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An Annotated Key to the Amphibians and Reptiles of Sind and Las Bela, West Pakistan

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INTRODUCTION

There appears to be a real need for keys to the identification of regional faunas in the Indo-Pakistan subcontinent. Local zoologists who are not specialists must either rely for identification on general works or on the volumes of "The fauna of British India" series, which are often difficult to obtain. Because the amphibians and reptiles are groups of considerable general interest and of some economic and medical importance as well, it is hoped this key will fulfill a useful function and stimulate further interest in the field of herpetology. For people whose only concern with reptiles is the identification of dangerous species, I have added an expanded and simplified section on identification of the poisonous snakes of West Pakistan.

The geographic area covered in the key includes the former province of Sind and the Baluchistan state of Las Bela. The only earlier faunal work treating this area exclusively is Murray's "The vertebrate zoology of Sind" (1884). The present key includes 80 of the 98 amphibian and reptile species recognized by Murray. Eight species have been deleted, because the records are apparently based on incorrect identifications or

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erroneous locality data; 10 additional species are no longer recognized as valid. Several more of Murray's Sind records are badly in need of confirmation, but the species have been included in the key. Additional records are from Boulenger (1890), Smith (1931, 1935, 1943), and Mertens (1956, 1959a, 1959b). I have personally obtained 81 of the 118 species in the key. Because much of Sind and Las Bela is poorly explored zoologically, it is almost certain that other species will be discovered in the area. The sections of the key treating turtles, crocodylians, and amphibians include most of the species known from all of West Pakistan. The lizard section and, to a lesser degree, the snake section will be unsatisfactory for identification of material from northern and western Baluchistan, the Northwest Frontier, and the alpine Punjab.

In selecting characters for identification, I have tried whenever possible to use those that can be determined by simple inspection without dissection or the use of a microscope. Local zoologists more often than not will have fresh specimens, so I have used color characters freely. Notes on distributions and abundance are based largely on my field work and should be interpreted accordingly. I designate as common those species that may be collected or observed whenever their habitat is visited under suitable weather conditions. Snakes, however, are designated as common only when individual species are represented in my collections by more than 10 specimens. Species listed as rare are those that are represented in my collections by fewer than five individuals, except in a few instances in which information from other sources indicates that the animal is more plentiful than my field work indicates.

I have followed the nomenclature of Smith (*op. cit.*) except in a few instances. I recognize the snake genus *Spalerosophis* included by Smith in *Coluber*, *Eirenus* instead of *Contia*, *Telescopus* instead of *Tarbophis*, *Dendrelaphis* instead of *Ahaetulla*, and *Fowlea* and *Amphiesma* for species that Smith placed in *Natrix*. I have not used trinomials.

IDENTIFICATION OF POISONOUS SNAKES

Identification of the living snake in the field is usually made on the basis of color, pattern, habitus, and behavior. This requires practice and experience; the clues used do not lend themselves well to brief verbal description. A "poisonous vs. harmless" identification of a dead snake is relatively easy, especially if the specimen is fresh and not badly mutilated. The steps in identification listed below can be followed by any person with a minimal knowledge of snake anatomy. It should be emphasized that these characters are not necessarily reliable when used in areas other than West Pakistan.

1. If the snake has a vertically flattened tail and the ventral scutes are very small or absent, it is a sea snake and poisonous. Of the local species, *Enhydrina schistosa*, *Hydrophis spiralis*, *H. cyanocinctus*, *H. ornatus*, *Microcephalophis gracilis*, and *Pelamis platurus* reportedly inflict fatal bites; information regarding other local species is lacking.

2. The hood instantly identifies a living cobra, although a few species of local harmless snakes flatten the neck slightly when angry. Identification of a dead cobra may be more difficult. Stretching the skin of the neck with the fingers is not a reliable test. The neck skin of most snakes is quite distensible when the specimen is fresh and limp. Later, because of rigor and dehydration, even the neck skin of a cobra cannot always be distended. If the head is not badly mutilated, look for rather large, fixed fangs in the front of the upper jaw and the large third labial shield that touches both the eye and the shield bordering the nostril (fig. 10B). These two characteristics positively identify a cobra. If unable to determine these points, look on the under side of the neck ventral to where the hood should be. Cobras have considerable dark pigment here, often alternating with irregular transverse bands of yellow or white; the rest of the belly may be light, dark, or mottled. No harmless snake in this area has such markings on the under side. Adult cobras (3 feet or more) in Sind and most of the Punjab are essentially black, dark brown, or dark olive above, with no definite markings; the young are lighter and variegated. The hood marking is usually absent in local adult cobras.

3. If the top of the head is covered with small scales irregularly arranged (fig. 9A), and the ventral scutes extend the full width of the belly (fig. 7C), the snake is one of the dangerously poisonous vipers. The Saw-scaled Viper (*Echis carinatus*) is common throughout most of West Pakistan. Russell's Viper (*Vipera russelli*) is confined mostly to the Indus Valley in Sind but occurs over much of the eastern Punjab. The Mountain Viper (*V. lebetina*) and Leaf-nosed Viper (*Eristocophis*) occur in Waziristan and parts of northern Baluchistan and are rare. The Horned Viper (*Pseudocerastes*) occurs over much of Baluchistan.

4. If the top of the head is covered with large shields (fig. 9B), the vertebral scale row is definitely enlarged, and the scutes on the under side of the tail are in a single row, the snake is a krait and poisonous. Additional features helpful in identifying the Indian Krait (*Bungarus caeruleus*) are: (A) it is a black or dark brown snake with white or yellow cross bands that often break up into spots on the anterior part of the body; (B) the eye is small and very dark, with the pupil almost invisible; and (C) the loreal shield (fig. 10B) is absent.

5. If there is a pit between the eye and the nostril (fig. 14), the snake

is the Himalayan Viper (*Ancistrodon himalayanus*). This snake is found in mountainous parts of extreme north Pakistan such as Chitral, Azad Kashmir, and Gilgit. Although poisonous, it probably cannot inflict a fatal bite.

6. Any snake not fitting clearly into one of the foregoing five categories is non-poisonous.

HAZARDS FROM OTHER REPTILES

The two species of crocodiles in West Pakistan rarely if ever are man-eaters or make unprovoked attacks. Any crocodile more than 4 feet long may be dangerous if injured or cornered.

The largest pythons of West Pakistan could theoretically swallow a child up to 25 or 30 pounds in weight. Man-eating by pythons is, however, extremely rare. Although the Indian Python is ordinarily a sluggish and docile snake, one of 10 feet or more could be dangerous to an unarmed man, if the snake were injured or molested.

The large river turtles, *Trionyx gangeticus* and *Chitra indica*, bite savagely when cornered on land or taken by nets or other fishing gear. Painful injuries may be inflicted; amputation of a toe or finger by a large turtle is not impossible.

There are no poisonous lizards in Pakistan or anywhere else except in parts of the United States and Mexico. All but the smallest local lizards may bite, scratch, or strike blows with their tail. These injuries may be painful, but only in most exceptional circumstances could serious injury be caused.

ACKNOWLEDGMENTS

Dr. A. R. Ranjha, Director of the Zoological Survey of Pakistan, generously made available certain scarce and critical literature and permitted me free access to the collections of the Zoological Survey. Mr. Charles M. Bogert, Dr. Richard G. Zweifel, and other members of the Department of Herpetology of the American Museum of Natural History identified some of the material that I collected in Pakistan and offered valuable criticism of the manuscript. Dr. Philip W. Smith of the Illinois Natural History Survey checked early versions of the manuscript by using the keys to attempt to identify Pakistan material, and made several helpful suggestions as a result. Mr. Roger Conant of the Philadelphia Zoological Society and Mr. Hymen Marx of the Chicago Natural History Museum assisted in locating literature references unavailable to

me in Karachi. Most of the text figures were drawn by Miss Brooks R. Minton. Mrs. Isabelle Hunt Conant supplied excellent photographs of some of the species depicted. Others are enlarged from my Kodachrome slides or are from the files of the American Museum of Natural History.

ANNOTATED KEY

KEY TO THE TOADS AND FROGS

- 1. Large, elevated gland (the parotoid) on the shoulder area (fig. 1) 2
 Parotoid gland absent 4
- 2. Cranial crests present (fig. 1) . . . *Bufo melanostictus* (South Asian Garden Toad)
 Tatta and Jungshahi; local and rare.
 Cranial crests absent 3

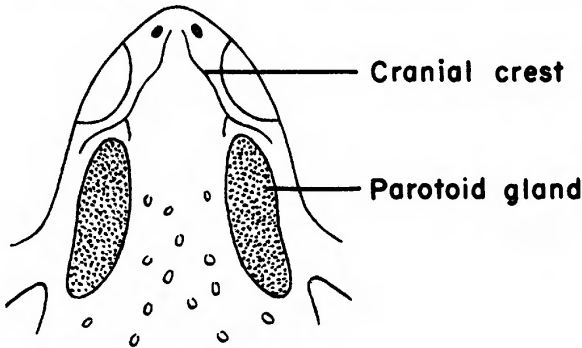


FIG. 1. Dorsal view of head and shoulder region of toad, showing cranial crests and parotoid glands.

- 3. Parotoid gland large, reaching almost to sacrum; skin smooth or nearly so *Bufo olivaceus* (Makran Toad)
 Probably occurs in western Las Bela; no definite records.
 Parotoid gland smaller; skin warty *Bufo andersoni* (Indus Toad; fig. 15)
 Common throughout the area except in very arid situations.
- 4. Tympanum absent; eye small; adult body length not exceeding 30 mm
 *Microhyla ornata* (Ant Frog)
 No definite local records.
 Tympanum present; eye large; adult body length usually exceeding 30 mm 5
- 5. Inner metatarsal tubercle large, with sharp, free edge; toes less than half webbed (fig. 2) 6
 Inner metatarsal tubercle not as above; toes at least half webbed 7
- 6. Tympanum smaller than eye; first finger longer than second
 *Rana breviceps* (Indian Burrowing Frog; fig. 16)
 Hab and Malir River areas; locally common.

- Tympanum as large as eye; first and second fingers of equal length.
 *Rana strachani* (Malir Burrowing Frog)
 Described from Malir by Murray (1884); apparently no subsequent records.
7. Web between toes distinctly indented; light middorsal stripe present in most individuals. 8
 Web between toes slightly or not indented; no light middorsal stripe. 9
8. Body length often 100 mm. or more, web almost to tips of toes.
 *Rana tigrina* (Tiger Frog; fig. 17)
 Common in Indus Valley; also found in Hab River and on larger oases.
 Adult body length, 30-40 mm.; web to about middle of toes.
 *Rana limnocharis* (Indian Cricket Frog)
 Indus Valley; common.



FIG. 2. Foot of burrowing frog, showing metatarsal tubercle.

9. Tympanum as large as eye or larger; heel reaching anterior to eye; male with external vocal sacs and without dark excrescences on chest.
 *Rana cyanophlyctis* (Skittering Frog; fig. 18)
 Common throughout the area in all fresh-water habitats.
- Tympanum smaller than eye; heel not reaching anterior to eye; male without external vocal sacs and with dark excrescences on chest.
 *Rana sternosignata* (Baluch Frog)
 Malir; local and rare.

