



Q L Lahiri

from

Prof. Kuntz

March 1966



Paiwan Totem

Snakes have played an important part in the religions, folklore and artistic symbolism of many primitive people. The Paiwan, one of the nine aboriginal tribes in Taiwan, have adopted the 100-pacer (*Agkistrodon acutus*) not only as a tribal symbol but also as the mythological ancestor of their race. In Paiwan legend, their first leaders sprang from the eggs of this snake. The distinctive patterns of *A. acutus*, with the characteristic dorsal diamond shapes provide the basic motifs for almost all Paiwan art from embroidery to the carvings on ceremonial wedding cups, water pots, spoons or decorative plaques, such as this example.

Snakes of Taiwan

Captain Robert E. Kuntz, MSC, USN



United States Naval Medical Research Unit No. 2
Taipei, Taiwan

U.S. Naval Medical Research Unit No. 2

7-1 Kung Yuan Road

Taipei, Taiwan

U.S. Mail: NAMRU - 2, Box 14, APO 63, San Francisco, California

Reprinted from the Quarterly Journal of the Taiwan Museum
Vol. XVI, Nos. 1 & 2

June 1963

The opinions and assertions contained herein are those of the author and are not to be construed as official or reflecting the views of the Navy Department or the Naval Service at large. This publication was supported by funding under Public Law 480, Section 104(c).

Snakes of Taiwan



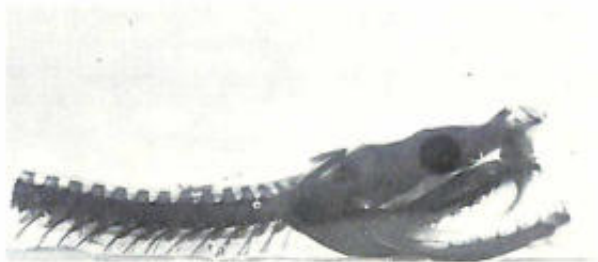


Introduction

Reptiles are among the most fascinating groups of vertebrate fauna in any area. Snakes, one of four categories (others: lizards, turtles and crocodiles or alligators) of the class Reptilia, are of special interest to the naturalist even though they are less than popular with the laity. But, in spite of the distrust and fear most people feel for snakes, they wish to learn more about them.

Several studies have been prepared on the taxonomy and biology of the snakes of Taiwan. These, however, are scattered in scientific literature. Some are written in Japanese or in Chinese. Few are easily available to the layman or to the biologist. An extensive and well-illustrated book, *A Monograph on the Snakes of Japan*, with emphasis on taxonomy, was written in 1931 by Maki. This includes detailed descriptions and keys for the identification of the snakes of Taiwan, which was then a

part of the Japanese empire. More recently, in 1956, Wang and Wang published a paper, *The Reptiles of Taiwan*, which lists and briefly describes turtles and lizards as well as snakes. *The Reptiles of China*, by



*The well-developed, long, curved fangs characteristic of the pit vipers, such as the bamboo snake, *Trimersurus stejnegeri*.*



*Denition of *Natrix piscator*, a non-poisonous snake without fangs.*

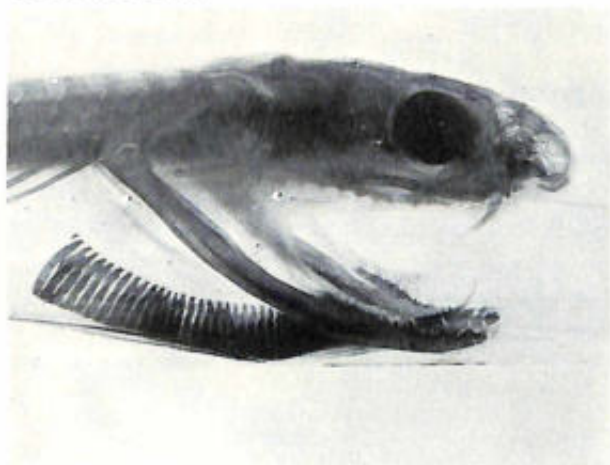
Pope (1935) describes many snakes common to Taiwan. Information on poisonous species of snakes and on treatment of snake bite may be found in Keegan's *Some Venomous and Noxious Animals of the Far East* (1960), which covers the venomous snakes of Taiwan. Mimeographed papers, *Snakes in Taiwan*, by Dasch (1952) and *Venomous Snakes in Taiwan* by Lin (1954) give general descriptions of some snakes common to the island. The latter presents information on the prevalence of snake bite, along with mortality figures.

The present paper has been prepared

Snakes of Taiwan

in response to many requests made to NAMRU-2 for identification and general information on the snakes of Taiwan.

It is hoped that color photographs along with simple descriptions will provide a means of recognition by the layman with a general interest or the physician who may need an identification for proper treatment of snake bite.



The short, rigid fangs seen in the Taiwan cobra, Naja naja.

Since this is not a taxonomic study of the snakes of Taiwan, simple binomial nomenclature is employed for scientific names. Specific differentiation and discussion of zoogeographic and taxonomic relationships await a careful study of specimens taken on the island during the past few years. Some commonly used local names are given, but colloquial names must be used with care. It is often difficult to give an accurate translation from Chinese into English and names employed by local residents are general and vague. The same common name is often applied to two or more snakes which may be taxonomically unrelated.

Recognition of Snakes

Snakes on Taiwan differ widely in size, coloration, individual disposition, habitat preference, etc. However, a majority of the snakes of any one species possess features which allow a listing of characteristics for recognition purposes. It is impossible to

prepare a description which will apply to all specimens. Snakes, as well as man and other animals, are individuals. Age, sex, habitat and other factors cause variations in characteristics.

