Asia.

45. *Cnemaspis beddomei* (Theobald, 1876):

Distribution: India. (WG). Endemic to south Asia.

46. *Cnemaspis boiei* (Gray, 1842):

Distribution: India***. Endemic to south Asia.

47. *Cnemaspis goaensis* Sharma, 1976:

Distribution: India. (WG). Endemic to south Asia.

48. *Cnemaspis indica* (Gray, 1846):

Distribution: India. (WG). Endemic to south Asia.

49. *Cnemaspis jerdoni* (Theobald, 1868)

Cnemaspis jerdoni jerdoni (Theobald, 1868):

Distribution: India. (WG). Endemic to south Asia.

Cnemaspis jerdoni scalpensis (Ferguson, 1877):

Distribution: Sri Lanka. (SL). Endemic to south Asia.

50. *Cnemaspis kandianus* (Kelaart, 1852):

Distribution: India, Sri Lanka. (AN, SL, WG).

51. *Cnemaspis littoralis* (Jerdon, 1853):

Distribution: India. (WG). Endemic to south Asia.

52. *Cnemaspis mysoriensis* (Jerdon, 1853):

Distribution: India. (WG). Endemic to south Asia.

53. *Cnemaspis nairi* Inger, Marx & Koshy, 1984:

Distribution: India. (WG). Endemic to south Asia.

54. *Cnemaspis ornatus* (Beddome, 1870):

Distribution: India. (WG). Endemic to south Asia.

55. *Cnemaspis podihuna* Deraniyagala, 1944:

Distribution: Sri Lanka. (SL). Endemic to south Asia.

56. *Cnemaspis sisparensis* (Theobald, 1876):

Distribution: India. (WG). Endemic to south Asia.

57. *Cnemaspis tropidogaster* (Boulenger, 1885):

Distribution: India, Sri Lanka. (SL, WG). Endemic to south Asia.

58. *Cnemaspis wynadensis* (Beddome, 1870):

Distribution: India. (WG). Endemic to south Asia.

59. *Cosymbotus platyurus* (Schneider, 1792):

Distribution: Bhutan, India, Nepal, Sri Lanka. (HM, SL).

60. *Crossobamon eversmanni* (Wiegmann, 1834)
Crossobamon eversmanni eversmanni (Wiegmann, 1834):
Distribution: Pakistan. (NW). Endemic to south Asia.
Crossobamon eversmanni maynardi (Smith, 1933):
Distribution: Pakistan. (NW). Endemic to south Asia.
61. *Crossobamon orientalis* (Blanford, 1876):
Distribution: Pakistan. (NW). Endemic to south Asia.
62. *Cyrtopodion agamuroides* Nikolsky, 1900:
Distribution: Pakistan. (NW). Endemic to south Asia.
63. *Cyrtopodion fedtschenkoi* (Strauch, 1887):
Distribution: Pakistan. (NW, TH).
64. *Cyrtopodion kachhensis* (Stoliczka, 1872):
Distribution: India, Pakistan. (NW). Endemic to south Asia.
65. *Cyrtopodion scaber* (Heyden, in Rüppell, 1827):
Distribution: India, Pakistan. (NW, TH).
66. *Cyrtopodion watsoni* (Murray, 1892):
Distribution: Pakistan. (TH). Endemic to south Asia.
67. *Eublepharis hardwickii* Gray, 1827:
Distribution: Bangladesh, India. (DC, EG). Endemic to south Asia.
68. *Eublepharis macularius* (Blyth, 1854):
Distribution: India, Pakistan. (NW).
69. *Geckoella collegalensis* (Beddome, 1870):
Distribution: India, Sri Lanka. (SL, WG). Endemic to south Asia.
70. *Geckoella dekkanensis* (Günther, 1864):
Distribution: India. (WG). Endemic to south Asia.
71. *Geckoella jeyporensis* (Beddome, 1877):
Distribution: India. (EG). Endemic to south Asia.
72. *Geckoella nebulosa* (Beddome, 1870):
Distribution: India. (EG). Endemic to south Asia.
73. *Geckoella triedrus* (Günther, 1864):
Distribution: Sri Lanka. (SL). Endemic to south Asia.
74. *Geckoella yakhuna* (Deraniyagala, 1945):
Distribution: Sri Lanka. (SL). Endemic to south Asia.
75. *Gehyra mutilata* (Wiegmann, 1834):
Distribution: India, Sri Lanka. (AN, EG, SL, WG).
76. *Gekko gecko* (Linnaeus, 1758)
Gekko gecko gecko (Linnaeus, 1758):
Distribution: India, Nepal, Pakistan. (AN, HM, NE, NI).
Gekko gecko azhari Mertens, 1955:
Distribution: Bangladesh. (NE).
77. *Gekko smithii* Gray, 1842:
Distribution: India. (NI).
78. *Gekko verreauxi* (Tytler, 1864):
Distribution: India. (AN). Endemic to south Asia.
79. *Gonydactylus chitralensis* (Smith, 1935):
Distribution: Pakistan. (NW). Endemic to south Asia.
80. *Gonydactylus dattanensis* (Khan, 1980):
Distribution: Pakistan. (NW). Endemic to south Asia.
81. *Gonydactylus fasciolatus* (Blyth, 1860):
Distribution: India. (TH). Endemic to south Asia.
82. *Gonydactylus frenatus* (Günther, 1864):
Distribution: Sri Lanka. (SL). Endemic to south Asia.
83. *Gonydactylus gubernatoris* (Annandale, 1913):
Distribution: India. (HM). Endemic to south Asia.
84. *Gonydactylus himalayanus* (Duda & Sahi, 1978):
Distribution: India, Nepal. (TH). Endemic to south Asia.
85. *Gonydactylus khasiensis* (Jerdon, 1870)
Gonydactylus khasiensis khasiensis (Jerdon, 1870):
Distribution: India. (HM, NE).
86. *Gonydacylus lawderanus* (Stoliczka, 1871):
Distribution: India. (HM). Endemic to south Asia.
87. *Gonydactylus malcolmsmithi* (Constable, 1949):
Distribution: India. (TH). Endemic to south Asia.
88. *Gonydactylus mansarulus* (Duda & Sahi, 1978):
Distribution: India. (TH). Endemic to south Asia.

89. *Gonydactylus mintoni* (Szczerbak & Golubev, 1981):

Distribution: Pakistan. (TH).

90. *Gonydactylus pulchellus* (Gray, 1828):

Distribution: India. (NE).

91. *Gonydactylus rubidus* (Blyth, 1860):

Distribution: India. (AN, NI). Endemic to south Asia.

92. *Gonydactylus stoliczkai* (Steindachner, 1869):

Distribution: India, Pakistan. (NW). Endemic to south Asia.

93. *Gonydactylus walli* (Ingoldby, 1922):

Distribution: India/Pakistan**. (TH). Endemic to south Asia.

94. *Hemidactylus anamallensis* (Günther, 1875):

Distribution: India. (WG). Endemic to south Asia.

95. *Hemidactylus bowringii* (Gray, 1845):

Distribution: Bangladesh, India. (DC, HM, NE).

96. *Hemidactylus brookii* (Gray, 1845):

Distribution: Bangladesh, Bhutan, India, Maldives, Nepal, Pakistan, Sri Lanka. (DC, EG, HM, NE, NW, SL, TH, WG).

97. *Hemidactylus depressus* Gray, 1842:

Distribution: Sri Lanka. (SL). Endemic to south Asia.

98. *Hemidactylus flaviviridis* Rüppell, 1840:

Distribution: Bangladesh, India, Nepal, Pakistan. (HW, NW).

99. *Hemidactylus frenatus* Duméril & Bibron, 1836:

Distribution: Bangladesh, Bhutan, India, Maldives, Nepal, Pakistan, Sri Lanka. (AN, DC, EG, HM, SL, NI, NW, SL).

100. *Hemidactylus garnotii* Duméril & Bibron, 1836:

Distribution: Bhutan, India. (HM, NE).

101. *Hemidactylus giganteus* Stoliczka, 1871:

Distribution: India. (EG, WG). Endemic to south Asia.

102. *Hemidactylus gracilis* Blanford, 1870:

Distribution: India. (DC). Endemic to south Asia.

103. *Hemidactylus karenorum* (Theobald, 1868):

Distribution: India. (NE).

104. *Hemidactylus leschenaulti* Duméril & Bibron, 1836:

Distribution: India, Pakistan, Sri Lanka. (DC, EG, NW, SL, WG). Endemic to south Asia.

105. *Hemidactylus maculatus* Duméril & Bibron, 1836

Hemidactylus maculatus maculatus Duméril & Bibron, 1836:

Distribution: India. (EG, WG). Endemic to south Asia.

Hemidactylus maculatus hunae Deraniyagala, 1937:

Distribution: India, Sri Lanka. (SL). Endemic to south Asia.

106. *Hemidactylus mahendrai* Shukla, 1983:

Distribution: India. (HM). Endemic to south Asia.

107. *Hemidactylus persicus* Anderson, 1872:

Distribution: Pakistan. (NW).

108. *Hemidactylus porbandarensis* Sharma, 1981:

Distribution: India. (NW). Endemic to south Asia.

109. *Hemidactylus prashadi* Smith, 1935:

Distribution: India. (WG). Endemic to south Asia.

110. *Hemidactylus reticulatus* Beddome, 1870:

Distribution: India. (WG). Endemic to south Asia.

111. *Hemidactylus scabriceps* (Annandale, 1906):

Distribution: India, Sri Lanka. (EG, SL). Endemic to south Asia.

112. *Hemidactylus subtriedrus* Jerdon, 1853:

Distribution: India. (EG). Endemic to south Asia.

113. *Hemidactylus triedrus* (Daudin, 1802)

Hemidactylus triedrus triedrus (Daudin, 1802):

Distribution: India, Pakistan. (DC, EG, NW, WG). Endemic to south Asia.

Hemidactylus triedrus lankae Deraniyagala, 1953:

Distribution: Sri Lanka. (SL). Endemic to south Asia.

114. *Hemidactylus turcicus* (Linnaeus, 1758)

Hemidactylus turcicus turcicus (Linnaeus, 1758):

Distribution: Pakistan. (NW).

115. *Hemiphyllodactylus typus* Bleeker, 1860

Hemiphyllodactylus typus typus Bleeker, 1860:

Distribution: India, Sri Lanka. (SL).

Hemiphyllodactylus typus aurantiacus Beddome, 1870:

Distribution: India. (WG). Endemic to south Asia.

116. *Lepidodactylus lugubris* (Duméril & Bibron, 1836):

Distribution: India, Sri Lanka. (AN, NI, SL).

117. *Microgecko helenae* Nikolsky, 1907:

Distribution: Pakistan. (NW).

118. *Phelsuma andamanense* Blyth, 1860:

Distribution: India. (AN). Endemic to south Asia.

119. *Pristurus rupestris* Blanford, 1874:

Distribution: Pakistan. (NW).

120. *Ptychozoon kuhli* Stejneger, 1902:

Distribution: India. (NI).

121. *Ptyodactylus homolepis* Blanford, 1876:

Distribution: Pakistan. (NW). Endemic to south Asia.

122. *Tenuidactylus battalensis* Khan, 1993:

Distribution: Pakistan. (NW). Endemic to south Asia.

123. *Tenuidactylus baturensis* Khan, 1992:

Distribution: Pakistan. (NW). Endemic to south Asia.

124. *Tenuidactylus fortmunroi* Khan, 1993:

Distribution: Pakistan. (NW). Endemic to south Asia.

125. *Tenuidactylus indusoani* (Khan, 1988):

Distribution: Pakistan. (NW). Endemic to south Asia.

126. *Tenuidactylus kohsulaimanai* Khan, 1991:

Distribution: Pakistan. (NW). Endemic to south Asia.

127. *Tenuidactylus montiumsalsorum* (Annandale, 1913):

Distribution: Pakistan. (NW). Endemic to south Asia.

128. *Tenuidactylus rohtasfortai* Khan & Tasnim, 1990:

Distribution: Pakistan. (NW). Endemic to south Asia.

129. *Teratolepis albofasciatus* (Grandison & Soman, 1963):

Distribution: India. (WG). Endemic to south Asia.

130. *Teratolepis fasciata* (Blyth, 1853):

Distribution: Pakistan. (NW). Endemic to south Asia.

131. *Teratoscincus microlepis* Nikolsky, 1899:

Distribution: Pakistan. (NW).

132. *Teratoscincus scincus* (Schlegel, 1858)

Teratoscincus scincus keyserlingii (Strauch, 1863):

Distribution: Pakistan. (NW).

133. *Tropiocolotes persicus* (Nikolsky, 1903)

Tropiocolotes persicus persicus (Nikolsky, 1903):

Distribution: Pakistan. (NW).

Tropiocolotes persicus euphorbiacola Minton, Anderson & Anderson, 1970:

Distribution: Pakistan. (NW).

AGAMIDAE

134. *Bronchocela cristatella* (Kuhl, 1820):

Distribution: India. (NI).

135. *Bronchocela danieli* Tiwari & Biswas, 1973:

Distribution: India. (NI). Endemic to south Asia.

136. *Bronchocela jubata* Duméril & Bibron, 1837:

Distribution: India. (AN, NI).

137. *Bufoniceps laungwalensis* (Sharma, 1978):

Distribution: India. (NW). Endemic to south Asia.

138. *Calotes andamanensis* Boulenger, 1891:

Distribution: India. (AN). Endemic to south Asia.

139. *Calotes bhutanensis* Biswas, 1975:

Distribution: Bhutan. (HM). Endemic to south Asia.

140. *Calotes calotes* (Linnaeus, 1758):

Distribution: India, Sri Lanka. (NI, SL, WG). Endemic to south Asia.

141. *Calotes ceylonensis* (Müller, 1887):

Distribution: Sri Lanka. (SL). Endemic to south Asia.

142. *Calotes ellioti* Günther, 1864

Calotes ellioti ellioti Günther, 1864:

Distribution: India. (WG). Endemic to south Asia.

Calotes ellioti amarambalamensis Murthy, 1978:

Distribution: India. (WG). Endemic to south Asia.

143. *Calotes emma* Gray, 1845

Calotes emma alticristatus (Schmidt, 1927):
Distribution: India. (AN, NE, NI).

144. *Calotes grandisquamis* Günther, 1875:
Distribution: India. (WG). Endemic to south Asia.

145. *Calotes jerdoni* Günther, "1870" 1871:
Distribution: Bangladesh, India. (NE).

146. *Calotes liocephalus* Günther, 1872:
Distribution: Sri Lanka. (SL). Endemic to south Asia.

147. *Calotes liolepis* Boulenger, 1885:
Distribution: Sri Lanka. (SL). Endemic to south Asia.

148. *Calotes maria* Gray, 1845:
Distribution: India. (NE). Endemic to south Asia.

149. *Calotes mystaceus* Duméril & Bibron, 1837:
Distribution: India. (AN, NI).

150. *Calotes nemoricola* Jerdon, 1853:
Distribution: India. (WG). Endemic to south Asia.

151. *Calotes nigrilabris* Peters, 1860:
Distribution: Sri Lanka. (SL). Endemic to south Asia.

152. *Calotes rouxii* Duméril & Bibron, 1837:
Distribution: India. (WG). Endemic to south Asia.

153. *Calotes versicolor* (Daudin, 1802):
Calotes versicolor versicolor (Daudin, 1802):
Distribution: Bangladesh, Bhutan, India, Maldives, Nepal, Pakistan, Sri Lanka. (AN, DC, EG, HM, NE, TH, SL, WG).
Calotes versicolor nigrigularis Auffenberg & Rehman, 1993:
Distribution: India, Pakistan. (NW). Endemic to south Asia.

154. *Ceratophora aspera* Günther, 1864:
Distribution: Sri Lanka. (SL). Endemic to south Asia.

155. *Ceratophora stoddartii* Gray, 1834:
Distribution: Sri Lanka. (SL). Endemic to south Asia.

156. *Ceratophora tennentii* Günther, 1861:
Distribution: Sri Lanka. (SL). Endemic to south Asia.

157. *Cophotis ceylanica* Peters, 1861:
Distribution: Sri Lanka. (SL). Endemic to south Asia.

158. *Coryphophylax subcristatus* (Blyth, 1860):
Distribution: India. (AN, NI). Endemic to south Asia.

159. *Draco blanfordii* Boulenger, 1885
Draco blanfordii norvillii (Alcock, 1895):
Distribution: Bangladesh, India. (NE).

160. *Draco dussumieri* Duméril & Bibron, 1837:
Distribution: India. (WG). Endemic to south Asia.

161. *Japalura andersoniana* Annandale, 1905:
Distribution: Bhutan, India. (NE). Endemic to south Asia.

162. *Japalura kumaonensis* (Annandale, 1907):
Distribution: India, Nepal. (HM).

163. *Japalura major* (Jerdon, 1870):
Distribution: India, Nepal. (HM). Endemic to south Asia.

164. *Japalura planidorsata* Jerdon, 1870:
Distribution: India. (NE).

165. *Japalura tricarinatus* (Blyth, 1854):
Distribution: India, Nepal. (HM). Endemic to south Asia.

166. *Japalura variegata* Gray, 1853:
Distribution: Bhutan, India, Nepal. (HM). Endemic to south Asia.

167. *Laudakia agrorensis* (Stoliczka, 1872):
Distribution: India, Pakistan. (TH). Endemic to south Asia.

168. *Laudakia caucasicus* (Eichwald, 1831):
Distribution: Pakistan. (TH).

169. *Laudakia himalayanus* (Steindachner, 1867):
Distribution: India, Pakistan. (TH).

170. *Laudakia melanura* (Blyth, 1854):
Distribution: India, Pakistan. (NW). Endemic to south Asia.

171. *Laudakia minor* (Hardwicke & Gray, 1827):
Distribution: India, Pakistan. (DC, NW). Endemic to south Asia.

172. *Laudakia nupta* (De Filippi, 1843)
Laudakia nupta nupta (De Filippi, 1843):
Distribution: Pakistan. (NW, TH).
Laudakia nupta fusca (Blanford, 1876):
Distribution: Pakistan. (TH). Endemic to south Asia.

173. *Laudakia pakistanica* (Baig, 1989):
Distribution: India/Pakistan**. (TH). Endemic to south Asia.

174. *Laudakia tuberculata* (Hardwicke & Gray, 1827):

Distribution: India, Nepal, Pakistan. (HM, TH). Endemic to south Asia.

175. *Lyriocephalus scutatus* (Linnaeus, 1758):

Distribution: Sri Lanka. (SL). Endemic to south Asia.

176. *Mictopholis austeniana* (Annandale, 1908):

Distribution: India. (NE). Endemic to south Asia.

177. *Oriocalotes paulus* Smith, 1935:

Distribution: India. (NE).

178. *Otocryptis beddomii* Boulenger, 1885:

Distribution: India. (WG). Endemic to south Asia.

179. *Otocryptis wiegmanni* Wagler, 1830:

Distribution: Sri Lanka. (SL). Endemic to south Asia.

180. *Phrynocephalus alticola* Peters, 1984:

Distribution: India. (TH). Endemic to south Asia.

181. *Phrynocephalus clarkorum* Anderson & Leviton, 1967:

Distribution: Pakistan. (NW). Endemic to south Asia.

182. *Phrynocephalus euptilopus* Alcock & Finn, 1896:

Distribution: Pakistan. (TH). Endemic to south Asia.

183. *Phrynocephalus luteoguttatus* Boulenger, 1887:

Distribution: Pakistan. (TH).

184. *Phrynocephalus maculatus* Anderson, 1872:

Distribution: Pakistan. (TH).

185. *Phrynocephalus ornatus* Boulenger, 1887:

Distribution: Pakistan. (TH).

186. *Phrynocephalus scutellata* (Olivier, 1807):

Distribution: Pakistan. (NW).

187. *Phrynocephalus theobaldi* Blyth, 1863:

Distribution: India, Nepal. (HM, TH).

188. *Psammophilus blanfordanus* (Stoliczka, 1870):

Distribution: India. (DC, EG, WG). Endemic to south Asia.

189. *Psammophilus dorsalis* (Gray, 1831):

Distribution: India. (EG, WG). Endemic to south Asia.

190. *Pseudocalotes microlepis* (Boulenger, 1887):

Distribution: India. (NE).

191. *Ptyctolaemus gularis* (Peters, 1864):

Distribution: India. (NE).

192. *Salea anamallayana* (Beddome, 1878):

Distribution: India. (WG). Endemic to south Asia.

193. *Salea horsfieldii* Gray, 1845:

Distribution: India. (WG). Endemic to south Asia.

194. *Salea kakhiensis* (Anderson, 1878):

Distribution: India. (NE).

195. *Sitana ponticeriana* Cuvier, 1844:

Distribution: India, Nepal, Pakistan, Sri Lanka. (EG, DC, HM, NW, SL, WG). Endemic to south Asia.

196. *Trapelus agilis* (Olivier, 1804):

Distribution: India, Pakistan. (NW, TH).

197. *Trapelus megalonyx* Günther, 1864:

Distribution: Pakistan. (TH).

198. *Trapelus ruderatus* (Olivier, 1804)

Trapelus ruderatus baluchiana Smith, 1935:

Distribution: Pakistan. (TH). Endemic to south Asia.

199. *Trapelus rubrigularis* Blanford, 1875:

Distribution: Pakistan. (NW, TH). Endemic to south Asia.

200. *Uromastyx asmussi* (Strauch, 1863):

Distribution: Pakistan. (TH).

201. *Uromastyx hardwickii* Gray, 1827:

Distribution: India, Pakistan. (DC, NW). Endemic to south Asia.

CHAMAELEONIDAE

202. *Chamaeleo zeylanicus* Laurenti, 1768:

Distribution: India, Pakistan, Sri Lanka. (DC, EG, NW). Endemic to south Asia.

DIBAMIDAE

203. *Dibamus leucurus* (Bleeker, 1860):

Distribution: India. (NI).

SCINCIDAE

204. *Ablepharus grayanus* (Stoliczka, 1872):

Distribution: India, Pakistan. (NW). Endemic to south Asia.

205. *Ablepharus pannonicus* Fitzinger in: Lichtenstein in: Eversmann, 1823:

Distribution: India, Pakistan. (NW).

206. *Barkudia insularis* Annandale, 1917:

Distribution: India. (EG). Endemic to south Asia.

207. *Chalcides ocellatus* (Forsskål, 1775):
Distribution: Pakistan. (NW).
208. *Chalcides pentadactylus* (Beddome, 1870):
Distribution: India. (WG). Endemic to south Asia.
209. *Chalcidoseps thwaitesii* (Günther, 1872):
Distribution: Sri Lanka. (SL). Endemic to south Asia.
210. *Dasamia rugifera* (Stoliczka, 1870):
Distribution: India. (NI).
211. *Dasia halianus* (Haly & Nevill, 1887):
Distribution: India, Sri Lanka. (SL, WG). Endemic to south Asia.
212. *Dasia nicobariensis* Biswas & Sanyal, 1977:
Distribution: India. (NI). Endemic to south Asia.
213. *Dasia olivacea* Gray, 1838:
Distribution: India. (AN, NI).
214. *Dasia subcaeruleum* (Boulenger, 1891):
Distribution: India. (WG). Endemic to south Asia.
215. *Eumeces blythianus* (Anderson, 1871):
Distribution: India. (NW). Endemic to south Asia.
216. *Eumeces poonaensis* Sharma, 1970:
Distribution: India. (DC). Endemic to south Asia.
217. *Eumeces schneideri* (Daudin, 1802)
Eumeces schneideri schneideri (Daudin, 1802):
Distribution: India (NW).
Eumeces schneideri blythianus (Anderson, 1871):
Distribution: India, Pakistan. (NW, TH). Endemic to south Asia.
Eumeces schneiderii zarudnyi (Nikolski, 1899):
Distribution: Pakistan. (TH).
218. *Eumeces taeniolatus* (Blyth, 1854):
Distribution: India, Pakistan. (NW, TH).
219. *Lankascincus deignani* (Taylor, 1950):
Distribution: Sri Lanka. (SL). Endemic to south Asia.
220. *Lankascincus deraniyagalae* Greer, 1991:
Distribution: Sri Lanka. (SL). Endemic to south Asia.
221. *Lankascincus fallax* (Peters, 1860):
Distribution: Sri Lanka. (SL). Endemic to south Asia.
222. *Lankascincus gansi* Greer, 1991:
Distribution: Sri Lanka. (SL). Endemic to south Asia.
223. *Lankascincus taprobanensis* (Kelaart, 1852):
Distribution: Sri Lanka. (SL). Endemic to south Asia.
224. *Lankascincus taylori* Greer, 1991:
Distribution: Sri Lanka. (SL). Endemic to south Asia.
225. *Lipinia macrotympanum* (Stoliczka, 1873):
Distribution: India. (AN). Endemic to south Asia.
226. *Lipinia quadrivittatum* (Peters, 1867):
Distribution: India. (NI).
227. *Lygosoma albopunctata* (Gray, 1846):
Distribution: Bangladesh, India, Maldives. (DC, EG, NE, WG). Endemic to south Asia.
228. *Lygosoma ashwamedhi* (Sharma, 1969):
Distribution: India. (EG). Endemic to south Asia.
229 *Lygosoma bowringii* (Günther, 1864):
Distribution: India. (AN).
230. *Lygosoma goaensis* (Sharma, 1976):
Distribution: India. (WG). Endemic to south Asia.
231. *Lygosoma guentheri* (Peters, 1879):
Distribution: India. (WG). Endemic to south Asia.
232. *Lygosoma lineata* (Gray, 1839):
Distribution: India. (WG). Endemic to south Asia.
233. *Lygosoma pruthi* (Sharma, 1977):
Distribution: India. (EG). Endemic to south Asia.
234. *Lygosoma punctatus* (Gmelin, 1799):
Distribution: Bangladesh, India, Pakistan, Sri Lanka. (DC, EG, HM, NE, NW, SL, WG). Endemic to south Asia.
235. *Lygosoma singha* (Taylor, 1950):
Distribution: Sri Lanka. (SL). Endemic to south Asia.
236. *Lygosoma vosmaeri* (Gray, 1839):
Distribution: Bangladesh, India. (NE). Endemic to south Asia.
237. *Mabuya allapallensis* Schmidt, 1926:
Distribution: India. (DC, WG). Endemic to south Asia.
238. *Mabuya andamanensis* Smith, 1935:

Distribution: India. (AN, NI). Endemic to south Asia.

239. *Mabuya aurata* (Linnaeus, 1758):

Distribution: Pakistan. (NW).

240. *Mabuya beddomii* (Jerdon, 1870):

Distribution: India, Sri Lanka. (SL, WG). Endemic to south Asia.

241. *Mabuya bibronii* (Gray, 1838):

Distribution: India, Sri Lanka. (EG, WG, SL). Endemic to south Asia.

242. *Mabuya carinata* (Schneider, 1801)

Mabuya carinata carinata (Schneider, 1801):

Distribution: Bangladesh, India, Maldives, Nepal. (DC, EG, HM, NE, WG). Endemic to south Asia.

Mabuya carinata lankae Deraniyagala, 1953:

Distribution: Sri Lanka. (SL). Endemic to south Asia.

243. *Mabuya clivicola* Inger, Shaffer, Koshy & Bakde, 1984:

Distribution: India. (WG). Endemic to south Asia.

244. *Mabuya dissimilis* (Hallowell, 1857):

Distribution: Bangladesh, India, Nepal, Pakistan. (DC, HM, NW). Endemic to south Asia.

245. *Mabuya floweri* Taylor, 1950:

Distribution: Sri Lanka. (SL). Endemic to south Asia.

246. *Mabuya gansi* Das, 1991:

Distribution: India. (WG). Endemic to south Asia.

247. *Mabuya innotatus* (Blanfordi, 1870):

Distribution: India. (DC). Endemic to south Asia.

248. *Mabuya macularius* (Blyth, 1853)

Mabuya macularius macularius (Blyth, 1853):

Distribution: Bangladesh, India, Nepal, Pakistan, Sri Lanka. (DC, EG, HM, NE, NW, SL, WG).

249. *Mabuya madaraszi* Méhely, 1897:

Distribution: Sri Lanka. (SL). Endemic to south Asia.

250. *Mabuya multifasciata* (Kuhl, 1820):

Distribution: India. (NE).

251. *Mabuya nagarjuni* (Sharma, 1969):

Distribution: India. (EG). Endemic to south Asia.

252. *Mabuya quadratilobus* Bauer & Günther, 1992:

Distribution: Bhutan. (HM). Endemic to south Asia.

253. *Mabuya quadricarinata* Boulenger, 1887:

Distribution: India. (NE).

254. *Mabuya rudis* Boulenger, 1887:

Distribution: India. (NI).

255. *Mabuya trivittata* (Hardwicke & Gray, 1827):

Distribution: India. (DC, EG, WG). Endemic to south Asia.

256. *Mabuya tytleri* (Theobald, 1868):

Distribution: India. (AN). Endemic to south Asia.

257. *Nessia bipes* Smith, 1935:

Distribution: Sri Lanka. (SL). Endemic to south Asia.

258. *Nessia burtonii* Gray, 1839:

Distribution: Sri Lanka. (SL). Endemic to south Asia.

259. *Nessia deraniyagalai* Taylor, 1950:

Distribution: Sri Lanka. (SL). Endemic to south Asia.

260. *Nessia didactylus* (Deraniyagala, 1934):

Distribution: Sri Lanka. (SL). Endemic to south Asia.

261. *Nessia hickanala* Deraniyagala, 1940:

Distribution: Sri Lanka. (SL). Endemic to south Asia.

262. *Nessia layardi* (Kelaart, 1853):

Distribution: Sri Lanka. (SL). Endemic to south Asia.

263. *Nessia monodactylus* (Gray, 1839):

Distribution: Sri Lanka. (SL). Endemic to south Asia.

264. *Nessia sarasinorum* (Müller, 1889):

Distribution: Sri Lanka. (SL). Endemic to south Asia.

265. *Ophiomorus blanfordii* Boulenger, 1887:

Distribution: Pakistan. (NW). Endemic to south Asia.

266. *Ophiomorus raithmai* Anderson & Leviton, 1966:

Distribution: India, Pakistan. (NW). Endemic to south Asia.

267. *Ophiomorus tridactylus* (Blyth, 1855):

Distribution: India, Pakistan. (NW).

268. *Ristella beddomii* Boulenger, 1887:

Distribution: India. (WG). Endemic to south Asia.

269. *Ristella guentheri* Boulenger, 1887:
Distribution: India. (WG). Endemic to south Asia.
270. *Ristella rurkii* Gray, 1839:
Distribution: India. (WG). Endemic to south Asia.
271. *Ristella travancoricus* (Beddome, 1870):
Distribution: India. (WG). Endemic to south Asia.
272. *Scincella bilineatum* (Gray, 1846):
Distribution: India. (WG). Endemic to south Asia.
273. *Scincella capitanea* Ouboter, 1986:
Distribution: Nepal. (HM). Endemic to south Asia.
274. *Scincella ladacensis* (Günther, 1864)
Scincella ladacensis ladacensis (Günther, 1864):
Distribution: India, Nepal. (HM, TH).
Scincella ladacensis himalayanus (Günther, 1864):
Distribution: India, Nepal, Pakistan. (HM, TH). Endemic to south Asia.
Scincella ladacensis tragbulense (Alcock, 1898):
Distribution: India. (TH). Endemic to south Asia.
275. *Scincella macrotis* (Steindachneri, 1869):
Distribution: India. (NI). Endemic to south Asia.
276. *Scincella sikimmensis* (Blyth, 1853):
Distribution: Bangladesh, Bhutan, India, Nepal. (HM).
277. *Scincella travancoricum* (Beddome, 1870):
Distribution: India. (WG). Endemic to south Asia.
278. *Scincus mitranus* Anderson, 1871:
Distribution: Pakistan. (NW).
279. *Sepsophis punctatus* Beddome, 1870:
Distribution: India. (EG). Endemic to south Asia.
280. *Sphenomorphus courcyanus* (Annandale, 1912):
Distribution: India. (NE).
281. *Sphenomorphus deignani* Taylor, 1950:
Distribution: Sri Lanka. (SL). Endemic to south Asia.
282. *Sphenomorphus dorsicatenatus* Deraniyagala, 1953:
Distribution: Sri Lanka. (SL). Endemic to south Asia.
283. *Sphenomorphus dussumieri* (Duméril & Bibron, 1839):
Distribution: India, Sri Lanka. (SL, WG). Endemic to south Asia.
284. *Sphenomorphus indicus* (Gray, 1853):
Distribution: Bhutan, India. (HM, NE).
285. *Sphenomorphus maculatus* (Blyth, 1853):
Distribution: Bangladesh, Bhutan, India. (AN, HM, NI, NE).
286. *Sphenomorphus megalops* (Annandale, 1906):
Distribution: Sri Lanka. (SL). Endemic to south Asia.
287. *Sphenomorphus reevesi* (Gray, 1838)
Sphenomorphus reevesi reevesi (Gray, 1838):
Distribution: India. (NE).
288. *Sphenomorphus rufogulus* Taylor, 1950:
Distribution: Sri Lanka. (SL). Endemic to south Asia.
289. *Tropidophorus assamensis* Annandale, 1912:
Distribution: Bangladesh. (NE). Endemic to south Asia.