KEY TO THE TURTLES

1. Carapace and plastron with horny laminae (fig. 3) 2
 Carapace and plastron without horny laminae. 10
2. Limbs paddle-shaped, with one or two claws. 3
 Limbs not paddle-shaped, with three or more claws. 5
3. Dorsal laminae overlapping. . *Eretmochelys imbricata* (Hawksbill Turtle; fig. 19)
 Generally distributed in Indian waters; no definite local records.
- Dorsal laminae juxtaposed. 4

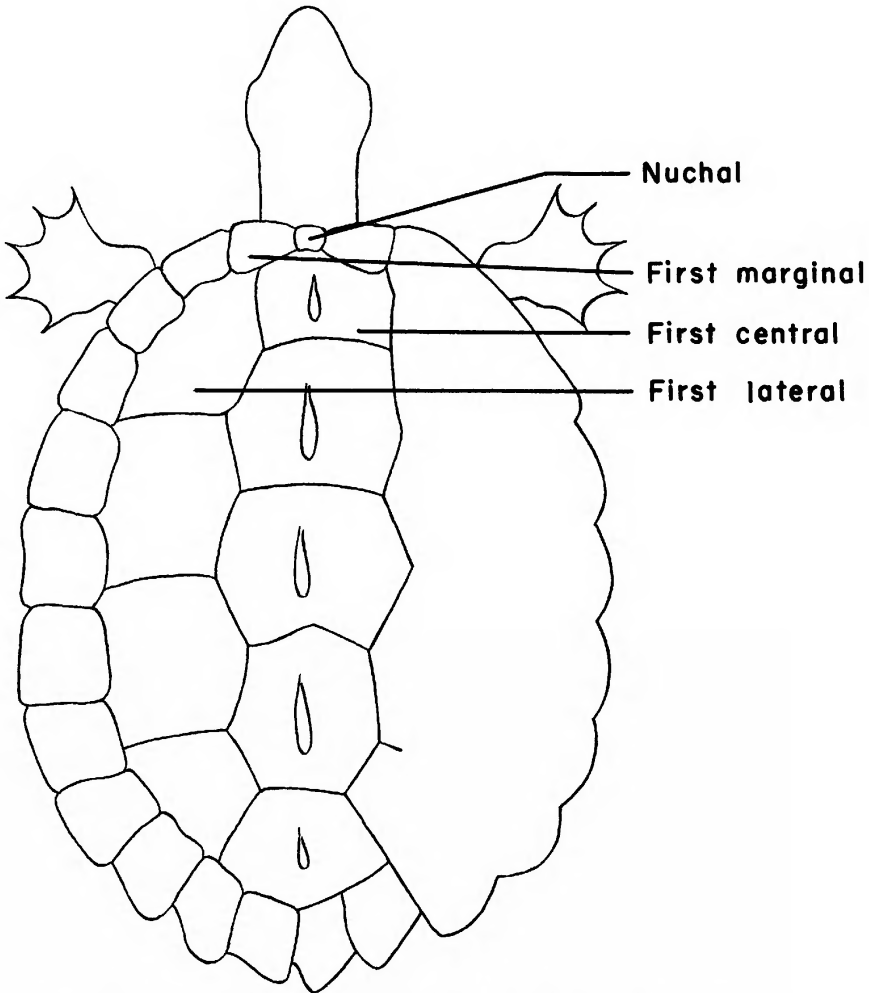


FIG. 3. Carapace of emydid turtle, showing nomenclature of laminae.

- 4. Four pairs of lateral laminae; first central lamina in contact with marginals; carapace with median ridge in young
Chelonia mydas (Green Turtle; fig. 20)
 Coastal waters and marine littoral; common.
- Five or more pairs of lateral laminae; first central separated from marginals; carapace with three ridges in young
Caretta caretta (Loggerhead Turtle; fig. 21)
 Coastal waters and marine littoral.
- 5. Hind limbs club-shaped; toes without webbing 6
 Hind limbs not club-shaped; toes webbed 7

6. Carapace high; pattern of radiating yellow stripes
 *Testudo elegans* (Star Tortoise; fig. 22)
 Hab River Valley, local and rare; Karachi (in semi-domestication).
 Carapace low; little or no pattern *Testudo horsfieldi* (Afghan Tortoise)
 Extreme northern Sind and Las Bela in uplands; rare.
7. Carapace with three ridges; small yellow spots on head and limbs
 *Geoclemys hamiltoni* (Spotted Pond Turtle; fig. 23)
 Indus Valley and upper Hab River; rare.
 Carapace with median keel; markings not as above 8
8. Fourth central lamina wider than long; yellow stripes on head; yellow band
 at junction of lateral and marginal laminae
 *Hardella thurgi* (Indus Painted Turtle; fig. 24)¹
 Indus Valley; local.
 Fourth central lamina longer than wide; markings not as above 9
9. Shell high, with prominent knobbed ridge; plastral laminae light, with black
 spots; neck with distinct greenish stripes
 *Kachuga tectum* (Indian Sawback Turtle; fig. 25)
 Indus Valley (Bubak, Saidabad); rare.
 Shell lower, with less distinct ridge; plastral laminae black, with light edges;
 neck with faint yellowish stripes or unstriped
 *Kachuga smithi* (Brown River Turtle; fig. 26)
 Indus Valley; common.
10. Shell with three ridges; limbs without claws
 *Dermochelys coriacea* (Leatherback Turtle; fig. 27)
 Generally distributed in tropical and subtropical seas; Hawke's Bay; rare.
 Shell without ridges; limbs with claws 11
11. Plastron with movable flanges; bones of carapace finely granular
 *Lissemys punctata* (Indian Flapshell Turtle; fig. 28)
 Indus Valley; common.
 Plastron without flanges; bones of carapace smooth to rugose 12
12. Head broad and massive, green, with black markings; alveolar ridges wide
 and blunt *Trionyx gangeticus* (Indian Softshell Turtle; fig. 29)
 Indus Valley; common.
 Head narrow, grayish, with dark-edged light stripes extending onto neck;
 alveolar ridges narrow and sharp
 *Chitra indica* (Narrow-headed Softshell Turtle; fig. 30)
 Indus River and larger canals; local.

KEY TO THE CROCODILIA

1. Snout very slender, at least three times as long as broad at the base
 *Gavialis gangeticus* (Gharial)
 Indus River and Nara Canal; rare.
 Snout broad and blunt *Crocodilus palustris* (Snub-nosed Crocodile)
 Indus Valley and Hab River; local.

¹ The population in the Indus may well be taxonomically distinct from that in the Ganges and Brahmaputra, but adequate study has not been made. The name *Hardella indi* Gray, 1870, is available for the Indus population.

KEY TO THE LIZARDS

- 1. Ends of digits dilated, forming clinging pads. 2
- Ends of digits not dilated as clinging pads. 8
- 2. Dilated portion of toes ovoid (fig. 4) 3
- Dilated portion of toes fan-shaped.
- *Ptyodactylus homolepis* (Fan-toed Gecko)
- Hills of northern and western Sind; rare.



FIG. 4. Ventral aspect of foot of *Hemidactylus*, showing laminae under fourth toe.

- 3. Dorsum with prominently enlarged keeled scales. 4
- Most of dorsal scales finely granular. 7
- 4. Pattern of small dark spots irregularly arranged. 5
- Pattern of large brown saddles with narrow light interspaces.
- *Hemidactylus triedrus* (Blotched Gecko; fig. 31)
- Lowland desert.

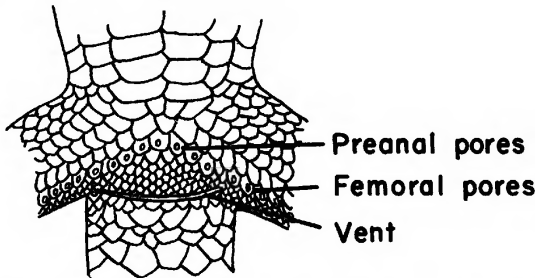


FIG. 5. Inguinal region of lizard, showing preanal and femoral pores.

- 5. Males with preanal and femoral pores (fig. 5); larger dark spots usually about a quarter of the width of the back; eight to 10 lamellae under fourth toe *Hemidactylus brooki* (Spotted Indian House Gecko; fig. 32)
- Indus Valley; on oases and in cities; common in both sylvan and urban habitats.
- Males with preanal pores only; dark spots usually less than a quarter of the

- width of the back 6
6. Fourth toe with 12–14 lamellae; enlarged dorsal scales conspicuously pale in life; average adult body length, 65–75 mm
Hemidactylus persicus (Persian Gecko; fig. 33)
 Desert and oasis habitat; common.
- Fourth toe with 10–12 lamellae; enlarged dorsal scales not conspicuously pale in life; average adult body length, 50–60 mm.
Hemidactylus turcicus (Mediterranean Gecko; fig. 34)
 Urban and edificial habitat; common.
7. Dorsum with numerous scattered, enlarged tubercles; males with a total of 20 or more femoral pores *Hemidactylus* sp.¹ (Bark Gecko)
 Forested parts of Indus Valley and oases; rarely edificial.
- Dorsum with few or no enlarged tubercles; males with a total of fewer than 15 femoral pores . . . *Hemidactylus flaviviridis* (Yellow-bellied House Gecko)
 Urban and edificial habitat; common.
8. Pupil of eye vertically elliptical 9
 Pupil of eye round or slightly oval 16
9. Eyelids movable; tail distinctly segmented, often thick and fleshy; average adult body length, 100–130 mm.
Eublepharis macularis (Fat-tailed Gecko; fig. 35)
 Locally common in desert habitat.
- Eyelids fused into transparent cap; tail not as above; body length, less than 100 mm. 10
10. Tail broad and flat, with large imbricated scales on dorsal aspect
Teratolepis fasciata (Broad-tailed Gecko; fig. 36)
 Lower Indus; rare.
- Tail not as above 11



FIG. 6. Foot of *Gymnodactylus*, showing angulation between ultimate and penultimate phalanges.

¹ The geckos with the combination of characters given here require further study. Specimens from Karachi have been identified as *Hemidactylus frenatus*, although more extensive comparison with typical *frenatus* from southeast Asia is necessary. Specimens from Sanghar District in eastern Sind are not *frenatus* but apparently are close to *H. leschenaulti*.