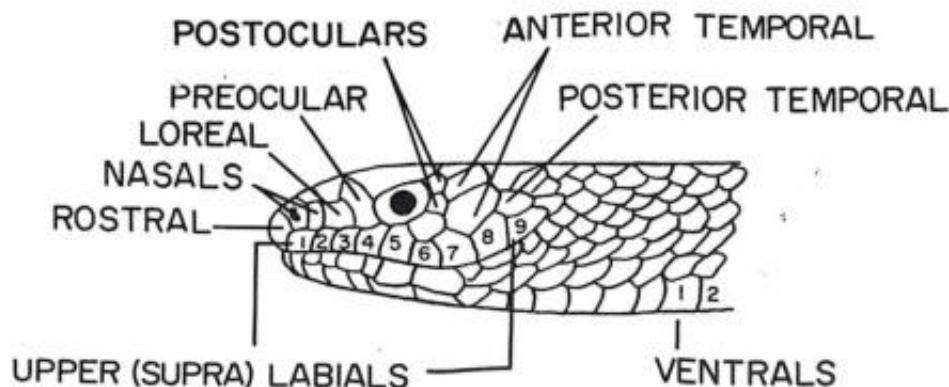
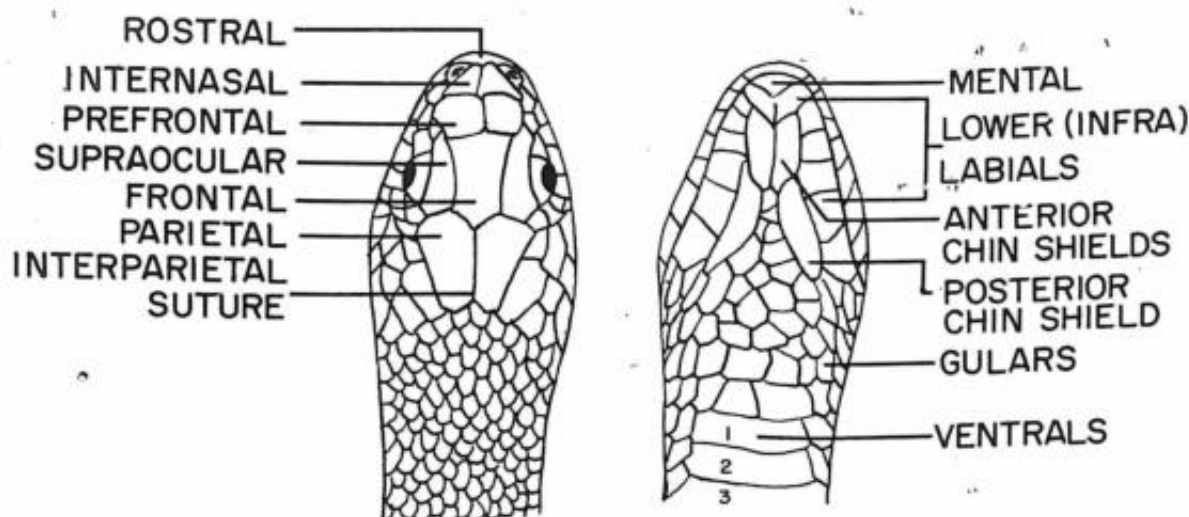
In describing the species included in this review, stress has been laid on characteristics common to adult snakes while living or shortly after death. These descriptions, especially as to coloration, do not hold for specimens preserved in alcohol or formalin. Such fixatives alter colors quickly.

In a critical taxonomic study it would be necessary to employ minute details which are not included in this general description. To facilitate quick recognition, an attempt has been made to highlight those features which the layman can detect easily without a knowledge of anatomy or the use of a microscope. In most instances, morphological characteristics included in the descriptions can be determined by the use of an ordinary hand lens. Minor exceptions do occur. In the case of small, fine-scaled snakes such as *Typhlops*, the blind snake, scale counting would be difficult if not impossible without more elaborate equipment.

Different groups of animals possess characteristics which favor survival in a world in which competition for life is keen. Some snakes, for example, are provided with well-developed fangs, and venom, produced in glands located back of the eyes. We can assume that the poison and fangs were evolved for killing the snake's prey. However, this apparatus is used also for defensive purposes. An understanding of fangs, their modification, specific relationships and the different types of venoms produced by snakes is a field of study in itself.

Two general types of fangs are found in the venomous snakes of Taiwan. The presence of well-developed fangs is an indication that the snake is poisonous and therefore potentially dangerous.

The illustrations show the types of poison fangs found in snakes on the island and also the dentition of a nonpoisonous spe-



Head of the common water snake, *Natrix piscator*, showing the scalation and nomenclature for scales or scutes on the dorsal, ventral and lateral surfaces.

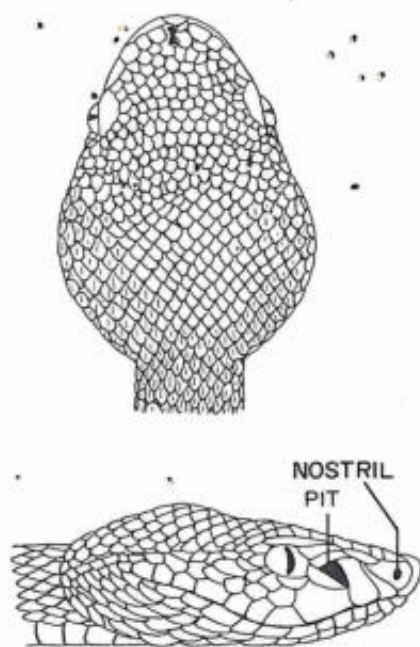
cies, *Natrix piscator*. The vipers have long, curved, moveable fangs covered by a fleshy sheath in the anterior part of the mouth. Fangs in the cobras, kraits and related species are more rigid, smaller in size and more difficult to recognize. In the sea snakes (*Pelamydrus*, *Hydrophis*, etc.) the fangs are even less prominent and may not be noticeably different from adjacent teeth in the upper jaw.