LACERTIDAE

290. *Acanthodactylus blanfordii* Boulenger, 1918:
Distribution: India, Pakistan. (TH).
291. *Acanthodactylus cantoris* Günther, 1864:
Distribution: India, Pakistan. (NW, TH).
292. *Acanthodactylus micropholis* Blanford, 1874:
Distribution: Pakistan. (TH).
293. *Eremias brevirostris* Stoliczka, 1872:
Distribution: Pakistan. (TH).
294. *Eremias guttulata* (Lichtenstein, 1823)
Eremias guttulata watsonana (Stoliczka, 1872):
Distribution: India. (NW, TH).
295. *Eremias persica* Blanford, 1875:
Distribution: Pakistan. (TH).
296. *Eremias velox* (Pallas, 1771):
Distribution: Pakistan. (TH).
297. *Ophisops beddomei* (Jerdon, 1870):
Distribution: India. (DC, WG). Endemic to south Asia.
298. *Ophisops elegans* Ménétriés, 1832:

Distribution: Pakistan. (NW).

299. *Ophisops jerdoni* Blyth, 1853:

Distribution: India, Pakistan. (DC, NW, TH). Endemic to south Asia.

300. *Ophisops leschenaultii* (Milne-Edwards, 1829)

Ophisops leschenaultii leschenalutii (Milne-Edwards, 1829):

Distribution: India. (DC, EG, WG). Endemic to south Asia.

Ophisops leschenaultii lankae (Deraniyagala, 1953):

Distribution: Sri Lanka. (SL). Endemic to south Asia.

301. *Ophisops microlepis* Blanford, 1870:

Distribution: India. (DC, NW). Endemic to south Asia.

302. *Ophisops minor* (Deraniyagala, 1971)

Ophisops minor minor (Deraniyagala, 1971):

Distribution: Sri Lanka. (SL). Endemic to south Asia.

Ophisops minor nictans Arnold, 1989:

Distribution: India. (DC, EG). Endemic to south Asia.

303. *Rhabderemias fasciata* (Blanford, 1874):

Distribution: Pakistan. (TH).

304. *Rhabderemias scripta* (Strauch, 1867):

Distribution: Pakistan. (TH).

305. *Scapteira acutirostris* Boulenger, 1887:

Distribution: Pakistan. (TH). Endemic to south Asia.

306. *Scapteira aporosceles* (Alcock & Finn, 1896):

Distribution: Pakistan. (TH). Endemic to south Asia.

307. *Takydromus haughtonianus* Jerdon, 1870:

Distribution: India. (NE). Endemic to south Asia.

308. *Takydromus sexlineatus* Daudin, 1802

Takydromus sexlineatus khasiensis (Boulenger, 1890):

Distribution: India. (NE).

ANGUIDAE

309. *Ophisaurus gracilis* (Gray, 1845):

Distribution: India. (HM, NE). Endemic to south Asia.

VARANIDAE

310. *Varanus bengalensis* (Daudin, 1802):

Distribution: Bangladesh, Bhutan, India, Nepal, Pakistan, Sri Lanka. (DC, EG, HM, NE, NW, TH, SL, WG).

311. *Varanus flavescens* (Hardwicke & Gray, 1827):

Distribution: Bangladesh, India, Nepal, Pakistan. (EG, HM, NE, NW). Endemic to south Asia.

312. *Varanus griseus* (Daudin, 1803)

Varanus griseus caspius (Eichwald, 1831):

Distribution: Pakistan. (NW).

*Varanus griseus koniczny*i Mertens, 1854:

Distribution: India, Pakistan. (DC, NW). Endemic to south Asia.

313. *Varanus salvator* (Laurenti, 1768)

Varanus salvator salvator (Laurenti, 1768):

Distribution: Bangladesh, India. (EG, NE).

Varanus salvator andamanensis (Deraniyagala, 1944):

Distribution: India. (AN, NI). Endemic to south Asia.

Varanus salvator karbaragoya (Deraniyagala, 1947):

Distribution: Sri Lanka. (SL). Endemic to south Asia.

SERPENTES

LEPTOTYPHLOPIDAE

314. *Leptotyphlops blanfordi* (Boulenger, 1890)

Leptotyphlops blanfordi blanfordi (Boulenger, 1890):

Distribution: India, Pakistan. (NW, TH).

315. *Leptotyphlops macrorhynchus* (Jan, 1861):

Distribution: India, Pakistan. (NW, TH).

TYPHLOPIDAE

316. *Ramphotyphlops braminus* (Daudin, 1803):

Distribution: Bangladesh, Bhutan, India, Maldives, Nepal, Pakistan, Sri Lanka. (AN, DC, EG, HM, NI, NE, NW, SL, TH, WG).

317. *Typhlops acutus* (Duméril & Bibron, 1844):

Distribution: India. (DC, EG, NW, WG). Endemic to south Asia.

318. *Typhlops andamanensis* Stoliczka, 1871:

Distribution: India. (AN). Endemic to south Asia.

319. *Typhlops beddomei* Boulenger, 1890:

Distribution: India. (EG, WG). Endemic to south Asia.

320. *Typhlops bothriorhynchus* Günther, 1864:
Distribution: India. (HM, NE). Endemic to south Asia.
321. *Typhlops ceylonicus* Smith, 1943:
Distribution: Sri Lanka. (SL). Endemic to south Asia.
322. *Typhlops diardii* Schlegel, 1839
Typhlops diardii diardii Schlegel, 1839:
Distribution: Bangladesh, India. (HM, NE).
323. *Typhlops jerdoni* Boulenger, 1890:
Distribution: India, Nepal. (HM, NE).
324. *Typhlops lankaensis* Taylor, 1947:
Distribution: Sri Lanka. (SL). Endemic to south Asia.
325. *Typhlops leucomelas* Boulenger, 1890:
Distribution: Sri Lanka. (SL). Endemic to south Asia.
326. *Typhlops loveridgei* Constable, 1949:
Distribution: India***. Endemic to south Asia.
327. *Typhlops malcolmi* Taylor, 1947:
Distribution: Sri Lanka. (SL). Endemic to south Asia.
328. *Typhlops mirus* Jan, 1860:
Distribution: Sri Lanka. (SL). Endemic to south Asia.
329. *Typhlops oatesii* Boulenger, 1890:
Distribution: India. (AN). Endemic to south Asia.
330. *Typhlops oligolepis* Wall, 1909:
Distribution: India. (HM). Endemic to south Asia.
331. *Typhlops porrectus* Stoliczka, 1871:
Distribution: Bangladesh, India, Pakistan, Sri Lanka. (DC, EG, HM, NE, NW, SL, TH, SL).
332. *Typhlops psammeces* Günther, 1864:
Distribution: India. (EG). Endemic to south Asia.
333. *Typhlops tenebrarum* Taylor, 1947:
Distribution: Sri Lanka. (SL). Endemic to south Asia.
334. *Typhlops tenuicollis* (Peters, 1864):
Distribution: India. (DC, HM, NE). Endemic to south Asia.
335. *Typhlops thurstoni* Boettger, 1890:
Distribution: India. (WG). Endemic to south Asia.
336. *Typhlops tindalli* Smith, 1943:
Distribution: India. (WG). Endemic to south Asia.
337. *Typhlops veddae* Taylor, 1947:
Distribution: Sri Lanka. (SL). Endemic to south Asia.
338. *Typhlops violaceus* Taylor, 1947:
Distribution: Sri Lanka. (SL). Endemic to south Asia.

XENOPELTIDAE

339. *Xenopeltis unicolor* Reinwardt in: Boie, 1827:
Distribution: India. (AN, NI).

UROPELTIDAE

340. *Brachyophidium rhodogaster* Wall, 1921:
Distribution: India. (WG). Endemic to south Asia.
341. *Cylindrophis maculata* (Linnaeus, 1754):
Distribution: Sri Lanka. (SL). Endemic to south Asia.
342. *Melanophidium bilineatum* Beddome, 1870:
Distribution: India. (WG). Endemic to south Asia.
343. *Melanophidium punctatum* Beddome, 1871:
Distribution: India. (WG). Endemic to south Asia.
344. *Melanophidium wynaudense* (Beddome, 1863):
Distribution: India. (WG). Endemic to south Asia.
345. *Platyplectrurus madurensis* Beddome, 1877
Platyplectrurus madurensis madurensis Beddome, 1877:
Distribution: India. (WG). Endemic to south Asia.
Platyplectrurus madurensis ruhanae (Deraniyagala, 1954):
Distribution: Sri Lanka. (SL). Endemic to south Asia.
346. *Platyplectrurus trilineatus* (Beddome, 1867):
Distribution: India. (WG). Endemic to south Asia.
347. *Plectrurus aureus* Beddome, 1880:
Distribution: India. (WG). Endemic to south Asia.
348. *Plectrurus canaricus* (Beddome, 1870):

Distribution: India. (WG). Endemic to south Asia.

349. *Plectrurus guentheri* Beddome, 1863):

Distribution: India. (WG). Endemic to south Asia.

350. *Plectrurus perroteti* Duméril & Bibron, 1854:

Distribution: India. (WG). Endemic to south Asia.

351. *Pseudotyphlops philippinus* (Schlegel, 1839):

Distribution: Sri Lanka. (SL). Endemic to south Asia.

352. *Rhinophis blythii* Kelaart, 1853:

Distribution: Sri Lanka. (SL). Endemic to south Asia.

353. *Rhinophis dorsimaculatus* Deraniyagala, 1941:

Distribution: Sri Lanka. (SL). Endemic to south Asia.

354. *Rhinophis drummondhayi* Wall, 1921:

Distribution: Sri Lanka. (SL). Endemic to south Asia.

355. *Rhinophis fergusonianus* Boulenger, 1896:

Distribution: India. (WG). Endemic to south Asia.

356. *Rhinophis oxyrhynchus* (Schneider, 1801):

Distribution: Sri Lanka. (SL). Endemic to south Asia.

357. *Rhinophis philippinus* (Cuvier, 1829):

Distribution: Sri Lanka. (SL). Endemic to south Asia.

358. *Rhinophis porrectus* Wall, 1921:

Distribution: Sri Lanka. (SL). Endemic to south Asia.

359. *Rhinophis punctatus* Müller, 1832:

Distribution: Sri Lanka. (SL). Endemic to south Asia.

360. *Rhinophis sanguineus* Beddome, 1863:

Distribution: India. (WG). Endemic to south Asia.

361. *Rhinophis travancoricus* Boulenger, 1892:

Distribution: India. (WG). Endemic to south Asia.

362. *Rhinophis trevelyana* (Kelaart, 1853):

Distribution: Sri Lanka. (SL). Endemic to south Asia.

363. *Rhinophis tricolorata* Deraniyagala, 1975:

Distribution: Sri Lanka. (SL). Endemic to south Asia.

364. *Teretrurus sanguineus* Beddome, 1867:

Distribution: India. (WG). Endemic to south Asia.

365. *Uropeltis arcticeps* (Günther, 1875):

Distribution: India. (WG). Endemic to south Asia.

366. *Uropeltis beddomii* (Günther, 1862):

Distribution: India. (WG). Endemic to south Asia.

367. *Uropeltis broughami* (Beddome, 1878):

Distribution: India. (WG). Endemic to south Asia.

368. *Uropeltis ceylanicus* Cuvier, 1829:

Distribution: India. (EG, WG). Endemic to south Asia.

369. *Uropeltis dindigalensis* (Beddome, 1877):

Distribution: India. (WG). Endemic to south Asia.

370. *Uropeltis ellioti* (Gray, 1858):

Distribution: India. (EG, WG). Endemic to south Asia.

371. *Uropeltis liura* (Günther, 1875):

Distribution: India. (WG). Endemic to south Asia.

372. *Uropeltis macrolepis* (Peters, 1861)

Uropeltis macrolepis macrolepis (Peters, 1862):

Distribution: India. (WG). Endemic to south Asia.

Uropeltis macrolepis mahableshwarensis Chari, 1955:

Distribution: India. (WG). Endemic to south Asia.

373. *Uropeltis macrorhyncha* (Beddome, 1877):

Distribution: India. (WG). Endemic to south Asia.

374. *Uropeltis maculata* (Beddome, 1878):

Distribution: India. (WG). Endemic to south Asia.

375. *Uropeltis melanogaster* (Gray, 1858):

Distribution: Sri Lanka. (SL). Endemic to south Asia.

376. *Uropeltis myhendrae* Beddome, 1886:

Distribution: India. (WG). Endemic to south Asia.

377. *Uropeltis nitida* (Beddome, 1878):

Distribution: India. (WG). Endemic to south Asia.

378. *Uropeltis ocellata* (Beddome, 1863):

Distribution: India. (WG). Endemic to south Asia.

379. *Uropeltis petersi* (Beddome, 1878):

Distribution: India. (WG). Endemic to south Asia.

380. *Uropeltis phillipsi* (Nicholls, 1929):

Distribution: Sri Lanka. (SL). Endemic to south Asia.

381. *Uropeltis phipsonii* (Mason, 1888):

Distribution: India. (WG). Endemic to south Asia.

382. *Uropeltis pulneyensis* (Beddome, 1863):

Distribution: India. (WG). Endemic to south Asia.

383. *Uropeltis rubrolineata* (Günther, 1875):

Distribution: India. (WG). Endemic to south Asia.

384. *Uropeltis rubromaculatus* (Beddome, 1867):

Distribution: India. (WG). Endemic to south Asia.

385. *Uropeltis ruhanae* Deraniyagala, 1954:

Distribution: Sri Lanka. (SL). Endemic to south Asia.

386. *Uropeltis smithi* Gans, 1966:

Distribution: India. (WG). Endemic to south Asia.

387. *Uropeltis woodmasoni* (Theobald, 1875):

Distribution: India. (WG). Endemic to south Asia.

BOIDAE

388. *Eryx conica* (Schneider, 1801)

Eryx conica conica (Schneider, 1801):

Distribution: Bangladesh, India, Pakistan. (DC, EG, HM, NW, WG). Endemic to south Asia.

Eryx conica brevis Deraniyagala, 1951:

Distribution: Sri Lanka. (SL). Endemic to south Asia.

389. *Eryx johnii* (Russell, 1801)

Eryx johnii johnii (Russell, 1801):

Distribution: India, Pakistan. (DC, EG, NW). Endemic to south Asia.

Eryx johnii persicus (Nikolsky, 1907):

Distribution: India, Pakistan. (NW, TH).

390. *Eryx tatarica* (Lichtenstein, 1823)

Eryx tatarica vittatus Chernov, 1959:

Distribution: Pakistan. (TH).

391. *Eryx whitakeri* Das, 1991:

Distribution: India. (WG). Endemic to south Asia.

392. *Python molurus* (Linnaeus, 1758)

Python molurus molurus (Linnaeus, 1758):

Distribution: Bhutan, India, Nepal, Pakistan, Sri Lanka. (DC, EG, HM, SL, TH, WG).

Python molurus bivittatus Kuhl, 1820:

Distribution: Bangladesh, India. (NE).

393. *Python reticulata* (Schneider, 1801):

Distribution: Bangladesh, India. (NI, NE).

ACROCHORDIDAE

394. *Acrochordus granulatus* (Schneider, 1799):

Distribution: Bangladesh, India, Pakistan, Sri Lanka. (estuarine).

COLUBRIDAE

395. *Ahaetulla dispar* (Günther, 1864):

Distribution: India. (WG). Endemic to south Asia.

396. *Ahaetulla fronticinctus* (Günther, 1858):

Distribution: India. (HM, NE).

397. *Ahaetulla nasutus* (Lacepède, 1789):

Distribution: Bangladesh, India, Nepal, Sri Lanka. (DC, EG, HM, NE, SL, WG).

398. *Ahaetulla perroteti* (Duméril & Bibron, 1854):

Distribution: India. (WG). Endemic to south Asia.

399. *Ahaetulla prasina* (Reinwardt in: Boie, 1827)

Ahaetulla prasina prasina (Reinwardt in: Boie, 1827):

Distribution: Bangladesh, Bhutan, India. (HW, NE).

400. *Ahaetulla pulverulentus* (Duméril & Bibron, 1854):

Distribution: India, Sri Lanka. (SL, WG). Endemic to south Asia.

401. *Amphiesma beddomei* (Günther, 1864):

Distribution: India. (WG). Endemic to south Asia.

402. *Amphiesma khasiensis* (Boulenger, 1890):

Distribution: India. (NE).

403. *Amphiesma modesta* (Günther, 1875):

Distribution: India (NE).

404. *Amphiesma monticola* (Jerdon, 1853):

Distribution: India. (WG). Endemic to south Asia.

405. *Amphiesma nicobariensis* (Sclater, 1891):

Distribution: India. (NI). Endemic to south Asia.

406. *Amphiesma parallela* (Boulenger, 1890):

Distribution: India, Nepal. (HM, NE).

407. *Amphiesma pealii* (Sclater, 1891):

Distribution: India. (NE). Endemic to south Asia.

408. *Amphiesma platyceps* (Blyth, 1854):

Distribution: Bangladesh, Bhutan, India, Nepal, Pakistan. (HM, NE, TH). Endemic to south Asia.

409. *Amphiesma sieboldii* (Günther, 1860):

Distribution: Bangladesh, India, Nepal, Pakistan. (HM, NE, NW, TH). Endemic to south Asia.

410. *Amphiesma stolata* (Linnaeus, 1758):

Distribution: Bangladesh, Bhutan, India, Nepal, Pakistan, Sri Lanka. (AN, DC, EG, HM, NE, NW, SL, TH, WG).

411. *Amphiesma xenura* (Wall, 1907):

Distribution: India. (NE). Endemic to south Asia.

412. *Argyrogena fasciolatus* (Shaw, 1802):

Distribution: Bangladesh, India, Nepal, Pakistan. (DC, HM, NW). Endemic to south Asia.

413. *Aspidura brachyorrhos* (Boie, 1827):

Distribution: Sri Lanka. (SL). Endemic to south Asia.

414. *Aspidura copei* Günther, 1864:

Distribution: Sri Lanka. (SL). Endemic to south Asia.

415. *Aspidura deraniyagalae* Gans & Fetcho, 1982:

Distribution: Sri Lanka. (SL). Endemic to south Asia.

416. *Aspidura drummondhayi* Boulenger, 1904:

Distribution: Sri Lanka. (SL). Endemic to south Asia.

417. *Aspidura guentheri* Ferguson, 1876:

Distribution: Sri Lanka. (SL). Endemic to south Asia.

418. *Aspidura trachyprocta* Cope, 1860:

Distribution: Sri Lanka. (SL). Endemic to south Asia.

419. *Atretium schistosum* (Daudin, 1803):

Distribution: Bangladesh, India, Nepal, Sri Lanka. (DC, EG, HM, SL, WG). Endemic to south Asia.

420. *Balanophis ceylonensis* (Günther, 1858):

Distribution: Sri Lanka. (SL). Endemic to south Asia.

421. *Blythia reticulata* (Blyth, 1854):

Distribution: India (NE).

422. *Boiga andamanensis* (Wall, 1909):

Distribution: India. (AN). Endemic to south Asia.

423. *Boiga barnesii* (Günther, 1869):

Distribution: Sri Lanka. (SL). Endemic to south Asia.

424. *Boiga beddomei* (Wall, 1909):

Distribution: India, Sri Lanka. (SL, WG). Endemic to south Asia.

425. *Boiga ceylonensis* (Günther, 1858):

Distribution: India, Nepal, Sri Lanka. (EG, HM, NE, SL, WG). Endemic to south Asia.

426. *Boiga cyanea* (Duméril, Bibron & Duméril, 1854):

Distribution: Bangladesh, India, Nepal. (HM, NE, NI).

427. *Boiga cynodon* (Boie, 1827):

Distribution: Bangladesh, India. (HM, NE).

428. *Boiga dendrophila* (Boie, 1827)

Boiga dendrophila subspecies:

Distribution: India (NI). Endemic to south Asia.

429. *Boiga dightoni* (Boulenger, 1894):

Distribution: India. (WG). Endemic to south Asia.

430. *Boiga forsteni* (Duméril, Bibron & Duméril, 1854):

Distribution: India, Nepal, Sri Lanka. (DC, EG, HM, SL, WG). Endemic to south Asia.

431. *Boiga gokool* (Gray, 1834):

Distribution: Bangladesh, Bhutan, India. (HM, NE). Endemic to south Asia.

432. *Boiga multifasciata* (Blyth, 1861):

Distribution: Bhutan, India, Nepal. (HM). Endemic to south Asia.

433. *Boiga multomaculata* Reinwardt in: Boie, 1827:

Distribution: Bangladesh, India (NE).

434. *Boiga nuchalis* (Günther, 1875):

Distribution: India, Nepal. (HM, NE). Endemic to south Asia.

435. *Boiga ochraceus* (Günther, 1868)

Boiga ochraceus ochraceus (Günther, 1868):

Distribution: Bangladesh, Bhutan, India. (AN, HM, NE, NI).

Boiga ochraceus stoliczkae (Wall, 1909):

Distribution: India, Nepal. (HM).

Boiga ochraceus walli Smith, 1943:

Distribution: India. (AN, NI).

436. *Boiga quincunciatus* (Wall, 1908):

Distribution: India. (NE).

437. *Boiga trigonatus* (Schneider, 1802)

Boiga trigonatus trigonatus (Schneider, 1802):

Distribution: Bangladesh, India, Nepal, Pakistan, Sri Lanka. (DC, EG, HM).

Boiga trigonatus melanocephalus (Annandale, 1904):

Distribution: Pakistan. (TH).

438. *Calamaria pavimentata* Duméril, Bibron & Duméril, 1854:

Distribution: India. (NE).

439. *Cantoria violacea* Girard, 1857:

Distribution: India. (estuarine).

440. *Cerberus rhynchops* (Schneider, 1799)

Cerberus rhynchops rhynchops (Schneider, 1799):

Distribution: Bangladesh, India, Pakistan, Sri Lanka (estuarine).

441. *Cercaspis carinata* (Kuhl, 1820):

Distribution: Sri Lanka. (SL). Endemic to south Asia.

442. *Chrysopelea ornata* (Shaw, 1802)

Chrysopelea ornata ornata (Shaw, 1802):

Distribution: Bangladesh, India. (EG, HM, NE, WG).

Chrysopelea ornata sinhaleya Deraniyagala, 1945:

Distribution: Sri Lanka. (SL). Endemic to south Asia.

443. *Chrysopelea paradisi* Boie, 1827:

Distribution: India. (AN).

444. *Chrysopelea taprobanica* Smith, 1943:

Distribution: Sri Lanka. (SL). Endemic to south Asia.

445. *Coluber bholanathi* Sharma, 1976:

Distribution: India. (EG). Endemic to south Asia.

446. *Coluber gracilis* (Günther, 1862):

Distribution: India. (DC, WG). Endemic to south Asia.

447. *Coluber karelini* Brandt, 1838:

Distribution: Pakistan. (TH).

448. *Coluber korros* Schlegel, 1837:

Distribution: India. (NE).

449. *Coluber mucosus* (Linnaeus, 1758)

Coluber mucosus mucosus (Linnaeus, 1758):

Distribution: Bangladesh, India, Nepal, Pakistan. (AN, DC, EG, HM, NE, NW, TH, WG).

Coluber mucosus maximus (Deraniyagala, 1955):

Distribution: Sri Lanka. (SL). Endemic to south Asia.

450. *Coluber nigromarginatus* (Blyth, 1854):

Distribution: Bangladesh, Bhutan, India, Nepal. (HM, NE).

451. *Coluber ravergieri* Ménétriés, 1832:

Distribution: Pakistan. (TH).

452. *Coluber rhodorachis* (Jan, 1865):

Distribution: India, Pakistan. (TH).

453. *Coluber ventromaculatus* Gray, 1834:

Distribution: India, Pakistan. (DC, HM, TH).

454. *Coronella brachyurus* (Günther, 1866):

Distribution: India. (DC). Endemic to south Asia.

455. *Dendrelaphis bifrenalis* (Boulenger, 1890):

Distribution: India, Sri Lanka. (SL, WG). Endemic to south Asia.

456. *Dendrelaphis caudolineolatus* (Günther, 1869):

Distribution: India, Sri Lanka. (WG, SL). Endemic to south Asia.

457. *Dendrelaphis cyanochloris* (Wall, 1921):

Distribution: Bangladesh, India. (AN, HM, NE, NI).

458. *Dendrelaphis gorei* (Wall, 1910):

Distribution: India. (HM, NE).

459. *Dendrelaphis grandoculis* (Boulenger, 1890):

Distribution: India. (WG). Endemic to south Asia.

460. *Dendrelaphis humayuni* Tiwari & Biswas, 1973:

Distribution: India. (NI). Endemic to south Asia.

461. *Dendrelaphis oliveri* (Taylor, 1950):

Distribution: Sri Lanka. (SL). Endemic to south Asia.

462. *Dendrelaphis pictus* (Gmelin, 1789)

Dendrelaphis pictus pictus (Gmelin, 1789):

Distribution: Bangladesh, India, Nepal. (HM, NE).

Dendrelaphis pictus andamanensis (Smith, 1943):

Distribution: India. (AN, NI). Endemic to south Asia.

463. *Dendrelaphis tristis* (Daudin, 1803):

Distribution: Bangladesh, India, Nepal, Pakistan, Sri Lanka. (DC, EG, HM, NW, SL, WG). Endemic to south Asia.

464. *Dinodon gammiei* (Blanford, 1878):

Distribution: India. (HM). Endemic to south Asia.

465. *Dinodon septentrionalis* (Günther, 1875)

Dinodon septentrionalis septentrionalis (Günther, 1875):

Distribution: India. (HM, NE).

466. *Dryocalamus gracilis* (Günther, 1864):

Distribution: India, Sri Lanka. (EG, SL, WG). Endemic to south Asia.

467. *Dryocalamus nympha* (Daudin, 1803):

Distribution: India, Sri Lanka. (EG, SL, WG). Endemic to south Asia.

468. *Eirenis mcmahoni* (Wall, 1911):

Distribution: Pakistan. (TH). Endemic to south Asia.

469. *Eirenis persica* (Anderson, 1872):

Distribution: Pakistan. (NW, TH).

470. *Elachistodon westermanni* Reinhardt, 1863:

Distribution: Bangladesh, India, Nepal. (HM). Endemic to south Asia.

471. *Elaphe cantoris* (Boulenger, 1894):

Distribution: India, Nepal. (HM, NE).

472. *Elaphe flavolineata* (Schlegel, 1837):

Distribution: India. (AN, NI).

473. *Elaphe frenata* (Gray, 1853):

Distribution: India. (NE).

474. *Elaphe helena* (Daudin, 1803)

Elaphe helena helena (Daudin, 1803):

Distribution: Bangladesh, India, Nepal, Pakistan, Sri Lanka. (DC, EG, HM, NE, NW, SL). Endemic to south Asia.

Elaphe helena monticollaris Schulz, 1992:

Distribution: India. (WG). Endemic to south Asia.

475. *Elaphe hodgsonii* (Günther, 1860):

Distribution: India, Nepal. (HM, NE, TH).

476. *Elaphe mandarina* (Cantor, 1841):

Distribution: India. (NE).

477. *Elaphe porphyracea* (Cantor, 1839)

Elaphe porphyracea porphyracea (Cantor, 1839):

Distribution: India. (HM, NE).

478. *Elaphe prasina* (Blyth, 1854):

Distribution: India. (HM, NE).

479. *Elaphe radiata* (Schlegel, 1837):

Distribution: Bangladesh, India, Nepal. (EG, HM, NE).

480. *Elaphe taeniura* (Cope, 1861)

Elaphe taeniura yunnanensis (Anderson, 1878):

Distribution: India. (HM, NE).

481. *Enhydris dussumieri* (Duméril & Libron, 1854):

Distribution: India. (WG). Endemic to south Asia.

482. *Enhydris enhydris* (Schneider, 1799):

Distribution: Bangladesh, India, Nepal. (DC, EG, HM, NE).

483. *Enhydris pakistanica* Mertens, 1959:

Distribution: Pakistan. (NW). Endemic to south Asia.

484. *Enhydris sieboldii* Schlegel, 1837:

Distribution: Bangladesh, India, Nepal. (DC, HM, NE, WG).

485. *Fordonia leucobalia* (Schlegel, 1837):

Distribution: Bangladesh, India. (estuarine).

486. *Gerardia prevostianus* (Eydoux & Gervais, 1837):

Distribution: Bangladesh, India, Sri Lanka. (estuarine).

487. *Gonyosoma oxycephalus* (Boie, 1827):

Distribution: India. (AN, NI).

488. *Haplocercus ceylonensis* Günther, 1858:

Distribution: Sri Lanka. (SL). Endemic to south Asia.

489. *Homalopsis buccata* (Linnaeus, 1754):

Distribution: Bangladesh, India. (NE).

490. *Liopeltis calamaria* (Günther, 1858):

Distribution: Bangladesh, India, Sri Lanka. (DC, HM, SL, WG). Endemic to south Asia.

491. *Liopeltis frenatus* (Günther, 1858):

Distribution: India. (NE).

492. *Liopeltis nicobariensis* (Stoliczka, 1870):

Distribution: India. (NI). Endemic to south Asia.

493. *Liopeltis rappi* (Günther, 1860):

Distribution: India, Nepal. (HM). Endemic to south Asia.

494. *Liopeltis stoliczkae* (Sclater, 1891):
Distribution: India. (HM, NE).
495. *Lycodon aulicus* (Linnaeus, 1758):
Distribution: Bangladesh, India, Nepal, Pakistan, Sri Lanka. (DC, EG, HM, NE, NW, SL, TH, WG).
496. *Lycodon capucinus* Boie, 1827:
Distribution: India, Maldives (AN, NI).
497. *Lycodon fasciatus* (Anderson, 1879):
Distribution: Bangladesh, India. (HM, NE).
498. *Lycodon flavomaculatus* Wall, 1907:
Distribution: India. (DC, WG).
499. *Lycodon jara* (Shaw, 1802):
Distribution: Bangladesh, India, Nepal. (EG, HM, NE).
500. *Lycodon laoensis* Günther, 1864:
Distribution: India. (NE).
501. *Lycodon mackinnoni* Wall, 1906:
Distribution: India. (HM). Endemic to south Asia.
502. *Lycodon osmanhilli* Taylor, 1950:
Distribution: Sri Lanka. (SL). Endemic to south Asia.
503. *Lycodon striatus* (Shaw, 1802)
Lycodon striatus striatus (Shaw, 1802):
Distribution: India, Pakistan. (DC, NW, TH).
Lycodon striatus bicolor (Nikolsky, 1903):
Distribution: Pakistan. (TH).
Lycodon striatus sinhaleyus Deraniyagala, 1955:
Distribution: Sri Lanka. (SL). Endemic to south Asia.
504. *Lycodon tiwarii* Biswas & Sanyal, 1965:
Distribution: India. (AN). Endemic to south Asia.
505. *Lycodon travancoricus* (Beddome, 1870):
Distribution: India. (DC, EG, WG). Endemic to south Asia.
506. *Lytorhynchus maynardi* Alcock & Finn, 1896:
Distribution: Pakistan. (TH). Endemic to south Asia.
507. *Lytorhynchus paradoxa* (Günther, 1875):
Distribution: Pakistan. (NW). Endemic to south Asia.
508. *Lytorhynchus ridgewayi* Boulenger, 1887:
Distribution: Pakistan. (TH).
509. *Macropisthodon plumbicolor* (Cantor, 1839)
Macropisthodon plumbicolor plumbicolor (Cantor, 1839):
Distribution: Bangladesh, India, Pakistan. (DC, EG, HM, NW, WG). Endemic to south Asia.
Macropisthodon plumbicolor palabariya Deraniyagala, 1955:
Distribution: Sri Lanka. (SL). Endemic to south Asia.
510. *Natrix tessellata* (Laurenti, 1768):
Distribution: Pakistan. (TH). Endemic to south Asia.
511. *Oligodon affinis* Günther, 1862:
Distribution: India. (WG). Endemic to south Asia.
512. *Oligodon albocinctus* (Cantor, 1839):
Distribution: Bangladesh, India, Nepal. (HM).
513. *Oligodon arnensis* (Shaw, 1802):
Distribution: Bangladesh, India, Nepal, Pakistan, Sri Lanka. (DC, EG, HM, NE, NW, SL, TH). Endemic to south Asia.
514. *Oligodon brevicaudus* (Günther, 1862):
Distribution: India. (WG). Endemic to south Asia.
515. *Oligodon calamarius* (Linnaeus, 1754):
Distribution: Sri Lanka. (SL). Endemic to south Asia.
516. *Oligodon catenatus* (Blyth, 1854):
Distribution: India. (NE).
517. *Oligodon cinereus* (Günther, 1864):
Distribution: Bangladesh, India. (NE).
518. *Oligodon cyclurus* (Cantor, 1839)
Oligodon cyclurus cyclurus (Cantor, 1839):
Distribution: Bangladesh, India. (NE).
519. *Oligodon dorsalis* (Gray & Hardwicke, 1834):
Distribution: Bangladesh, India. (NE).
520. *Oligodon dorsolateralis* (Wall, 1909):
Distribution: India. (HM).
521. *Oligodon erythrogaster* Boulenger, 1907:
Distribution: India, Nepal. (HM). Endemic to south Asia.
522. *Oligodon erythrorhachis* Wall, 1910:
Distribution: India. (NE). Endemic to south Asia.
523. *Oligodon juglandifer* (Wall, 1909):
Distribution: India. (HM). Endemic to south Asia.
524. *Oligodon kheriensis* Acharji & Ray, 1936:

Distribution: India. (HM). Endemic to south Asia.