11. Digits straight 12
 Digits angularly bent between last and next to last phalanx (fig. 6) 13
12. Digits with fringe of pointed scales; dorsal scales mostly small and granular
 *Stenodactylus orientalis* (Sind Sand Gecko; fig. 37)
 Common in tracts of fine, loose sand.
 Digits without fringe of scales; irregular rows of enlarged scales on dorsum
 *Alsophylax tuberculatus* (Baluch Rock Gecko)
 Las Bela and northwestern Sind in rocky upland.
13. Dorsum with rows of enlarged carinate scales. 14
 Enlarged dorsal scales absent or irregularly scattered. 15
14. Enlarged dorsal scales separated by small granules; subcaudals small and
 irregularly arranged. *Gymnodactylus kachhensis* (Warty Rock Gecko)
 Las Bela and southern Sind in arid habitat; common.
 Enlarged dorsal scales in contact; subcaudals transversely enlarged, in single
 row *Gymnodactylus scaber* (Keel Rock Gecko; fig. 38)
 Northern and eastern Sind; common.
15. Dorsal scales granular, intermixed with enlarged tubercles; tail thin and
 cylindrical, tapering abruptly at base; pattern indistinct.
 *Agamura persica* (Long-legged Gecko; fig. 40)
 Northern and western Las Bela in rocky upland; rare.
 Dorsal scales subimbricated; tail not tapering abruptly at base; yellow above,
 with distinct dark cross bands.
 *Tropicalotes helenae* (Banded Dwarf Gecko; fig. 39)
 Desert habitat west of Indus Valley; common.
16. Eyelids fused, forming transparent cap; dorsal scales small and granular; tail
 laterally compressed. *Pristurus rupestris* (Dwarf Rock Gecko)
 Karachi (Murray, 1884).
 Without the above combination of characters. 17
17. Dorsal and ventral scales imbricate, smooth or with multiple low keels; limbs
 short. 18
 Scales not as above; limbs usually long. 27
18. Habitus serpentine; limbs vestigial, with three toes.
 *Ophiomorus tridactylus* (Indian Sandswimmer; fig. 41)
 Common in tracts of fine, loose sand.
 Habitus not serpentine; limbs with four or five toes. 19
19. Digits with fringe of pointed scales; snout markedly depressed; lower jaw
 countersunk. *Scincus arenarius*¹ (Hab River Sand Skink)
 Plains of Hab River (Murray, 1884).
 With none of the above characters. 20
20. Eyelids fused; habitus very slender; average adult body length, 30-35
 mm. 21
 Eyelids movable; larger and more robust; adult body length exceeding
 50 mm. 22
21. Ear opening present. *Ablepharus pannonicus* (Mediterranean Dwarf Skink)

¹ Smith (1935) and other recent workers regard this species as identical with *Scincus mitranus*. Because the Hab River population is so markedly disjunct from the main range of *mitranus*, I prefer to retain Murray's *arenarius* until more material from Sind can be collected and comparison with typical *mitranus* made.

- Karachi (Murray, 1884).
 Ear opening absent. *Ablepharus grayanus* (Earless Dwarf Skink)
 Widely distributed in arid and semi-arid lowlands.
22. Scales of some dorsal rows markedly wider than those of lateral rows. 23
 Scales of dorsal and lateral rows equal or subequal in size. 24
23. Body robust, with 26–30 scale rows; adults in life with orange on sides and tail. *Eumeces schneideri* (Orange-tailed Skink)
 Arid coastal plain west of Indus Delta; rare.
 Body much elongated, with 21–23 scale rows; no orange markings.
 *Eumeces taeniolatus* (Yellow-bellied Skink; fig. 42)
 Widely distributed in arid lowlands.
24. Dorsal scales with multiple low keels. 25
 Dorsal scales smooth. 26
25. Dorsal scales with three keels; vertebral light stripe.
 *Mabuya dissimilis* (Striped Grass Skink)
 Indus Valley and larger oases; common.
 Dorsal scales with four to seven keels; no vertebral light stripe.
 *Mabuya macularia* (Bronzy Grass Skink)
 Indus Valley and oases west to Las Bela; common.
26. Toes of appressed limbs touching or overlapping; 34–38 scale rows at mid-body. *Mabuya aurata* (Five-striped Desert Skink)
 Sind (Murray, 1884).
 Toes of appressed limbs widely separated; 28–32 scale rows at midbody.
 *Chalcides ocellatus* (Ocellated Skink)
 Karachi and western Las Bela; local and rare.
27. Top of head with large, symmetrical shields. 28
 Top of head with small scales or irregularly arranged shields. 31
28. Toes with fringe of long, pointed scales. 29
 Toes without fringe of scales. 30
29. Dorsal scales distinctly larger than laterals; tail blue to bluish gray.
 *Acanthodactylus cantorisi* (Common Sand Lizard)
 Throughout the area in sandy habitat; common.
 Dorsal scales but slightly larger than laterals; tail yellow.
 *Acanthodactylus micropholis* (Yellow-tailed Sand Lizard)
 Northern and western Las Bela; locally common.
30. Eyelids fused; light dorsolateral stripes.
 *Ophisops jerdoni* (Snake-eyed Lacerta)
 Throughout the area; common.
 Eyelids movable; small light and dark spots or almost unicolored.
 *Eremias guttulata* (Long-tailed Desert Lacerta)
 Las Bela, northern and eastern Sind; common in desert habitat.
31. Snout long and pointed; tongue slender, deeply forked; adult body length 350 mm. or more. 32
 Snout blunt and rounded; tongue thick, not forked; body length rarely exceeding 200 mm. 33
32. Tail with low, double, dorsal ridges distally.
 *Varanus bengalensis* (Indian Monitor; fig. 43)
 Common throughout the area.
 Tail round without ridges. *Varanus griseus* (Desert Monitor; fig. 44)

- Widely distributed in arid lowland.
33. Tail thick and heavy, with dorsal half rings of large, spiny scales; a blue-black spot in the groin. *Uromastix hardwicki* (Spiny-tailed Lizard; fig. 45)
In arid and semi-arid habitat with clay soil; common.
Tail not as above; no dark spot in groin. 34
34. Body slightly compressed laterally; vertebral crest of spine-like scales.
. *Calotes versicolor* (Indian Garden Lizard; fig. 46)
Throughout the area except in very arid habitat; common.
Body slightly to strongly compressed dorsoventrally; no vertebral crest. . . 35
35. Tympanum concealed. 36
Tympanum exposed. 37
36. Spines on head and side of neck; dorsal scales unequal in size and strongly keeled. *Phrynocephalus luteoguttatus* (Spiny-headed Toad Agama)
Las Bela (Smith, 1935).
Head and neck without spines; dorsal scales subequal in size and feebly keeled
. *Phrynocephalus ornatus* (Black-and-white Toad Agama)
Las Bela (Smith, 1935).
37. Dorsal scales irregular in size and arrangement.
. *Agama rubrigularis* (Red-throated Agama)
Western Sind in hilly, arid habitat; rare.
Dorsal scales subequal in size and disposed in regular rows. 38
38. Scales of tail in regular whorls; adults with spiny excrescences around ear opening. 39
Scales of tail irregularly disposed; no spiny excrescences on head. 40
39. Median dorsal scales in eight to 10 straight rows; 12-16 upper labials.
. *Agama melanura* (Black-tailed Agama)
Las Bela and western Sind in rocky uplands; local.
Median dorsal scales in 16-20 oblique rows; 14-18 upper labials.
. *Agama nupta* (Yellow-speckled Agama)
Northern and western Sind in rocky uplands; local.
40. Tail length exceeding snout to vent length; males with callous preanal scales
. *Agama agilis* (Brilliant Agama)
In desert habitat; common.
Tail length not exceeding snout to vent length; males without callous preanal scales. *Agama minor* (Short-tailed Agama)
Sind (Smith, 1935).

KEY TO THE SNAKES

1. Tail round or nearly so; ventral scutes large in most species, absent in some. 2
Tail strongly compressed laterally; ventral scutes much reduced or absent on posterior half of body. 38
2. Ventral scutes transversely enlarged; eyes exposed and well developed; size variable. 3
Ventral scutes absent; eyes vestigial, covered by shields; very small and worm-like. 35
3. Ventral scutes usually extending full width of venter (fig. 7C); dorsal scale rows 35 or fewer. 4

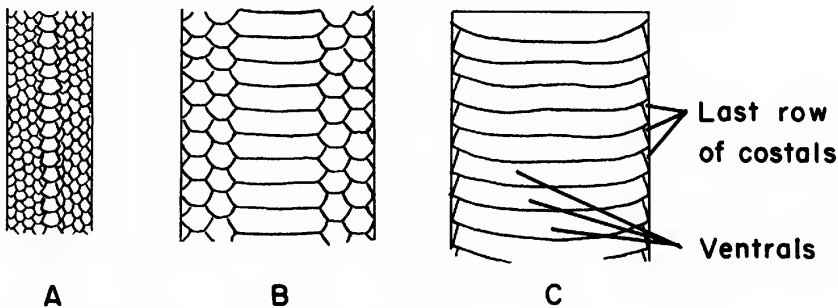


Fig. 7. Ventral aspect. A. Sea snake. B. Boa. C. Russell's Viper.

Ventral scutes not extending full width of venter (fig. 7B); dorsal scale rows 39 or more.....33

4. Top of head with small scales irregularly arranged (fig. 9A); large maxillary fangs, folding against roof of mouth.....5

Top of head with large symmetrical plates (fig. 9B); maxillary fangs if present small and fixed.....6

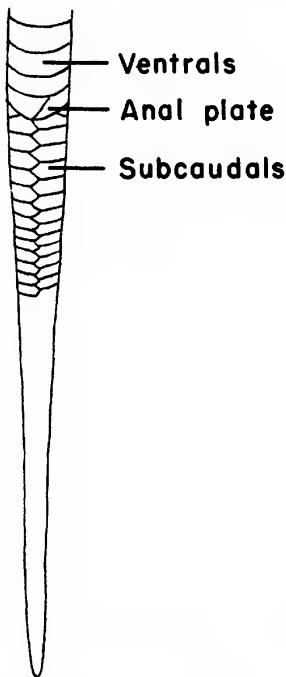


FIG. 8. Ventral aspect of tail of *Natrix*, showing anal plate divided and double row of subcaudals.

- 5. Lateral scale rows smaller and more strongly oblique than dorsal; central row of whitish blotches and wavy light lateral stripe
Echis carinatus (Saw-scaled Viper; fig. 47)
 Throughout the area; common.
- Scale rows regular; three rows of dark spots on lighter ground color
Vipera russelli (Russell's Viper; fig. 48)
 Indus Valley and Delta.
- 6. Anterior maxillary fangs present; loreal shield absent 7¹
 Anterior maxillary fangs absent; loreal usually present (fig. 10A) 8

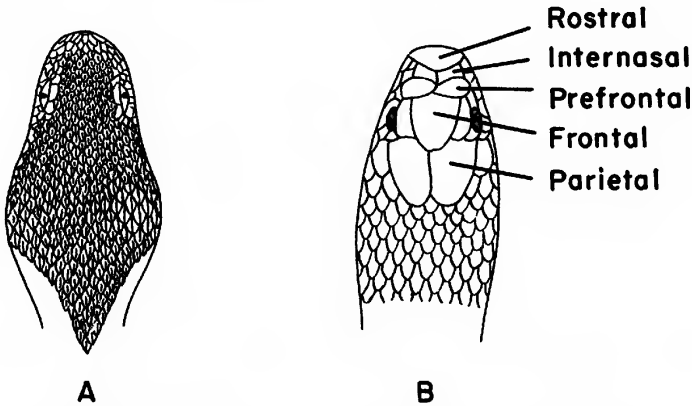


FIG. 9. Dorsal aspect of head. A. Viper (*Echis*). B. Colubrid (*Coluber*).