As a rule, fangs are more difficult to detect in fixed or preserved snakes than in recently dead specimens in which tissues are still soft. In searching for fangs the mouth should be propped open and the up-

per jaw probed with forceps, a needle or a small stick.

Most snakes have one or several prominent characteristics which assist in immediate recognition of the species. In the descriptions which follow, the more salient features are italicized.

Emphasis has also been placed upon a description of body design and coloration since these are basic considerations in *living* snakes. Head characteristics are of great importance; a photograph of the head has been included for most species. Descriptions are arranged so that the first para-



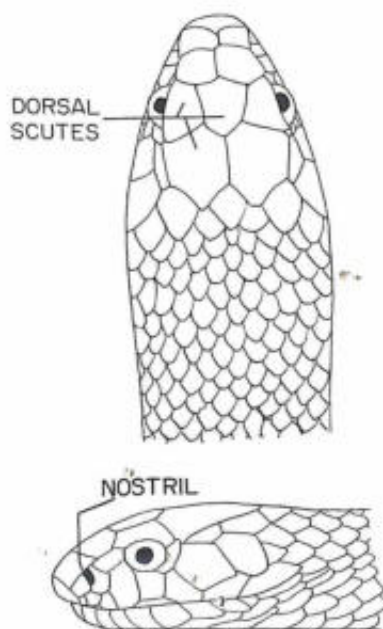
Dorsal and lateral surfaces of the head of the bamboo snake, Trimersurus stejnegeri; dorsal scales approximately equal in size; head broad and distinctly separated from the neck. The position of the "pit," characteristic of the pit vipers, is indicated.

graph includes impressions likely to be gained in the first glance at the snake, i.e. size, general body shape and length of the tail. This is followed by a more detailed description of the upper part of the reptile from the nose to the body and the tail. The final part of the description is of the snake after it has been turned over to expose its ventral side. Measurements given indicate extremes for the species; it is likely that the size of the usual specimen to be identified will fall somewhere within the middle range of length.

Descriptions of the less common species of snakes have been based upon limited numbers of specimens. In order to take into account the broader ranges in size and other variations, data from the works of other authors have been included. This additional information, given in parentheses,

was obtained primarily from the works of Maki (1931) and from Wang and Wang (1956) who previously studied snakes taken on Taiwan. Some of their measurements may be misleading since these authors included measurements of a number of young snakes in their studies.

A more realistic evaluation of the distribution of snakes on Taiwan has been provided by related data also taken from the above-mentioned authors. Information on the occurrence of snakes in areas other than Taiwan has been extracted from Pope (1935). Insofar as possible, distribution records are based upon collections taken from known localities. Some specimens, however, were obtained from semi-professional collectors and from snake merchants who make their living selling these reptiles for skins and medicinal purposes. Snakes obtained from such "middle men" represent a hazard from the standpoint of accu-



Dorsal and lateral surfaces of the Taiwan cobra, Naja naja; dorsal surface covered with well-developed large scutes or scales; head approximately same width as and therefore not separated from neck.

rate reporting. Such sources may account for questionable data on distribution in papers describing the snakes of the Orient. As an example, species from the southern part of the island frequently appear in the shops of Taipei and in other cities of northern Taiwan. Additional inaccuracies probably have occurred as a result of difficulties in translation of local names from Japanese and Chinese into English. Five or six villages with the same name are common.

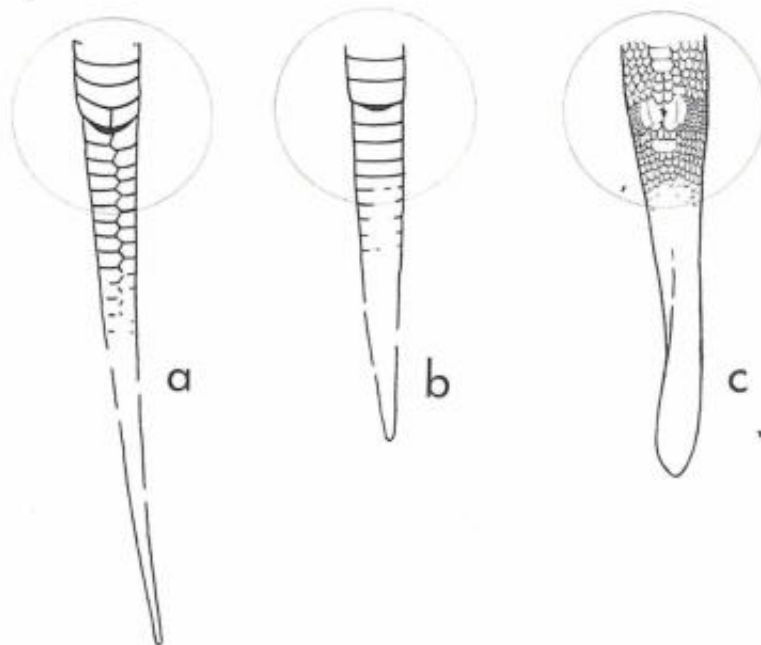
Descriptive Criteria Used

Although non-professional terms have been largely employed in this paper, it seems desirable to include a guide to the basic anatomical terms used by the herpetologist. The illustrations give the names applied to the scales on the dorsal, ventral

and lateral surfaces of the head. These terms are used freely by a herpetologist describing snakes but only a few of the more obvious features have been used in the text.