525. *Oligodon melaneus* Wall, 1909:

Distribution: India. (NE). Endemic to south Asia.

526. *Oligodon melanozonatus* Wall, 1922:

Distribution: India. (NE). Endemic to south Asia.

527. *Oligodon nikhili* Whitaker & Dattatri, 1982:

Distribution: India. (WG). Endemic to south Asia.

528. *Oligodon sublineatus* Duméril, Bibron & Duméril, 1854:

Distribution: Sri Lanka. (SL). Endemic to south Asia.

529. *Oligodon taeniolata* (Jerdon, 1853):

Distribution: Bangladesh, India, Pakistan, Sri Lanka. (DC, HM, NW, SL, TH, WG). Endemic to south Asia.

530. *Oligodon theobaldi* (Günther, 1868):

Distribution: India. (NE).

531. *Oligodon travancoricum* Beddome, 1877:

Distribution: India. (WG). Endemic to south Asia.

532. *Oligodon venustum* (Jerdon, 1853):

Distribution: India. (WG). Endemic to south Asia.

533. *Oligodon woodmasoni* (Sclater, 1891):

Distribution: India. (AN, NI). Endemic to south Asia.

534. *Ophiodrys doriae* (Boulenger, 1888):

Distribution: India. (NE).

535. *Pareas macularius* Theobald, 1868:

Distribution: Bangladesh, India. (NE).

536. *Pareas monticola* (Cantor, 1839):

Distribution: Bangladesh, India. (HM, NE).

537. *Psammodynastes pulverulentus* (Boie, 1827):

Distribution: Bangladesh, India, Nepal. (EG, HM, NE).

538. *Psammophis condanarus* (Merrem, 1820)

Psammophis condanarus condanarus (Merrem, 1820):

Distribution: India, Nepal, Pakistan. (DC, HM, NW).

539. *Psammophis leithii* Günther, 1869:

Distribution: India, Pakistan. (NW, TH). Endemic to south Asia.

540. *Psammophis lineolatus* (Brandt, 1838):

Distribution: Pakistan. (TH).

541. *Psammophis longifrons* Boulenger, 1896:

Distribution: India. (DC). Endemic to south Asia.

542. *Psammophis schokari* (Forsskål, 1775):

Distribution: India, Pakistan. (NW, TH).

543. *Pseudoxenodon macrops* (Blyth, 1854)

Pseudoxenodon macrops macrops (Blyth, 1854):

Distribution: Bhutan, India, Nepal. (HM, NE).

544. *Rhabdophis himalayanus* (Günther, 1864):

Distribution: Bangladesh, Bhutan, India, Nepal. (HM, NE).

545. *Rhabdophis subminiatus* (Schlegel, 1837):

Distribution: Bangladesh, India, Nepal. (HM, NE).

546. *Rhabdops bicolor* (Blyth, 1854):

Distribution: India. (NE).

547. *Rhabdops olivaceus* (Beddome, 1863):

Distribution: India. (WG). Endemic to south Asia.

548. *Sibynophis bistrigatus* (Günther, 1868):

Distribution: India. (NI).

549. *Sibynophis collaris* (Gray, 1853):

Distribution: India, Nepal. (HM, NE).

550. *Sibynophis sagittaria* (Cantor, 1839):

Distribution: Bangladesh, India, Nepal. (DC, HM, NE). Endemic to south Asia.

551. *Sibynophis subpunctatus* (Duméril & Bibron, 1854)

Sibynophis subpunctatus subpunctatus (Duméril & Bibron, 1854):

Distribution: India. (DC, EG, WG). Endemic to south Asia.

Sibynophis subpunctatus ceylonicus De Silva, 1969:

Distribution: Sri Lanka. (SL). Endemic to south Asia.

552. *Spalerosophis arenarius* (Boulenger, 1890):

Distribution: India, Pakistan. (NW). Endemic to south Asia.

553. *Spalerosophis diadema* (Schlegel, 1837)

Spalerosophis diadema diadema (Schlegel, 1837):

Distribution: India, Pakistan. (DC, NW).

Spalerosophis diadema schiraziana (Jan, 1865):

Distribution: Pakistan. (TH).

554. *Stoliczkaia khasiensis* Jerdon, 1870:
Distribution: India. (NE). Endemic to south Asia.
555. *Telescopus rhinopoma* (Blanford, 1874):
Distribution: Pakistan. (NW, TH).
556. *Trachischium fusca* (Blyth, 1854):
Distribution: India, Nepal. (HM, NE, TH). Endemic to south Asia.
557. *Trachischium guentheri* Boulenger, 1890:
Distribution: Bangladesh, Bhutan, India, Nepal. (HM). Endemic to south Asia.
558. *Trachischium laeve* Peracca, 1904:
Distribution: India. (HM). Endemic to south Asia.
559. *Trachischium monticola* (Cantor, 1839):
Distribution: Bangladesh, India. (HM, NE).
560. *Trachischium tenuiceps* (Blyth, 1854):
Distribution: Bangladesh, India, Nepal. (HM).
561. *Xenochrophis asperrimus* (Boulenger, 1891):
Distribution: Sri Lanka. (SL). Endemic to south Asia.
562. *Xenochrophis cerasogaster* (Cantor, 1839):
Distribution: Bangladesh, India, Nepal, Pakistan. (HM, NE, NW). Endemic to south Asia.
563. *Xenochrophis flavipunctatum* (Hallowell, 1860)
Xenochrophis flavipunctatum flavipunctatum (Hallowell, 1860):
Distribution: India. (NE).
Xenochrophis flavipunctatum schnurrenbergeri Kramer, 1977:
Distribution: Nepal. (HM). Endemic to south Asia.
564. *Xenochrophis melanzostus* (Boie, 1826):
Distribution: India. (AN, NI). Endemic to south Asia.
565. *Xenochrophis piscator* (Schneider, 1799)
Xenochrophis piscator piscator (Schneider, 1799):
Distribution: Bangladesh, Bhutan, India, Nepal, Pakistan, Sri Lanka. (DC, EG, HM, NE, NW, SL, TH, WG).
566. *Xenochrophis punctulatus* (Günther, 1858):
Distribution: India. (NE).
567. *Xenochrophis sanctijohannis* (Boulenger, 1890):
Distribution: India, Pakistan. (HM, NW, TH). Endemic to south Asia.
568. *Xenochropis trianguligerus* (Boie, 1827):
Distribution: India. (NI).
569. *Xylophis perroteti* (Duméril & Bibron, 1854):
Distribution: India. (WG). Endemic to south Asia.
570. *Xylophis stenorhynchus* (Günther, 1875):
Distribution: India. (WG). Endemic to south Asia.

ELAPIDAE

571. *Bungarus andamanensis* Biswas & Sanyal, 1978:
Distribution: India. (AN). Endemic to south Asia.
572. *Bungarus bungaroides* (Cantor, 1839):
Distribution: India. (HM, NE).
573. *Bungarus caeruleus* (Schneider, 1801):
Distribution: Bangladesh, India, Nepal, Pakistan, Sri Lanka. (DC, EG, HM, NW, SL). Endemic to south Asia.
574. *Bungarus ceylonicus* Günther, 1864
Bungarus ceylonicus ceylonicus Günther, 1864:
Distribution: Sri Lanka. (SL). Endemic to south Asia.
Bungarus ceylonicus karavala Deraniyagala, 1955:
Distribution: Sri Lanka. (SL). Endemic to south Asia.
575. *Bungarus fasciatus* (Schneider, 1801):
Distribution: Bangladesh, India, Nepal. (EG, HM, NE).
576. *Bungarus lividus* Cantor, 1839:
Distribution: Bangladesh, India. (HM, NE). Endemic to south Asia.
577. *Bungarus niger* Wall, 1908:
Distribution: Bangladesh, Bhutan, India. (HM, NE). Endemic to south Asia.
578. *Bungarus sindanus* Boulenger, 1897
Bungarus sindanus sindanus Boulenger, 1897:
Distribution: India, Pakistan. (DC, NW). Endemic to south Asia.
Bungarus sindanus razai Khan, 1985:
Distribution: Pakistan. (NW). Endemic to south Asia.
Bungarus sindanus walli Wall, 1907:
Distribution: Bangladesh, India, Nepal. (HM). Endemic to south Asia.

579. *Calliophis beddomei* Smith, 1943:
Distribution: India. (EG). Endemic to south Asia.
580. *Calliophis bibroni* (Jan, 1858):
Distribution: India. (WG). Endemic to south Asia.
581. *Calliophis macclellandi* (Reinhardt, 1844)
Calliophis macclellandi macclellandi (Reinhardt, 1844):
Distribution: India. (NE).
Calliophis macclellandi univirgatus (Günther, 1858):
Distribution: India, Nepal. (HM).
582. *Calliophis melanurus* (Shaw, 1802)
Calliophis melanurus melanurus (Shaw, 1802):
Distribution: Bangladesh, India. (DC, WG). Endemic to south Asia.
Calliophis melanurus nigrescens Günther, 1862:
Distribution: India. (WG). Endemic to south Asia.
Calliophis melanurus sinhaleyus Deraniyagala, 1951:
Distribution: Sri Lanka. (SL). Endemic to south Asia.
583. *Naja naja* (Linnaeus, 1758):
Distribution: Bangladesh, India, Nepal, Pakistan, Sri Lanka. (DC, EG, HM, NW, WG). Endemic to south Asia.
584. *Naja kaouthia* Lesson, 1831:
Distribution: Bangladesh, India. (AN, HM, NE).
585. *Naja oxiana* (Eichwald, 1831):
Distribution: India, Pakistan. (TH).
586. *Ophiophagus hannah* (Cantor, 1836):
Distribution: Bangladesh, Bhutan, India, Nepal. (AN, EG, HM, NE, WG).

HYDROPHIIDAE

587. *Astrotia stokesii* (Gray, 1846):
Distribution: India, Pakistan, Sri Lanka. (marine).
588. *Enhydrina schistosus* (Daudin, 1803):
Distribution: Bangladesh, India, Pakistan. (marine).
589. *Hydrophis bituberculatus* Peters, 1873:
Distribution: Sri Lanka. (marine).
590. *Hydrophis caerulescens* (Shaw, 1802):
Distribution: Bangladesh, India, Pakistan. (marine).
591. *Hydrophis fasciatus* (Schneider, 1799)
Hydrophis fasciatus fasciatus (Schneider, 1799):
Distribution: Bangladesh, India, Pakistan. (marine).
592. *Hydrophis lapemoides* (Gray, 1849):
Distribution: India, Pakistan, Sri Lanka. (marine).
593. *Hydrophis mamillaris* (Daudin, 1803):
Distribution: India, Pakistan, Sri Lanka. (marine).
594. *Hydrophis nigrocinctus* Daudin, 1803:
Distribution: Bangladesh, India, Sri Lanka. (marine).
595. *Hydrophis obscura* Daudin, 1803:
Distribution: Bangladesh, India, Sri Lanka. (marine).
596. *Hydrophis ornatus* (Gray, 1842)
Hydrophis ornatus ornatus (Gray, 1842):
Distribution: Bangladesh, India, Pakistan, Sri Lanka. (marine).
597. *Hydrophis stricticollis* Günther, 1864:
Distribution: Bangladesh, India, Sri Lanka. (marine).
598. *Kerilia jerdonii* Gray, 1849
Kerilia jerdonii jerdonii Gray, 1849:
Distribution: India, Sri Lanka. (marine).
599. *Lapemis curtus* Shaw, 1802:
Distribution: Bangladesh, India, Pakistan, Sri Lanka. (marine).
600. *Laticauda laticaudata* (Linnaeus, 1758):
Distribution: Bangladesh, India. (marine).
601. *Laticauda colubrina* (Schneider, 1799):
Distribution: Bangladesh, India. (marine).
602. *Leioselasma cyanocincta* (Daudin, 1803):
Distribution: Bangladesh, India, Pakistan, Sri Lanka. (marine).
603. *Leiocephalus spiralis* (Shaw, 1802):
Distribution: India, Pakistan, Sri Lanka. (marine).
604. *Microcephalophis cantoris* Günther, 1864:
Distribution: Bangladesh, India, Pakistan. (marine).
605. *Microcephalophis gracilis* (Shaw, 1802):
Distribution: Bangladesh, India, Pakistan, Sri Lanka. (marine).
606. *Pelamis platurus* (Linnaeus, 1766):

Distribution: India, Maldives, Pakistan, Sri Lanka. (marine).

607. *Praescutata viperina* (Schmidt, 1852):

Distribution: India, Pakistan, Sri Lanka. (marine).

VIPERIDAE

608. *Agkistrodon himalayanus* (Günther, 1864):

Distribution: India, Nepal, Pakistan. (HM, TH). Endemic to south Asia.

609. *Echis carinata* (Schneider, 1801)

Echis carinata carinata (Schneider, 1801):

Distribution: India, Sri Lanka. (DC, EG, SL). Endemic to south Asia.

Echis carinata astolae Mertens, 1970:

Distribution: Pakistan. (TH). Endemic to south Asia.

Echis carinata multisquamatus Cherlin, 1981:

Distribution: Pakistan. (TH).

Echis carinata sochureki Stemmler, 1969:

Distribution: Bangladesh, India, Pakistan. (DC, NW, TH). Endemic to south Asia.

610. *Eristicophis macmahoni* Alcock & Finn, 1896:

Distribution: India, Pakistan. (TH).

611. *Hypnale hypnale* (Merrem, 1820):

Distribution: India, Sri Lanka. (SL, WG). Endemic to south Asia.

612. *Hypnale nepa* (Laurenti, 1768):

Distribution: Sri Lanka. (SL). Endemic to south Asia.

613. *Hypnale walli* Gloyd, 1977:

Distribution: Sri Lanka. (SL). Endemic to south Asia.

614. *Ovophis monticola* (Günther, 1864)

Ovophis monticola monticola (Günther, 1864):

Distribution: Bangladesh, India, Nepal. (HM, NE).

615. *Protobothrops jerdonii* (Günther, 1875)

Protobothrops jerdonii jerdonii (Günther, 1875):

Distribution: India. (NE).

616. *Protobothrops mucrosquamatus* (Cantor, 1839):

Distribution: Bangladesh, India. (NE).

617. *Trimeresurus albolabris* (Gray, 1842)

Trimeresurus albolabris septentrionalis Kramer, 1977:

Distribution: Bangladesh, India, Nepal. (HM, NE).

618. *Trimeresurus cantori* (Blyth, 1846):

Distribution: India. (AN, NI). Endemic to south Asia.

619. *Trimeresurus erythrurus* (Cantor, 1839):

Distribution: Bangladesh, India, Nepal. (HM, NE).

620. *Trimeresurus gramineus* (Shaw, 1802):

Distribution: Bangladesh, India, Nepal. (EG, HM, WG). Endemic to south Asia.

621. *Trimeresurus huttoni* Smith, 1949:

Distribution: India. (WG). Endemic to south Asia.

622. *Trimeresurus labialis* Fitzinger, 1861:

Distribution: India. (NI). Endemic to south Asia.

623. *Trimeresurus macrolepis* Beddome, 1862:

Distribution: India. (WG). Endemic to south Asia.

624. *Trimeresurus malabaricus* (Jerdon, 1854):

Distribution: India. (WG). Endemic to south Asia.

625. *Trimeresurus popeiorum* Smith, 1937:

Distribution: Bangladesh, India. (HM, NE).

626. *Trimeresurus purpureomaculatus* (Gray & Hardwicke, 1830)

Trimeresurus purpureomaculatus andersoni Theobald, 1868:

Distribution: India. (AN, NI). Endemic to south Asia.

627. *Trimeresurus stejnegeri* Schmidt, 1925

Trimeresurus stejnegeri yunnanensis Schmidt, 1925:

Distribution: India, Nepal. (HM, NE).

628. *Trimeresurus strigatus* Gray, 1842:

Distribution: India. (WG). Endemic to south Asia.

629. *Trimeresurus trigonocephala* (Sonnini & Latreille, 1801):

Distribution: Sri Lanka. (SL). Endemic to south Asia.

630. *Vipera lebetina* (Linnaeus, 1758)

Vipera lebetina obtusa Dvigubsky, 1832:

Distribution: Pakistan. (TH).

631. *Vipera persicus* (Duméril & Bibron, 1854)

Vipera persicus persicus (Duméril & Bibron, 1854):

Distribution: Pakistan. (TH).

632. *Vipera russellii* (Shaw & Nodder, 1797)

Vipera russellii russellii (Shaw & Nodder, 1797):

Distribution: Bangladesh, India, Pakistan, Sri Lanka. (DC, EG, HM, NW, SL, TH). Endemic to south Asia.

SUMMARY

The Indian region is exceptionally diverse in reptiles, with 632 species represented. This fauna, along with the 246 amphibian species recorded from the Subcontinent (Das, in prep), is thus one of the richest in the world: 878 species of amphibians and reptiles, far greater than those of much larger areas, such as China, with 661 species (Zhao and Adler, 1993), North America north of the Rio Grande River, with 496 species (Collins, 1990) or Europe east of the Ural Mountains, with 187 species (Böhme, *in* Zhao and Adler, 1993). This fauna is therefore comparable to several tropical countries in the Indo-Pacific and Neotropical regions, such as Indonesia, with an almost identical figure (870), Australia, with 883 species, Colombia, with 790 species and Brazil, with 983 species (Mittermeier *et al.*, 1992).

The reptiles of the south Asian region is also diverse, with 185 genera and 25 families. Geological features, such as the Himalayan range, and long periods of isolation of both the mainland and the islands in the Bay of Bengal (composed of the Andaman and Nicobar Islands) have contributed to the evolution of many endemics, both at the generic and specific levels. Among this fauna, as many as 306 are restricted to a single physiographic zone and not found extralimitally, an additional 98 species being found in more than one zone but not outside the Indian region. Endemicity is 64% (404 of 632 species), high for a largely continental landmass.

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THE IDENTITY OF THE PLIO-PLEISTOCENE TURTLE, *GEOEMYDA PILGRIMI* PRASAD AND SATSANGI, 1967 (TESTUDINES: CRYPTODIRA: BATAGURIDAE)

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(with four text-figures)

ABSTRACT: The taxonomic status of the Plio-Pleistocene batagurid turtle from the Indian Siwaliks, *Geoemyda pilgrimi* Prasad and Satsangi (1967) is reevaluated. Based on an examination of the holotype, a partially preserved shell, it is concluded that the material is inseparable from the extant *Hardella thurjii* (Gray, 1831) which is distributed over the north of the south Asian region, and is being synonymized under it.

KEY WORDS: *Geoemyda pilgrimi*, taxonomy, *Hardella thurjii*, Plio-Pleistocene, India.

INTRODUCTION

The Plio-Pleistocene deposits of the Siwaliks of northern India and Pakistan have yielded large number of fossil turtles of the family Bataguridae, which have been described by several workers, including Lydekker (1876-1887). However, nearly all have been synonymized by Smith (1931) under extant species. Since Smith (1931), a further two species of fossil turtle belonging to the family Bataguridae have been described from India: *Geoclemys sivalensis* by Tewari and Badam (1969) from Punjab, which has been synonymized under *Geoclemys hamiltonii* by Das (1991a) and *Geoemyda pilgrimi* by Prasad and Satsangi (1967), whose specific status will be dealt with in this paper. The description of *Geoemyda pilgrimi* appeared in an abstract in 1963 (Prasad and Satsangi, 1963) and the complete paper appeared four years later (Prasad and Satsangi, 1967), Prasad (1968) republishing the description in a monograph of the fossil vertebrates of Haritalyanagar, Himachal Pradesh, northern India.

The fossil turtle was examined at the Geological Survey of India (GSI), Calcutta, India, and Recent turtles were studied at the Natural History Museum, London, Great Britain (BMNH), Bangladesh National Museum, Dhaka, Bangladesh (BNM), Madras Crocodile Bank Trust, Madras, India (MCBT), Naturhistorisches Museum, Vienna, Austria (NMW), Niederösterreiches Landmuseum, Vienna, Austria (NOLM), Oxford University (Zoological Museum) (OM), Oxford, Great Britain, Musée National d'Histoire Naturelle, Paris, France (MNHN), Natur-Museum und Forschung-Institut Senckenberg, Frankfurt/Main, Germany (SMF), Zoologisches Forschunginstitut und Museum Alexander Koenig, Bonn, Germany (ZFMK) and Zoological Survey of India, Calcutta, India (ZSI). Nomenclature of shell components follows Dundee (1989); in addition, the following terms have been used: suture (juncture between two bony plates), seam (juncture between two scutes) and sulcus (impression of seam on shell bones).

Referred material: GSI 18091. An incomplete shell (Fig. 1), showing four vertebrals, three pleurals and eight marginals. The anterior part of the carapace is partially preserved. The plastron is entire, except for the left gular and both anals. Cranial, limb and tail bones are unpreserved.

Measurements: The following measurements were taken on the fossil material with dial vernier calipers: Fossil length 168.7 mm, fossil width 132.4 mm; shell measurements: Nuchal length 9.1 mm, nuchal width 19 mm, vertebral I length 31.9 mm.

The following estimates were made based on the restored diagram (Fig. 2): Straight carapace length (SCL)- Distance between cervical at restored carapace midline to the posterior-most point of marginal XII: 200 mm; straight carapace width (SCW)- Distance across widest part of re-

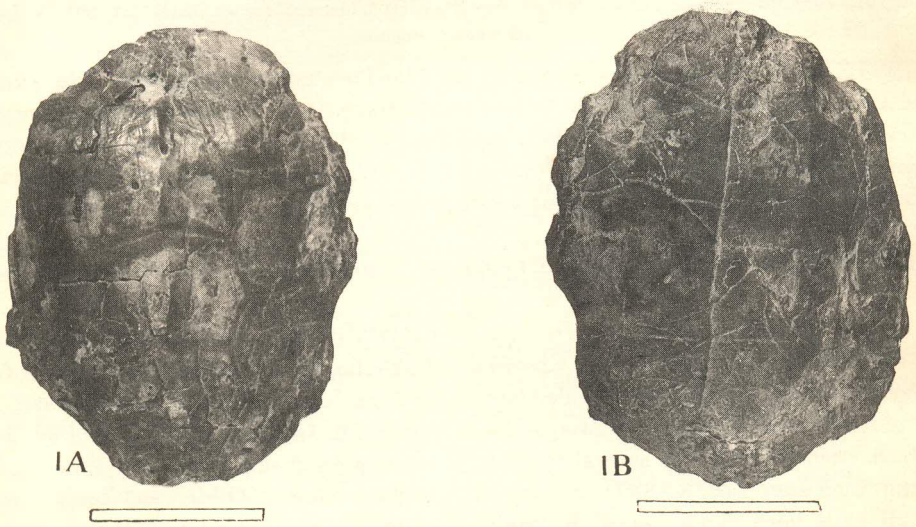
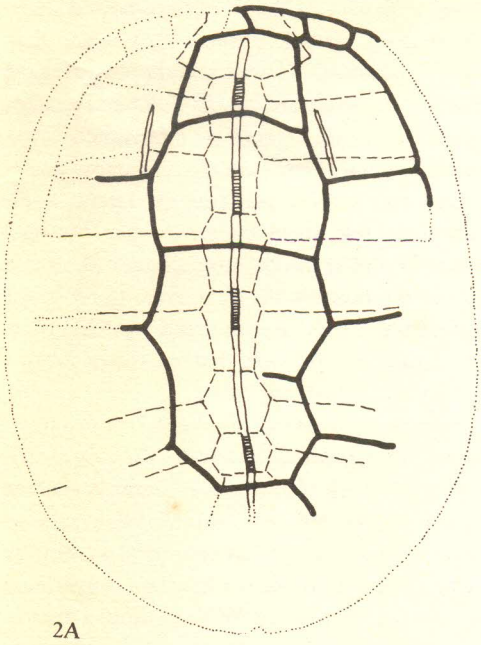


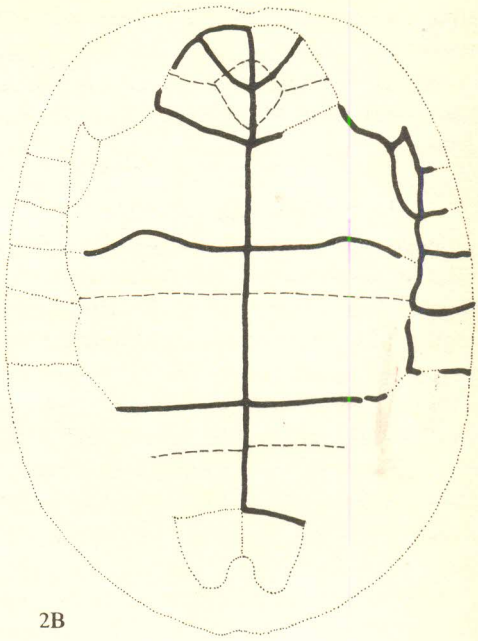
FIGURE 1: Carapace (1A) and plastron (1B) of the type of *Geomyda pilgrimi* (GSI 18091). Markers represent 50 mm.

stored carapace, perpendicular to the longitudinal body axis: 140 mm; plastron length (PL)- Distance between the anterior-most tip of the gulars and the posterior-most tip of the anals of the restored plastron: 172 mm.

Description: The small shell (Fig. 2), when restored has an estimated straight carapace length of 200 mm and a straight carapace width of 140 mm. Shell elongate (SCW/SCL ratio 0.70) and moderately convex in profile (SH/SCL ratio 0.32), the highest point situated on the middle of vertebral III sulcus. Shell laterally flared (SH/SCW ratio 0.46). Vertebral keel greatly developed, interrupted with a series of four nodose prominences. Neural formula: ?-?-6-6-6-6-? (neurals I, II and VIII missing). Neurals I-IV short-sided in front; neural V transitional, somewhat wider than neural IV; neural VI relatively very wide (wider than long) and short. A pair of weak lateral keels present, parallel to the vertebral keel on pleural I sulcus. Cervical trapezoid, without indentation, widest behind, length/width ratio 0.94. Vertebral I elongate, trapezoid (vertebral I length/vertebral I width ratio 0.82) and wider posteriorly; vertebral II (vertebral II length/vertebral II width ratio 0.88), vertebral III (vertebral III length/vertebral III width ratio 0.63) and vertebral IV (vertebral IV length/vertebral IV width ratio 0.97) wider and hexagonal. Proneural hexagonal, broader than long (proneural length/width ratio 0.51), narrowed anteriorly. Pleurals I-III narrower anteriorly, where they contact the neurals, than posteriorly. Plastron approximately 172 mm, truncated anteriorly, shorter than the carapace (PL/SCL ratio 0.86). Humero-pectoral sulcus does not enter the suture demarking the entoplastron. Interabdominal sulcus longest, interhumeral sulcus shortest of the seams preserved (both anals missing). Anterior lobe of plastron shorter than the posterior lobe, the former estimated to be the wider.



2A



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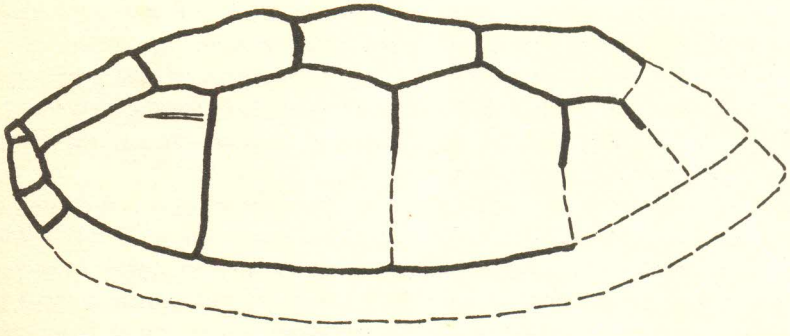

2C

FIGURE 2: Partially restored views of the shell of the type of *Geoemyda pilgrimi*. 2A, carapace (marker = 50 mm); 2B, plastron (marker = 50 mm) and 2C, shell in lateral view (marker = 40 mm). Scutes are indicated with thick solid lines; sulci with broken lines; the vertebral and pleural keels with narrow solid lines, shaded at the nodose regions and restored areas with dotted lines.

Locality and Age: *Geoemyda pilgrimi* was collected from the Tatrot beds east of Chakrana in Bilaspur District, Himachal Pradesh, India (Prasad and Satsangi, 1967). The Upper Tatrots are considered transitional between Pliocene Dhok Pathan and Pleistocene Pinjor by Prasad (1968).

TAXONOMIC STATUS

Species of the family Bataguridae currently referred to the genus *Geoemyda* include *G. silvatica* Henderson, 1912, median carapace length to 131 mm, terrestrial turtle from the Western Ghats forests (Das, 1991b), *G. spengleri* (Gmelin, 1789), length to 107.1 mm, from southern China to Indo-China (Pritchard, 1979; Moll *et al.*, 1986) and *G. japonica* Fan (1931) to 155.7 mm, from Okinawa island in Japan. The last mentioned species was considered a subspecies of *G. spengleri* in older works (e.g., Pritchard, 1979) but has been shown to be a valid species by Yasukawa *et al.* (1992). All three of these species possess the following suite of characteristics that are not shown by the fossil material under review: depressed carapace with uninterrupted vertebral keels (as opposed to the moderately convex carapace with interrupted vertebral keel in *G. pilgrimi*), elongated vertebral IV (squarish vertebral IV in *G. pilgrimi*), prominent pleural keels (weak in *G. pilgrimi*). In addition, *Geoemyda pilgrimi* is immediately separable from members of the *Geoemyda* complex in possessing hexagonal neurals that are short-sided in front. Prasad and Satsangi (1967) considered *Geoemyda pilgrimi* to be "closely allied to *Clemmys watsoni*", which, according to them, is "closely related to *Geoemyda trijuga*". The basis of these relationships is unclear: *Melanochelys trijuga* (to which *G. trijuga* has been assigned by McDowell, 1964) is not closely related to *Hardella* (a monotypic genus, containing *H. thurjii*), in the scheme of McDowell (1964) and Hirayama (1984). *Clemmys watsoni* had been transferred to the genus *Geoemyda* as early as 1889 by Lydekker, and subsequently by Smith (1931), who considered this particular taxon to be closely-related to '*Geoemyda trijuga*' (= *Melanochelys trijuga*).