- 7. Hood seen in life; third upper labial touching nasal; vertebral scale row not enlarged; subcaudals divided *Naja naja* (Indian Cobra; fig. 49)
 Common in Indus Valley; elsewhere rare, mostly in oasis habitat.
- No hood; third upper labial not touching nasal; vertebral scale row distinctly enlarged; subcaudals undivided
Bungarus caeruleus (Indian Krait; fig. 50)
 Throughout the area, except in markedly arid habitat.
- 8. Nostrils on upper surface of snout, valvular; ventrals reduced in size 9
 Nostrils lateral or nearly so, no valves; ventrals large 10
- 9. Scales smooth; pattern of longitudinal stripes
Enhydris pakistanica (Striped River Snake)
 Indus Delta (Jati); rare.
- Scales keeled; pattern of dark spots or cross bars
Cerebrus rhynchops (Tidal Marsh Snake)
 Sind and Makran coasts, no definite records.

¹ If the teeth cannot be examined properly and the loreal is absent, check the specimen against the other characters in couplet 7. If it does not fit here, go to couplet 8. The loreal is sometimes absent in *Oligodon* and *Eirenis*, rarely in other genera.

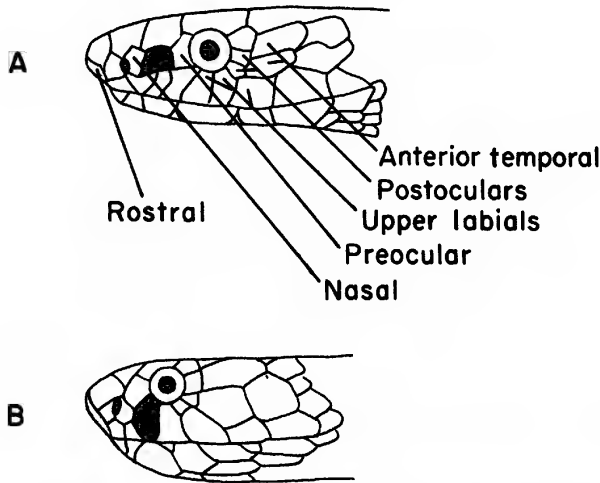


FIG. 10. Lateral aspect of head. A. Colubrid (*Coluber*) with loreal shaded. B. Cobra (*Naja naja*) with third labial shaded.

- 10. Dorsal scales smooth throughout 11
- At least some of dorsal scales keeled 26
- 11. Eye very dark, pupil in life barely visible; black or dark brown, with white to pale yellow markings 12
- Eye with light iris and distinct pupil; color and pattern not as above . . . 13
- 12. Ventrals strongly angulate laterally; nine upper labials
- *Lycodon aulicus* (Common Wolf Snake)
- Karachi (Murray, 1884).
- Ventrals not angulate laterally; eight upper labials
- *Lycodon striatus* (Northern Wolf Snake; fig. 51)
- Widely distributed except in very arid habitat.
- 13. Rostral large, pointed, concave below; nostrils small slits
- *Lytorhynchus paradoxus* (Awl-headed Snake; fig. 52)
- Northern and eastern Sind in tracts of fine sand; rare.
- Rostral and nostrils not as above 14
- 14. Ventrals notched and with lateral keel
- *Dendrelaphis tristis* (Indian Bronzeback)
- Near mouth of Indus River (Smith, 1943).
- Ventrals not as above 15
- 15. Eye with elliptical pupil; head much wider than neck 16
- Pupil round; head but slightly wider than neck 17
- 16. Head with light inverted-Y mark; lateral scale rows strongly oblique
- *Boiga trigonata* (Gamma Snake; fig. 53)
- Coastal plain in desert scrub and in oasis and urban habitats; common.
- Head without inverted-Y mark; lateral scale rows not strongly oblique
- *Telescopus rhinopoma* (Indian Desert Cat Snake)
- Upper Sind (Smith, 1943).
- 17. Head and nape black or with distinctive dark markings (fig. 11); adult length

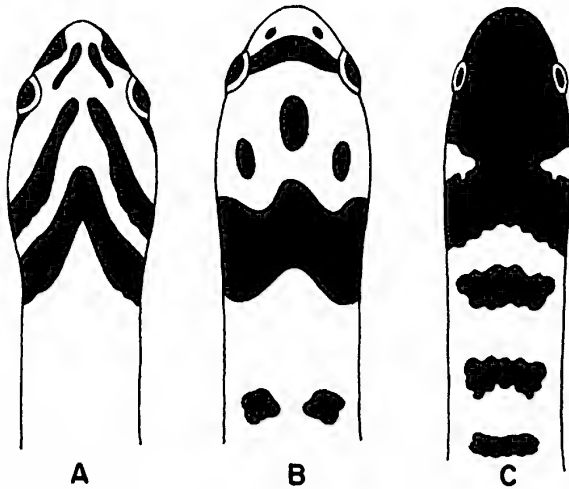


FIG. 11. Head and neck patterns. A. *Oligodon arnensis*. B. *Oligodon taeniolatus*. C. *Eirenis persicus*. Sketched from specimens collected in Sind.

- less than 70 cm. 18
- Head pattern not as in figure 11; adult length exceeding 70 cm. 20
- 18. One postocular; subcaudals 60 or more.
- *Eirenis persicus* (Barred Desert Snake)
- Upper Sind; rare.
- Two postoculars; subcaudals fewer than 60. 19
- 19. Extensive dark area on neck; 15 scale rows at midbody.
- *Oligodon taeniolatus* (Streaked Kukri Snake)
- Coastal plain; Indus Valley.
- Dark chevrons on head and nape; 17 scale rows at midbody.
- *Oligodon arnensis* (Russet Kukri Snake; fig. 54)
- Indus Valley (Larkana); rare.
- 20. Scale rows at midbody 19 to 23; ventrals 195 or more. 21
- Scale rows at midbody 17; ventrals fewer than 190. 24
- 21. Dark with light cross bands or almost unicolored; 21 or 23 scale rows. . . . 22
- Light with dark markings often fading out on tail; 19 scale rows. 23
- 22. Fewer than 100 subcaudals; eight supralabials.
- *Coluber fasciolatus* (Banded Racer)
- Indus Valley (Larkana); rare.
- More than 100 subcaudals; nine supralabials.
- *Coluber gracilis* (Ornate Racer)
- Sind (Murray, 1884).
- 23. Pattern of small, dark spots; no vertebral stripe on neck; scale rows just anterior to vent 11-13. *Coluber rhodorachis* (Cliff Racer; fig. 55)
- Rocky, arid habitat from Indus westward; locally common.
- Pattern of dark cross bars or rhombs; short vertebral dark stripe; scale rows just anterior to vent 13-15.

-*Coluber ventromaculatus* (Glossy-bellied Racer; fig. 56)
Throughout the area in arid or semi-arid habitat; common.
24. Top of head with irregular dark markings; central part of belly light gray or reddish.....*Psammophis schokari* (Afro-Asian Sand Snake; fig. 57)
Throughout the area in arid habitat.
Top of head with dark longitudinal stripes; central part of belly yellow in life.....25
25. Preocular in contact with frontal; anal undivided.....
.....*Psammophis leithi* (Pakistan Ribbon Snake; fig. 58)
Throughout the area; common.
Preocular not touching frontal; anal divided.....
.....*Psammophis condanarus* (Punjab Sand Snake)
Northern Sind; rare.
26. Labials separated from eye by suboculars; temporals small and irregular in arrangement.....27
Suboculars absent, labials in contact with eye; temporals large and in more or less regular rows.....28
27. Rostral higher than broad; pattern of reddish blotches on very pale ground color.....*Spalerosophis arenarius* (Red-spotted Snake; fig. 59)
In arid lowland; locally common.
Rostral broader than high; pattern extremely variable but not as described above.....*Spalerosophis diadema* (Royal Snake; fig. 60)
Throughout the area in arid and semi-arid habitat; common.
28. Anal undivided; ventrals 217 or more.....*Elaphe helenae* (Trinket Snake)
Sind and Karachi (Murray, 1884).
Anal divided (fig. 8); ventrals fewer than 215.....29
29. Scale rows at midbody 23-27; seven upper labials.....
.....*Macropisthodon plumbicolor* (Green Keelback)
Sind (Murray, 1884).
Scale rows 19; eight or nine upper labials.....30
30. Ventrals 190 or more; adult length exceeds 125 cm.....
.....*Ptyas mucosus* (Dhaman; fig. 61)
Indus Valley and larger oases; common.
Ventrals fewer than 160; maximum length not exceeding 125 cm.....31
31. Belly mostly dark, with light stripe on tips of ventrals and first scale row...
.....*Xenochrophis cerasogaster* (Dark-bellied Marsh Snake; fig. 62)
Indus Delta and Valley; locally common.
Belly light, unmarked or with sparse dark pigment.....32
32. Dorsal pattern of cross bands or alternating spots.....
.....*Fowlea piscator* (Checkered Keelback; fig. 63)
Indus Valley; locally common.
Dorsal pattern with longitudinal stripes.....
.....*Amphiesma stolata* (Striped Keelback; fig. 64)
Indus Valley; rare.
33. Pattern of regular, large, brown saddles; anterior supralabials with pits; adult length, 2 meters or more...*Python molurus* (Indian Python; fig. 65)
Indus Valley and Delta; local mostly in wooded areas.
Pattern not as above; no supralabial pits; length not exceeding 1.5 meters...34
34. Pattern of irregular dark blotches often partly fused; tail tapering abruptly

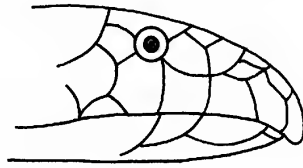
-*Eryx conicus* (Russell's Sand Boa; fig. 66)
Indus Valley.
- Unicolored or with widely separated transverse bands; end of tail blunt, often as wide as head.....*Eryx johni* (Indian Sand Boa; fig. 67)
Throughout the area; common.
- 35. Scale rows 14; color in life pale brown to pinkish.....36
Scale rows 18 or more; color dark brown to almost black.....37
- 36. Rostral large, hooked (fig. 12A); diameter of body 80–110 times in total length.....*Leptotyphlops macrorhynchus* (Beaked Thread Snake)
Karachi and Indus Valley; rare.
- Rostral rounded (fig. 12B); diameter of body 55–80 times in total length...
.....*Leptotyphlops blanfordi* (Sind Thread Snake)
Indus Valley; rare.



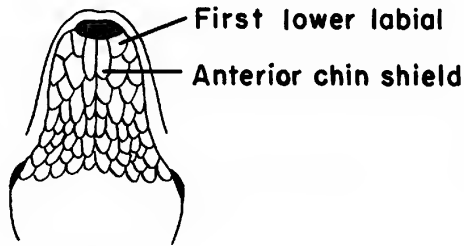
FIG. 12. Head profiles (enlarged). A. *Leptotyphlops macrorhynchus*. B. *Typhlops braminus*, showing configuration of rostral. *Leptotyphlops blanfordi* and *Typhlops porrectus* are similar to B.