Also pictured are two contrasting types of head scalation encountered in the snakes of Taiwan, i.e. the bamboo snake (*Trimeresurus stejnegeri*,) in which there is little differentiation of dorsal head scales and the cobra (*Naja naja*,) in which a number of the dorsal scales appear as large prominent scutes or shields.

These differences in the dorsal head scales divide snakes into two general groups. The bamboo snake (*Trimeresurus stejnegeri*), the habu (*Trimeresurus mucrosquamatus*) and Russell's viper (*Vipera*



Tail characteristics for snakes of Taiwan.

- a. *Natrix piscator*—anal scale divided; subcaudals divided into pairs; tail long and drawn out to moderate filament.
- b. *Bungarus multicinctus*—anal plate not divided; subcaudals not divided; tail tapered to blunt end.
- c. *Hydrophis cyanocinctus*—anal divided into four scales; subcaudals irregular and modified; tail compressed laterally.

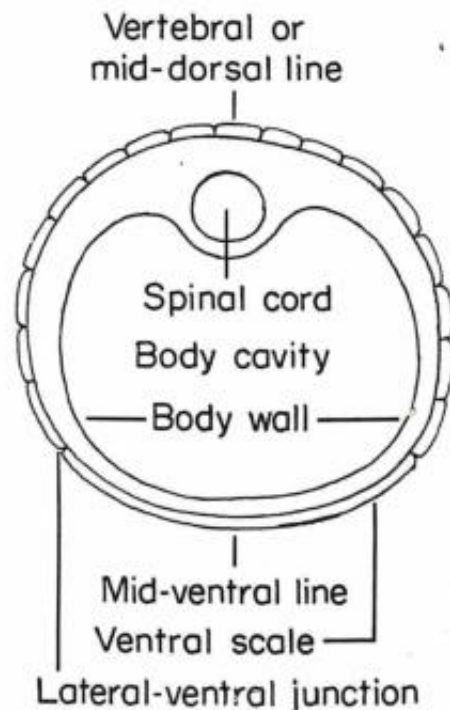
Snakes of Taiwan

russelli) are members of a group in which head scales are more or less equal in size. The difference in snakes with heads clearly differentiated or not differentiated from the body is also illustrated.

The skin of a snake is modified and possesses thickenings called scales. These, although variable in number, normally constitute a reliable guide in identification. It must be realized, of course, that a scale count is only one of a number of steps necessary to classify an individual snake. Scales are of two general types, i.e. smooth or keeled. There are also intermediate types with partial or broken keels.

Keels found in different species of snakes range from low flattened or broadly rounded keels to those which are sharp and rough to the touch.

The illustrations show the general relationship of the dorsal and ventral scales as seen on the majority of snakes. Scales are numbered to indicate the usual system of counting scale rows. Scale counting may be accomplished by rolling a recently killed



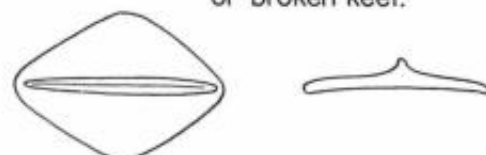
Cross section view to illustrate the relationship of dorsal and ventral scales.



a. Enhydris - smooth scale.



b. Hydrophis - low, rounded, partial or broken keel.



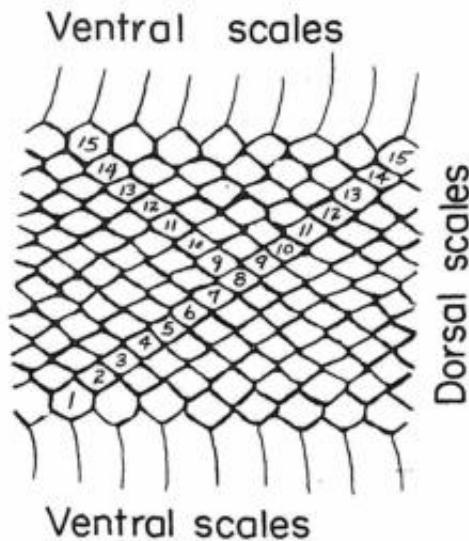
c. Trimeresurus - complete, strong keel.

Smooth, intermediate and rough scale types as seen from above or in cross-section at the right.

and/or limp snake on a flat surface or between the fingers. As a rule, it is much easier to count along a diagonal line from the latero-ventral line on one side of the body to the junction of the dorsal and ventral scales on the opposite side. Naturally, such procedures should not be attempted on living snakes which are poisonous or suspected of being poisonous.

In scientific identification three scale counts are usually given. Counts read from left to right, (15-17-17) the former representing the anterior count, made from a diagonal row of scales approximately two head lengths from the head. The posterior count is made an equal distance in front of the anus. A third count is made midway between the head and anus. As noted, scale counting may be difficult in small species, even with the use of a hand lens.

Ventral scale counts are made more easily but the process is tedious in small or unusually long species. This scale count includes all of the belly or ventral scales from



A section of skin removed from body and flattened to illustrate relationship of dorsal and ventral scales. Ventral scales have been cut along the mid ventral line.

the gulars on neck to the anal scale. The latter may be a single large scale or it may be divided into two. Exceptions occur among some sea snakes, e. g. *Hydrophis*.

Complete, divided and modified anal scales or plates are illustrated.