The neural configuration shown by *Geoemyda pilgrimi*, with neurals I to IV hexagonal and short-sided in front, neural V somewhat wider than neural IV and neural VI wide and short, wider than long, are features shared by *Hardella* and another batagurid, *Morenia petersi*. Its interrupted vertebral keel, laterally flared carapace, narrow posterior lobe of plastron, presence of lateral keels trapezoid cervical, strongly convex seam between vertebrals I and II, moderately convex shell and failure of the humero-pectoral seam to cross the entoplastron, which is traversed by the gular-humeral sulci, are features that are restricted to a single living batagurid turtle, *Hardella thurjii*. Two subspecies are considered valid, both extant: *H. thurjii thurjii*, which lacks lateral keels and *H. thurjii indi*, which shows weak lateral keels (see Figure 9e in Das, 1991b). *Hardella thurjii* shows extreme sexual dimorphism in body size, females growing to 61 cm, while males attain only 18 cm (Das, 1991a). Minton (1966) mentioned that in (presumably adult) females, the plastrons range between 97-101% of the carapace length, while in males, it is 91-94%. In '*Geoemyda pilgrimi*', the ratio was 86%, thus closer to the range exhibited by males. Additionally, the lack of carapacial fontanelles (see Fig. 2A), characteristic of adult females, but not of adult males of *Hardella thurjii*, suggests that the present specimen is an adult male. The presence of lateral keels makes it possible to identify it as the western subspecies *indi*. *Geoemyda pilgrimi* Prasad and Satsangi (1967) thus joins the synonymy of *Hardella thurjii indi* Gray, 1870. However, the type locality of the fossil almost abuts the known range of the typical (eastern) subspecies than of *indi* (Figure 3).

In the shape of the entoplastron, the present specimen does appear to differ from that of *Hardella thurjii* as illustrated in Smith (1931: Fig. 4; opposite pg. 50), which shows a bell-shaped figure, widest posteriorly. In the material at hand, the entoplastron is more shield-shaped, with the anterior ends shorter than the posterior. Ontogenetic changes of the entoplastron or sexual dimorphism in shell components in *Hardella* is almost unknown, given the rarity of juveniles and adult males in museum collections as well as in the wild, a fact alluded to by Anderson (1878). However,

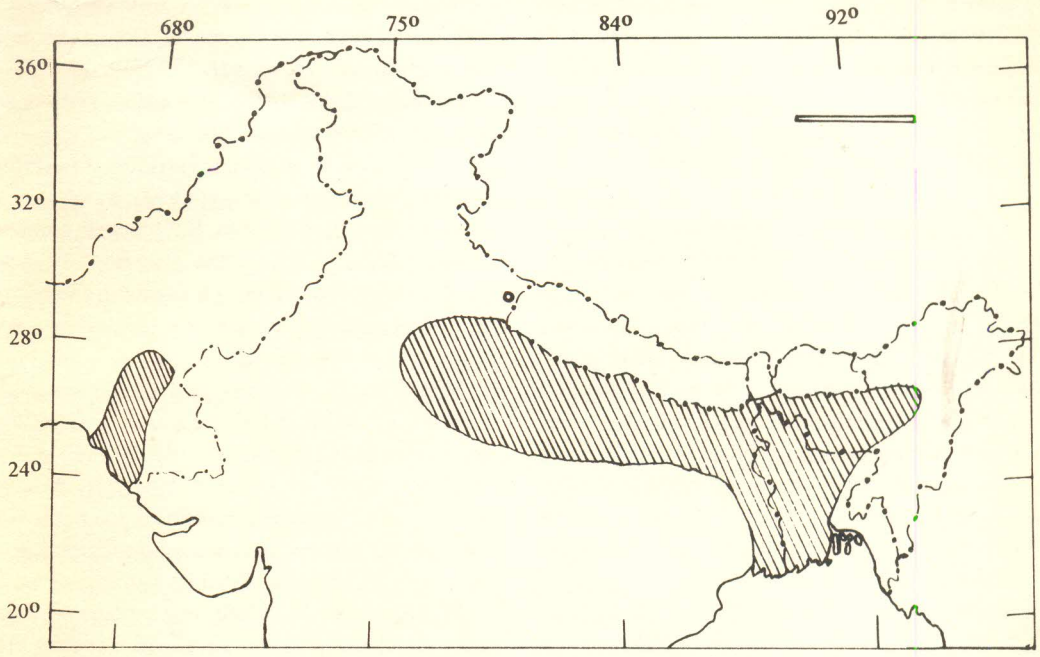

FIGURE 3: Map of south Asia, showing the known distribution of *Hardella thurjii* (hatched) and the type locality of *Geoemyda pilgrimi* (circle). Marker represents 400 km.

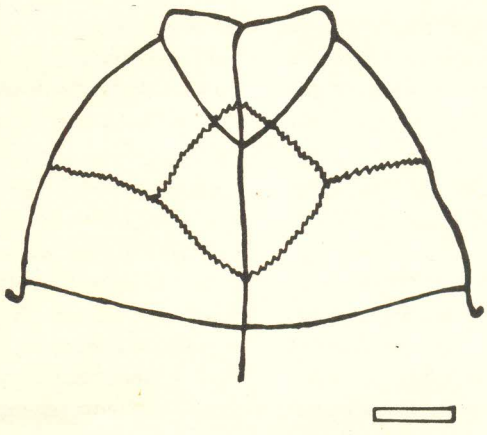

FIGURE 4: Anterior lobe of plastron of a juvenile male *Hardella thurjii* (straight carapace length 159.0 mm; straight plastron length 143.20 mm), showing the shape and position of the entoplastron (MCBT: Chambal River, India).

the shell of a juvenile male (straight carapace length 159.0 mm; straight plastron length 143.20 mm) from Chambal River, India (MCBT), shows a squarish entoplastron, approximately intermediate between the two shapes described (Fig. 4). I therefore hereby assign the Plio-Pleistocene batagurid *Geoemyda pilgrimi* to the extant species *Hardella thurjii*, which is widespread in the northern parts of the Indian subcontinent (Fig. 3).

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SOME NOTABLE RECORDS OF TESTUDINES FROM THE INDIAN AND BURMESE SUBREGIONS

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ABSTRACT: Observations on 21 species of Testudines from the Indian and Burmese Subregions are discussed, including 11 terrapins, three land tortoises and seven softshells. Major range extensions are documented for *Melanochelys tricarinata* and *M. trijuga*, as well as for *Aspideretes gangeticus*. In other cases, small range extensions and the confirmation of overlooked records are documented and clarified. Systematic and up-to-date information on geographic distributions of Testudines in this area are very scant, and the records presented here help to fill in many zoogeographical and biological gaps.

KEY WORDS: Testudines, Distribution, India, Pakistan, Bangladesh, Myanmar.

INTRODUCTION

Interest in non-marine Testudines in India resurged rapidly in the 1980s with a series of surveys carried out by E. O. Moll and collaborators; numerous publications resulted from these studies (e.g., Moll and Vijaya, 1986; Moll, 1987a; b). Further field work on Indian turtles and tortoises was carried out in northern, western and southern India, as well as briefly in Pakistan and Myanmar, from June 1986 to September 1987 by JGF. Popular accounts were published (Frazier, 1987a; 1988; 1989a; b; c; d; e; 1990), and an interim report on the findings (Frazier, 1987b) was circulated to various colleagues, and some generalities based on this information were reported in subsequent publications (Stubbs, 1989; Swingland and Klemens, 1989; Das, 1991). From January to July 1988 ID carried out surveys in north-east and southern India and from December 1988 to February 1989 in Bangladesh, and reports on some of these findings have been published (Das, 1989a; b; 1990a; b; 1991). From May 1991 to July 1992, a large bi-national project on the freshwater turtles and land tortoises of India was conducted, with the field research spearheaded by S. Bhupathy, and guidance provided by B. C. Choudhury and E. O. Moll; reports of these findings are now being distributed (Bhupathy *et al.*, 1992; Choudhury and Bhupathy, 1992; 1993).

During these studies, specimens have been found well outside the known ranges of the species, or in localities that help to define the geographic distributions of the species. The initial intention of JGF was to produce one comprehensive report, consolidating the many and diverse sources of information; however, this has not proved feasible, and the present report is finally to put on record part of the information from field studies on non-marine Indian Testudines.

In addition to the field data, bibliographic research revealed previously published records that had been overlooked, as well as other information relevant to the species in question. These data are integrated in the present study, together with data from specimens in collections that have been overlooked. For the present work the identities of the animals were determined by using the diagnostic keys in Smith (1931) and Moll (1987a; 1987b); sources of information on geographic ranges are Smith (1931), Das (1985), Iverson (1986; 1992), Moll and Vijaya (1986) and Moll (1987a; 1987b); nomenclature follows Meylan (1987); Iverson (1986; 1992) and Moll (1987a; 1987b).

Each species account includes a brief description of the localities where specimens were found, the specimens examined, and other information

relevant to the species, locality and/or specimens. A brief explanation of the relevance of the locality (or localities) is given, if it is not obvious. In the cases of five species (*Geochelone elegans*, *Indotestudo elongata*, *I. forstenii*, *Melanochelys trijuga*, and *Lissemys punctata*), only a resumé of information is presented; in each of these cases a more detailed account of the species will be published separately.

Abbreviations used in the text include: CCL = curved carapace length (at the midline of the shell; i.e. not necessarily the maximum length); CCW = curved carapace width (perpendicular to the long axis of the body); HW = head width (greatest perpendicular to long axis); PL = plastron length (at the midline); SCL = straight carapace length (at midline; i.e., not necessarily the maximum length); SCN = supracaudal notch (depth of notch between supracaudals); SCW = straight carapace width (greatest width, perpendicular to long axis); SH = maximum shell height (perpendicular to plastron); BM = body mass. All measurements are in mm, except mass which is in g, or as specified otherwise. Usual museum abbreviations include: AMNH = American Museum of Natural History; BMNH = Natural History Museum, London; USNM = United States National Museum; ZSI = Zoological Survey of India, which includes the main collection (the National Zoological Collection) in Calcutta, together with numerous collections in the field and research stations. JGF refers to the collection of the first author, ID to those of the second.

In cases where a definitive common name was recorded from a study locality, the transliteration is given immediately after the scientific name. Where there is a photographic record for a specimen, 'photos' is indicated. Scutes, or scales, that occur in pairs are recorded as 'x/y' where 'x' is the number on the left and 'y' the number on the right.

RESULTS

BATAGURIDAE

***Batagur baska* (Gray)**

On 2 September 1987 a turtle was seen in the tank at Botataung Pagoda, Yangoon (Rangoon), Myanmar (Burma). It appeared to have a carapace about 50 cm long. There is little doubt that it had been released into the tank, and the original locality is unknown.

As Moll (1987a:550) remarked, *B. baska* is easily confused with *Kachuga kachuga*, and it is impossible from a few sightings of a freely swimming animal to ascertain with total confidence which of these two species was in the tank, although the animal in question was definitely not a male *K. kachuga* in breeding colouration. However, of the two possibilities, only *B. baska* is definitely known to occur in Myanmar (Iverson, 1986:21, 44; 1992:105, 132; Moll, 1987a:552). There has been no report of *B. baska* from Myanmar in more than half a century (van Dijk, 1993), and this species is regarded as endangered throughout most of its range. The nearby Indian (Das, 1986a; 1986b; 1987:21; 1989c; 1991:75) and Bangladeshi (Whitaker, 1982; Khan, 1982a; 1987; Das, 1989a; b) populations are evidently small; and if there still is a wild population in Myanmar (Anon, 1984:98; 1985:48), it is also likely to be small.

The geographic range of this turtle in India shown in Tikader and Sharma (1985:52) is inaccurate, for *B. baska* is not widely distributed along the West Bengal coast, as they indicate. Furthermore, in contrast to their map, there are no records of this estuarine species from the Indian states of Tripura and Mizoram, which are far from the coast.

***Cuora amboinensis* (Daudin)** *Chapa Katha* ("closed turtle") Bengali

In addition to the records from Mangaldai, Assam, reported by Moll and Vijaya (1986:57), there are two specimens from Kaziranga National Park (Das, 1990a). The species has also been seen in Manas, and there is evidence of several other records in the region (Das, 1990a), so its occurrence in Assam is confirmed on both sides of the Brahmaputra River.

A specimen from Salutikar, north of Sylhet City, Bangladesh, was measured on 16 January 1989: CCL = 222. The fact that the species has

also been recorded from Cox's Bazar (Khan, 1982a; 1982b:31) indicates that it may occur in the area between these known localities, i.e., at least in the Indian State of Tripura, if not also in Mizoram and Manipur.

***Cyclemys dentata* (Gray)** *Kachup* or *Kochchop* Bengali, *Kachua* or *Thateru* Nepali (all are generic names, used for turtles or terrapins in general).

At the ZSI Eastern Regional Station, Shillong is a specimen (ZSI/ER VI/1439) from Sangber Camp, North Cachar Hills, Assam, collected by S. K. Talukdar on 17 March 1970. Its measurements are: SCL = 108; SCW 86 mm.

On 3 April 1987, at Mahananda Wildlife Sanctuary (Sukhna), Darjeeling Dist. (North Bengal), West Bengal, a carapace (JGF 5439; now in USNM) was collected. This area is characterized by tropical moist deciduous forest. The specimen was said, by a Forest Department worker, to have been caught in approximately 30 cm of water in the Panchenai River about the first week of March, and it was later eaten. It measures: CCL = 152, SCL = 136, CCW = 140, SCW = 110, SCN = 2, SH 43. Colouration: thin black lines radiate out from the centre of each scute of the carapace. Scales: marginals are conspicuously dentate.

As reviewed by Frazier (1986), there is a mention of this species half a century ago from nearly the same locality in West Bengal. Shaw (1931) reported a specimen, the description of which was tentatively identified by Annandale, as '*Cyclemys dhor*' (=*dentata*). About 20 cm long, the specimen was from a shallow stream in Sivoke Dist., West Bengal. Unfortunately, this specimen cannot now be traced in the collections of either the Bengal Natural History Society (Darjeeling) or the Zoological Survey of India (Calcutta). Ingles *et al.* (1920:158) had earlier predicted that this species occurs in Jalpaiguri Dist. of North Bengal. A specimen in the ZSI (Reg. No. 12603) was collected in the Joranti River, W. Dooars, North Bengal, probably at the end of the last century.

The distribution shown by Tikader and Sharma (1985:83) omits a large part of the western extent of the range (e.g., the Garo Hills and northern West Bengal). As Das (1985:51) mentioned, there had been no recent records from India; ZSI/ER VI/1493 and JGF 5439 appear to be the first records in half a century. The occurrence of specimen JGF 5439 nearly 200 km north-west of the Brahmaputra River suggests that the species may occur along the Himalayan foothills in neighbouring Nepal and northern Bihar. Although *Cyclemys dentata* has been considered as part of the Indo-Chinese and Malayan fauna (Hora, 1948:291), a distribution across the Terai, or Himalayan foothills, would be consistent with ranges of other Testudine species that have been assigned to the same zoogeographic region (e.g., *Indotestudo elongata* and *Melanochelys* spp.).

***Geoclemys hamiltonii* (Gray)** *Nal dura* ("reed turtle") Assamese, *Bagh kathua* Bengali.

Several juvenile-sized specimens caught by Hashem Jogi (an animal collector) were photographed on 16 June 1986 in Karachi, Pakistan. These were said to have come from a lake at the lower reaches of the Indus River. A recent review of the distribution of this species, showing point localities (Iverson, 1986:34; 1992:121) has not included this area. In addition, several other localities from which this terrapin has been reported have also missed attention, so a brief review of additional published and unpublished records is warranted.

Shorely (1968:68) simply stated that this species is found in 'Upper Sind'. Ghalib *et al.* (1976:38) listed several localities along the Indus (and parallel streams) ranging from Gujranwala Dist. to Hyderabad Dist. However, it is unclear on what specimens they based these records; only one specimen of this species was in their collections in June 1986: Reg. No. RO2 - Zoological Survey Department, Karachi, Pakistan, wet specimen from Jacobabad, Sind, collected in 1973 by the ZSD staff. Duda and Sahi (1977) reported the species from Satwari, Jammu and Kashmir, and Prof. P. L. Duda (*in litt.* 8 July 1987) reported that the species is also present in the Jammu area. A report was made by Shaw (1931) of a specimen 'near to' *Damonia* (= in part *Geoclemys*) *hamiltonii* from Sukhna, Darjeeling Dist. (North Bengal),

West Bengal. Unfortunately, the specimen cannot be traced, and the original identity was anyway uncertain. Vijaya (1983) reported this species from Kaziranga National Park, Jorhat Dist., Assam, a locality not included by Iverson in 1986 (pg. 34), but later included in 1992 (pg. 121). Recent information presented in Das (1990a), on eight specimens from Kaziranga National Park, Golaghat Dist., as well as two ZSI specimens from Sonarpur, Kamrup Dist. and West Khasi Hills, Meghalaya, leaves no doubt that this terrapin is found in several areas of north-eastern India.

In summary, especially given records from rivers in the Thar Desert (Mathur, 1975; Prakash, 1982), Bharatpur, Rajasthan (Bhupathy and Vijayan, 1991; Das and Bhupathy, in press), and north-western Bihar (Moll and Vijaya, 1986:58), *Geoclemys hamiltonii* appears to be much more widely distributed than has been indicated in recent reviews (e.g., Iverson 1986:34). It is remarkable that Bhupathy and Vijayan (1991) recorded this turtle from only one out of 25 riverine and wetland sampling sites in eastern Rajasthan; this indicates that it may be difficult to observe and/or has specialized habitat requirements. In this light, it is noteworthy that Blyth (1864:61) reported this turtle to be second to "*E. tectum*" in commonness in the Calcutta area. Although essentially Indo-Gangetic-Brahmaputran in distribution, this species can occur considerable distances from the present-day courses of these major rivers.

On the other hand, the distribution shown in Tikader and Sharma (1985:80) is inaccurate by greatly exaggerating the range in the upper reaches of the Ganges and north-western India. It is also misleading in not indicating the presence of this species in either Bangladesh (Khan, 1982a; 1987) or Pakistan (see above).

***Hardella thurjii* (Gray)** *Boro Kathua* ("big turtle"), *Kath Kathua* ("wood turtle") Bengali.

A specimen (ID/NE 08) from Kaziranga National Park, Assam, captured on 29 January 1988, measured: CCL = 555; SCL 505. An additional specimen from the same area is in the ZSI (Reg. No. 20802). A juvenile male (ID/NE 21) from further south (bought from Cherrapunji market), was reportedly captured at Shella (south-east of Cherrapunji), Meghalaya, on 27 June 1988 and measured: CCL = 200; SCL = 177; SCW = 127. At the time of writing (October 1994), ID/NE 21 is alive in the collection of ID (photo).

Four specimens were recorded from Bangladesh. At Hael Haor, Moulvi Bazar Dist., on 11 January 1989 two specimens were seen; one (ID/BGD 03) was measured: SCL = 300. At Gayashi, near Fenchugani, Sylhet Dist., on 15 January 1989 a locally caught specimen was photographed and measured: CCL = 255. The next day at Erali Beel, Golapgunj, Sylhet Dist., a specimen (ID/BGD 05) measured: SCL = 129; SCW = 97. In addition, the locality of AMNH 85774 is given as Baramchal, Sylhet Dist.

Few localities for *H. thurjii* in north-east India and Bangladesh have been reported (Iverson, 1992:124). The above-mentioned records clearly show that this species is a regular part of the turtle fauna of this region.

Bhupathy and Vijayan (1991) found only one specimen of this species after investigating 17 sites along the Gambir River in eastern Rajasthan, but remarkably this turtle was common in Keolodeo National Park. This indicates that *H. thurjii* may be difficult to observe and/or that it has very specific habitat requirements.

***Kachuga smithii* (Gray)**

This species was observed commonly during September 1987 in Dhikala, Corbett National Park, Naini Tal Dist., Uttar Pradesh), in an area characterized by moist tropical deciduous forest.

A female (JGF 5063) was captured on 30 September 1987, approximately 2 or 3 km east of Dhikala, under a log in 15 cm of water in a side stream of the main river which feeds into the artificial lake. It measured: CCL = 246, SCL = 220, CCW =231, SCL = 166, SH = 102. A second individual, unsexed (JGF 5072) was captured on 3 October 1987, about 5 km east of Dhikala, at Nimbu Boji, in a slow-moving stream. Its measurements were: CCL = 231, SCL = 212, CCW = 211, SCW = 156, SH = 95.

On both specimens there were: single large black blotches in each plastron scute, except for the pectorals and abdominals, which had two blotches each; axillaries, one pair, each large with a single black blotch; inguinal, one pair, each large with a single black blotch; behind each eye on the side of the head was a polygonal, chestnut-coloured blotch; a colour photo of JGF 5063 is in Frazier (1987a:7). Scales: median sutures of plastral scutes Ab >F >H >P >An >G; posterior margin of carapace not serrate. Green filamentous algae were attached to both carapaces. In other respects these two specimens were generally consistent with the description in Moll (1987b:7 ff.).

Commonly during the day up to a dozen of these terrapins could be seen sunning on logs in the south-east corner of the artificial lake at Dhikala. Although Auffenberg and Khan (1991:25) concluded that "this is not a common species outside of Pakistan," there appears to be a large population of this terrapin at Dhikala.

The colouration (plastral, head and limb) of the two specimens examined in detail was consistent with the description in Moll (1987b) for *Kachuga smithii smithii* and contrasted from that of his new sub-species, *K. smithii pallidipes*. It is remarkable that the Dhikala locality is little more than 500 km west of the western-most record of Moll's new taxon, indicating that - if this subspecies is valid - it is restricted to a limited zone of the Indian-Nepalese border area. In contrast, the nominate form ranges widely from Pakistan (Auffenberg and Khan, 1991) to Bangladesh and eastern India (Iverson, 1986:45; 1992:133), and includes localities from Assam and the Brahmaputra drainage (Das, 1990a).

A taxon based on three unusually pigmented specimens from the centre of the distribution of a wide-ranging species bespeaks a need for its verification. The fact that some specimens show characteristics of both subspecies (Moll, 1987b) further emphasizes the problem with the validity of this new subspecies.

The distribution for *Kachuga smithii* shown in Tikader and Sharma (1985:68) is inaccurate by exaggerating the range in the upper reaches of the Ganges and in north-western India; at the same time, they omit Jammu, from where the species has been recorded earlier by Duda and Sahi (1977). Although their book deals with India, the lack of any indication of this species in the Indus River drainage (Pakistan) is misleading.

***Kachuga tecta* (Gray)**

There have been reports of this species from the Sabarmati and Naramada Rivers, but not from the Mahi River (Iverson, 1986:47; 1992:135; Moll, 1987b:16; R. J. Rao *in litt.* 18 March 1989), which lies between them. Recently, Vyas and Patel (1990) reported two specimens from near Lunawada, on the Mahi River.

Two additional specimens were studied at the Sayaji Baug Zoo, Baroda, Gujarat, on 21 February 1987. They were reputed to have come from the Mahi River nearby, Kheda/Vadodara Dists., Gujarat. Measurements are JGF 5222: CCL = 107; SCL = 93.0; SH = 46; BM = 110 g; JGF 5223: CCL = 106; SCL = 91.8; SH = 45; BM = 100 g (photos). Both specimens were consistent with Smith's (1931:126) description of *K. tectum* (an old name for *K. tecta*) and Moll's (1987b:12 ff.) description of *K. tecta*.

Bhupathy and Vijayan (1991) recorded this species from numerous sites in eastern Rajasthan, and it was common in the Banganga River drainage. Since it is relative small and usually found in large water bodies, *K. tecta* may often escape detection.

A shell of this species (ID/BGD 02) was collected from a Hindu village near Hael Haor, Moulvi Bazar Dist., Bangladesh on 11 Jan. 1989. Its measurements were: SCL = 163 and SCW = 121. Together with a record from Cherrapunji, Meghalaya (Moll 1987b:15), this is the second precise locality record for this species in the Brahmaputra drainage.

Two specimens in the AMNH (Reg. Nos. 58559 and 58560) identified as *K. tecta* are labeled as coming from "Upper Chindwin Dist., Kuang

Hein, Burma". These need to be verified, for this locality represents a major range extension.

The distribution shown by Tikader and Sharma (1985:74) omits the three rivers which flow into the Gulf of Kambhat: Sabarmati, Mahi and Naramada Rivers, as well as Jammu, from where the species is also recorded (Duda and Sahi, 1977). On the other hand, it greatly exaggerates the known range in northern and western India.

***Melanochelys tricarinata* (Blyth)**

Two specimens (JGF 5069 and 5070) were studied on 3 October 1986 at Dhikala, Corbett National Park, Naini Tal Dist., U. P. The region is characterized by tropical moist deciduous forest.

JGF 5069 was a hatchling caught alive in high grass at the edge of a forest. Measurements: CCL = 52.0, SCL = 42.5, CCW = 49.0, SCW = 38.6, SH = 21.1, BM = 13.5 g. Colouration: carapace red-brown with yellow lines that run down the mid-vertebral keel and the mid-pleural keels, as well as along the edges of the marginals; a fine red stripe on each side of the top of the head; a small bright red spot on each side of the base of the tail. Scales: cervical trapezoidal with the posterior edge longest; axillaries 1/1; inguinals 0/0 (photos).

JGF 5070 was an adult male caught alive in high grass outside of forest. Measurements: CCL >177, SCL >143, CCW ≅ 140, SCW ≅ 91, SH = 60, BM = 410 g. Colouration: carapace black with faint light line on mid-vertebral keel and bold yellow edges to marginals; plastron bright yellow. Scales and body: growth rings >8; claws strong and horn-coloured; forelimbs powerful, holding the animal high off the ground - like a tortoise - when walking; scars (from fire?) on right marginals and posterior of carapace, plastral sutures obliterated (photos).

Moll and Vijaya (1986:58) reported three specimens from West Champaran Dist., Bihar, thus extending the known range considerably to the west. On the basis of their specimens they suggested that the species may occur even further west. Recently, Busack (1994) reported a *M. tricarinata* on the Wildlife Institute of India Campus, Chandrabani, Dehradun, Uttar Pradesh, "and at least ten additional specimens in the area". He suggested that these animals might be a disjunct population or a successful introduction. Specimens JGF 5069 and 5070, as well those from Dehradun, represent range extensions of about 600 km westward of Moll and Vijaya's records.

Das (1990a; 1991:97) recorded this species in Manas and reported on a ZSI specimen from Sonarpur, Assam. Khan (1982a; b; 1987) reported *M. tricarinata* from two areas in Bangladesh; and although no exact localities were provided, it shows that the distribution extends to the south banks of the Brahmaputra.

There is no evidence that this species occurs in Sikkim and Darjeeling (c.f. Waltner, 1973:29), an error which has evidently arisen from the inappropriate use by Swan and Leviton (1962:135, 138, Table 1) of 'Sikkim-Darjeeling' to refer to North Bengal (which includes the three districts of Darjeeling, Jalpaiguri and Koch Bihar) and Sikkim. There is a record from Jalpaiguri Dist. (Smith, 1931:96), but no record of *M. tricarinata* is known from either Darjeeling or Koch Bihar Dists., much less from Sikkim. As Das (1990a) mentioned, a report of this species from the Sunderbans (Mukherjee, 1975) is suspect. Tikader and Sharma (1985:89) showed a geographic distribution which, as well as omitting the western extension, greatly exaggerates the known distribution in the southern part of the range (c.f. Iverson, 1992:145).

M. tricarinata has been characterized as 'Indo-Chinese' (Smith, 1931:16) because it is found in the zoogeographical area termed 'Eastern Himalayas'. Smith (1931:21) defined this area as 'from the western frontier of Nepal to the termination of the range at the bend of the Brahmaputra.' The western frontier of Nepal is perhaps convenient to locate geographically, but it is not a biologically meaningful limit, for the ecological area under consideration may be about 15% greater (to westward) than that delimited by the Nepalese border.

The term 'Eastern Himalayas' is also misleading. First, the species is found a considerable

distance westward of the eastern end of the Himalayas, in what would commonly be called the 'Central Himalayas.' Second, this is not a truly montane species, as 'Himalaya' suggests. As Moll and Vijaya (1986:85) pointed out, although this species was regarded as a 'hill species' by Smith (1931:16), their own specimens came from 'flat-land forest'. It might be more accurate to refer to *Melanochelys tricarinata* as characteristic of the foothills, an area for which the term 'Terai' (or Tehri') specifically applies. Hora (1948:292, 300) and Jayaram (1949:39) did not specify the geographic distribution of this species to the same detail as did Smith (1931). They simply stated that it occurs in an area at the eastern extreme of the Indian Subregion (Chota Nagpur) and in an area at the western extreme of the Indo-Chinese Subregion (Eastern Himalayas).

It is an exaggeration and a misrepresentation to label *Melanochelys tricarinata* as either 'Indian' or 'Indo-Chinese' in distribution. Instead, it is a singular case of a species which seems to be restricted to the areas which border between these two zoogeographic subregions.

It is not known on what basis Hora (1948:300) called this an 'herbivorous, aquatic species.' Given the locomotory posture - raising itself well off the ground with the limbs nearly vertical - and agility and speed on land, Smith's (1931:96) suggestion that this species is 'almost entirely terrestrial' seems most reasonable. Das (1991:97) called this a grassland species.

***Melanochelys trijuga* (Schweigger)**

Seven subspecies of this terrapin have been described, but these taxa will not be used in this study. A detailed account of *Melanochelys trijuga* is in preparation and will be published separately.

Northern India: A total of 25 specimens (JGF 5052 to 5080; excluding 5063, 5069, 5070, and 5072) was caught at Dhikala and environs, Corbett National Park, Naini Tal Dist., U.P., between 29 September and 7 October 1986; each specimen was examined and photographed. The area is characterized by tropical moist deciduous forest. The specimens were found in man-made water holes in the forest and in slow-moving streams that flow into the artificial lake at Dhikala. There is clearly a large population here. The species also occurs in the Kukrail Canal, U. P. (R. J. Rao *in litt.* 18 March 1989).

Whitaker (1979a) had previously recorded this species from Malani Tal, near Bijrani, Corbett Park; and taken together these observations and specimens extend the known range of the species (Iverson, 1986:56; Moll and Vijaya, 1986:59), 600 km further west along the Terai, or Himalayan foothills, supporting the suggestion that *M. trijuga* occurs throughout southern Nepal (see Iverson, 1992: 146).

According to conventional taxonomic considerations, this population in U. P. would be *Melanochelys trijuga indopeninsularis* (Annandale), and Das (1990a) presented evidence for the occurrence of this subspecies as far east as Manas, Assam. The geographic range for this subspecies shown in Tikader and Sharma (1985:100) greatly exaggerates the area of known distribution at Chota Nagpur, while omitting northern and western records. As with other species, Waltner (1973:29) stated that *M. trijuga* occurs in Sikkim and Darjeeling: there is no evidence for this.

Southern India: A total of 13 specimens (JGF 5412, 5413, 5415 to 5424 and 5508) was caught, measured and photographed between 25 and 26 March and on 27 July 1987. These were from Kollur, Hebri and Neria, all in Dakshin Kannad Dist., to the north of Mangalore, Karnataka, areas characterized by moist tropical evergreen forest.

An additional 13 specimens (JGF 5240a to 5242a, 5244a to 5246a, 5249a to 5251a, 5501, and 5505 to 5507) were studied on 19 and 20 March and 22 and 23 July, 1987. These were from near Mangalore, southwards to Puttur and Subrahmanya and eastwards to Chabidre, all to the south of Mangalore, in Dakshin Kannad Dist., Karnataka, also characterized by moist tropical evergreen forest.

Three additional specimens (JGF 5439 to 5441) were studied on 5 May 1986, at Nagerhole

National Park, Kodagu Dist., Karnataka. This park is characterized by moist semi-deciduous forest.

None of these 29 specimens from Karnataka represents a range extension for the species, but all of the localities help to fill in the known distribution in western Karnataka, between Goa (Sharma, 1976:151) and northern Kerala, from where there appear to be no records (Iverson, 1986:56; 1992:146).