- 37. Scale rows 18; diameter of body at least 50 times in total length.....
.....*Typhlops porrectus* (Slender Blind Snake; fig. 68)
Karachi, in urban area.
- Scale rows 20; diameter of body not more than 50 times into total length...
.....*Typhlops braminus* (Brahminy Blind Snake; fig. 69)
Karachi and Indus Valley; common.
- 38. Mental shield elongated and concealed in cleft; tip of rostral decurved and pointed.....*Enhydrina schistosa* (Beaked Sea Snake; fig. 70)
Coastal waters and creeks to limit of tidal flow; common.
- Mental and rostral not as above.....39
- 39. Ventrals at midbody small but definitely larger than adjacent scales....40
Ventrals at midbody absent or no larger than adjacent scales.....47
- 40. Ventrals of almost uniform size.....41
Ventrals larger anteriorly than posteriorly.....46
- 41. Head very small and neck slender; ventrals more than 400.....
.....*Hydrophis fasciatus* (Small-headed Banded Sea Snake; fig. 71)
Karachi, Sonmiani; rare.
- Head and neck not as above; fewer than 400 ventrals.....42
- 42. Scales on thickest part of body with rounded or bluntly pointed tips, distinctly or feebly imbricated; eight or fewer maxillary teeth.....43
Scales on thickest part of body hexagonal or quadrangular, feebly imbricated or juxtaposed; eight or more maxillary teeth.....44

43. One anterior temporal; dark annuli much narrower than interspaces.
 *Hydrophis spiralis* (Yellow Sea Snake)
 Reported common in coastal waters.
 Two anterior temporals; dark annuli about as wide as interspaces.
 *Hydrophis cyanocinctus* (Annulated Sea Snake)
 Coastal waters.
44. Top of head with curved yellow mark, more distinct in young; pattern of cross bands, black in young, greenish in adult; ventrals 314–372
 *Hydrophis lapemoides* (Persian Gulf Sea Snake)



A



B

FIG. 13. Lateral and ventral views of head of Beaked Sea Snake (*Enhydrina*).

- Makran coast; rare.
 Top of head without markings; pattern blackish cross bands or rhombs.45
45. Top of head olive; 30 or more scale rows on neck; ventrals 209–312.
 *Hydrophis ornatus* (Cochin Banded Sea Snake)
 Persian Gulf and most of Indian Ocean; no definite local records.
 Top of head black; fewer than 30 scale rows on neck; ventrals 302–390.
 *Hydrophis mamillaris* (Bombay Sea Snake)
 Karachi; rare.
46. Ventrals 225 or more, anterior ones half of the width of the body.
 *Praescutata viperina* (Viperine Sea Snake)
 Coastal waters.
 Ventrals fewer than 200, anterior ones not half of the width of the body.
 *Lapemis curtus* (Malabar Sea Snake)
 Arabian and Indian coasts; Manora, Makran coast.

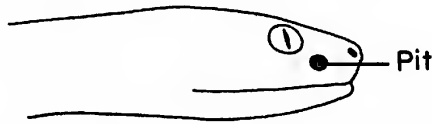


FIG. 14. Diagrammatic lateral view of head of pit viper, showing location of pit.

47. Dorsal scales pointed and imbricated; head large and body very stout.
 *Astrotia stokesi* (Large-headed Sea Snake)
 Coastal waters.
 Dorsal scales juxtaposed; habitus not as above. 48
48. Head long and flat; neck short; body strongly compressed laterally.
 *Pelamis platurus* (Pelagic Sea Snake; fig. 72)
 Open sea as well as coastal waters but rarely entering tidal creeks;
 common.
 Head small; neck long and slender; body subcylindrical. 49
49. Ventrals more than 400.
 *Microcephalophis cantoris* (Cantor's Small-headed Sea Snake)
 Coastal waters.
 Ventrals fewer than 350.
 *Microcephalophis gracilis* (Russell's Small-headed Sea Snake)
 Coastal waters.

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FIG. 15. Indus Toad (*Bufo andersoni*).



FIG. 16. Indian Burrowing Frog (*Rana breviceps*).



FIG. 17. Tiger Frog
(*Rana tigrina*).



FIG. 18. Skittering Frog
(*Rana cyanophlyctis*).



FIG. 19. Hawksbill Turtle (*Eretmochelys imbricata*).



FIG. 20. Green Turtle (*Chelonia mydas*).



FIG. 21. Loggerhead Turtle (*Caretta caretta*).



FIG. 22. Star Tortoise (*Testudo elegans*).



FIG. 23. Spotted Pond Turtle (*Geoclemys hamiltoni*).



FIG. 24. Indus Painted Turtle (*Hardella thurgii*).

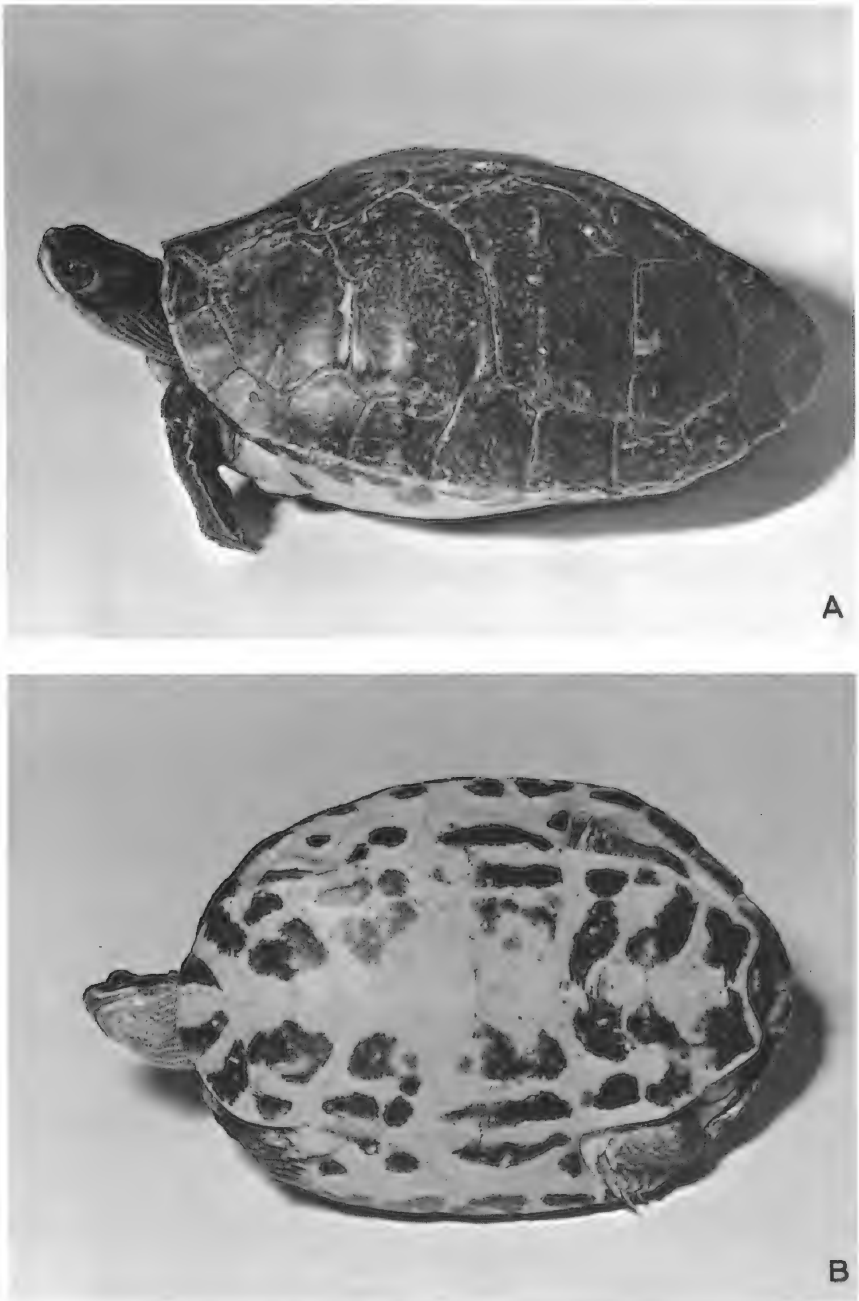


FIG. 25. Indian Sawback Turtle (*Kachuga tectum*). A. Side. B. Under side.



FIG. 26. Brown River Turtle (*Kachuga smithi*).



FIG. 27. Leatherback Turtle (*Dermochelys coriacea*).

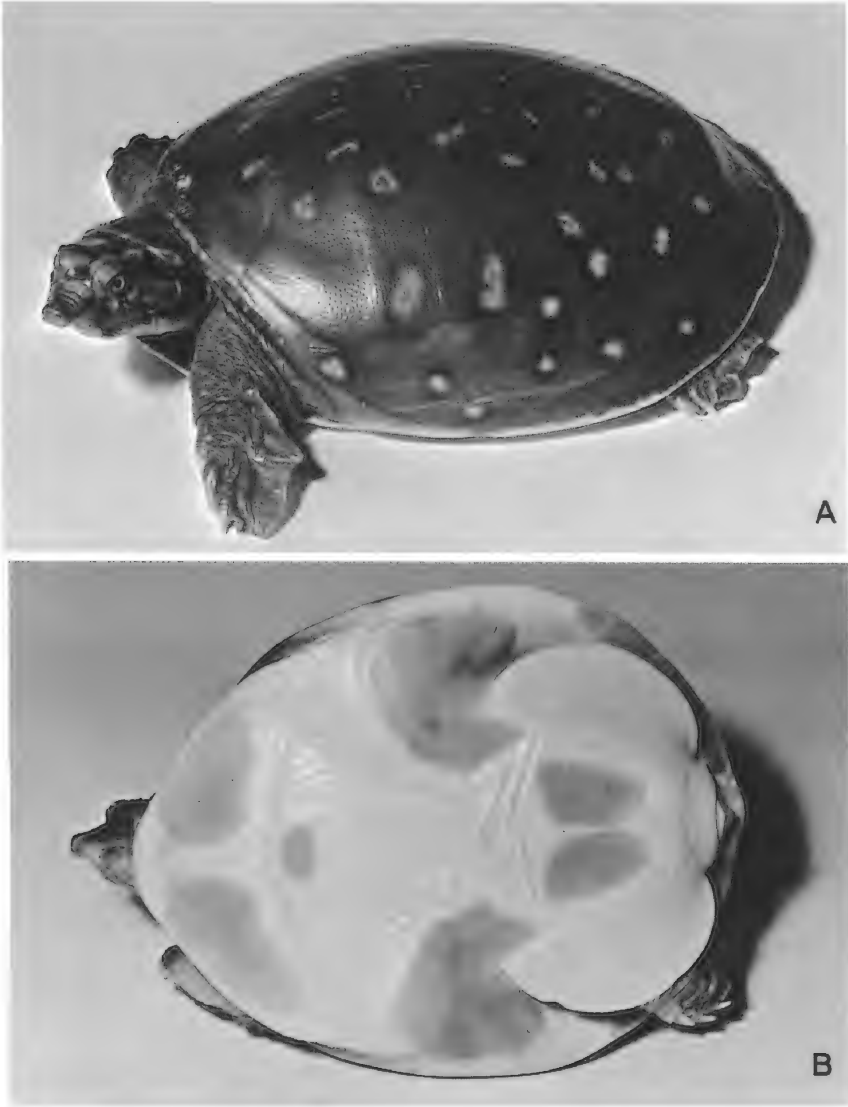


FIG. 28. Indian Flapshell Turtle (*Lissemys punctata*). A. Side. B. Under side.