In the majority of snakes the subcaudals or the scales on the lower side of the tail are divided, as in the common water snake *Natrix piscator*, and are therefore indicated as pairs in recording counts. *Bungarus multicinctus*, the krait, is an exception to the rule since it possesses undivided subcaudals. Other modifications occur in sea snakes which exhibit an unusual scalation owing to their laterally compressed tails. The subcaudals may be difficult to count accurately in snakes with long tails or, especially, with tails drawn out to a fine filament.

Abbreviations, like technical terms, have been kept to a minimum. The primary purpose of this report is to provide a practical means for identifying the snakes of Taiwan which can be used by anybody with a working knowledge of English. When feasible, general information is given to permit a better understanding of the biology of the species. Obviously much remains to be learned about the life histories and biology of the snakes common to Taiwan.

Robert E. Kuntz

Taipei, Taiwan
June, 1963

ACKNOWLEDGEMENTS

Dr. Robert F. Inger, Curator of Reptiles, Chicago Museum of Natural History, has contributed much to this work and the scientific names for the snakes are those provided by him. Mr. Mao Shou-hsian, Department of Biomorphics, National Defense Medical Center, Taipei, has loaned specimens and LCDR W. H. Wells MSC, USN, has assisted in the collection of materials. Mr. Ward D. Smith has contributed much to the organization of the present pamphlet and Mr. Charles E. Knight, Head, Medical Illustrations Department NAMRU No. 2, has provided the line drawings. Special acknowledgement is due the National Geographic Society, Washington, D. C., without whose photographic support the color photographs for the present pamphlet would have been impossible, and to the Commanding Officer of NAMRU No. 2, Captain Robert A. Phillips, MC, USN, who has provided outstanding support to biomedical studies on Taiwan.

	<i>Page</i>
Introduction	1
<i>Sibynophis collaris</i> (Gray)	11
<i>Typhlops braminus</i> (Daudin)	12
<i>Natrix annularis</i> (Hallowell)	14
<i>Natrix piscator</i> (Schneider)	15
<i>Natrix stolata</i> (Linnaeus)	17
<i>Natrix sauteri</i> (Boulenger)	20
<i>Natrix suriki</i> Maki	21
<i>Natrix swinhonis</i> (Guenther)	23
<i>Macropisthodon rudis</i> Boulenger	24
<i>Enhydris chinensis</i> (Gray)	26
<i>Enhydris plumbea</i> (Boie)	28
<i>Zaocys dhumnades</i> (Cantor)	30
<i>Ptyas korros</i> (Schlegel)	31
<i>Ptyas mucosus</i> (Linnaeus)	33
<i>Elaphe carinata</i> (Guenther)	35
<i>Elaphe porphyracea</i> (Cantor)	36
<i>Elaphe taeniurus</i> Cope	38
<i>Liopeltis major</i> (Guenther)	41
<i>Dinodon rufozonatum</i> (Cantor)	42
<i>Dinodon septentrionale</i> (Guenther)	44
<i>Oligodon ornatus</i> Van Denburgh	45
<i>Oligodon formosanus</i> (Guenther)	47
<i>Boiga kraepelini</i> Stejneger	49
<i>Psammodynastes pulverulentus</i> (Boie)	51
<i>Amblycephalus formosensis</i> Van Denburgh	52
<i>Bungarus multicinctus</i> Blyth	54
<i>Naja naja</i> (Cantor)	56
<i>Calliophis maclellandi</i> (Rheinhardt)	58

<i>Hemibungarus sauteri</i> (Steindachner)	59
<i>Laticauda colubrina</i> (Schneider)	60
<i>Laticauda semifasciata</i> (Reinhardt)	63
<i>Hydrophis cyanocinctus</i> Daudin	65
<i>Pelamis platurus</i> (Linnaeus)	67
<i>Vipera russelli</i> Shaw	69
<i>Agkistrodon acutus</i> (Guenther)	71
<i>Trimeresurus stejnegeri</i> Schmidt	73
<i>Trimeresurus macrosquamatus</i> (Cantor)	75
Note on the cultural and Economic Importance of Snakes in Taiwan	77
Bibliography	79

Snakes of Taiwan

671H

Sibynophis collaris (Gray)