Das and Pritchard (1990) reported an adult male (233 mm SCL) collected live from Chichli, Indira Gandhi Wildlife Sanctuary, Coimbatore Dist., Tamil Nadu. Additional specimens from the hills of Tamil Nadu have been overlooked in museums in Madras. At the Zoological Survey of India, Southern Regional Station, Madras, there are at least nine specimens: two from Mudumalai Wildlife Sanctuary, Nilgiris Dist. (Lot no. 9, 13 October 1987 and no number, 11 January 1987); one adult male (206 mm SCL) from Nambiar, Nambi Koril Road (alt. 140 m), Kalakkadu Wildlife Sanctuary, Tirunelveli Dist. (Lot no. 6 [VRT 5], 11 January 1987); one individual from Kalakkadu Wildlife Sanctuary, Tirunelveli Dist. (Lot no. 9, 13 October 1987); two specimens from Berijam Lake, Kodaikanal, Madurai Dist. (Lot no. 3, 11 April 1980); one from Javadi Hill, Bhimamadug, North Arcot Dist. (Lot no. 2, 1 March 1983); and one juvenile (81 mm SCL) from Kombiar Charagam, Kalakkadu Wildlife Sanctuary, Tirunelveli Dist. (alt. 210 m; lot no. 10). Finally, T. S. N. Murthy (*in litt.* 2 Sept. and 30 Dec. 1987) reported a ninth specimen in this collection, from Mansholai area, Kalakad, Tirunelveli Dist. (Reg. No. VRT 2, 24 August 1986).

In addition, there are five specimens with data in the Government Museum, Madras (G. Kesavaram, *in litt.* 3 June 1988). These localities include: Ramnad (= Ramanathapuram) Dist. and Madras, both in Tamil Nadu and Calicut, Kozhikode Dist., in Kerala. Two additional specimens were found by ID on 20 March 1989: from Kilakkarai, South Arcot Dist., Tamil Nadu and from Cochin, Kerala.

According to conventional taxonomic wisdom, the specimens from Kerala should be *M. trijuga coronata*, those from southern Tamil Nadu should be *M. trijuga* thermalis and those from northern Tamil Nadu and Karnataka, *M. trijuga trijuga*. However, it is not clear how distinctive these subspecies are, since the geographic ranges are not well defined. Furthermore, intergrades of *M. t. coronata* and *M. t. trijuga* have been reported from the hill ranges of the Western Ghats. Das and Pritchard (1990) described three intergrade specimens, two in the collections of the ZSI Southern Regional Station: an adult male from Nambiar, Nambi Koril Road, Kalakkadu Wildlife Sanctuary, Tirunelveli Dist. (Lot no. 6 [VRT 5], 11 January 1987); a juvenile from Kombiar Charagam, Kalakkadu Wildlife Sanctuary, Tirunelveli Dist. (Lot no. 10), and one collected alive from Chichli, Indira Gandhi (formerly Annamalai) Wildlife Sanctuary, Coimbatore Dist.

The geographic range for the nominate form in Tikader and Sharma (1985:94) greatly exaggerates the distribution of known northern records, while omitting the southern records. In addition, their caption for this subspecies is reversed with *M. t. coronata*.

The AMNH has a specimen (Reg. No. 85594) from the Indus River near Tatta, Tatta Dist., Pakistan, labeled as *M. trijuga*. This specimen and locality need verification; there are no verified records of *Melanochelys trijuga* from Pakistan.

An immature specimen from the Girna River, near Bardipuda in Dhulda Forest, Nasik Dist., Maharashtra (approximately 21° 30'N, 74° 0'E) was photographed by K. Bhatt (*in litt.* 23 March 1987). This record represents an range extension of nearly 200 km from Goa (Sharma, 1976:151) northward along the west coast of peninsular India. The species was recorded from Surat Dang, southern Gujarat first by Daniel and Shull (1963) and has subsequently been found to be widespread in the areas around the tributaries of the Ambie and Purna Rivers, in the Dangs (Vyas and Patel, 1990). As the Dangs highlands are the northernmost extension of the Western Ghats, the species is unlikely to occur much further than 22°N. How-

ever, an isolated population could be waiting to be discovered on Mount Abu (Rajasthan). *M. trijuga* may also occur in the inland highlands of the Satpura Range of south-western Madhya Pradesh. Presumably, individuals from this region would belong to the nominate subspecies.

There do not appear to be any valid records from Gujarat, except for those from the Dangs, much less from the environs of Vadodara (Baroda). However, it is worthy of note that this species was reportedly used commonly in the anatomical and physiological investigations of George and Shah (1954; 1955; 1959) who were based at M. S. University, Vadodara. The collection sites of the specimens were not reported.

***Morenia ocellata* (Duméril & Bibron)**

During the first week of September 1987, this turtle was often observed to be the most abundant species in various temple tanks in Yangon, Myanmar. More recently, van Dijk (1993) made the same observation in Yangon temple tanks and zoo. Clearly, all of these animals had been transported by people, but the species appears to be abundant, at least in the Yangon area.

***Morenia petersi* (Anderson)** *Haldey Katha* ("yellow turtle") Bengali

A specimen (ID/BGD 06) was collected from Jagannathpur, south-west of Sylhet City, Bangladesh, on 16 January 1989. Its measurements were: CCL = 202; SCL = 176; CCW = 173; SCW = 122 (photo deposited in the Bangladesh National Museum, Shahbag, Dhaka, and in Das 1991: pl. 9).

There have been claims that this species is endemic to Bangladesh (Khan 1982b:32); however, records from Bihar (Moll and Vijaya, 1986) as well as a specimen in the ZSI (Reg. No. 18335) from "N. Brahmaputra, Assam," collected in 1916 by L. W. Middleton, show that its geographic range includes at least parts of north-eastern India. Blyth (1864:81) stated that "*E. ocellata*" (= *M. petersi*) occurred in Calcutta.

TESTUDINIDAE

***Geochelone elegans* (Schoepff)**

A detailed account of this species is in preparation. Suffice it to mention here that distributional records indicate the presence of two separate mainland populations (Frazier, 1987b; in press). The western Indian distribution comprises central and southern Rajasthan; Gujarat, including Kachchh (formerly spelled 'Cutch' or 'Kutch') and Saurashtra; and the western extreme of Madhya Pradesh. The south Indian population includes south-eastern Orissa, Andhra Pradesh, eastern Karnataka, Tamil Nadu and south-eastern Kerala. The western range in India abuts Nagar Parker, in Sind, Pakistan from where this tortoise has been recorded; there could be one continuous population in the north-west. Starred tortoises from the southern range in India are generally smaller and more humpy than those from the north-west, but they may be indistinguishable from those further south in Sri Lanka. This scheme contrasts with the conventional wisdom that there is one continuous population from Rajasthan south to Tamil Nadu (c.f. Tikader and Sharma, 1985:105).

***Indotestudo elongata* (Blyth)** *Hunro* Khasia.

On 11 January 1989, a shell (ID/BGD 01) was collected from Khasia tribesmen from West Bhanugach Reserve Forest, Moulvi Bazar Dist., Bangladesh. Its measurements are: CCL = 277; SCL = 238; CCW = 237; SCW = 159. This the only record from north-eastern Bangladesh (photo).

A discussion of Nepalese records, and related information from India, has been published separately in Frazier (1992) (however, the first published report of *I. elongata* from Corbett National Park [Whitaker, 1979b] was not included in that review). A separate account of this species, involving a study of specimens in Indian and other museums is in preparation.

In India, the range of this species extends west throughout the Terai to nearly Dehradun (Frazier, 1992) and south as far as Puri in Orissa. Hence, its distribution in general appears to be limited to sal (*Shorea robusta*) forests. The distribution shown

in Tikader and Sharma (1985:109) greatly exaggerates the known range in eastern Indian and also in West Bengal, while omitting the northern and western records.

***Indotestudo forstenii* (Schlegel & Müller)**

Five carapaces of specimens that had been killed and cooked were obtained from local people between Subrahmanya and Neria, Dakshin Kannad Dist. (D.K.), Karnataka, all near areas with tropical wet evergreen forest.

JGF 5247a and 5248a: 21 March 1987, Subrahmanya (12° 40'N, 75° 37'E). Respective measurements: CCL = 268, SCL 228; and CCL = 118, SCL = 155.

JGF 5502: 22 July 1987, Gundia; CCL = 222, SCL = 182, CCW 177, SCW = 120.

JGF 5503: 23 July 1987, Chabidri (13° 3'N, 75° 25'E); broken and unmeasurable, but larger than JGF 5504.

JGF 5504: 23 July 1987, Neria (12° 58'N, 75° 24'E); CCL = 287, SCL = 244, CCW = 237, SCW = 164.

These specimens are the first to be recorded from D. K. Dist. Previously, the northern-most record was from Coorg (now Kodagu) Dist., reported by Smith (1931:144). Two specimens are known from Coorg. One is catalogued in the Indian Museum, Calcutta, as ZSI No. 18044, coll. 16 May 1913 by F. Hannyngton; according to an entry in the catalogue, it was later donated to Agra College, but it has not been traced. An unregistered, stuffed specimen (SCL = 147) with the locality 'South Coorg' is in the Government Museum, Madras.

Iverson (1986:157; *in litt.* 17 Jan. 1989) indicated only one of the two records from Coorg. Unfortunately, neither of the Coorg records includes a specific locality. As the Neria specimen is about 70 km north of the north-west corner of the Kodagu Dist. limit, these recent specimens from Dakshin Kannad represent range extensions of at least 70 km.

B. K. Sharath (*in litt.* 25 Oct. 1987) collected and photographed two live specimens near Chabidri, D. K. during the first week of October 1987, and he collected one live specimen at Neria on 8 October 1987. This further confirms these northern localities.

The most northerly record of this species is that of Borges (1987:44). She reported (*in litt.* 12 June and 9 July 1987) that in October 1984 a chelonian was found near Kirkumbatti Settlement, Magod, Yellapur Reserve Forest, Uttar Kannad Dist., Karnataka, in tropical moist deciduous forest. It was released without a photograph, but was observed to fit the description and photo of the Travancore tortoise in Daniel (1983:31 & pl.).

As for the eastern limit, there are two records from Indira Gandhi (formerly Annamalai) Wildlife Sanctuary, Coimbatore Dist., Tamil Nadu. On 27 March 1989 a female was collected from a rocky outcrop, beside a dried up stream at Chichali (ID/SI/F 04); measurements are: CCL = 263; SCL = 222; CCW = 220; SCW = 141. On 26 January 1990 a weak and dehydrated specimen was found in an abandoned elephant-capture pit. Its measurements are: SCL = 220; SCW = 148; PL 170 (C. Wemmer *in litt.* 3 May 1991; photo). The southern-most records extend into Kerala, an area worked extensively by J. Vijaya.

The distribution shown in Tikader and Sharma (1985:111) is highly inaccurate and greatly exaggerated in area, especially for the eastern range. A detailed description of this species, including museum specimens not mentioned here, will be given separately.

TRIONYCHIDAE

***Aspideretes gangeticus* Cuvier**

There are various records of this softshell turtle from mainland Gujarat. A specimen (JGF 5217) measured on 18 February 1987 at the Sayaji Baug Zoo, Vadodara was said to be from the Viswa Mitri River, Vadodara Dist. Measurements: CCL (disk) = 705, CCL (bone) = 470, Wt = 30 kg. Colouration: dorsum light olive green/grey with no conspicuous dark vermiculations/markings except several chevron-shaped lines on the top of the

head; ventral cream white. Body: a patch of skin between neck and each brachium was slightly raised and rugose (but not warty in the sense of hard protuberances); photos.

A specimen in the Municipal Garden, Surat, in January 1987, was said to have come from the Tapi River; CCL (disk) = 620 cm (T. Mundkur, *pers. comm.*, photo). *A. gangeticus* is reported to be common in the Tapi (or 'Tapti') River (K. Bhatt *in litt.* 23 March 1987).

Two individuals of this species were seen in the artificial lake at Dakor, Kheda Dist., Gujarat, on 21 February 1987. One, grey with no conspicuous black markings dorsally on either the carapace or the head, was estimated to have a CCL (disk) >800 mm (photo). A second, almost black dorsally, was estimated to have a CCL (disk) ≅ 600 mm. Both individuals swam slowly below the surface, occasionally feeding on puffed rice thrown to them by visitors to the shrine at the end of a short pier.

A large individual with a dark head with black lines on the side was seen at the shore of the Mahi River, between Sindarota and Jaspur Fort, Vadodara Dist., on 25 February 1987. Heads of trionychids, thought to be mainly *A. gangeticus*, were very common at the surface in this same stretch of river. Two predated nests along the bank in this section of river were said to have been made by turtles of this species. Both nests were 30 cm deep and between 16 and 17 cm wide at the mouth, with the remains of eggshells outside.

Vyas (1989) and Vyas and Patel (1990) recorded this turtle from various localities in the north of mainland Gujarat: Raja Rani talao, Vadodara City; the Vishwamirti River, Harni Village pond, Vadodara Dist.; the Mahi River near Sinthrot Dist.; and the Narmada River near Bharuch, Bharuch Dist. Sharma (1982:86) reported *A. gangeticus* from Malegaon Forest (Malagam), Dangs Dist., Gujarat; it was about 200 m from a 'nullah' (stream bed); a specimen in Jodhpur (DSR/ZSI No. 1292) has locality data that match this site. The closest rivers to this locality are the Purna or Khapri, which run parallel to, but south of, the Tapi River, draining westwards into the Gulf of Khambhat. Clearly, *A. gangeticus* is widely distributed and common in mainland Gujarat.

There are also records from Saurashtra, or the Kathiawar Peninsula. Three specimens (JGF 5138b, 5139, and 5140) were collected on 18 January 1987 at Nayaka Dam (or Wadhwan Bhagao 1) on the Bhogava River near Muli, Surendranagar Dist., Gujarat. This is an area of arid scrublands and arable land.

JGF 5138b: adult male found dead in holding tank near dam; water temperature at both surface and at 60 cm depth was 15°C. Measurements: CCL (disk) ≅ 520, CCL (bone) = 335, SCW (disk) = 365, HW = 17.1, Wt = 11 kg. Colouration: dorsal dark olive green with irregular black markings (vermiculations); ventral cream coloured; photos. The stomach contained remains of an Orthopteran identified as a species of Leptysminae (Acrididae), a grasshopper typically found on marsh reeds along the shore (D. Nickel, USNM, *pers. comm.*).

JGF 5139 and 5140: bony carapace and costal bone found by holding tanks near dam; estimated CCL (disk) were 300 mm and >700 mm, respectively.

Sight records of softshelled turtles at least 40 cm in carapace length- well above the maximum known size of the common flapshell (*Lissemys punctata*)- have been reported from various sites in Rajkot Dist., Saurashtra. During the 1950s these large turtles were common in Alansagar Lake, and they were abundant in Vinchhiya Lake, where they could be seen basking on the banks; they have not been seen in recent years (Shivrajkumar Khachar, *pers. comm.*). A large individual was seen at Nyari Lake, Rajkot Dist. during the height of the dry season of 1985 (T. Mundkur, *pers. comm.*).

In Rajasthan, the species has recently been recorded from several localities in the eastern extreme of the state (Breeden and Breeden, 1982; Bhupathy, 1991; Bhupathy and Vijayan, 1991), where it is reported to be common. In addition,

there are several published records of this turtle which have been ignored. Sharma and Vazirani (1977:78) reported *A. gangeticus* from Satlana, Jodhpur Dist. and from Surpur, Dungapur Dist., Rajastan (which matches specimen DRS/ZSI Reg. No. 1256; see below). The Luni is the nearest river to the Jodhpur locality and the Mahi is the nearest river to the Dungapur record. Both of these rivers drain southwestwards, the first into the Great Rann of Kachchh and the second into the Gulf of Khambhat. In both cases the localities are hundreds of kilometres from the Indus and Ganges drainage systems. This turtle apparently also occurs in the southern extreme of Rajasthan; for during the intense droughts of the 1970s, turtles estimated to be 80 cm long were found in Pichola and Fathe Sagar Lakes, Udaipur (P. L. Menaria, *pers. comm.*).

Three specimens, identified by R. C. Sharma, are in the Desert Research Station of the ZSI, in Jodhpur, Rajasthan. DSR/ZSI Reg. No. 1254 is from Surpur Ki Nadi, about 4 km north-west of Dungepur, Tajasthan, collected on 26 March 1964 by R. N. Bhargava. DRS/ZSI No. 1255 is from Satlana Tank, about 36 km south of Jodhpur, collected on 9 January 1964 by R. S. Pillai. DRS/ZSI No. 1292 is from a forest near Malagam, Gujarat, about one furlong from a nullah, collected on 14 February 195 by T. G. Vazirani. A stuffed specimen in the collections of the Zoological Survey Department of Pakistan ("R63") was collected in Hyderabad Division, Sind, by Farouq Ahmad on 7 June 1980.

A. gangeticus is said to occur in Lake Mobanadi, Cuttack Dist., Orissa (L. N. Acharjyo *in litt.* 27 July 1987) and also in several lakes in Bhopal (R. J. Rao *in litt.* 18 March 1989).

Of all these records, the most remarkable are those from Saurashtra. JGF 5138b to 5140 establish for the first time that this turtle occurs on the arid Kathiwar Peninsula (c.f. Iverson 1986:187). The sight records from Rajkot Dist. suggest that the species occurs (or occurred) throughout much of the Kathiawar Peninsula.

These extreme western localities in Saurashtra are hundreds of kilometers from the Gangetic drainage, and what was formerly known to be the western distribution of this turtle. However, various records from the Gujarat mainland and eastern Rajastan show that *A. gangeticus* is widely distributed in western India.

The earliest indication of this species occurring on the west coast, far to the south of the Indus drainage system is in a six-part treatise on "Waters of Western India" by "Keswal" (*nom de plume* of W. F. Sinclair). The first part (1886a:115), in describing the fauna of the Deccan and Khandesh, states that the most common species of freshwater turtle (Trionychidae) is *Trionyx javanicus* (an old name associated with *Trionyx* (= *Aspideretes*) *gangeticus* [see Smith, 1931:167 ff.]. In subsequent parts on the Konkan coast ('Keswal', 1886b:169), Gujarat (Anon, 1887:226) and Sind ('Keswal', 1888:7) it was stated that the chelonian fauna was comparable to that already listed, thus indicating that T. '*javanicus*' (= *A. gangeticus*) was a common species in these areas.

Besides the nomenclatural problem, there are other more serious difficulties in the interpretation of these reports. 'Keswal' (1886a:115) never made any mention of *Lissemys punctata*, the most abundant and ubiquitous of the Indian softshell turtles today. Hence, his early records must be treated with great caution.

Nonetheless, it is clear that *Aspideretes gangeticus* is not restricted to the present-day Indus, Ganges and Mahanadi and their tributaries' as was once thought (Smith, 1931:168). Numerous reliable records show that the species' distribution encompasses areas well outside these drainage systems. However, as W. Auffenberg (*in litt.* 27 Jan. 1989) pointed out, many of the records from Saurashtra and Gujarat are consistent with prehistoric and historic Indus drainage systems.

Furthermore, this species is not restricted to large bodies of flowing water; it occurs - at least in Sind (Auffenberg *in litt.* 27 Jan. 1989), Saurashtra and Bharatpur - in artificial bodies of water ("jheels") which may almost dry up in times of drought. In fact, this turtle is distributed widely

from the mouth of the Ganges to the mouth of the Indus and south to about 20°N latitude.

It is important to emphasize that the dorsal colouration of *A. gangeticus* is extremely variable, ranging from almost black, to green with black markings/vermiculations (possibly the most common colour pattern), to light green or grey with no black markings. The dorsum of the head is often marked with several lines forming black chevrons, but these may be absent or obscured by a more general dark colouration; Vyas (1989) and Vyas and Patel (1990) reported that the head markings are lost in "old" (= large) specimens. Hence, identifications based on examinations of only colouration (e.g., drawings) must be treated with great caution (c.f. Webb, 1980:65 ff.)

The maximum size reported by Smith (1931:167), 'length of dorsal disc 700 mm', has been surpassed by the specimen from the Baroda Zoo, and an animal at Dakor appears to be considerably larger than Smith's maximum. Vyas (1989) reported that 56 out of 67 turtles were greater than 71 cm in carapace length, and the largest individual measured 94 cm. Hardwicke (in Webb 1980:67) stated on a drawing (later identified as *Trionyx* (= *Aspideretes*) *gangeticus* by Webb [1980:67] that this turtle 'grows to 240 lbs' (>100 kg); this indicates an animal considerably larger than 70 cm.

The distribution shown by Tikader and Sharma (1985:129), while exaggerating the known range in north and western India, omits mention of rivers further south such as the Luni, Mahi, Tapi and Mahanadi. Other published locality records on this turtle raise a number of questions. Sharma (1971:81) reported a juvenile of *Trionyx* (= *Aspideretes*) *gangeticus* from the Nagarjunasagar Dam, near Pullareddygudem Village, Guntur Dist., Andhra Pradesh. This locality needs verification because it is part of the Krishna River system, which is hundreds of kilometres south of the Mahanadi River, draining into the Bay of Bengal, and, thus, well outside the known range of this species.

***Aspideretes hurum* (Gray)** *Bor Kasso* ("big turtle") Assamese, *Karpu Kachim*, *Duil* Bengali.

On 23 January 1988 a specimen (ID/NE 01) was acquired from Tinsukia Market (SCL = 126); it was reportedly caught at Guijan Ghat in the Dibru River, 11 km from Tinsukia, Assam. A second specimen (ID/NE 05) was collected on 28 January 1988 from Bokakhat Market, near Kaziranga National Park (SCL = 133; SCW = 115); it was reported to have been caught from the Brahmaputra nearby, in Assam. Two additional specimens were measured and photographed at Gayashi, near Fenchuganj, Sylhet Dist., Bangladesh on 15 January 1989 (CCL = 450 and 240, respectively). On 23 January 1989 ID/BD 07 was collected from Dohazari in the Sangu River, Chittagong Dist., Bangladesh. As the Sangu River originates in the hills which form the frontier between Bangladesh and Myanmar, it is likely that the peacock softshell also occurs in Myanmar.

Moll and Vijaya (1986) recorded the species near the Nepali-Indian border in Champaran Dist., Bihar. Other recent publications report this turtle: from Keoladeo National Park, Bharatpur, Rajasthan, but not in nearby rivers (Bhupathy and Ajith Kumar, 1989; Bhupathy and Vijayan, 1991); Bhopal, Madhya Pradesh (Das, 1988); and Pune, Maharashtra (Varghese and Tonapi, 1986).

Although it remains to be seen if any of the last three records are from introductions, it is clear that this turtle is distributed much more widely than was originally thought. The peacock softshell was for some time thought to be restricted to the lower reaches of the Ganges and Brahmaputra.

***Aspideretes leithii* Gray** *Pale poo* Tulu

A specimen of this turtle (JGF 5243) was recorded in south-west Karnataka. On 21 June 1987: Marigundi River (downstream of Subrahmanya and upstream of Kallaje), Dakshin Kannad Dist., Karnataka; tropical wet evergreen forest; caught live in a pool in the river; sex undetermined. Measurements: CCL (disk) = 350, CCL (bone) = 200, SCL (disk) = 325, SCL (bone) = 196, CCW (disk) = 305, CCW (bone) = 230, SCW (disk) = 279, SCW (bone) = 205, PL = 240, Wt = 3.5 kg. Colouration: dorsum olive green with six red ocelli, in two irregular lines (photos; Frazier, 1990).

Two specimens with data are in the Government Museum, Madras (G. Kesavaram, *in litt.* 3 June 1988). The localities recorded are: Nallamalais and Tungabadra River, Kurnool Dist., Andhra Pradesh. The former was mentioned by Annandale (1915). Recently, Kalaiarasan *et al.* (1992) reported a specimen from the Coleroon River, Thanjavur Dist., Tamil Nadu. According to K. Bhatt (in litt. 23 March 1987), *A. leithii* is found commonly in the Tapi River, Surat, Gujarat. If this turns out to be true, it will be not only the northernmost record of the species, but also a site of sympatry for *A. gangeticus* and *T. leithii*.

L. N. Acharjyo (*in litt.* 27 July 1987) reported *A. leithii* from Koraput Dist., Orissa, a locality previously established by Moll and Vijaya (1986:60). Sharma (1971:81) recorded the species from the Peddavagu River, Guntur Dist., Andhra Pradesh (not far from where he also reported *A. gangeticus*, but the presence of this last named species in Andhra Pradesh must be verified - see above).

There has been some question as to whether or not this softshell occurs in northern India. Iverson (1992:308) showed two localities in Uttar Pradesh, in the Gangetic drainage; and Mishra (1992) reported a specimen from Gomti River, U. P. However, as Moll and Vijaya (1986:60-61) explained, there has been considerable and long-standing confusion about *A. leithii*, and often it has been confused with *A. gangeticus*. For example, Acharya (1949) not only reported that *leithii* was in Daka Pond, Gujarat, and that it grows to 5 feet long (>1.5 m), but that he had seen a turtle attack and eat a full grown man! It was not long ago that *leithii* was reported to occur in "Lower Egypt, western Syria, and Sindh" (Finn, 1929:22). It is now thought that *A. leithii* does not occur in the Ganges, but is restricted to peninsular India (Das, 1991:61). The distribution shown in Tikader and Sharma (1985:132) greatly exaggerates the northern and eastern ranges of known occurrence, and omits a large area of known occurrence in the south of India.

***Chitra indica* (Gray)**

A carapace in the Government Museum, Madras, is labeled as coming from the Coleroon River, Tanjore Dist., Tamil Nadu. This remarkable specimen extends the range of the species well south into peninsular India, far from where the species was formerly thought to occur. Unfortunately, there are no other data associated with the specimen.

During field work in Bangladesh and northeast India, ID heard accounts from fishermen in Assam and Sylhet of a turtle known as *Dhush Kassim* ("turtle which hits blows with its head"), the description of which was consistent with *C. indica*. Furthermore, Sharma and Nakhasi (1981) studied the chromosomes of *C. indica*, supposedly based on specimens from Shillong, Meghalaya. This is strong evidence that this poorly know turtle is also in the upper Brahmaputra drainage.

***Lissemys punctata* Lacépède** *Chip Katta* ("hook turtle"), *Kachim* Sylhet dialect of Bengali; *Machua Kochchop* ("fish turtle") Chittagong dialect of Bengali.

Specimens were observed and measured in a variety of localities in western India. In Rajasthan, between 25 July and 26 Sept 1986, more than a dozen were observed in Pali Dist., one in Jalor Dist., and several in Bharatpur Dist. In Gujarat, between 4 November 1986 and 24 January 1987, several were observed in the Little Rann of Kachchh, two were measured in Rajkot Dist., six in Surendra Nagar Dist., and several in Junagadh Dist. Two specimens were examined in Tamil Nadu and the carapace of a slaughtered animal was examined in Darjeeling Dist., West Bengal.

Recently, Bhupathy (1991), Bhupathy and Vijayan (1991) and Sivasubramanian and Bhupathy (1991) reported the species from numerous surveyed sites in eastern Rajasthan, where it is generally common. These localities were all on tributaries to the Yamuna or Chambal Rivers.

Despite arid conditions and droughts, the species is common in many places in western India. For example, the records from Saurashtra (or the Kathiawar Peninsula) clearly show that *L. punctata* is widespread there. In addition, Das (1990a) showed that the flapshell turtle is widespread in the Brahmaputra drainage. These ob-

servations help to fill a large area of the geographic distribution, not shown in recent reviews of the species (Webb, 1982: Fig 1; Iverson, 1986:179).

Webb (1982) argued that there are two subspecies of this softshell: the spotted form occurring in the north, and the unspotted form in peninsular India. The zone of intergradation is not well established, and the specimens observed during the present study indicate that this zone may run through the Kathiwar peninsula. Bhupathy and Vijayan (1991) reported intermediate forms from south of Bharatpur, which is north-east of Saurashtra.

It must be emphasized that the distribution shown in Tikader and Sharma (1985:120) is extremely generalized, filling in vast areas with no known records, and it does not accurately depict the known zone of intergradation between the two subspecies. Furthermore, claims that the flapshell is in Sikkim (Waltner, 1973:29) are unfounded. In a separate study, more details of this species will be presented.

***Lissemys scutata* (Peters)**

These turtles were common in temple tanks at most major pagodas in Yangon (formerly Rangoon), Myanmar during the first week of September 1987. In general, the colouration of both the appendages and the carapace was a uniform light yellow-green, and no turtle larger than 180 SCL was seen. All of the animals seen had evidently been released into the tanks, and original localities are unknown.

Webb (1982:183) argued that the Burmese flapshell is a distinct species, and there had been no reports of this species in Myanmar for at least a half a century. More recently, van Dijk (1993) reported the Burmese flapshell to be common in a variety of sites, from Mandalay south to the Ayeyarwady Delta.

***Nilssonia formosa* Gray**

On 2 September 1987 a single large specimen was seen in the tank at Botataung Pagoda, and at least three or four others were seen in Tiger Tank, near the base of Shwedagon Pagoda, Yangon, Myanmar. The larger individuals had arrow-shaped heads at least 10 cm wide, brown with numerous bold black spots. About four individuals were photographed.

The specimens seen in tanks had clearly been deposited there by people. This species is evidently recorded from the Yangon area (Iverson, 1986:186; 1992:312), and Smith (1931:173) reported that it is 'not uncommon on the lower reaches of the Irrawady.' There had been no report of this species from Myanmar in half a century. More recently, van Dijk (1993) reported this turtle in temple tanks in Yangoon and the zoo at Mandalay.

DISCUSSION

The present day distribution records of turtles in the Indian region must be interpreted with caution. First, many locality records- reported here or elsewhere- are based on specimens (or parts of specimens) not examined in situ, but found in middens or brought in by villagers. Second, visual descriptions- especially when they are not supported by at least photographic evidence- are contestable but not resolvable. These two classes of records, particularly the second, serve mainly as indicators of places to investigate further- not as confirmed records.

Third, the degree of habitat perturbation in India and the region (deforestation, industrial development, pollution of soil and rivers, hydro-projects, etc.) has tremendously altered vast areas of 'original' habitat during the last few decades. As a result, some species (both terrestrial and aquatic) are certain to have been completely exterminated, or so reduced in numbers, that they cannot now be found where they formerly occurred.

Finally, on the other side of the problem of extirpation, is the problem of introductions and exotic species. Annandale (1906:206), for example, stated that the Madagascar tortoise, *Geochelone radiata*, was feral in parts of Bengal, near to Calcutta. He also indicated that *Geochelone elegans* was native to the Calcutta area, while Jayakar and Spurway (1966) reported

that this tortoise occurs even further east, in Dhaka Dist. There is no evidence that the starred tortoise occurs, or occurred, naturally in either West Bengal or Bangladesh. Just as remarkable is the fact that five of seven paratypes of *Kachuga tentoria circumdata* are listed as being collected from Calcutta (Mertens, 1966), when in fact this form is restricted to the western Ganges (Moll 1987b).

Throughout much of India, turtles and tortoises are often kept as pets. A notable exception is in Tamil Nadu, where it is a very bad omen to have a turtle in the house; viz. 'Amai nuzhaintha veedum, ameena nuzhaintha veedum uruppattathillai' = 'The house where a tortoise or a bailiff have entered will never prosper' (Rani Rema Devi *in litt.* 20 March 1988). [A variant of the saying is 'Aamai pugunda veedum ameena pugunda veedum uruppadadu' = 'There is no prosperity for a house where a turtle has entered it or a bailiff has entered it' (S. Dattatri *in litt.* 22 May 1987).]

The Indian star tortoise, *Geochelone elegans*, is a particularly favoured pet species in urban areas, and there was once an active commercial trade in this animal at a national level. Various former rulers of numerous states in India commonly keep, or kept, turtles on their grounds. In addition to land tortoises, other colourful and attractive species of turtles are also kept.

It is also important to realize that testudines are of tremendous religious importance in this region. To the Hindus, the turtle has a wide range of symbolic meanings; a few of the better known are: Prajapati (the creator); Kurma, an early (commonly the second) avatar of Lord Vishnu; the Van of Goddess Jamuna; and an essential element in many early Vedic rituals and myths (Annandale and Shastri, 1914; Patyal, 1978-79; Arole, 1987). At Sri Kurmnadha Swamy Temple, Srikakulam, Srikakulam Dist., Andhra Pradesh, specimens of *Geochelone elegans* are deposited inside the temple compound by visitors to the shrine (R. J. Rao *in litt.* 22 May and June 1987). In photographs these tortoises appear more like those from western India (Rajasthan and Gujarat) than those from south India, suggesting that some of them may have been transported considerable distances before being left at the temple.

Burmese Buddhists release captive animals to earn merits for the afterlife, and the release of terrapins into artificial ponds at pagodas is a common way to comply with this need. Even Moslems are not without religious interactions with turtles. At the shrine of Byazid Bostami in Chittagong Dist., Bangladesh, visitors feed and protect the endemic *Aspideretes nigricans* Anderson (Annandale and Shastri, 1914; Khan, 1980).