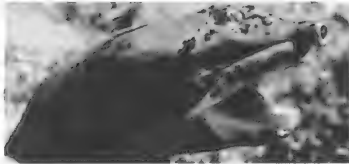


FIG. 29. Indian Softshell Turtle (*Trionyx gangeticus*), head only.



FIG. 30. Narrow-headed Softshell Turtle (*Chitra indica*).



FIG. 31. Blotched Gecko (*Hemidactylus triedrus*).

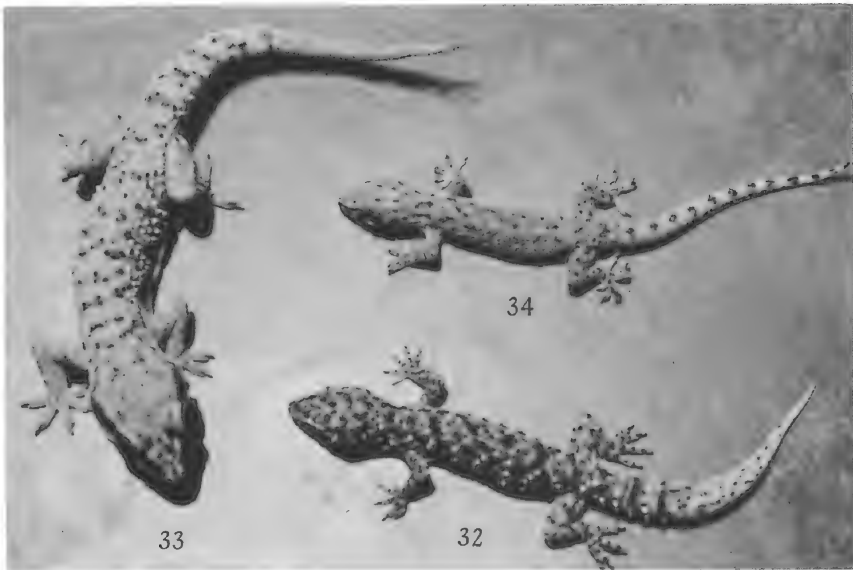


FIG. 32. Spotted Indian House Gecko (*Hemidactylus brooki*).

FIG. 33. Persian Gecko (*Hemidactylus persicus*).

FIG. 34. Mediterranean Gecko (*Hemidactylus turcicus*).



FIG. 35. Fat-tailed Gecko (*Eublepharis macularis*). A. Adult. B. Juvenile.

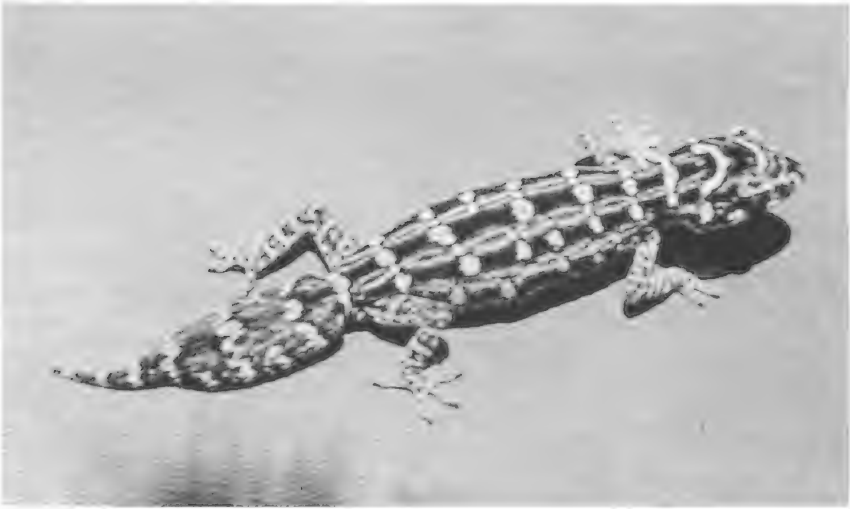


FIG. 36. Broad-tailed Gecko (*Teratolepis fasciata*).



FIG. 37. Sind Sand Gecko (*Stenodactylus orientalis*).



FIG. 38. Keeled Rock Gecko (*Gymnodactylus scaber*).



FIG. 39. Banded Dwarf Gecko (*Tropicalotes helenae*).



FIG. 40. Long-legged Gecko (*Agamura persica*).



FIG. 41. Indian Sandswimmer (*Ophiomonus tridactylus*).



FIG. 42. Yellow-bellied Skink (*Eumeces taeniolatus*).



FIG. 43. Indian Monitor (*Varanus bengalensis*).



FIG. 44. Desert Monitor (*Varanus griseus*).



FIG. 45. Spiny-tailed Lizard (*Uromastix hardwicki*).



FIG. 46. Indian Garden Lizard (*Calotes versicolor*).

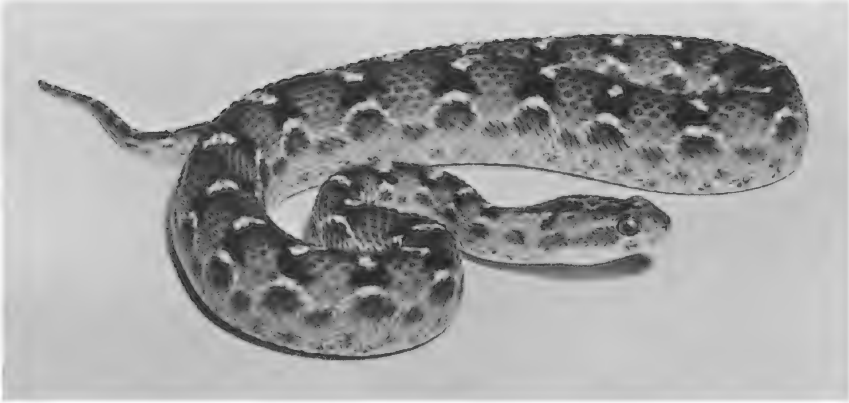


FIG. 47. Saw-scaled Viper (*Echis carinatus*).



FIG. 48. Russell's Viper (*Vipera russelli*).



FIG. 49. Indian Cobra (*Naja naja*).



FIG. 50. Indian Krait (*Bungarus caeruleus*).



FIG. 51. Northern Wolf Snake (*Lycodon striatus*).



FIG. 52. Awl-headed Snake (*Lytorhynchus paradoxus*).

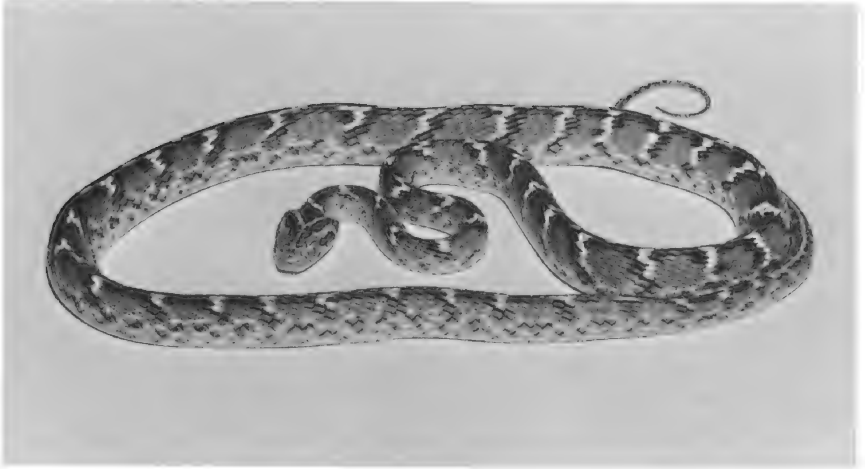


FIG. 53. Gamma Snake (*Boiga trigonata*).



FIG. 54. Russet Kukri Snake (*Oligodon arnensis*).

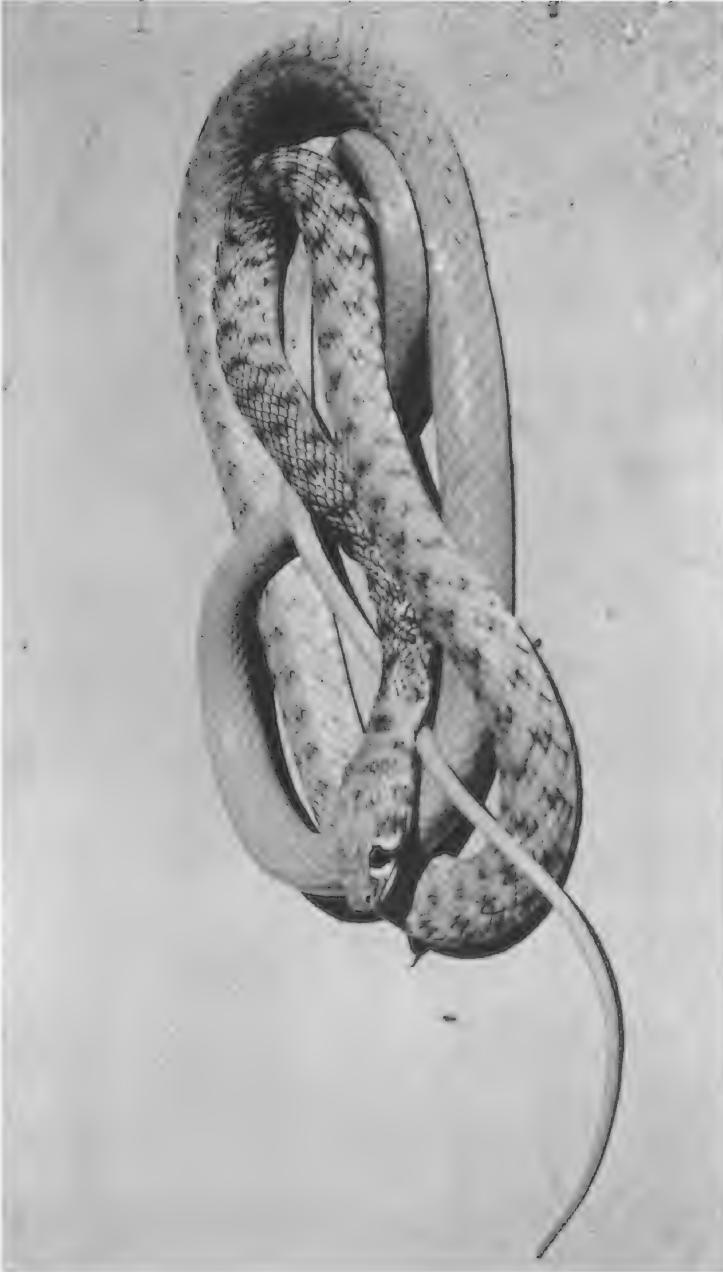


FIG. 55. Cliff Racer (*Coluber rhodorachis*).