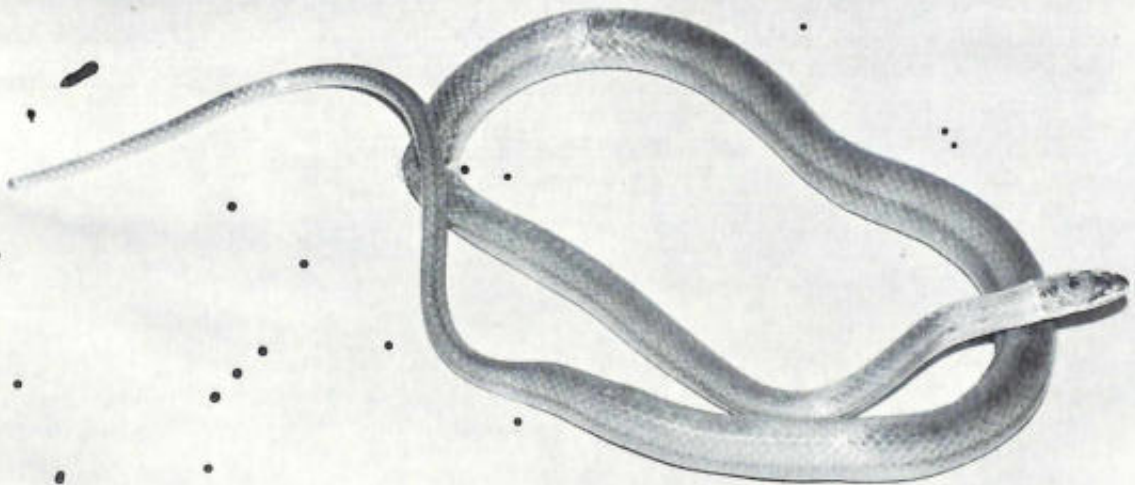
Nonpoisonous

Common Name—Black Head Snake,

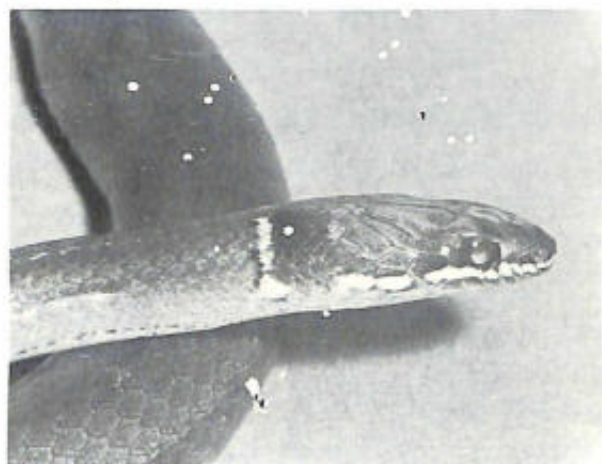
Description: Total length — $25\frac{1}{4}$ -in. ($17\frac{3}{4}$ to 28-in., Maki); tail — $6\frac{1}{2}$ -in. or approximately a third to a quarter of length. Medium to small snake; body — slender; scale counts — 17-17-17; tail — tapers gradually to filament and point.

Dorsal contour of head—slightly triangular; nose — slightly tapered to broad round end; nostril—small, inconspicuous,

on side and near tip of nose; eye—medium to small, dark, black dappled on dirty yellow; iris — jet black, round, circled with distinct orange red band; head—flattened posteriorly, convex anteriorly, slightly expanded posteriorly but not distinct from neck; dorsal shields—large but not prominent due to velvet texture, smooth; upper head — brown, darkened by diffuse black



Sibynophis collaris



Sibynophis collaris

pigment, black design, roughly a broad "V" on head between and posterior to eyes, black spot on posterior part of each parietal, broad irregular black band across back of head, followed posteriorly by narrow band of cream to tan; upper labials—prominently marked with white spots, partly bordered by black; tongue—dark, stem mottled.

Upper body—gray brown to brown with 3 indistinct longitudinal strips of diffuse black pigment, mid-dorsal stripe widest but becomes less distinct in posterior quarter of body, lines extend onto tail but gradually fade out; upper tail—slightly darker than upper body; scales—smooth, iridescent.

Ventral head—dirty white mottled with coarse diffuse black or brown pigment; ventral body—neck region dirty white, anterior ventrals (eight to 10) with scattered flecks of black; body posterior to neck light yellow to yellow green, brown of upper body extends onto outer quarter or fifth of ventral scales, area of black pigment at junction of brown and yellow on each ventral scale forms longitudinal line which extends onto tail; underside of tail—light green; ventral scales—large, smooth, glossy, 182 (164 to 175, Maki); anal scale—divided; subcaudals—79 pairs (incomplete), (111 to 176, Maki).

Distribution: Only one specimen of this species has been collected by NAMRU-2. The works of Maki (1931) and Wang and Wang (1956) also indicate that this snake cannot be considered common. Available records suggest that it probably ranges from low mountain areas up to the heights of Mt. Ali (2,000-3,000 meters). The same or a closely related species of the genus is common in several provinces of mainland China.

Habitat and Habits: *Sibynophis* apparently occurs in cultivated as well as in well-wooded and shrub areas and Pope (1935) has indicated that on mainland China this snake prefers to live a few hundred feet above sea level.

***Typhlops braminus* (Daudin)**

Nonpoisonous

Common Names—Taiwan Worm Snake, Blind Snake

Description: Total length— $4\frac{3}{4}$ to $6\frac{1}{2}$ -in. ($5\frac{1}{2}$ to $7\frac{1}{8}$ -in., Maki); tail— $\frac{1}{8}$ to $\frac{1}{4}$ -in. or approximately one-twentieth to one-twentyfifth of length. *Very small snake:* body—stout, but only $\frac{1}{8}$ to $\frac{3}{16}$ -in. in its greatest diameter; scale counts—20-20-20; tail—very short, stubby, tapers rapidly from a base approximately equal to width of body to a *very short ventrally curved, moderately blunt tip.*

Dorsal contour of head—very broad, round, almost a semicircle; nose—indistin-

guishable from rest of head, protrudes beyond lower jaw in lateral view; nostril—microscopic, hardly detectable with hand lens, low on side of nose; eyes—minute, poorly developed, appear as black pigmented spots on upper head, covered by head scales; head—round or convex, hardly distinguishable from body, no neck; dorsal shields—very small, fairly uniform in size, do not conform with scale patterns common to other snakes; upper head—uniform dark brown to brown black; scales of upper

mouth—lighter than scales on upper head, some specimens with small white or light spot above corner of mouth; tongue—dirty white, almost colorless.

Upper body and tail—uniform brown to brown black; scales darkened by deposits of very fine black pigment on margins; body scales—uniform in size, smooth, glossy, greasy to touch.