Turtles of considerable size and danger (e.g., large *Aspideretes* spp.) are in artificial ponds throughout the region. This is a manifestation of a tremendous will to carry turtles and tortoises from place to place and to protect them for religious motives. The implications that this has on geographic distributions is tremendous.

Culinary motives are also of immense importance. Most contemporary Hindus do not eat turtles, but in former times- according to the Sutras and other ancient writings- testudine flesh was highly regarded for specific cures and uses (Chakravarti, 1906). Although nowadays turtles are not eaten by most people in the region, they are relished by Assamese, well-to-do Bengalis and numerous tribal groups. The commercial trade in turtles for consumption in Calcutta was phenomenal, with vast numbers of turtles being shipped hundreds or even thousands of kilometres across India (Choudhury and Bhupathy, 1993). To supply the local demand, turtles have been shipped from as far off as Rajasthan and southern India, to Bengal. Dausa, in the desert state of Rajasthan, was an important railhead for softshells that were sent to Calcutta (V. D. Sharma, *pers. comm.*).

J. Anderson, of Karachi, claimed (*pers. comm.*) that in the past, before the partition of British India, certain castes of Hindus on pilgrimage would carry live turtles with them as food. As these pilgrimages could encompass thousands of kilometres and fixed sites were visited, the potential was good for establishing viable populations of a species a long distance from its origin.

There has also been an active international trade from Bangladesh (Fugler, 1984; Anon, 1987; Das, 1990b). Also, attempts to set up such a trade have been made in Myanmar (U Ye Htoon, *pers. comm.*).

Consider that many of these activities, involving turtles as pets, religious symbols, and food items, have been going on for centuries- if not millennia. Hence, the net result, regardless of the original motives, is that contemporary distributions of turtles and tortoises in this region may be both extended and reduced as a result of human agency. This points to the need for establishing zoogeographic patterns involving numerous species to verify the distributions of Indian testudines.

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SURVIVORSHIP AND TIMING OF REPRODUCTION IN THE ROUND ISLAND GECKO (*PHELSUMA GUENTHERI*) IN CAPTIVITY

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(with five text-figures)

ABSTRACT: *Phelsuma guentheri* is a large day-active gecko, restricted to Round Island, Mauritius. The species has become endangered due to the introduction of non-native goats and rabbits and the resultant habitat destruction. A captive breeding programme for the species was initiated at the Jersey Wildlife Preservation Trust in 1977. The present study is based on records kept at this facility. The largest clutches are produced when females are 3,200-3,500 days old, the mean clutch size being 13.38. The survivorship curve shows that mortality is uniform throughout life in both the sexes.

KEY WORDS: *Phelsuma guentheri*, reproduction, mortality, seasonality, Round Island.

INTRODUCTION

The genus *Phelsuma* comprises 57 living species and subspecies, almost all of which occur on islands of the Indian Ocean (McKeown, 1993). Of these, five are restricted to the island of Mauritius or on one of the offshore islets (McKeown, 1993; Vinson and Vinson, 1969). *Phelsuma guentheri*, the Round Island or Günther's gecko lacks the bright colours of its congeners and grows to about 140 mm in snout-vent length. At the time of European contact in the 1500s, this species occurred on the main island of Mauritius.

Today, *P. guentheri* exists only on Round Island, 20 km north-north-east of Mauritius, in close association with latan palms, *Latania loddigesii* (Garbutt, 1993; Vinson and Vinson, 1969). The habitat of the species has been described by Garbutt (1993). It is thought to have been exterminated on Mauritius during historic times by introduced mammalian species, which has devastated the natural vegetation, resulting in intense soil erosion. The situation is further aggravated by the cyclones that occur regularly.

Since Vinson (1975) estimated a population of 1,500-1,800 lizards, the cyclone 'Gervaise' hit Round Island in 1975, destroying much of the vegetation. A follow-up study gave a population estimate of only 200-300 individuals (Bullock and North, 1975). With the elimination of goats and rabbits during the last 20 years, the habitat is gradually recovering and the population of *P. guentheri* slowly making a comeback (McKeown, 1993). The species is listed as endangered in the IUCN Red Data Book and is a CITES Appendix I species.

The present study was conducted on a captive population at the Jersey Wildlife Preservation Trust (hereafter JWPT) in order to compile data on fecundity, timing of reproduction and survivorship. Bloxam and Vokins (1978) and Bloxam and Tonge (1980) have reported other aspects of the breeding biology and husbandry of this species.

MATERIAL AND METHODS

The primary source of information on which the present paper is based is the information stored in the database of the JWPT Animal Record System (1977-present). It was compiled by the Curator of Reptiles and the Head Keeper of the Reptile Section daily, and analyzed by the author at the Gaherty Reptile Breeding Centre after the arrival of the first nine specimens of the species.

OBSERVATIONS

The fecundity schedule in *Phelsuma guentheri*, wild-caught and captive-bred, shows that both groups start laying eggs when over 200 days (or

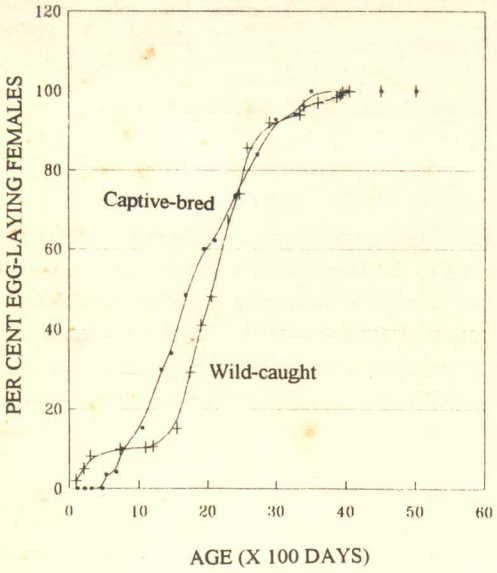

FIGURE 1: Fecundity rates of captive-born and wild-caught *Phelsuma guentheri* (1978-1992).

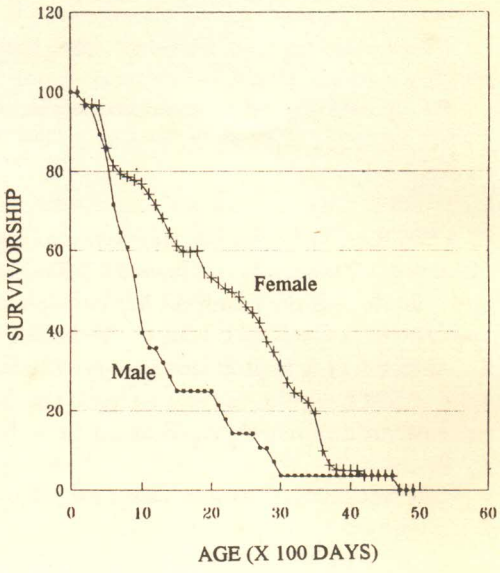

FIGURE 2: Survival rates of males and females of *Phelsuma guentheri* (1982-1992).

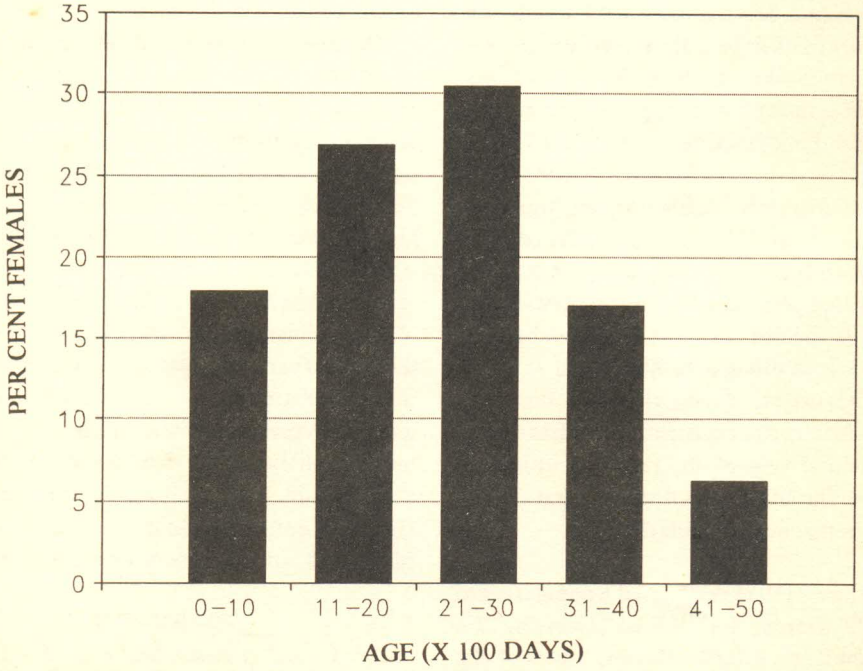

FIGURE 3: Life span and per cent female survivorship in *Phelsuma guentheri* (1978-1992).

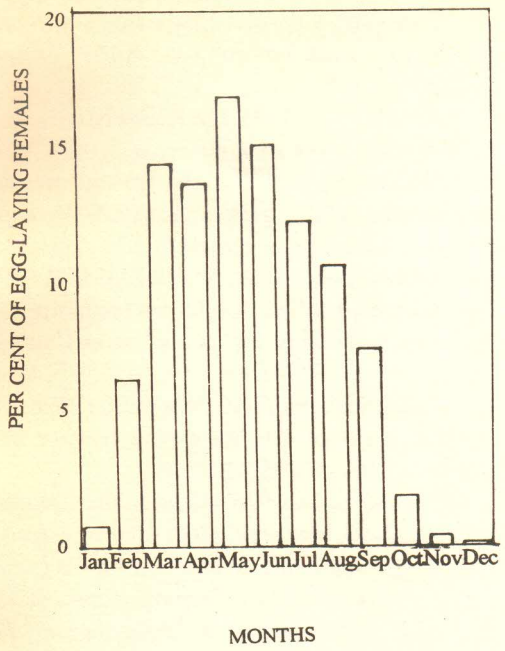

FIGURE 4: Seasonality of egg-laying in *Phelsuma guentheri* (1978-1992).

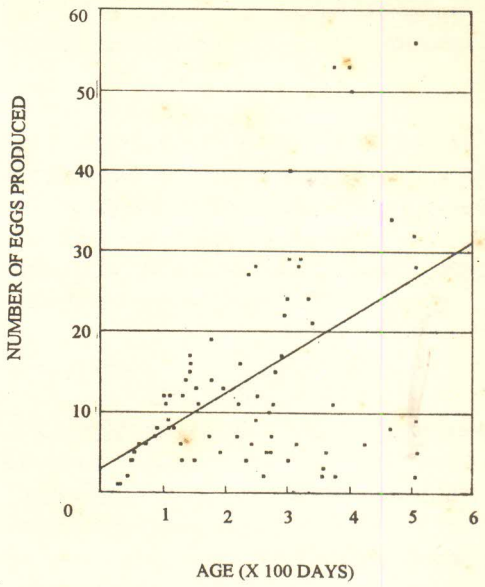

FIGURE 5: Total egg production in relation to age in *Phelsuma guentheri* (1978-1992).

0.76 years) old. Most females start laying the largest clutches of eggs between 3,200-3,500 days. Following this peak, egg production remains static. Wild-caught females were recorded laying eggs at 5,598 days (or 15.34 years). The last recorded egg-laying for captive-bred females was 4,829 days or 13.25 years (Fig. 1). The mean number of eggs produced by females is 13.38.

The survivorship curves of males and female reveal that animals die at the same rate at different age classes. The males die at the same rate but at a later phase in their lives, when 3,200-4,500 days (Fig. 2), the death rates of the males were steady. The mean life span of females is 2,176.39 days, ± SD 1145.86 (Fig. 3) and for males is 1,923.80 ± SD 1059.37 days.

More females start laying in March, egg-laying reaching a peak from November to January (Fig. 4). Most females produce eggs between May and July. The larger females produced larger clutches, the largest clutches produced when females are 3,000-3,700 days old. Fig. 5 shows the total egg production in relation to age in the species.

The main problem in breeding these geckos so far has been the skewed sex ratio in favour of females, although temperature-dependent sex determination has not been shown in geckos of the genus *Phelsuma*. Skewed sex ratios have also been noticed in the Mauritian species, *Phelsuma guimbeaui* that are captive-bred (McKeown, 1993). Thorogood and Whimster (1979) considered the skewed sex ratio among the leopard gecko, *Eublepharis macularius*, to be due to low incubation temperature, eublepharine geckos known to have temperature-dependent sex determination.

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THE ENDOPARASITES OF *CALOTES VERSICOLOR* IN MANNAMPANDAL AND PORAYAR AREAS OF TAMIL NADU, INDIA

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ABSTRACT: The endoparasitic helminths and arthropods recovered from *Calotes versicolor* in Mannampandal and Porayar, Tamil Nadu, south India, include *Paradistomum orientalis*, *Oochoristica indica*, *Strongyluris* sp., *Physaloptera* sp., *Thelandros* sp., *Ascaria frenatusi*, *Conispicum guindiensis* and *Raillientiella gehyrae*. The incidence of infection in relation to sex and size have been discussed.

KEY WORDS: *Calotes versicolor*, Endoparasites, Helminths, Arthropods, India.

INTRODUCTION

Detailed knowledge of the parasitic community is desirable. At its simplest, the presence of parasites provides information about the spatial and trophic relationships of the host (Kennedy, 1975). Intrinsic factors, such as size, sex, food habits as well as extrinsic ones, including the availability of suitable food and seasonality may also influence parasites (Spall, 1968). Size may influence the behaviour of the host species, so that habitat preference or quantity and type of food consumed will directly or indirectly influence the parasite population (Anderson, 1974). Studies by Esch (1967), Culbreth *et al.* (1972) and Novak (1975) have shown that the sex of the host can affect the establishment, growth and egg production in helminth parasites. The quantity and type of food consumed directly or indirectly influences the parasitic population (Anderson, 1974).

Calotes versicolor is the most familiar and widespread species of agamid lizard in India, being common in scrub jungles, open woodlands and city gardens from the Himalayan foothills to the southern tip of India. It is a predator of invertebrates that are known to be pests of such insects (Foster, 1942; Dickmans and Shorb, 1942; Anantaraman and Jayalakshmi, 1963; Lavoipierre and Lavoipierre, 1965; Anantaraman and Sen, 1966), or are vectors or intermediate hosts, such as earthworms (Alicata, 1934; Anderson and David, 1971) and crustaceans, slugs and snails (Schwartz and Bishop, 1942; Anderson and David, 1971). Thus, the species is suspected to be important in the control of a variety of diseases to humans and livestock. Additionally, *C. versicolor* is a paratenic host of *Spirocerca lupi* (Anantaraman and Sen, 1966) and is the intermediate host, harbouring the metacercariae of a digenetic trematode Lecithodendridae (Pandey and Agarwal, 1979). The parasites of *C. versicolor* thus merit investigation.

The objectives of the present study were:

1. To identify the endoparasitic helminths and arthropods of *Calotes versicolor*; 2. To estimate the incidence and intensity of infection of the endoparasitic helminths and arthropods; 3. To examine the incidence and intensity of infection in relation to body size of the host; and 4. To examine the relationship between the diet of the host and the parasitic fauna.

STUDY AREA

The present study was conducted in Mannampandal (11° 18'N and 80° 50'E) and Porayar (11° 02'N and 79° 51'E), in Thanjavur Dist., Tamil Nadu, south India. The two sites are situated approximately 25 km apart, Porayar (altitude 0 m above msl) being located near Tranquebar, 2 km from the eastern coast, while Mannampandal (altitude 11.25 m above msl) is 6 km from Mayiladuthurai.

MATERIAL AND METHODS

Examples of *Calotes versicolor* were caught using a noose attached to a long stick. In all, 100

lizards (sex ratio 80:20) were collected from Mannampandal, 100 (94:6) from Porayar. Each animal was killed with chloroform and the following activities and observations were conducted:

1. Host body length were recorded; 2. The abdominal cavity was opened and the sex of the host was recorded; 3. Fresh preparations from the blood from the caudal vein and heart were examined for microfilariae; 4. The urinary bladder, lungs, liver, stomach, intestine, caecum and rectum were placed in separate petri dishes containing 1% physiological saline and examined for parasites; 5. The stomach contents of the host were recorded; and 6. The type and number of parasites collected from each organ and region were recorded.

Prior to relaxation and fixation, the parasites were freed from the surrounding mucous. The digenetic trematodes were killed by plunging them into water at 60°C (Slusar'ski, 1958). They were flattened and fixed in AFA (alcohol-formol-acetic) solution, stained in acetic carmine or Delafield's haematoxylin, dehydrated in an alcohol series, cleared in creosote and mounted in DPX. The nematodes were killed in hot (70°C) 70% ethyl alcohol and fixed in 70% cold alcohol, the largest ones being cleared in lactophenol, while smaller ones were stained with Horen's trichrome stain, dehydrated in glacial acetic acid, cleared in glacial acetic acidmethyl salicylate series (Chubb, 1962) and mounted in DPX. The arthropods (pentastomids) from the lungs were killed in hot water and fixed in FAA (formalin-acetic alcohol) solution (Self and Kuntz, 1957).

RESULTS

The present survey of helminth and arthropod parasites in *Calotes versicolor* reveal the presence of the following parasites:

Paradistomum orientalis Narain and Das, 1929, was found in the gall bladder and bile duct.

Oochoristica indica Mishra, 1945, was found in the duodenum.

Strongyluris sp. was found in the stomach and intestines.

Physaloptera sp. was found attached to the inner wall of the stomach and other parts of the digestive tract.

Thelandros sp. was in the caecum and rectal regions.

Ascaridia frenatus Gupta and Jehan, 1969, was found in the stomach.

Conispiculum guindiensis Pandit *et al.*, 1928, was found in the body cavity along the dorsal blood vessels and sub-clavian artery.

Spirocerca lupi Rudolphi, 1809 cysts were found in the subcutaneous layer, muscles, abdominal cavity, mesenteries, kidney, liver and the walls of the stomach, intestines and rectum.

Raillietiella gehyrae Bovien, 1927, was found in the lungs.

The incidence and intensity of infections in *C. versicolor* have been presented in Tables 1 and 2.

The incidence of infection increase with body size. A uniformly high prevalence of infection (100%) was observed in the 11-11.9, 12-12.9, 13-13.9, 14-14.9, 15-15.9 cm length size-classes of the host. High (100%) incidence in the Porayar area was observed only in the 15-15.9 cm size-class.

DISCUSSION

Although the two study sites are within approximately 25 km, a considerable difference in the incidence and intensity of the endoparasitic fauna of *Calotes versicolor* were found. Similar geographic difference has been reported in *Haemotoloechus breviplexus* and *H. coloradensis*

TABLE 1: The overall incidence and intensity of infection by helminthic and arthropod parasites in *Calotes versicolor.*

Site	Number of hosts examined	Number (%) of hosts infected	Total number of parasites recovered	Intensity per infected host
Mannampandal	100	90 (90)	2441	27.12
Porayar	100	80 (80)	803	10.03

TABLE 2: Incidence and intensity of infection of individual parasitic groups in *Calotes versicolor* in the two study sites.

Parasitic groups	Mannampandal		Porayar	
	Number (%) of hosts infected	Total number of parasites and intensity	Number (%) of hosts infected	Total number of parasites and intensity
Digenetic trematodes	49 (54.44)	296 (6.04)	16 (20)	57 (3.56)
Cestodes	17 (18.88)	68 (4)	16 (20)	64 (4)
Nematodes	79 (87.77)	1814 (22.9)	68 (85)	680 (10)
Arthropods	11 (12.22)	263 (23.91)	1 (1.25)	2 (2)

infections in *Rana catesbiana* from the Sierra County, New Mexico and Brazos county, Texas, USA, by Dronen (1977).

Parasites in the present were generally found to be site-specific. *Paradistomum orientalis* was found occupying the gall bladder, and none were found in the liver or intestines, although Arora and Agarwal (1960), Arora *et al.* (1962) and Gupta and Agarwal (1982) have reported the species from these sites. The cestode *Oochoristica indica* was found attached to the inner wall of the duodenum by their scolices. Intraspecific competition is generally accepted to be widespread amongst parasite infrapopulations and specially in cestode populations where it is more frequently referred to as the "crowding effect" (Kennedy, 1977). In the present study, hosts with cestode infections had empty and shrivelled alimentary canals that measured 16-23 cm, while those of uninfected hosts measured 25-32 cm.

Among the nematodes, a greater plasticity in the selection of sites was observed, these found invading almost every organ system of the host. Numerous cysts (25-1500) of *Spirocerca lupi* were found in the subcutaneous layers, muscles, stomach wall, abdominal cavity, mesentery, kidney, liver, intestines and the rectum. Several vertebrates have been reported as paratenic/transport hosts of the canine oesophageal worms, *Spirocerca sanguinolenta* and *S. lupi* (Faust, 1927; Hu and Hoeppli, 1935; 1937; Ono, 1933; Rhizkov and Nazarova, 1959; Bailey, 1963; Anantaraman and Sen, 1966). The carnivorous definitive host usually becomes infected by eating paratenic/transport hosts such as toads, reptiles, birds and small mammals (Faust, 1927).

Thelandros sp. was found in the caecal and rectal regions of the host, while *Raillietiella gehyrae*, which ranged in size from 2-20 mm, were found in the lungs. Noteworthy is that a single host from the Mannampandal sample was infected with 121 *R. gehyrae*.

The intermediate host of *Paradistomum orientalis* are reported to be land snails. It has been shown experimentally by Bharathi (1971) that the terrestrial snail, *Glossula neglecta*, acts as the first intermediate host and the terrestrial isopod, *Porcellio laevis*, the second intermediate host. The lower infection rate of digeneans at Porayar may be associated with the general scarcity of molluscs.

The size of the host appears to have far reaching effects on parasitism in natural infections (Dogiel, 1966; Spall, 1968; Noble and Noble, 1971). The infection by *Eustrongyloides* in brown trout, *Salmo trutta* is confined to larger fishes and no trout under 20 cm body length was found to harbour the parasite, and size, rather than age, was thought to influence infection (Kennedy and Lie, 1976). Chubb and Mishra (1969) showed that only larger pikes were infected by *Triaenophorus monetron*. The incidence and intensity of *Paraplerurus sauridae* increased with body length up to 20-24 cm (Sathyanarayana, 1982). A similar observation was noticed in the present study, where the incidence of infection increased with body size in *C. versicolor*.

The abundance of helminth and arthropod endoparasites is suspected to be related to the local distribution of intermediate hosts. It is thought that *C. versicolor* in the Mannampandal area feeds on a greater variety of food compared to those at Porayar, which may be reflected in the higher intensity and incidence of the parasitic fauna in the former population.

The information currently available is sufficiently interesting to justify further work on the species. It is suggested that differences in the habitat, environment and/or the intermediate host fauna result in the differences in the parasitic fauna of *C. versicolor.*

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OBSERVATIONS ON THE DIET AND MICROHABITAT USE BY *PLATYMANTIS DORSALIS* A. DUMÉRIL, 1853 (ANURA: RANIDAE) AT MOUNT MAKILING, LOS BANÕS, PHILIPPINES

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(with two text-figures)

ABSTRACT: Dietary and microhabitat data are presented for 17 examples (15 adult males, two juveniles) of *Platymantis dorsalis*, a ranid frog endemic to the Philippines, from Mount Makiling in Luzon. Spiders, insect larvae and termites are the dominant prey of the species at the site, other food taken including ants, beetles, millipedes and centipedes. There appears to be no relationships between the size of the trophic apparatus (here head width) and prey size or the size of frog and number of prey items harvested. Frogs were taken from low vegetation, the substrate and from buttresses of *Pandanus*, at altitudes between 105-145 m above msl.

KEY WORDS: *Platymantis dorsalis*, diet, microhabitat, Luzon, Philippines.

INTRODUCTION

Mount Makiling (altitude 1,130 m above mean sea level) on south-western Luzon, in the northern Philippines, lies between 145° 05-15' N and 121° 08-18' S, approximately 65 km from Metro Manila. In extent 4,244 ha, it is situated within the Los Banõs campus of the University of the Philippines, sprawled over the provinces of Laguna and Batangas. A proclamation in 1910 made Mount Makiling the country's first National Forest Reserve.

Perhumid climate prevails, with two distinct seasons, January to April being dry, while the rains come between May and December. Average annual rainfall in the area is about 2,200 mm, rainfall peaking between June and August. The soil of the region is of volcanic origin, with a pH range of 6.5-7.5 (alkaline). The altitudinal range of the Park is between 100 to over 1,000 m above sea level. Several streams originate from the hill ranges, including the Calo, Molawin, Pili and Dampalit. The floristic diversity of the area is remarkable: Mount Makiling contains more woody species than the entire United States of America (Myers, 1988).

The herpetofauna of the area is fairly well known. Taylor (1922) produced the first inventory of the area's herpetofauna. Delos Santos (1992) reported on the amphibians found in the Mud Spring area, including *Platymantis dorsalis* and *P. corrugata*. The most recent checklist of the area's herpetofauna includes 22 species of amphibians and 61 species of reptiles (Diesmos, 1993).

This communication presents observations made on the diet and microhabitat use by the ranid *Platymantis dorsalis*, which we studied at Mount Makiling. The species is widespread in the Philippines Archipelago, being recorded from all islands except Palawan (Alcala, 1986). Little is on record of its biology in the literature, and till Brown and Inger (1964) showed the valid name for the taxon, the species was listed in the older literature as *Platymantis meyeri* Günther, 1873 (see Inger, 1954; Alcala, 1962) and as *Cornufer laticeps* in Taylor (1920).

MATERIAL AND METHODS

Investigations were conducted between September 16-20, 1993. We located most frogs from calls. Upon capture, we took detailed microhabitat description, including distance from substrate (to nearest 5 cm), altitude (to nearest 5 m), a general description of microhabitat type, date and time of

calling. Specimens were fixed in formalin and subsequently transferred to 70% ethanol.

In the laboratory, measurements (hereafter, SVL = snout-vent length; TBL = left tibia length; BW = body width; HL = head length; HW = head width) were taken of all specimens. Specimens were dissected, and the stomach contents removed. Prey items were identified with a dissecting microscope and measured with a dial vernier caliper. Prey volumes (V) were estimated from the measurements of the length, width and depth of the prey ($V = l \times w \times d$).

RESULTS

SIZE

Of the 17 individuals of *Platymantis dorsalis* collected, 15 are adult males, with enlarged testes. The remaining two are juveniles that could not be reliably sexed, showing gonads that are not differentiated. SVL of the males ranged between 21.2-28.8 (mean 22.65 ± SE 0.48) mm, TBL 10.7-16.5 (mean 12.09 ± SE 0.34) mm, BW 6.6-10.4 (mean 8.90 ± SE 0.30) mm, HL 6.7-11.6 (mean 8.27 ± SE 0.300) mm and HW 8.1-11.9 (mean 8.75 ± SE 0.23) mm. The two juveniles measured SVL 10.7 and 11.3 mm, TBL 6.1 and 6. 3 mm, BW 3.5 and 5.1 mm, HL 4.5 and 4.9 mm and HW 4.3 and 4.8 mm. Two of our 17 (11.7%) frogs possess a pale paravertebral stripe.

DIET

All 17 frogs contained food in their stomachs. By frequency of occurrence, spiders, insect larvae and termites were the most important of the identifiable prey types, each of which occured in three frogs. Other prey recorded include ants and beetles (both in two frogs), while a single millipede and one centipede were found, indicating that these prey items are taken less frequently.

Prey length ranged between 0.12-29 (mean 5.73 ± SE 1.57) mm, prey volume between 0.0002-132.5 (mean 13.02 ± SE 9.00) mm^3. There was no correlation between the size of the trophic apparatus (here HW) and prey length ($r = 0.19$; $p > 0.05$) or prey volume ($r = 0.125$; $p > 0.05$), suggesting prey choice is based on criterion other than prey size. Each of the frogs had 1-8 (mean 2.29 ± SE 0.62) prey items in its stomach, and no frog had an empty stomach. Based on the dietary spectrum of this species (Fig. 1) and the number of prey taken (Fig. 2), *Platymantis dorsalis* appears to be an opportunistic predator.

MICROHABITAT USE

Of the 17 examples of *Platymantis dorsalis* collected, microhabitat data exist for 16. Our collections were made between 1733 and 2145 hours, with the exception of a juvenile which was taken at 1215 hours. These were taken from low vegetation (one example), on leaves of the moist forest floor (two examples) and from buttresses of the screw pine, *Pandanus* sp. (13 examples). Alcala (1962) mentioned that on Negros Island, in the central part of the Philippine Archipelago, these frogs occupied the forest floor, usually beneath rotting leaves and logs and under mats of moss in the montane forests, and occasionally in aerial ferns growing on leaning tree trunks that are close to the ground. On Mindanao, in the southern Philippines, Taylor (1920) recorded the species (as *Cornufer laticeps*, which was included in the synonymy of *Platymantis dorsalis* by Brown and Inger, 1964) from "...the immediate vicinity of water, at low elevations, usually under leaves or logs along the edges of small mountain streams.". The altitudinal range of the species at Negros is from sea level to about 1,750 m above msl (Alcala, 1962), although it is most common at altitudes of over 1,000 m (Alcala, 1986). On Mindanao, four of eighteen (22.2%) of frogs of the present species were taken at elevations between 760 and 915 m, the remainder 14 (77.8%) from below 30 m (Inger, 1954). The altitudinal range of the 13 specimens from this study for which data are available was between 105-145 m above msl.

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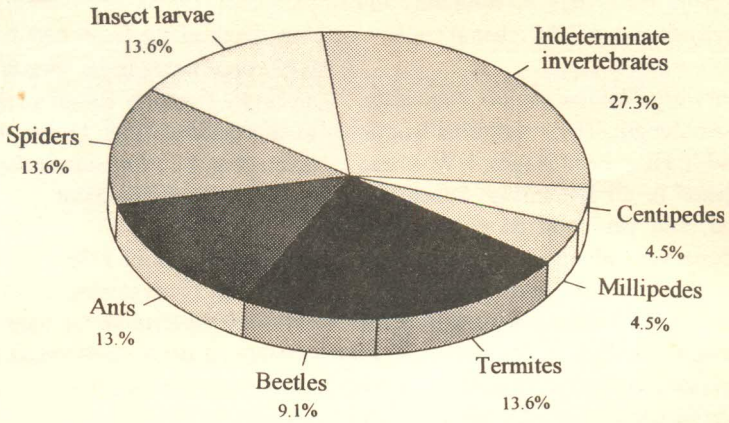

FIGURE 1: Frequency of occurence of prey types taken by *Platymantis dorsalis* (n of frog = 17).

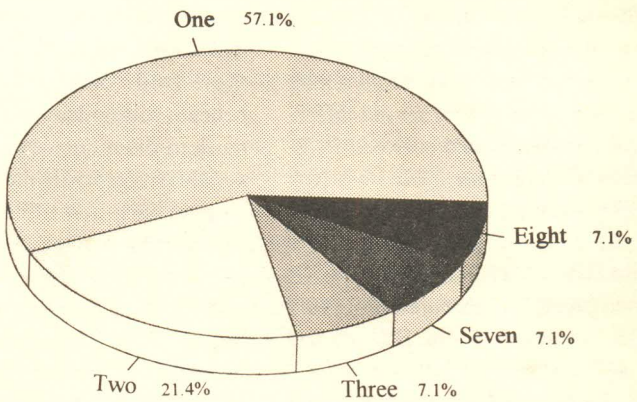

FIGURE 2: Number of prey items in stomachs of *Platymantis dorsalis* (n of frog = 17)

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STATUS OF THE SALTWATER CROCODILE (*CROCODYLUS POROSUS* SCHNEIDER, 1801) IN NORTH ANDAMAN ISLAND

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INTRODUCTION

The saltwater crocodile (*Crocodylus porosus*) was once common and abundant in deltaic habitats in India comprised of mangrove forests, ranging from Cochin on the south-western coast, which is the easternmost extremity range of the species, to the Sunderbans in West Bengal. (IUCN/SSC Crocodile Specialist Group India Task Force Report, 1993). This large reptile also occurs in the mangrove habitats in the Andaman and Nicobar Islands, considered to be one of the world's largest mangrove ecosystems.