FIG. 56. Glossy-bellied Racer (*Coluber ventromaculatus*).

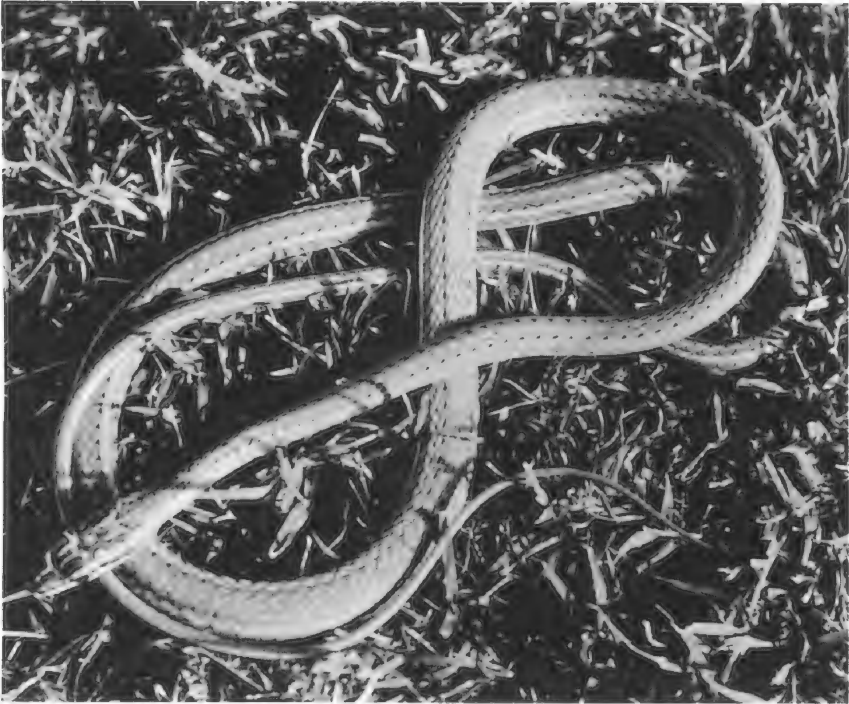


FIG. 57. Afro-Asian Sand Snake (*Psammophis schokari*).

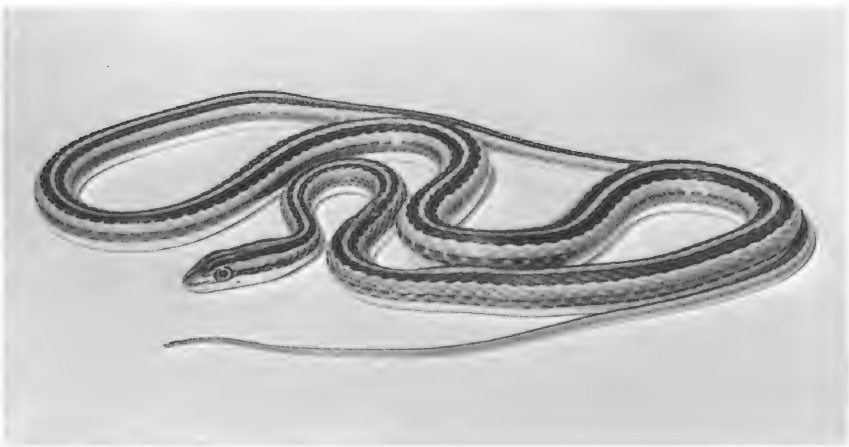


FIG. 58. Pakistan Ribbon Snake (*Psammophis leithi*).



FIG. 59. Red-spotted Snake (*Spalerosophis arenarius*).

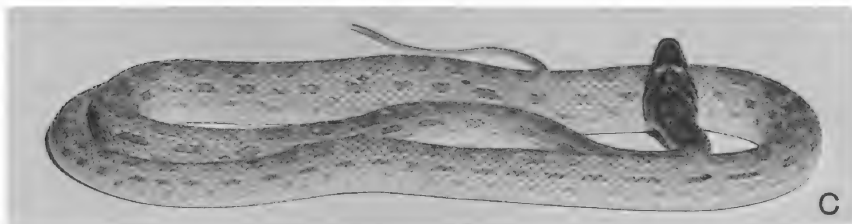
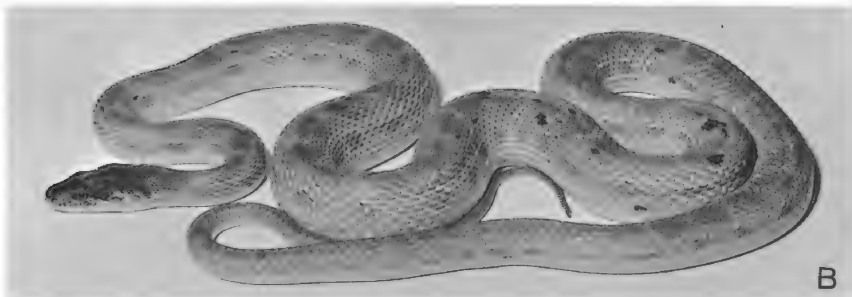
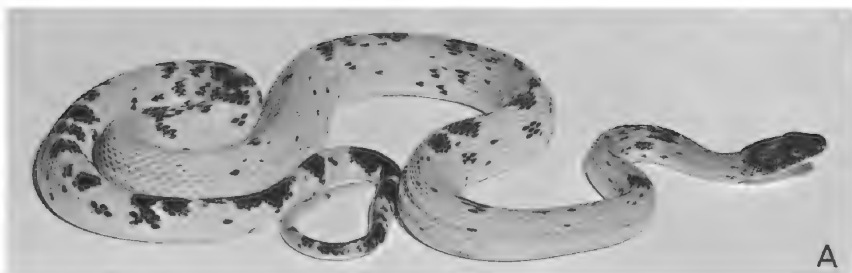


FIG. 60. Royal Snake (*Spalerosophis diadema*). A. Large adult. B. Subadult. C. Half grown.

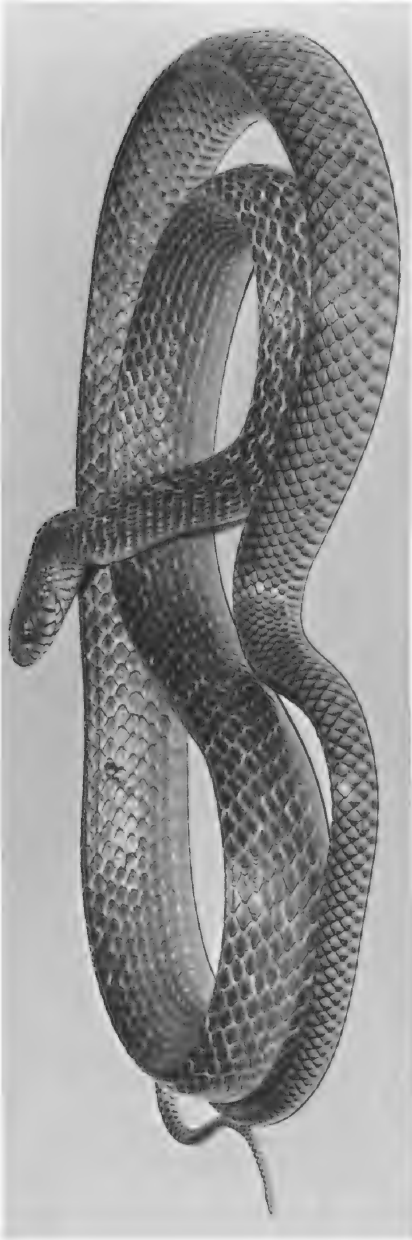


FIG. 61. Dhaman (*Ptyas mucosus*).



FIG. 62. Dark-bellied Marsh Snake (*Xenochrophis cerasogaster*).



FIG. 63. Checkered Keelback (*Fowlea piscator*).

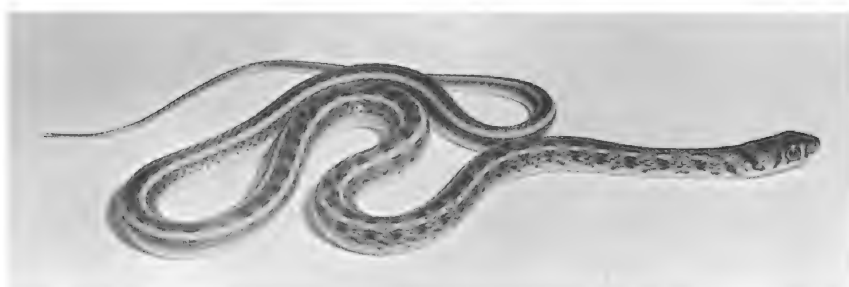


FIG. 64. Striped Keelback (*Amphiesma stolata*).

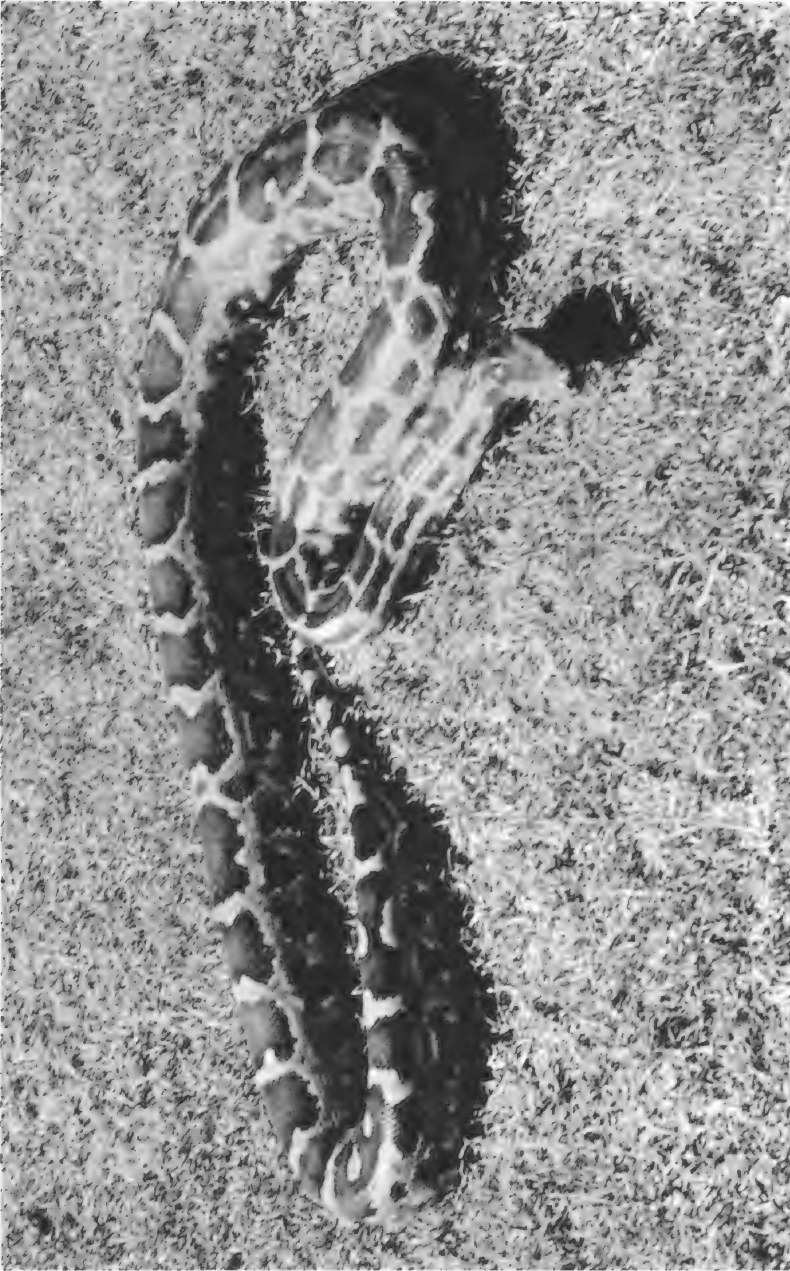


FIG. 65. Indian Python (*Python molurus*).