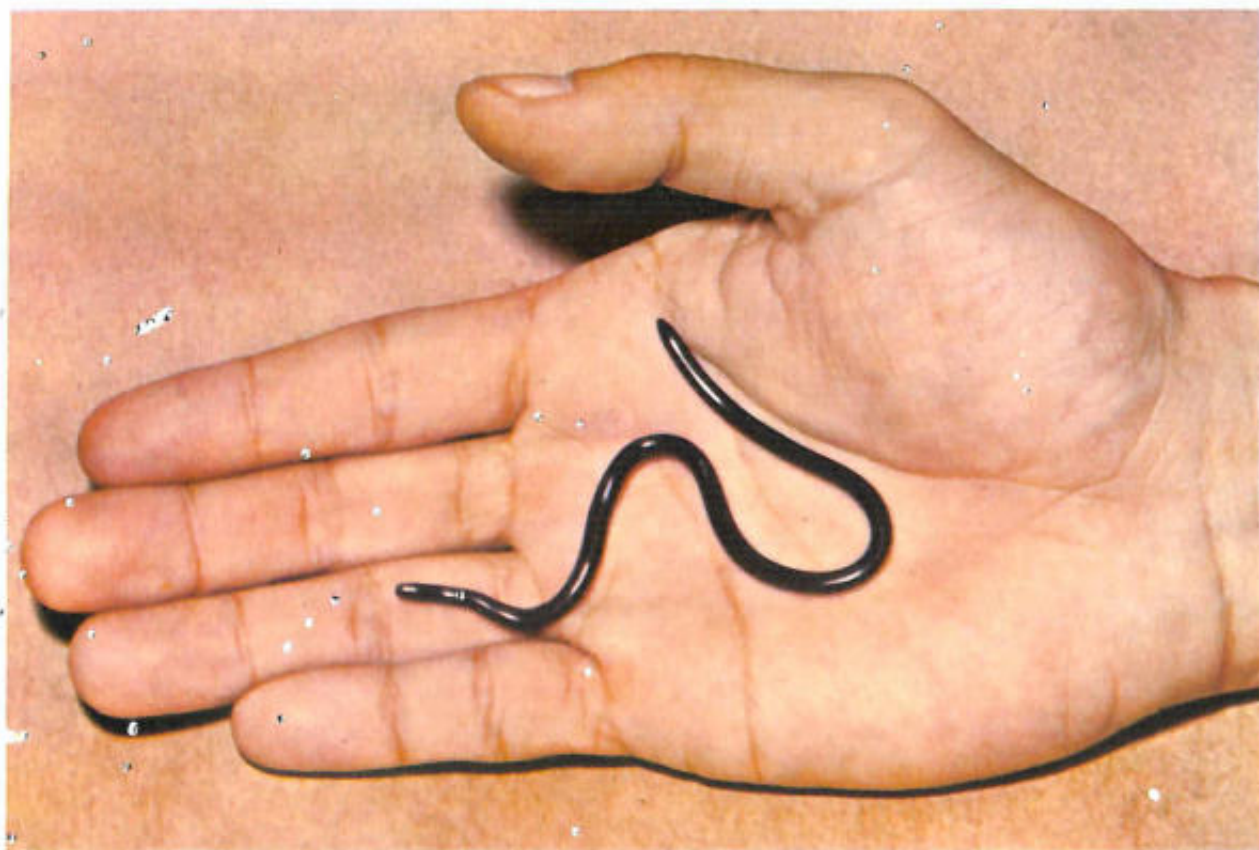
Ventral head—tan to flesh color; light color of upper lip extends across lower labials and chin plates, this light area may be fairly well differentiated from darker neck region; ventral body—light brown to brown, lighter than and gradually merging at sides with darker brown of upper body; light area involving six to eight scales just anterior to anus; underside of tail—same as ventral body with light area at tip; ventral scales—not enlarged or differentiated from other scales of body; smooth, glossy.

Distribution: The blind snake is found



Typhlops braminus

everywhere in Taiwan at lower altitudes. It occurs throughout southern Asia, the Malay Archipelago, as well as in the Phil-