The Andaman and Nicobar archipelago, consisting of over 550 islands, islets and rocky outcrops, with a land area of 8,213 sq km and a coastline of 1,962 km, lies between 6° 45'N and 13° 41'N and 92° 12'E and 93° 57'E. Whitaker and Whitaker (1978) and Whitaker (1983), during surveys in the Andaman Islands in 1975 and 1976, estimated the population in North Andaman to consist of 15 breeding females, and a total population of 100-200 crocodiles. Choudhury and Bustard (1979) reported the finding of 30 nests and sighting of 39 crocodiles during a nest predation study in North Andaman. The sighting of such a low number may be attributed to the fact that only a few areas were surveyed, with the nest study being the main objective. It was confirmed that no crocodiles were released in areas in North Andaman under the Andaman and Nicobar Island Forest Department's restocking program (I. H. Khan and A. Saxena, *pers. comm.*, 1993), as it was felt that following the ban on hunting, the population numbers would recover and stablize.

METHODS

A 22 feet dugout canoe, fitted with a 8 HP diesel inboard engine was the research vessel used for the survey. The survey team consisted of the authors and two Karens (settlers from Myanmar), one a boatman and the other an employee of the Andaman and Nicobar Islands Forest Department. The survey was carried out during November and December 1993. Creek and bay surveys were mostly carried out during low tide during the day. Methods used for crocodile counts included spotlighting at night for eye-shines with a 6V flashlight and day counts, considered as direct sightings. Indirect evidence such as tracks, old nests, interviews with local fishermen, farmers, settlers and Forest Department were also recorded. The population status in this paper was determined by direct sightings and indirect evidence of tracks and old nests. Assessment of disturbances such as logging, siltation, encroachment, land use, vegetational and topographical changes, fishing, mechanized boat traffic and other human interferences were recorded. Two to four days were spent in each area depending on the size and number of creeks in each bay. Due to the size of the dugout, night counts were carried out only during high tide after 2100 hours. A spotlight survey was carried out once up each of the creeks with stops at intervals of 30-60 minutes, and then back down the same creek and into the bay. Day counts were carried out during low tide and repeated twice during the same day at different times, depending on the timing of the tide. Temperatures during November - December 1993 were recorded for 51 days as follows: Morning temperatures between 0600-0630 hours, air and water temperatures in the creek at 50 cm depth, mid-day temperatures between 1200-1400 hours and night temperatures between 2000-0000 hours were recorded. Temperatures were recorded with a Keilthley, Tegam 866 digital thermometer with a resolution of 0.1°C and YSI 45004 thermister.

Crocodile nesting habitats and freshwater marshes were surveyed on foot to assess the present status of these habitats and for the presence of old nests. The survey was started from the

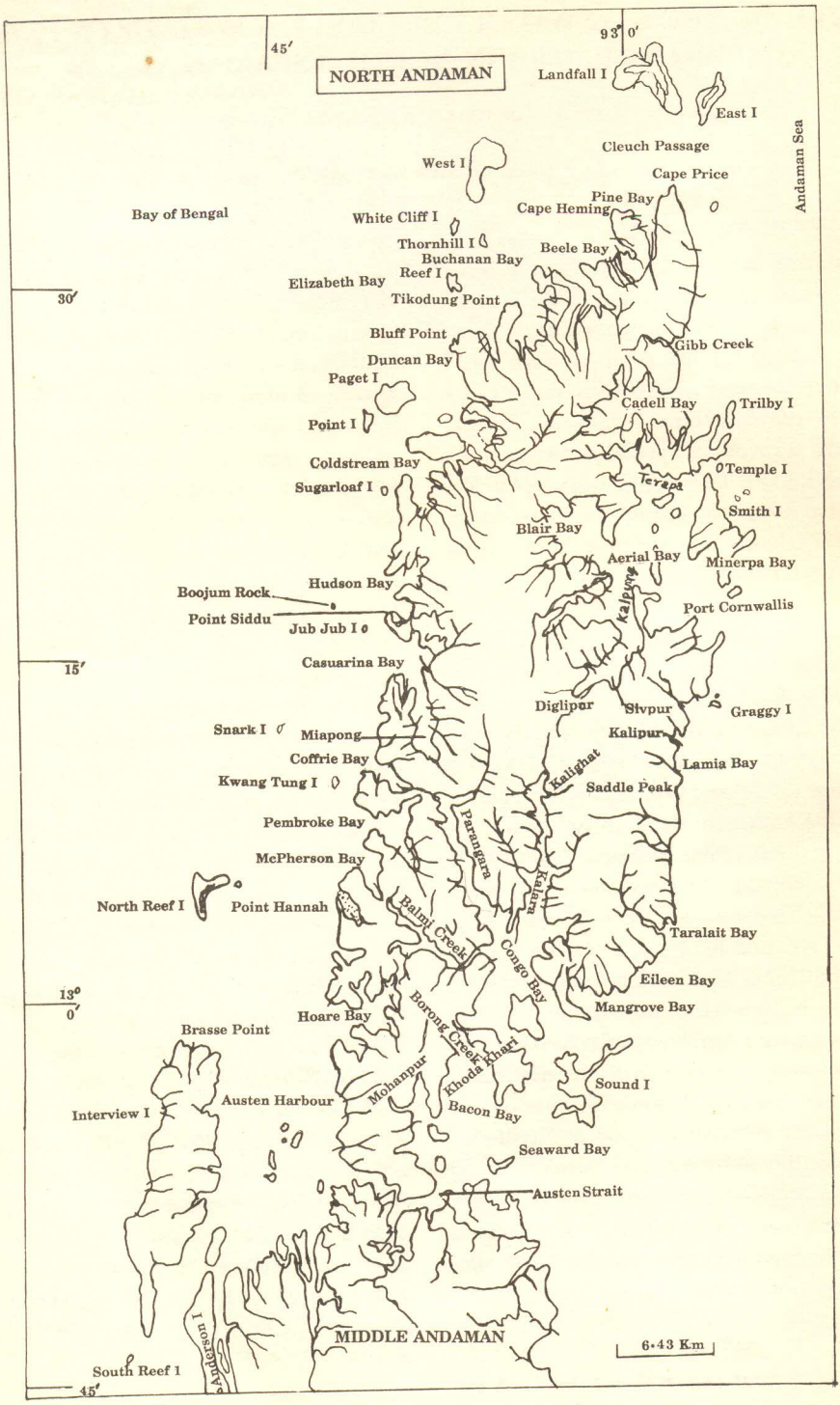

FIGURE 1: Map showing survey localities in the North Andamans.

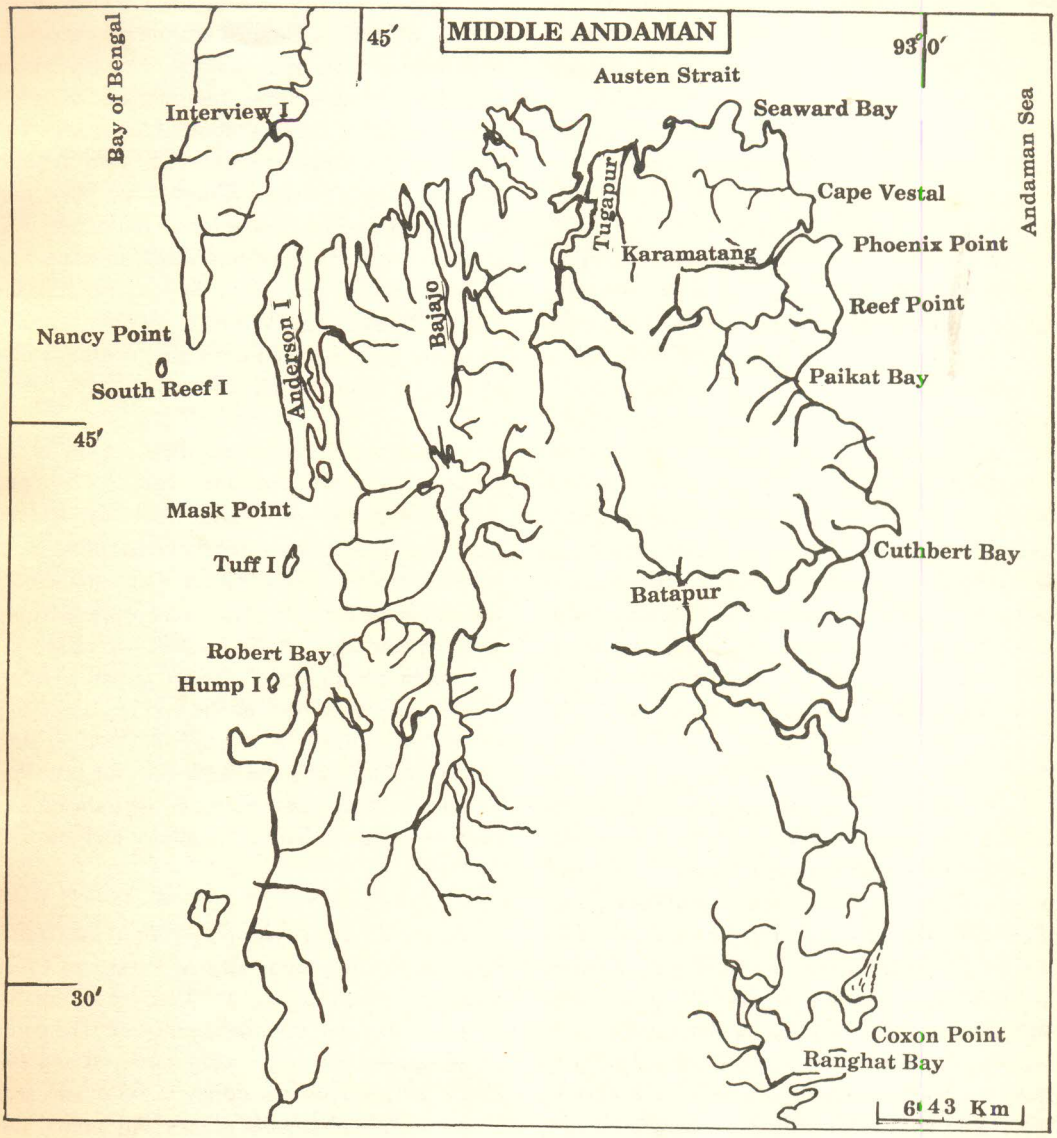

FIGURE 2: Map showing survey localities in the north of Middle Andaman.

southern part of North Andaman, continuing along the western coast through bays and around the eastern coast down to the northern part of Middle Andaman. A total of 110 main creeks and several smaller creeks were surveyed (Fig. 1). The outlying islands surveyed were Interview, North Reef, Point, West Landfall and Smith. A few areas in the north of Middle Andaman were also surveyed (Fig. 2). A total of 220 hours for day and 176 hours for night surveys were expended.

OBSERVATIONS

Kalara River or Kalighat Creek: This creek was surveyed during the day and night, including the three small creeks branching off from the main creek. A total of four crocodiles were sighted in the main system: two 2.5-3.5 m and two about 1.5 m. No crocodiles were sighted past the Kalighat jetty where the creek narrowly tapers down. Fishing activity is intense, fishermen in boats and on both sides of the bank were observed fishing with lines and throw nets. The freshwater stream that flows into this creek is silted and the creek is blocked by fallen trees about one kilometre above the jetty. The flat area above this freshwater creek, once crocodile nesting habitat, has dense human settlements with all of the land under agriculture.

Interviews with local people and farmers indicate that there are no crocodiles to be found beyond the jetty in the upper reaches of the creek close to the freshwater sources. People living near the jetty reported the sighting of a crocodile measuring >4 m that was floating dead in the creek in 1993. It is believed that the crocodile was responsible for attacking and killing a man in the area. In a survey of the area in January 1988, eight crocodiles were sighted within one hour, and most of these animals were in the 3-4 m size class (A. Saxena, *pers. comm.*, 1993). Regular boatmen and ferry people between Mayabundar and Kalighat report the presence of at least ten crocodiles in the main creek. Whitaker and Whitaker (1978) reported the sighting of a crocodile 4.5 m in length close to the jetty.

The small creeks branching out from the main Kalighat Creek surveyed during the night revealed the evidence of smaller crocodiles in the 1-1.5 m size class. Some of the habitats surveyed at the end of the creek for suitable nesting habitat are under heavy fishing pressure, regular harvesting of cane and bamboo from the adjacent flat land and illegal logging by settlers. Limited nesting habitat exists, with most of the primary habitat being taken over by settlers for agriculture. Improper land use practices have led to rapid siltation of the creeks. The traffic in the creek is congested, with dugouts ferrying people between Kalighat and Mayabundar, log-rafting and fishing boats. Interviews with settlers, fishermen and Forest Department personnel indicate that crocodiles no longer nest in the area. Whitaker and Whitaker (1978) reported three hatched nests and a female guarding a nest of 72 eggs, which hatched successfully.

Parangara Creek: A spotlight survey of the creek revealed six crocodiles: four 2-2.5 m and two 1-1.5 m. Interviews with local boatmen and Forest Department boatmen report the presence of seven or eight adult crocodiles. Two small creeks branching off from the main creek were surveyed and two crocodiles in the 1-1.5 m size class were sighted by spotlighting. No nesting habitat exists in the area, with most of the viable areas being under agriculture (A. Vaughan, *pers. comm.*, 1993). This area was one of the sites suggested for a nest predation study, however, no indication of nests were found here (Choudhury and Bustard, 1979).

Balmi Creek (Pylong-Karens): This fairly large creek runs south-west of Parangara Creek and drains into Congo Bay. There are six smaller branches draining into the main creek. The entire creek system was intensively surveyed and evidence of five adult crocodiles, 2.5-3 m was seen in the main and smaller creeks. An animal was sighted in each of the smaller branches, and the larger animals occupied the main creek.

The creek is fairly undisturbed, with fishing activities restricted to the mouth. Also, unlike any of the other creeks surveyed in North Andaman, no settlements were found at the end of the creek. The nesting habitat was found to be intact, although evidence of cane and bamboo harvesting

was observed. An old Forest Department camp Aamdehara (mango village) started by the British, is situated at the mouth of the main creek. No mechanized dugouts are used in the main and smaller creeks, except those belonging to the forest camp. The area could prove to be an ideal restocking site, subject to further survey and assessment prior to restocking.

Borong Creek: This is one of the most highly disturbed areas consisting of degraded mangrove forests, a settlement and a forest camp. Mechanized dugouts belonging to the Forest Department and settlers frequently ply up and down the creek and logs are also rafted. Forest Department boatmen report the sighting of two crocodiles in the creek: one with a stump tail <3m, and the other 3 m. The Karens report the presence of five large crocodiles.

The nesting habitats in the area were explored for old nests and the entire area assessed. Prime nesting areas (in the Andamans typically consisting of tiger fern, *Phoenix* palm, *Pandanus,* creeping cane and bamboo brakes) are now reduced to a few remnant patches of land where freshwater streams flow. The remaining areas are occupied by settlers. Some of the areas surveyed had large tracts of cleared land lying unused since several years ago. It is evident that the area consisted of a rich ecosystem prior to settlement. The entire area of flat land is completely degraded, the freshwater creek is silted up, and what was recently prime crocodile habitat is now gone.

Khoda Khari Creek: This small man-made creek connecting Bacon Bay and Congo Bay is mainly used for rafting logs. A 2.5 m crocodile was sighted in this creek. However, it is doubtful if nesting occurs along this narrow creek, as most of the area is disturbed by logging and rafting.

Mohanpur Creek: This highly disturbed creek leads to a settlement called Mohanpur. Mechanized dugouts ferry people from the settlement to Mayabundar, Kalighat and Parangara. Several small fishing boats were also observed. Most of mangrove trees are logged near a small jetty close to the settlement and most of the nesting habitat has been cleared for cultivation of paddy and other seasonal crops. There are four smaller creeks branching off from the main creek. A 2.5 m crocodile was seen basking on a mud bank in the shade of a mangrove tree, in one of the branches of the creek.

Austen Strait: This extensive area could not be thoroughly surveyed, due to the lack of a boat and outboard motor, and will be surveyed during June 1994. Five large crocodiles >3 m were observed on two occasions. Interviews with local boatmen and Forest Department personnel indicate the presence of at least 7-8 large crocodiles. The area, which falls within the sanctuary, requires a thorough assessment as it is contains some of the last undisturbed areas for crocodiles.

Hoare Bay Creeks: Day and night surveys were conducted in these creeks and evidence of crocodiles in four major creeks and one smaller creek were found. Interviews with people fishing at the mouth of the creeks and in the bay indicated at least five large crocodiles 2.5-4 m in size inhabiting the entire system. Tracks and slide marks were seen of a large crocodile that disapppeared into the water on hearing our boat. It was estimated to be at least 4 m. A fisherman in the area confirmed observing the crocodile basking at the same spot everyday. A nest, closely guarded by a female, was reported to have been found in 1992. Incidents of crocodile attacks have also been reported in this area. Crocodile eggs are frequently collected by settlers in this area, and females are killed for their fat and gall bladder. The nesting habitat, flat land with freshwater sources have all been cleared for agriculture. Some of the farmlands extend right up to the mangrove creeks and hence soil erosion and siltation is high. The only nesting habitat left is along the tidal fringe and in the cane stands, which could not be surveyed due to rains.

McPherson Bay Creeks: There are three main creeks draining into this Bay. All three creeks were surveyed by day and night. Although no fishing or mechanized boats were encountered in the bay or creeks, much of the area is heavily settled. The bay supports two small settlements on

its northern and southern sides. Areas at the end of creeks and further east inland are under intensive agriculture and large areas of flat land forest have been felled. Two crocodiles 2.5 m in size were sighted here. Interviews with Karens indicate the presence of at least two to three additional crocodiles in the area. A large crocodile was reported to regularly bask on a sandy beach on the southern side of the bay. The creeks and the bay are heavily silted. However, there is some remaining habitat that may be considered as a potential crocodile conservation area.

Pembroke Bay Area and Creeks: South of Pembroke Bay is a small bay locally called Camp Bay. Behind this sandy beach is a brackish water swamp connecting Pembroke Bay to a small creek, extending east into a mangrove swamp. Fifteen years ago a camp dog was taken by a large crocodile (P. Saw, *pers. comm.*, 1993). Both sides of the swamp were surveyed on foot, however, no evidence of crocodiles was found. The swamp being shallow (the maximum depth was 1 m, average approximately 50 cm) is probably used by crocodiles in transit but not as a permanent habitat.

Pembroke Bay has one large creek and two smaller creeks draining into it, with most of the area consisting of a mangrove swamp. No evidence of crocodiles was found. Karens report two to three crocodiles in this area. The western side of the creek is fairly wide and narrows down further inland. Some good nesting habitats still exist. However, settlements to the north and south of the bay are fast expanding and it is obvious that within a few years all the existing flat wetlands will be cleared and come under settlement and agriculture.

Coffrie Bay Creeks: This Bay has one large and one smaller creek draining into it on the northern and southern side. The creeks were surveyed during the day and night and evidence of three crocodiles was observed. One of the crocodiles was estimated to be 4 m in size. This is one of the less disturbed areas in North Andaman to be further assessed as a crocodile conservation area.

Casuarina Bay Creeks: Three major creeks and three smaller creeks drain into this Bay. All six creeks were surveyed by day and spotlighting at night. By direct sightings and indirect evidence, it is estimated that at least eight adult and five sub-adult crocodiles are present in the area. Interviews with several settlers confirmed the figure. One large crocodile, estimated to be over 4 m and three crocodiles in the 1.5 m size class were sighted in the bay. Attacks around the settlement by a large crocodile include an old lady who was eaten in 1991; a cow killed in August 1992 and another that survived an attack in October 1993 with a leg injury. On talking to settlers, there is a clear indication of seasonal movements of crocodiles and that most of the attacks were by female crocodiles, the highest frequency of sighting of crocodiles by settlers being in the nesting season. In 1993 a crocodile nested close to a fenced off piece of agricultural land. This area between Kishorinagar and Parsheemsagar where freshwater mixes with tidal waters, was once prime crocodile nesting habitat. A small freshwater creek close to the Bay flowing down from the northern side along a sea turtle nesting beach known locally as Mathan Creek was surveyed during the day. No evidence of crocodiles was found. However a local settler residing near the creek, employed by the Forest Department, reported the daily sighting of two crocodiles, estimated to be 2.5-3.5 m.

Hudson and Point Siddu Bay Creeks: Three large and two small creeks drain into Hudson Bay. These creeks were surveyed, including a stretch of marsh on the northern side of the bay, consisting of mangrove trees and palms. A portion of the marsh extends behind a stretch of beach. No evidence of crocodiles was found in the marsh and the last sighting of a crocodile in the area was over 20 years ago. (P. Saw, *pers. comm.*, 1993). The beach is highly disturbed, and hosts a camp for shark fishermen for many months in the year. Intensive fishing activities were observed in the Bay and despite our negative findings, fishermen report three crocodiles in these creeks, one of which is reportedly >4 m.

Cold Stream Bay Creeks: The three large creeks and three small creeks that drain into this

bay were surveyed. Two crocodiles 1-1.5 m, one crocodile 2.5 m and one <80 cm were sighted. Evidence of five crocodiles: two 3 m, two 2 m, and one of indeterminate size was observed. Fishermen report a large albino crocodile estimated to be around 4 m. Further interviews revealed it to be a light coloured, possibly xanthic (yellowish) individual. Reports from settlers and fishermen indicate the presence of at least three crocodiles in each of the creeks. The main creek is fairly wide at the bay, forking out into three small creeks leading into three settlements: Shyamnagar, Radhanagar and Krishnanagar. Intensive fishing activities was observed at the junction of these creeks, and 14 boats were counted at a time. Crocodiles are reported to nest close to these settlements in the agricultural areas, where little natural nesting habitat exists. The last remaining wild habitat is the tidal cane fringe, which is the least preferred nesting area, being prone to flooding.

Settlers and fishermen report that three cows were attacked and killed in 1993. Most of the attacks occurred during and after the breeding season. It was also reported that females found close to their nests were occasionally killed by people for their fat and gall bladers, and their eggs collected. Crocodiles (including small ones) are also frequently trapped in fishing nets.

The evergreen nesting habitat is being felled on a large scale, leaving huge tracts of cleared, unused land. Cane, bamboo and timber are regularly harvested by settlers, and the remaining areas of land under cultivation is fast-expanding. Regular traffic of mechanized boats transporting people, construction material, beach sand, cane and bamboo was observed. Settlers from all three settlements converge in the creeks and bay for fishing. Whitaker and Whitaker (1978) reported good nesting habitats in this area, and they also found steady progress in clearing of land and several crocodiles encounters with settlers. Little nesting habitat now remains and the chances of its survival is bleak due to its proximity to the agricultural areas and settlements. The banks of the creeks are fast eroding and the rate of siltation is high.

Duncan Bay Creeks: Three major creeks and one small creek drain into this bay. Two creeks were surveyed during the day and only one 3 m crocodile was sighted. Interviews with fishermen indicate that there are at least 2-3 adult crocodiles in each of these creeks. Heavy fishing and boat traffic was noticed in the area.

Bluff and Tikodung Points: A small bay between these points consists of a fairly large creek called "shark street" by the Karens. This creek was surveyed during the day and evidence of a 2.5-3 m crocodile was observed. The entire length of this creek could not be surveyed, as a portion of it was blocked off by fallen trees. It was reported that crocodiles were hunted in the creek over 20 years ago and a 6 m crocodile was killed in the 1960s (P. Saw, *pers. comm.*, 1993).

Elizabeth Bay Creeks: Day and night surveys were carried out in the creeks flowing into this bay, two of which are fairly large. One small creek could not be surveyed due to overhanging and fallen mangrove trees. Evidence of eight crocodiles were observed in the four creeks that were surveyed. The estimated sizes of these crocodiles were: one 4 m, two 3 m and five 1.5-2.5 m. The bay and its creeks unlike others surveyed, appeared completely undisturbed, and no fishing activities were observed. Although there is a fair amount of cane and bamboo harvesting, human interference to the nesting habitat is limited.

This area will be re-surveyed during the nesting season and should be considered a priority area for restocking and translocation of nuisance crocodiles. It is recommended that a buffer zone be designated around nesting habitats before these areas are also encroached upon. There are indications of a healthy population of crocodiles in the area and the reassessment will be carried out during the nesting season. It is necessary that a management and conservation plan be worked out and implemented for the area. Also, due to the absence of settlements nearby, the entire area may be designated a crocodile sanctuary.

Buchanan and Beele Bay Creeks: Two large creeks flow in these two bays. No evidence of crocodiles could be found here in the creeks. A fisherman interviewed reported seeing 2-3 crocodiles and the frequent sighting of a large crocodile estimated to be >5 m. He also reported that few people come into the bay and neighbouring creeks for fishing. The feasibility of making the area a crocodile conservation zone should be examined, being ideal due to the absence of human settlements and as no mechanized boats are used in the creeks.

Beele Bay Creeks: The five creeks and smaller branches that flow into the bay were surveyed intensively for three days. The central and largest creek leads up to Chepo, a Karen settlement and the other two are smaller creeks flowing alongside the central creek, one draining north-east and the other south-east into the bay.

Evidence of six crocodiles were observed and two were directly sighted. Estimates indicate that three crocodiles were 1-1.5 m, two were 2-2.5 m, one 3 m and one 4 m. The nesting habitat in this area was surveyed by foot. Two nests of the 1993 breeding season were found with the help of Karens, near freshwater drainage areas consisting of evergreen vegetation (cane, bamboo, *Pandanus*). An assessment of these two nest sites indicates that the area has been used by breeding females at least for the last 10 years, on the basis of number of wallows, eroded nest mounds and interviews with settlers. A skeleton of a crocodile was found about 30 m from one of the nest sites. The size, judging from the skull length (52 cm), was estimated to be 3.64 m in total length (seven times that of the skull length). This nesting site was about a kilometre away from a Karen settlement. The lowland area 200 m away from the nest site, is being cleared for settlement and agriculture. This area has three large perennial freshwater streams flowing through it and is situated south-west of the settlement. The other nesting sites are north-west of the settlement. Reports from the Karens and survey assessments show that much of the once prime nesting habitat, is now under the plough. These areas were surveyed and it is concluded that despite the limited existing nesting habitat, there are reports of the accidental finds of five nests per year.

Other reports include the incident of a man who was attacked and killed by a large crocodile in 1990, a large crocodile >4 m in size killed by settlers, a dog killed by a crocodile in 1992, and in August 1993, a crocodile 1-1.5 m was caught in a fishing net and killed. No heavy fishing activities were observed in the bay, despite the fact that settlers from other areas also fish in the creeks, and the area is relatively undisturbed in comparison to most other bays. Interviews with settlers indicate the presence of at least nine to 10 crocodiles in the area over the last ten years.

Pine Bay: There are no creeks draining into this bay, consisting of extensive mangrove marshes and a small freshwater stream flowing in from the southern side into the bay. Karens reported seeing a nest in the area in June 1993 and the remains of a dead crocodile (bones and skull close to the nest), probably the remains of a female that was killed and eggs taken by the settlers.

Gibb Creek: This small creek situated just above Cadell Bay on the eastern side of North Andaman, continues into a mangrove marsh. The creek and the marsh were surveyed and no evidence of crocodiles was found. A settlement exists at the edge of the mangrove forest and heavy fishing activities are underway. Settlers report the seasonal sighting of a crocodile 2 m in size, indicating that crocodiles use the area as a transit habitat. The mangrove area is open and the creek is short, narrow and silted. Whitaker and Whitaker (1978) reported the finding of two crocodile skeletons and scarcity of nesting habitat.

Cadell Bay Creeks: The five creeks in the bay were surveyed by day and night and fishermen in the area were interviewed. Evidence of five crocodiles was found through direct sighting and by tracks. Four animals were of the 2-2.5 m size class and one >3 m. The bay and its creeks are heavily fished throughout the day and night. Interviews with the locals indicate that there are at least four crocodiles in the main creek and two juvenile crocodiles in the bay. A large crocodile 4 m was

killed in the bay in 1992. However, no attacks on humans were reported from the area. There are two settlements nearby and several mechanized boats ply the creek day and night. The nesting habitat is now completely cleared and taken over by settlers and brought under agriculture. The tidal cane fringe adjacent to the creeks is the only habitat left, but this area is disturbed by settlers frequently walking through them to check their fishing lines set up all along the creek. Whitaker and Whitaker (1978) reported the sighting of a 4 m crocodile in one of these creeks and the scarcity of suitable nesting habitat.

Smith Island, Aerial Bay and Blair Bay Creeks: The entire area of this complex system of bays and creeks was surveyed over a period of six days, including four nights of spotlighting, and a total of 10 crocodiles were observed through direct and indirect evidences. Direct sightings included a 6 m crocodile, a 3 m crocodile and a yearling. Seven of the tracks observed were estimated to be in the 1.5-2.5 m size class.

The area is highly disturbed by continuous boat traffic, intensive fishing in the bay and creeks, illegal logging, and the remaining areas fast being cleared for settlements. Most of the banks are eroded and creeks and freshwater streams silted up. All the prime nesting habitats are occupied by settlers and are under cultivation. Agricultural activities extend right up to the banks of freshwater streams and creeks. The last remaining nesting habitat is restricted to the scanty and disturbed tidal cane fringes. The creeping cane and bamboo vegetation of the level lowland above the brackish water level, have all been cleared and taken up by settlers. Interviews with settlers and regular fishermen indicate that few crocodiles are present in the area with only one or two being sighted during the breeding season. There are several reports of nesting females being killed mainly out of fear and for their fat, gall bladder and eggs. Most crocodile sightings are during the breeding season (June and July), indicating a seasonal movement from other areas. Females have been seen close to settlements and near freshwater streams adjacent to agricultural land. Most of the creeks surveyed showed no evidence of crocodiles and none were sighted in the bays, mainly due to the intensive fishing activities and frequent plying of boats carrying sand, timber and people. Several man-crocodile conflicts were reported by settlers and fishermen, mostly in the breeding season. Settlers near the Kalpong River (once famous for large numbers of crocodiles), reported the frequent killing of crocodiles by fishermen and farmers who fear them. However, due to the intensive fishing activities and continuous plying of mechanized boats, the area does not provide a safe habitat for crocodiles. Whitaker and Whitaker (1978) reported extensive disturbance in this area, mainly the clearing of potential nesting habitat and collection of cane, bamboo and palm fronds for construction, extensive settlements and traffic in the creeks.

Shivpur and Kalipur: These two areas were surveyed on foot and no evidence of crocodiles was found. Interviews with settlers and farmers confirmed this view. There was absolutely no crocodile habitat left in these two areas, with the entire nesting habitat under cultivation and mangrove trees being logged and the open creek banks used for agriculture. One settler reported seeing a crocodile in 1989, but others reported that it was more than 12 years since crocodiles have nested in the area. The area is a typical example of total habitat loss and species disappearance. Whitaker and Whitaker (1978) reported this area as having the largest adult crocodile population in North Andaman and the lack of suitable nesting habitat.

Taralait, Elleen and Mangrove Bay Creeks: The creeks draining into these bays were not extensively surveyed. However, reports from settlers and fishermen indicate there have been no direct sightings of crocodiles in the creeks, except during the breeding season, when one or two crocodiles use the creeks. The creeks are silted and nesting habitat is under cultivation.

Interview Island: This fairly large outlying island of 133 sq km consisting of seven mangrove creeks draining out on its eastern side was surveyed. Evidence of seven crocodiles was found: four crocodiles were in the 3 m size class, two 1.5 m and one 4 m in size, respectively. The area is undisturbed and nesting habitat is still intact. As-

sessment of this island habitat indicate a small, but stable population. Further, the narrow, short stretches of creeks are insufficient to support a larger population. At least ten crocodiles are reported to exist in the area (Bonny, *pers. comm.*, 1993).

North Reef Island: This unique 3.48 sq km island, one of the few islands consisting of a long perennial freshwater swamp approximately 1.0 sq km on the eastern side, was surveyed for three days on foot. Evidence of two large crocodiles, 2.5 m and 3 m, was seen in November. Thirty yearlings and one animal >2 m in size were sighted on 28 May, 1993 (Bonny, *pers. comm.* 1993). A survey in early April 1994 confirmed the presence of three animals 2.5-3 m and one 1.5-2 m. A freshly-constructed nest was also found, confirming that females use this small island for nesting. An assessment of the freshwater marsh and strands of tall grass shows that some good nesting habitats still remains. It is estimated that at least two to three females breed on this island. There were also indications of crocodiles using the beach for basking and sightings of crocodiles going east into the reefs, either to get to the North Andaman or for feeding (P. Saw, *pers. comm.*, 1993). At least 20 people with 18 dugouts were seen camping here. Regular patrolling and monitoring of the island by the Forest Department personnel is difficult due to lack of staff and their inadequate patrol dugouts fitted with slow, inboard engines. In November 1993, these fishermen were moved out by the Forest Department.