FIG. 66. Russell's Sand Boa (*Eryx conicus*).

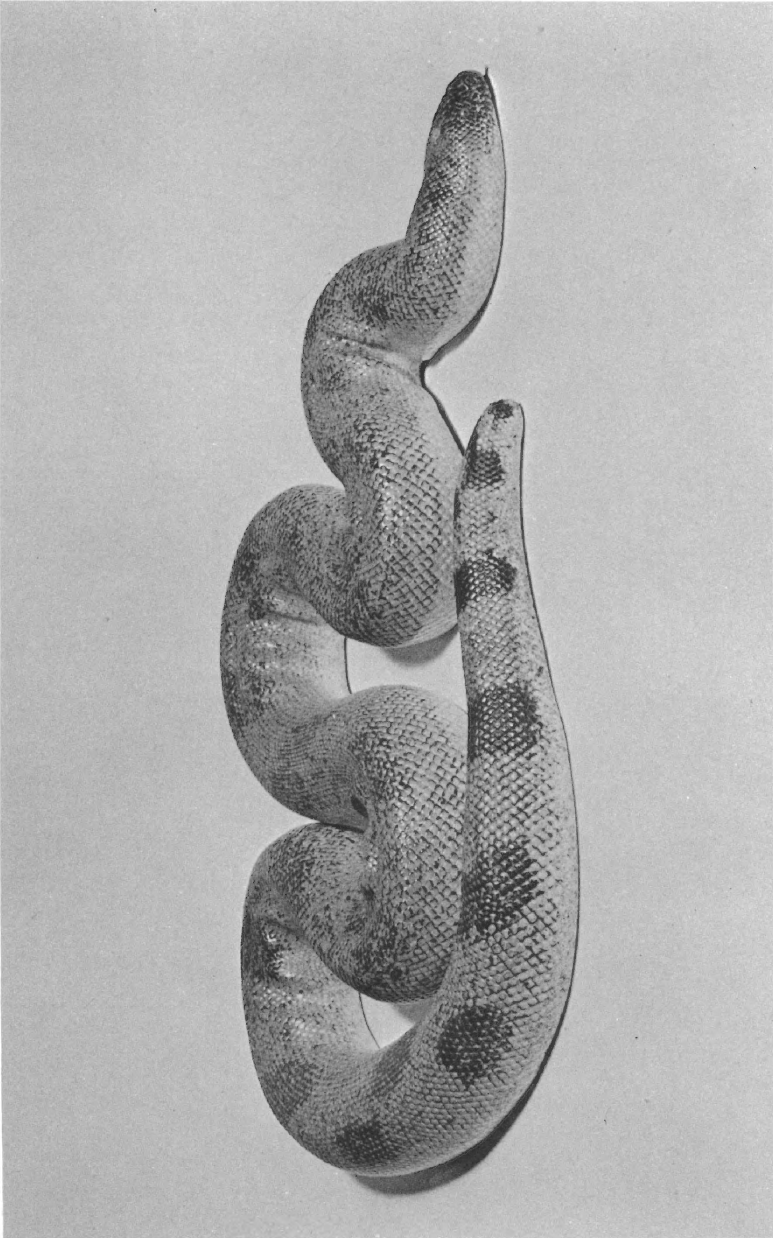


FIG. 67. Indian Sand Boa (*Eryx johni*).

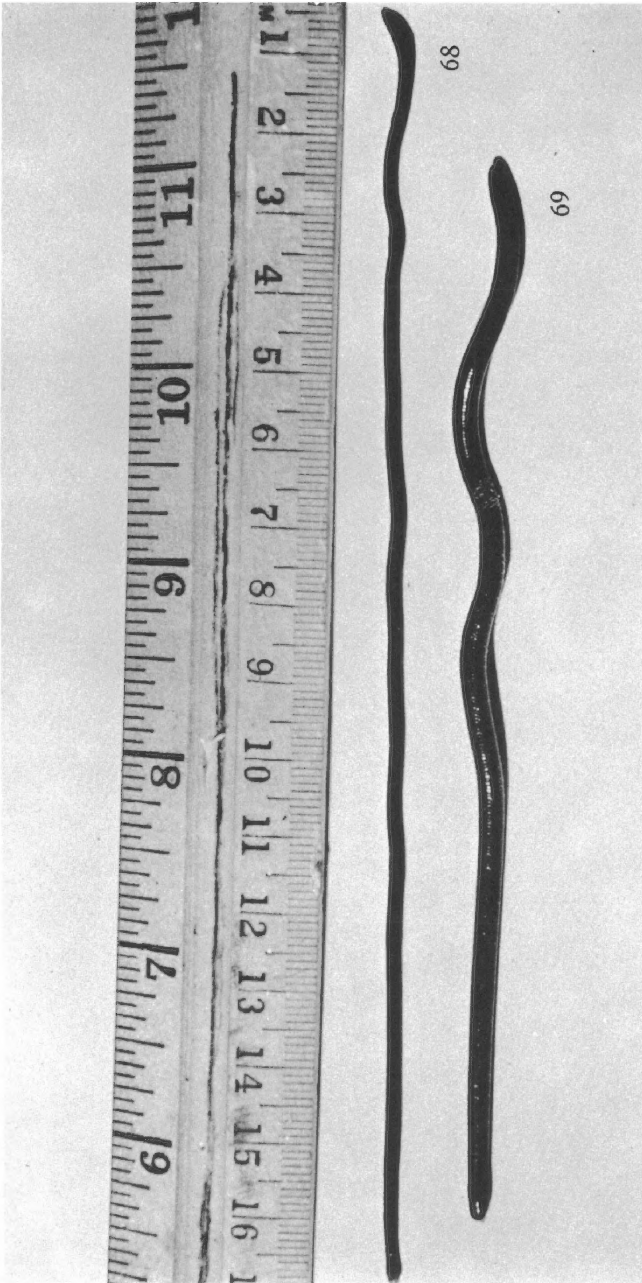


FIG. 68. Slender Blind Snake (*Typhlops porrectus*).

FIG. 69. Brahminy Blind Snake (*Typhlops braminus*).

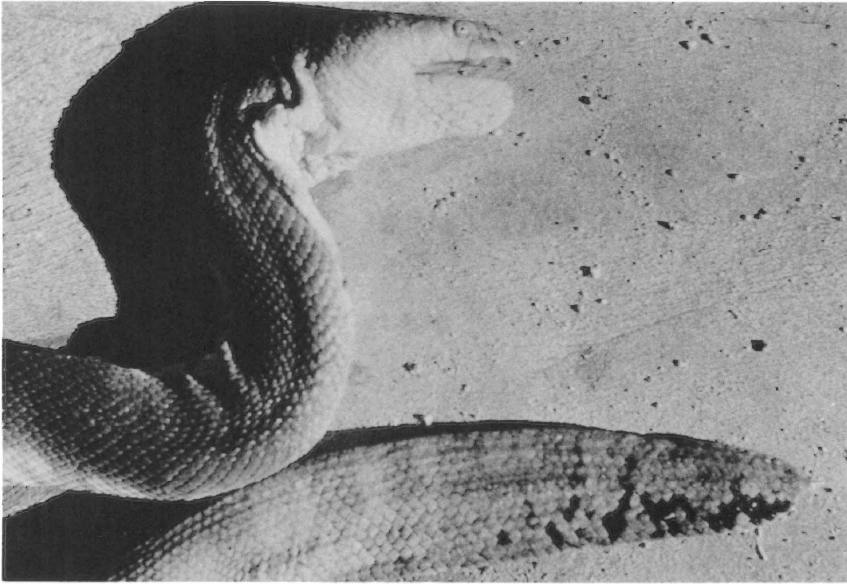


FIG. 70. Beaked Sea Snake (*Enhydrina schistosa*).

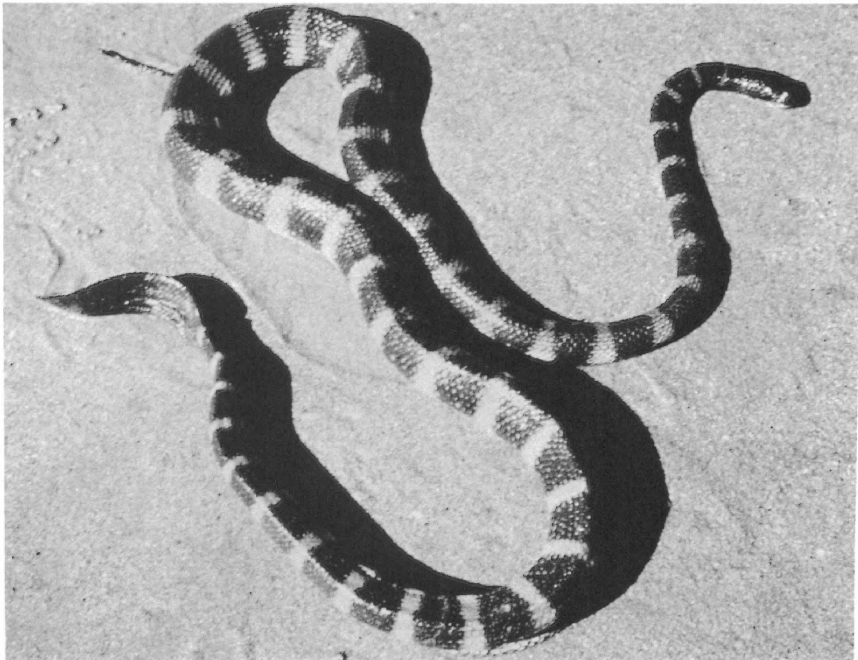


FIG. 71. Small-headed Banded Sea Snake (*Hydrophis fasciatus*).



FIG. 72. Pelagic Sea Snake (*Pelamis platurus*).