Point Island: Similar to North Reef, this 307 ha. island has a freshwater swamp, which is dry in summer. Crocodiles have been seen in this swamp (P. Saw, *pers. comm.*, 1993). Assessment of this ecosystem indicates a limited nesting habitat used seasonally by crocodiles from Coldstream Bay or Duncan Bay. Several species of water birds and water monitor lizards were observed on this island.

West Island: With an area of 640 ha., this island has a mangrove swamp with two small creeks and a small freshwater marsh. These areas were surveyed on foot and no evidence of crocodiles was found. However, there are reports of crocodiles in the area (Whitaker and Whitaker, 1978; P. Saw, *pers. comm.*, 1993), though there is no suitable nesting habitat.

Landfall Island: Due to rain and rough seas, only two creeks could be surveyed on this island. Although no evidence of crocodiles could be found, there are reports of crocodiles breeding on this island (Whitaker and Whitaker, 1978; P. Saw, *pers. comm.*, 1993). The habitat is relatively undisturbed and good nesting habitat still exists. It is reported that there were at least 30-35 adult crocodiles in the area in 1983 (Basu, *pers. comm.*, 1993). Some of the eastern and southern areas were surveyed on foot, and some good, undisturbed nesting habitat were observed. This island, consisting of an area of 2948 ha., will be thoroughly surveyed during the nesting season.

North Middle Andaman: A few areas in the northern part of Middle Andaman were surveyed.

Hanspuri Creek: This creek was surveyed intensively, two day counts and two spotlight surveys were conducted on separate days. The creek was found to be undisturbed and no fishing or extraction of forest produce was observed. Evidence of three large crocodiles was seen in this creek system. One track was estimated to be that of an animal >4 m and another 3 m. The creek and its many branches were adjudged to be suitable for smaller crocodiles. This area may be considered for restocking, as dispersal is possible between Anderson Island, Interview Island and the south main island into Luwis Inlet and Roberts Bay. There is also extensive, undisturbed evergreen nesting habitat.

Bajato Creek: This large creek draining into the South Passage of Austen Strait, was surveyed during the day. Two animals 1-1.5 m were sighted and evidence of two more crocodiles 2.5-3 m was observed. This creek with its many branches is disturbed due to fishing activities and the regular plying of mechanized boats. Despite this, some good nesting habitats still remain in this area.

Tugapura Creek: This creek was surveyed and the nesting habitat assessed. One crocodile of 3 m was sighted and evidence of a smaller sized crocodile, estimated to be <2 m, was found. Settlers report that the area was prime crocodile habitat more than 15 years ago. The banks of the creek are disturbed mainly due to agricultural activities extending right to the edge of the banks, and the level freshwater drainage area, once prime nesting habitat, is now completely cleared and cultivated. There is also tremendous erosion of both banks and siltation due to poor land use practices and deforestation. The last remaining patches of cane and bamboo close to the settlement are being extensively harvested and there are no further reports of crocodiles nesting in the area. However, man-crocodile encounters were reported from this area.

Karmatang Creek: Evidence of a large crocodile was found at the mouth of the creek. Karens living near here report two large crocodiles in this highly disturbed creek with its regular boat traffic. Most of the habitat on either side of the creek has been converted into agricultural land, leaving the junction of the tidal and fresh-water streams completely silted. There is no nesting habitat left and most of the mangrove forest has been cleared. One crocodile sighting was reported by a settler in the rainy season in June-July 1993, between Roper Point and Cape Vestal, off Rampur, south of Mayabundar in the bay.

Betapur Creek: This creek drains into Cuthbert Bay. Surveys during the day revealed the evidence of four crocodiles in the 3-4 m size class. A fisherman reported the sighting of two crocodiles in particular for the past 12 years, one of which basks opposite the settlement. He also reported the incident of a tiger shark caught in 1986, weighing 1,200-1,400 kg whose stomach contained a crocodile 2.5-2.75 m in length. A man was attacked and killed here in 1992 and a small boy was attacked while fishing on the bank of the creek in 1993 .

The freshwater stream, tidal creek and level lowlands are highly disturbed, resulting in large scale erosion of the banks and siltation of the stream, tidal creek, bay and reefs. There is also a lot of pressure on Mount Williams (the watershed) for forest produce such as timber, cane and bamboo that are collected by settlers. The entire nesting habitat has been converted into agricultural land and the creek is heavily fished and constantly disturbed with mechanized boats plying in and out. Surveys on foot and boat indicate the absence of habitat for nesting, hatchlings and juveniles. The crocodiles that still exist in the area are the remnant population of a once healthy and stable group, depleted due to over-hunting in the 1960s and early 1970s, and ultimately by habitat degradation due to uncontrolled expansion of settlements and agriculture.

RESULTS AND DISCUSSION

A total number of 113 *C. porosus* were observed during the two month survey of North Andaman from November to December 1993. Table 1 provides a locality-wise breakdown of the animals encountered. Twelve adult crocodiles were observed in areas surveyed in the northern part of Middle Andaman (Table 2). Of the total observed (n = 125), 95 were adults (76%), (animals >2.5 m), 14 sub-adults (2-2.5 m size class), 15 juveniles (<2 m) and one yearling (<80 cm).

An area-wise breakdown of the population structure in the various bays and creeks indicate at least one large animal >4 m total length inhabiting each area, the bay and the larger creeks. Each creek, depending on its length, supports a maximum of 1-2 adults. However, this assessment needs to be further quantified by repeat surveys.

Most crocodiles were sighted during low tide, while basking. Tracks and slide marks were also seen during low tide on the mud banks. Most animals were observed during day time counts. Thirty-two were observed in the 220 hours expended for day counts, and 13 animals were encountered in the 176 hour night count. This may be attributed to two factors: the noise generated from the large diesel engine inboard dugout, which had to be navigated slowly through the creeks, and the other factor may be that the air temperatures were lower than the water tempera-

TABLE 2: Estimated population of *Crocodylus porosus* in the northern part of Middle Andaman Island, through direct sightings and indirect evidence (tracks) during the survey. November to Deccember 1993. (see Fig. 2). Total crocodiles observed = 12.

Sl. No.	Locality	Distance (km)	Direct sightings	Indirect evidence	Total
1.	Hanspuri Creek	5.1	-	3	3
2.	Bajato Creek	7.5	2	2	4
3.	Tugapura Creek	5.0	1	1	2
4.	Karmatang	2.5	-	1	1
5.	Betapur	3.0	-	2	2

ture in the creeks. Temperatures recorded over a 51 day period during November-December 1993 show that air temperatures at night recorded between 2000 hours and 0000 hours was always lower than the water temperatures recorded at a depth of 50 cm. (Table 3).

Sighting of animals by settlers and man-crocodile conflicts, both in disturbed and undisturbed areas was more prevalent during the breeding season (May-July), possibly by migrating females to nesting habitats (now adjacent to human settlements) and animals moving up from bays into the creeks. The discovery of crocodiles and nests during May 1994 in North Reef Island, confirms the presence of a small nesting population on this 3.48 sq km island. Most crocodile habitat is highly disturbed and/or destroyed. Viable nesting habitat, flat wetlands with freshwater sources just behind the mangrove cane fringes has been, and is continually being taken up for settlement and intensive agriculture. This in turn has destroyed the nesting habitat and caused heavy siltation of the freshwater streams and the mangrove creeks. Felling of mangrove trees and cane and bamboo collection is also taking a heavy toll.

The only habitat remaining is the tidal cane fringe, close to settlements or paddy fields, prone to flooding and disturbances. A nest predation study carried out by Choudhury and Bustard (1979), show that this is the least preferred nesting habitat. Of the 15 nests reported in different vegetational complexes, only four were in the tidal cane fringes and in disturbed areas.

Mechanized boat traffic and intensive fishing is the main cause of disturbances, also resulting in the trapping of small crocodiles in fishing nets. Compensations for fishing nets destroyed by crocodiles were provided by the Fisheries Department.

TABLE 3: Temperature regimes during November - December 1993 over a 51 day period.

Morning	Mid-day 0600-0630 hours	Night 1200-1400 hours	2000-0000 hours
Air temperatures	23°C-29.1°C Average 26.4°C	27.7°C-35°C Average 30.5°C	23.7°C-27.8°C Average 26.3°C
Creek water temperatures at 50cm depth	25.9°C-29.5°C Average 28.3°C	27.9°C-30.7°C Average 34.0°C	28.2°C-29.0°C Average 28.5°C

Small creeks draining out from the mangrove marshes during low tide into the larger creeks are bridged across by nets which drown and kill hatchling and yearling crocodiles. Females nesting close to human settlements and agricultural land, are usually killed for their fat, gall bladder and eggs, locally considered to have a high medicinal value and sold among settlers in the islands. The remains of dead crocodiles were found near nest sites during the survey. Whitaker and Whitaker (1978), Whitaker (1983) and Choudhury and Bustard (1979), have reported extreme pressure on the

habitat of the species, namely, the mangrove swamps, creeks and the flat wetland areas, fast disappearing under the plough. They have also reported high nest predation by humans and killing of nesting females. Choudhury and Bustard (1979) reported that eggs from 17% of nests were taken by humans.

Evidence of human and crocodile encounters and loss of livestock were recorded from most areas surveyed. In most cases where human deaths have occurred, the crocodile is usually killed. These incidents are rarely reported to the Wildlife Wing of the Forest, mainly due to the remoteness of the area, fear of the invocation of the wildlife law by the Department, and in some cases, the settlements are on encroached forest land. These encounters take place close to settlements, where people have settled on nesting habitats adjacent to freshwater creeks. Reports from settlers indicate that these encounters occur mostly during the nesting season. Livestocks get taken while grazing along the freshwater streams or while using the streams. Most human attacks occur while fishing in the mangrove creeks or on the banks. So far there has been no incident of a person being attacked while fishing from a boat, although people report incidents of crocodiles getting entangled in fishing nets.

RECOMMENDATIONS

The major cause for the initial decline in crocodile numbers as cited by Whitaker and Whitaker (1978) and Choudhury and Bustard (1979) was large scale hunting, for the commercial skin trade prior to the enforcement of the Indian Wildlife (Protection) Act of 1972. However, the present survey provided no indication of large scale hunt-

TABLE 1: Population of *Crocodylus porosus* in North Andaman Island, through direct sightings and indirect evidence (tracks) during the survey period November to December 1993 (see Fig. 1). Total estimated adult population = 113. * refers to area (in sq km) of marsh.

Sl. No.	Locality	Distance (km)	Direct sightings	Indirect evidence	Total
1.	Kalara River or Kalighat Creek	13.6	4	2	6
2.	Parangara Creek	12.41	6	2	8
3.	Balmi Creek	16.0	2	3	5
4.	Borong Creek	4.0	-	2	2
5.	Khoda Khari Creek	1.5	1	-	1
6.	Mohanpur Creek	5.0	1	1	2
7.	Austin Strait	9.64	5	6	11
8.	Hoare Bay Creeks	10.21	-	5	5
9.	McPherson Bay Creeks	10.42	2	3	5
10.	Pembroke Bay area and creeks	8.21	-	-	-
11.	Coffrie Bay Creeks	4.21	1	3	4
12.	Casuarina Bay Creeks	13.64	4	4	8
13.	Hudson Bay and Point Siddu creeks	9.92	-	-	-
14.	Cold Stream Bay Creeks	17.56	3	5	8
15.	Duncan Bay Creeks	10.43	1	-	1
16.	Bluff and Tikadung Point Area	2.5	1	2	3
17.	Elizabeth Bay Creeks	9.0	2	8	10
18.	Buchanan Bay	7.0	-	-	-
19.	Beele Bay Creeks	11.0	2	6	8
20.	Pine Bay	2.0	-	-	-
21.	Gibb Creek	2.0	-	-	-
22.	Cadell Bay	16.85	2	3	5
23.	Smith Island. Aerial Bay and Blair Bay Creeks	29.29	3	7	10
24.	Interview Island (eastern side creeks only)	10.5	1	7	8
25.	North Reef Island	1.0*	1	2	3

ing for the skin trade. These authors have reported the loss of habitat, collection of eggs and killing of females, which have had a detrimental affect on the overall population, resulting in a decline of females, thereby reducing the recruitment rate.

The remoteness and inaccessibility of these areas, lack of staff, and adequate boats, further complicated by many of these areas falling under the classification of Revenue Land, out of the Forest Department's control, makes monitoring, protection and management difficult for the Wildlife Wing of the Forest Department. It is recommended that enhancement of staff, fast mechanized boats and other field equipment be given high priority. Further, yearly monitoring of populations through surveys and nest counts should be taken up. Immediate conservation measures and management options should be urgently considered for areas such as Balms Creek, Buchanan, Beale Bay creeks, Hanspuri area, Coffrie Bay, Elizabeth Bay creeks and Cape Heming areas.

Immediate creation of buffer zones are needed for the protection of nesting habitat and to reduce man-crocodile conflicts. The following are recommended:

1) A 1,000 m buffer zone surrounding the freshwater streams.

2) Planting of local forest tree species along the banks of freshwater streams to prevent erosion and siltation.

3) A 1,000 m buffer zone around the nesting habitat, including areas falling under Revenue Land, mainly in areas where freshwater and tidal streams converge.

4) An intensive environmental education programme for the local people, combined with a feasibility study for crocodile farming and ranching of eggs as a conservation measure and sustainable development programme to provide tangible incentives for conservation, ultimately benefitting the species and the fragile island ecosystem.

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NOTES

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CAPTIVE BREEDING OF THE MALAYAN BOX TURTLE (*CUORA AMBOINENSIS*) FROM THE NICOBAR ISLANDS

The Malayan box turtle, *Cuora amboinensis* (Daudin, 1802) is one of the most widespread turtles in tropical Asia, with a distribution extending from north-eastern India, south-east to peninsular Malaya and Indo-China, and also the insular regions of south-east Asia such as the Sundas, Maluku and the Philippines (Das, 1991). Three subspecies have been described (Rummler and Fritz, 1991), although differentiations between the described taxa are generally weak. Biswas and Sanyal (1977) reported the species from Great Nicobar for the first time, and subsequently, the turtle has also been found in other of the islands of the Nicobars group, such as Trinkat and Car Nicobar (Bhaskar, 1979; 1981). Data on the reproduction of the species are available in the terrarium literature (e.g., Paull *et al.*, 1982; Inskeep, 1984a; 1984b; Mudde, 1987; Grychta, 1989). In general, one to two large, elongate, brittle, hard-shelled eggs may be produced at a time, and incubation period ranges from 47 to 100 days, depending on the incubation temperature, although variation within identical temperature regimes is considerable. Thai populations apparently produce larger clutches, between three to five eggs at a time and two clutches a year (Nutaphand, 1979). However, little is known of the reproductive biology of the populations from the Nicobars. Bhaskar (1979) reported a clutch of two eggs in January at Trinkat Island, central Nicobars, with one egg measuring 50 x 25 mm.

A male Malayan box turtle (straight carapace length 19.3 cm) was received at the Mini Zoo, Port Blair, Andaman Island, India, from Great Nicobar Island on 10 December, 1993. It was kept in a 1.2 x 0.91 m enclosure with a pool of water, a sandy stretch, and an area of loose garden soil with grass. The turtle fed on leafy vegetables, such as *Amaranthus* sp., bananas, fish, etc. Another turtle, an adult female, was brought to the facility, also from Great Nicobar, on 6 January, 1994, and kept in the same enclosure. The female (straight carapace length 12.62 cm) produced a single egg of dimensions 51.7 x 29.6 mm in the grassy section of the enclosure on 24 February, 1994. The egg was partially covered with soil, and the female was usually observed near the nest. After about 15 days, the egg was candled and as it was found dried, the egg was removed and preserved for display. The female laid a second egg that measured 49.6 x 28.4 mm on 4 April, 1994, and a third egg which was not measured was produced on 9 May, 1994. However, the third egg was damaged by the female on 14 May. Thus, the three eggs were laid at intervals of 39 and 36 days, respectively. The average nest temperatures of the second egg (taken between March and June) were 28.5°C at 0800 hours and 28.8°C at 1600 hours and ambient temperatures were 24.5°C at 0800 hours and 29.6°C at 1600 hours.

The second egg hatched after 86 days on 28 June. The hatchling had a dark-coloured carapace and bright yellow stripes on both sides of the head. Measurements of the hatchling were: straight carapace length 44 mm, curved carapace length 67 mm, straight carapace width 34 mm, curved carapace width 52 mm, plastron length 42 mm, shell height 15 mm. The hatchling weighed 16.5 gm. The hatchling is being kept for observations in a glass vivarium with a small container of water. The substrate is soft mud with the grass *Cynodon dactylon*. The young turtle feeds on mashed *Tilapia* fish, although it has also been observed nibbling on grass blades.

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MUGGER CROCODILES IN THE VICINITY OF HUMAN SETTLEMENTS IN SOUTH GUJARAT

(with one text-figure)

The mugger or marsh crocodiles (*Crocodylus palustris*) is widely distributed in India (Daniels, 1983). The species still occurs in all major river systems and large reservoirs of Gujarat State. Reports of interactions of the mugger with people are quite frequent. During the last eight years (1986 - 1993), 37 muggers (11 males, 17 females and nine juveniles) were rescued from Bharuch, Kheda, Surat and Vadodara Dists. of Gujarat (Tables 1 and 2).

Bharuch: Eighteen muggers (six males, eight females and four juveniles) were rescued from Bharuch Dist. (Table 1). All these were caught from village ponds, puddles and nullahs during the monsoon. All sites are close to the Narmada River, except Amod Village which is close to the River Dhardhar.

Kheda: During a recent drought, a large female mugger was rescued from a tank in the middle of Cambay Town. According to senior citizens, the crocodile had lived in the tank for at least the last thirteen years and was perhaps the same crocodile noticed in the last drought of 1960. There are also some unsubstantiated reports of a small number of muggers dwelling in a tank of Traj Village.

Surat: A mugger was rescued on July 7, 1990, from a tank in Kadod Village. This crocodile had migrated from the Tapti River. Karmavir Bhatt (*pers. comm.*) reported that the Surat Zoo had received a few small muggers from local fishermen who were fishing in the Tapti.

Vadodara: Seventeen muggers (four males, eight females and five juveniles) were rescued from Vadodara Dist. Of these, 12 were found in densely populated Vadodara City (Table 2). All these were caught from tanks, ponds, puddles, nullahs, drainages, gardens and slums near the Vishvamitri River. A large man-eating crocodile was caught from a tank in Dundelav Village.

During the last three years, three muggers were killed within the town limits of Navidharti-Karelibaug, Vadasar and Sonatekari-Manjalpur by the local citizens. At present, six to eight muggers still live in the Vishvamitri River, between Fathenganj and Vadasar in Vadodara City.

Other Districts: Mugger encounters are also reported from other parts of the State. According

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TABLE 1: Mugger crocodiles (*Crocodylus palustris*) rescued from Bharuch (# 1-18), Surat (# 19) and Kheda (# 20) Districts (TBL = total body length, including tail [cm]). #1 to 19 were rescued by the Gujarat State Narmada Valley Fertilizer Company (GNFC). #20 was rescued by the personnel from the Sayaji Baug Zoo. M = Male, F= Female.

Sl. No.	Date of rescue	Locality	Sex	TBL	Transferred/translocated site
1.	6.7.1986	Motikoral	F	200	Sakkarbaug Zoo, Junagadh.
2.	11.8.1986	Bhalod	F	150	"
3.	17.8.1986	GNFC Town	-	50	GNFC Wildlife Complex, Bharuch.
4.	28.6.1987	Motikoral	M	150	Sakkarbaug Zoo, Junagadh.
5.	6.7.1987	Angaareshwar	M	180	Narmada Dam catchment area.
6.	6.8.1987	Jhanor	M	150	"
7.	16.9.1987	Nikora	F	180	"
8.	4.10.1987	Indor	M	200	"
9.	12.7.1988	Bhadbhut	F	200	"
10.	22.8.1988	Amod	F	200	Sakkarbaug Zoo, Junagadh.
11.	2.9.1988	Dharmshala	F	200	Narmada Dam catchment area.
12.	30.6.1989	Maktapore	-	34	GNFC Wildlife Complex, Bharuch.
13.	22.8.1989	Shuklatirth	-	35	"
14.	2.9.1989	Velugaam	F	210	Narmada Dam catchment area.
15.	14.8.1991	Tavra	F	160	"
16.	22.9.1991	Suvavangni	M	130	"
17.	22.8.1992	Mehegaam	M	195	"
18.	9.6.1993	Varacha	-	76	Sayaji Baug Zoo, Vadodara.
19.	7.7.1990	Kodad	M	180	Aliabet Island.
20.	4.5.1991	Cambay	F	280	(Died after one month)

TABLE 2: Mugger crocodiles (*Crocodylus palustris*) rescued from Vadodara District (TBL = total body length, including tail [cm]). #1-14 were rescued by the personnel from the Sayaji Baug Zoo. #15-17 were rescued by the Vadodara Society for Prevention of Cruelty to Animals. M = Male, F - Female.

Sl. No.	Date of rescue	Place of rescue	Sex	TBL	Transferred/translocated site
1.	12.5.1987	Tank, Manjalpur, Vadodara City (V)	F	180	Sakkarbaug Zoo, Junagadh.
2.	22.7.1989	Slum, Vemali Village	F	165	Sayaji Bau Zoo, Vadodara
3.	10.1.1989	Navlakhi, near Central Jail, V	-	79	Karjan Dam, Rajpipala.
4.	15.6.1990	Akota, V	-	76	"
5.	15.7.1990	Puddles, Kabir Ashram, V	F	79	"
6.	24.7.1990	Zoo Compound, Sayaji Baug, V	F	185	Sayaji Baug Zoo, Vadodara
7.	6.9.1990	Open drain, Dandiya Bazaar, V	-	72	Karjan Dam, Rajpipala
8.	20.10.1990	Slum, Dhaniyari Village	F	122	"
9.	16.11.1990	Slum, Parshuram Nagar, V	F	119	(Died after six months)
10.	28.6.1991	Tank, Dundelav Village	M	336	Sakkarbaug Zoo, Junagadh.
11.	1.10.1991	Compound, Harani, V	M	155	Narmada Dam catchment area.
12.	12.10.1991	Open drain, Lalbaug, V	M	180	"
13.	21.11.1991	Tank, Kalali Village	F	135	"
14.	22.9.1992	Technology College, Kala Bhavan, V	M	109	Sayaji Baug Zoo, Vadodara
15.	5.7.1993	Puddle, Sona Tekari, Manjalpur, V	-	80	(Handed over to Forest Department)
16.	11.7.1993	Puddle, Parshuram Nagar, V	F	120	"
17.	26.10.1993	Open drain, Badamdibaug, V	F	108	"

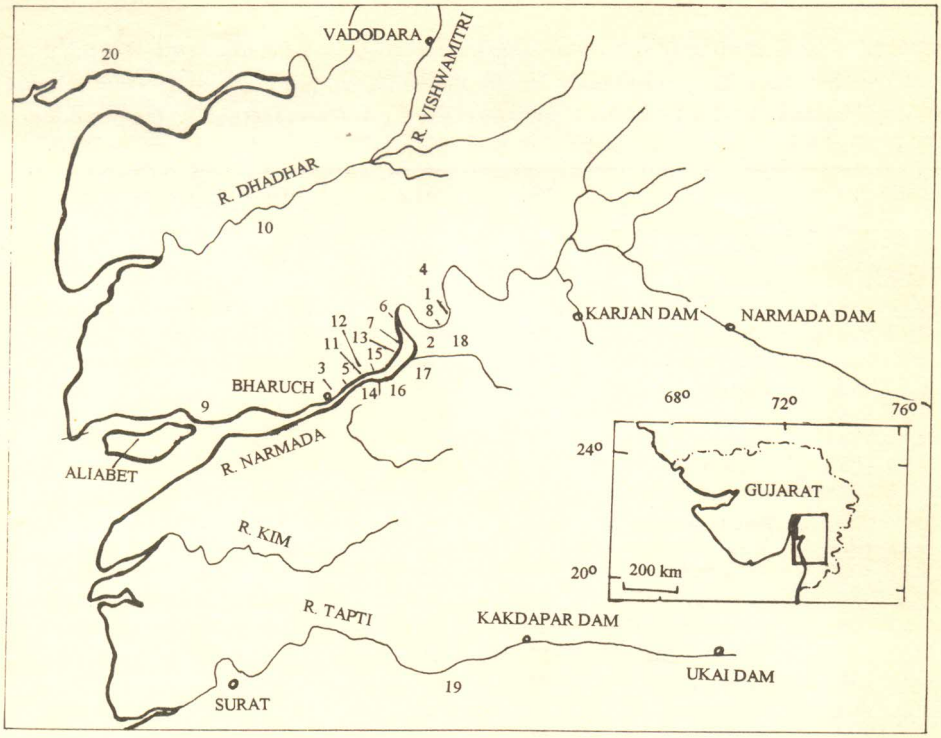

FIGURE 1: Map of south Gujarat, showing localities of capture of the mugger crocodile (*Crocodylus palustris*). References to sites are in Table 1.

to Bhavanisingh Mori (*pers. comm.*), a crocodile was killed and one rescued by the people of Naika and Kanpur Villages of Surendranagar Dist. Both are situated near the Bhogava River, where a small population of mugger still survives in the parts of the river with perennial water.

A mugger attacked a shepherd in June 1994, at Tungbhadra Dam, near Bhuj in Kutch Dist., but no other details are known at present.

Data on rescued muggers and incidents of crocodile conflicts with man indicate that small breeding populations of muggers survive in Tapti, Narmada, Dhadhar-Vishvamitri and Bhogava Rivers. Due to pressure from humans on habitats as well as their own population increase, some muggers migrate to new places during the monsoon. In addition, heavy monsoon rains sometimes wash crocodiles downriver from tributaries and more secluded habitats. Crocodile interactions with humans in Gujarat state seems to be on the increase and this phenomenon deserves a study and planned management for the future survival of the species as well as the welfare of the people of the state.

I thank R. Tiruvengadan, Wildlife Officer, GNFC Wildlife Complex, Bharuch, Bhavanisingh Mori, Surendranagar and Karmavir Bhatt, Surat for providing data on the rescued crocodiles.

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BOOK REVIEW

HERPETOLOGY OF CHINA by Er-Mi Zhao and Kraig Adler. 1994. Society for the Study of Amphibians and Reptiles. Contributions to Herpetology, No. 10. 522 pp. Available from Publications Secretary, Department of Biology, St. Louis University, 3507 Laclede, St. Louis, Missouri, 63103, U.S.A. Price: US$ 60 + postage US$2 (U.S.A.) or US$ 4 (other countries).

An amazing new book arrived here recently, Er-Mi Zhao's and Kraig Adler's 'Herpetology of China'. This is the latest from SSAR's Contributions to Herpetology series.

The historical chapter is illuminating and the photos of the herpetologists mentioned in the text adds a lot. In the first 66 pages of the book, we are given an account of the herpetological studies that were made by the ancient Chinese scholars, foreign visitors and the herpetologists of modern China. A section follows on endangered and economically important species. The keys to the 164 genera are well illustrated and easy to follow, and are followed by 48 pages of colour plates which are annotated with species names, locality, photographer and a habitat reference (to a separate set of colour photographs). The amphibian and turtle plates are good to excellent. The quality of some of the lizard and snake photos are not up to the overall very high standard. However, these are minor complaints.

The Annotated Checklist covers 661 species and subspecies and takes up a third of the book. This section is a straightforward, meticulously updated list (with ranges) for the region which is also useful to China's neighbours including us, here in India. As an example of the comprehensiveness of the authors' coverage, the following is the listing of the common water snake, *Xenochrophis piscator:*

"*Xenochrophis piscator* (Schneider, 1799) (PLATE 40C)

Hydrus Piscator J. G. Schneider, 1799, Hist. Amphib., Jena, 1: 247. Type locality: East Indies.

Xenochrophis piscator: E. V. Malnate and S. A. Minton, 1965, Proc. Acad. Nat. Sci. Philadelphia, 117: 19.

Amphiesma flavipunctatum E. Hallowell, "1860" (1861), Proc. Acad. Nat. Sci. Philadelphia, 12: 503. Type locality: Canton River (= Zhu Jiang, Guangzhou Shi), China (see Note).

RANGE: South China including Taiwan, Hong Kong, and Hainan. South and Southeast Asia, from Afghanistan, Pakistan, and Sri Lanka east to Indochina, south through Malay Peninsula to Indonesia (Sumatra, Java, Borneo, Celebes).

NOTE: E. H. Taylor (1965, Univ. Kansas Sci. Bull., Lawrence, 45: 832, 835) regarded *Xenochrophis piscator* and *X. flavipunctatum* as separate species, based on the existence of sympatric populations in northern Thailand. It is not known, however, which of these is conspecific with the taxon called *piscator* in China; collections of this snake have not been compared from across its wide range in China to determine whether one or both species are represented. Thus, we take a conservative position here in using only the name *piscator.*

Hallowell ("1860" [1861]: 504) mentioned a specimen from Hong Kong that has been construed by some as the type of *flavipunctatum* (for example, D. M. Cochran, 1961, Bull. U.S. Natl. Mus., Washington, 220: 158), but he drew his description from another species that was collected from the Canton River."

Following the Checklist is a chapter on Distribution with concise charts giving ranges by District as well as by the zoogeographical regions of China which are described in detail. There are over 100 pages in the Annotated Bibliography,

including the usefully compiled headings: General References, Regional References and References Cited in text. Appendix I consists of Chinese Geographical Names which will be useful to visiting scientists and preserving amphibians and reptiles. It would have been good to see a diagram of the tried and true snake hook and the bag on a hook system for bagging snakes. Appendix III lists Chinese herpetological journals and that is followed by indices to authors and, separately, to scientific names.

Overall, 'Herpetology of China' is a welcome volume in this part of the world, and the authors and SSAR are to be congratulated on an excellent production: well bound and well structured. Readers outside China are most fortunate that this work was published in English.

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MEETING

REPORT ON THE 14TH SEA TURTLE SYMPOSIUM

The Florida Marine Research Institute and Office of Protected Species Management of the Florida Department of Environmental Protection hosted the 14th Annual Symposium on Sea Turtle Biology and Conservation, at Hilton Head Island, South Carolina, between 1-5 March, 1994. The symposium was attended by about 600 participants from all over the world, involved in diversified areas of research, legal enforcement and conservation education activities. Apart from the vast magnitude of researchers and specialists, there were representations of a few NGOs working on marine turtle conservation.

The main course opened on 2 March. Following a brief introduction and an overview of the issues of sea turtle conservation and biology, participants presented scientific papers and reports, both in oral and poster formats. The presentation encompassed a wide gamut of topics pertaining to sea turtle biology and conservation. These included areas such as genetics, population biology and ecology, research techniques, assessment of management techniques, behavioural biology, conservation and legislation, physiology and disease, feeding and growth, nesting beaches, movements and migrations including threats and protective measures. Besides a range of topics for presentation, there were other technical sessions dealing with activities of IUCN Marine Turtle Specialist Group Committee on Tourism. All presentations concluded on 4 March.

Apart from indigenous research approaches in telemetry, gene mapping, sexing and biopsy techniques, there were areas of concern such as conservation plan of action and legislation.

The Gahirmatha issue was hotly debated. Just before the commencement of the symposium, the status of Gahirmatha remained unknown. This tiny area on the east coast of Orissa, India, is the site of nesting of the olive ridley turtle (*Lepidochelys olivacea*). Approximately a year back, administrative authorities of the state of Orissa promoted the construction of a jetty at Talchua, within the vicinity of the nesting beaches situated in the heart of Bhitarkanika Wildlife Sanctuary. This was seen as detrimental to the safety of the population of annually nesting olive ridleys. This was also a threat to the fragile mangrove ecosystem. Global concern about Gahirmatha prompted the three Indian representatives of the symposium to call for a separate meeting on the issue to promote action. A meeting was organized by 'The Indian Ocean Group'. A decision to put forward a resolution to the Ministry of Environment and Forests, Government of India and the Orissa State Government was taken. The group unanimously felt the need to halt the construction of jetties and roads in the vicinity of the nesting beaches.

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