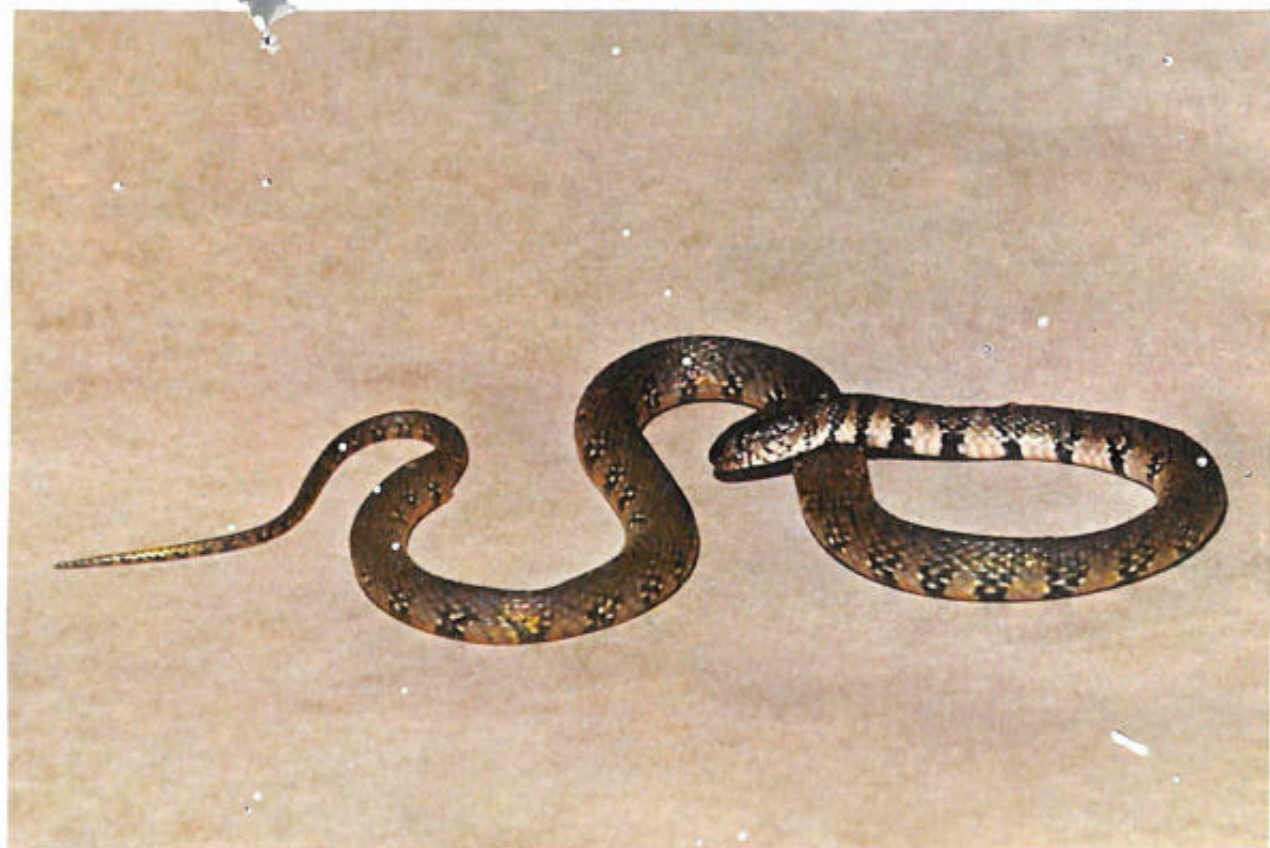
Typhlops braminus

Snakes of Taiwan

ippines and many islands of the Pacific, Africa, and Madagascar. *Typhlops* is closely associated with domestic as well as wild plants and probably has been carried great distances by man.

Habitat and Habits: The worm snake lives in a wide variety of habitats and may be found in cities and around human habitations. It occurs in wooded as well as in agricultural and developed areas. It is

secretive and remains hidden in piles of debris, under rocks, etc. where it is seldom noticed by the layman. It probably is accepted as a worm when unearthed by the gardener or swept aside by the housewife tending plants. *Typhlops* is partial to moist dark habitats and may be found under or inside decaying wood or trees. It feeds upon small worms, eggs and insect larvae. The worm snake is an egg layer.



Natrix annularis

***Natrix annularis* (Hallowell)**

Common Names—Banded Water or Ground Snake, Red Pig, Red Belly Traveler

Description: Total length— $19\frac{3}{4}$ to $29\frac{3}{4}$ -in. (18 to $31\frac{1}{2}$ -in., Maki; $12\frac{1}{2}$ to $41\frac{3}{4}$ -in., Wang and Wang); tail—4 to $5\frac{3}{4}$ -in., or approximately a fifth of length. Small to medium size snake; body—stout, round; scale counts—19-19-17; tail—long, tapered gradually to moderately sharp tip.

Dorsal contour of head—oval; nose—

Nonpoisonous

slightly tapered, round; nostril—small, inconspicuous, high on side of nose; eye—medium size, dark brown to black, slightly dappled with irregular areas of yellow brown; iris—black, round, surrounded by light yellow brown ring, sometimes off-center, i. e. toward upper part of eye; head—flattened posteriorly, convex anteriorly,

slightly wider than but not distinct from neck; dorsal shields—large, elongate, smooth, glossy; upper head—uniform dark gray to gray brown; upper labials—large, yellow to yellow tan, lighter than upper head, *clearly differentiated due to vertical or oblique black bands at sutures*; tongue—flesh color to red, darkened by diffuse black pigment, branches lighter than stem.

Upper body and tail—dark gray to gray brown, 38 to 42 *irregularly shaped designs on sides of body, 14 to 18 on tail*; lateral designs, variable, ill-defined to moderate in prominence, dark gray to black, extend two-thirds up body from lateral-ventral junction, designs (involving one to three scales at latero-ventral line) usually broaden (four to seven scales) on upper part of body, tend to fade out dorsally but may be united by very faint band with design on opposite of body; lateral designs may have diffuse white to cream centers, with scattered spots of white or cream nearby, lateral designs usually continuous with ventral bands; body and tail scales—keeled, moderately rough to touch, moderately glossy.

Ventral head—dirty white to cream; lower labials—*clearly marked by black margins* which appear as continuations of similar lines on upper labials; posterior gulars may possess black margins and form narrow black, diffuse or broken crossband at level of first to third ventrals; neck—yellow, tinted with orange, the orange progressively more intense posteriorly; *distinct irregular shaped broad bands* on remainder of body, involving one to four scales; some bands cross body, others stop near mid ventral line forming alternate patterns of black; most bands associated with or con-



Natrix annularis

tinue as bands on side of body; similar bands on underside of tail; ventral scales—large, smooth, glossy, 152 to 162 (145 to 161, Maki; 141 to 160, Wang and Wang); anal scale—divided; subcaudals—55 to 58 pairs (54 to 61, Maki; 61 to 71, Wang and Wang).

Distribution: Records show that this snake probably occurs all around Taiwan. Wang and Wang (1956) state that it is very common in southeastern parts of the island. The same species occurs in the eastern provinces of mainland China (Pope, 1935).

Habitat and Habit: *Natrix annularis* has been taken in rice paddies and adjacent protected ravines providing suitable moist habitats. It feeds upon loaches and amphibians and it bears its young alive (Maki, 1931).

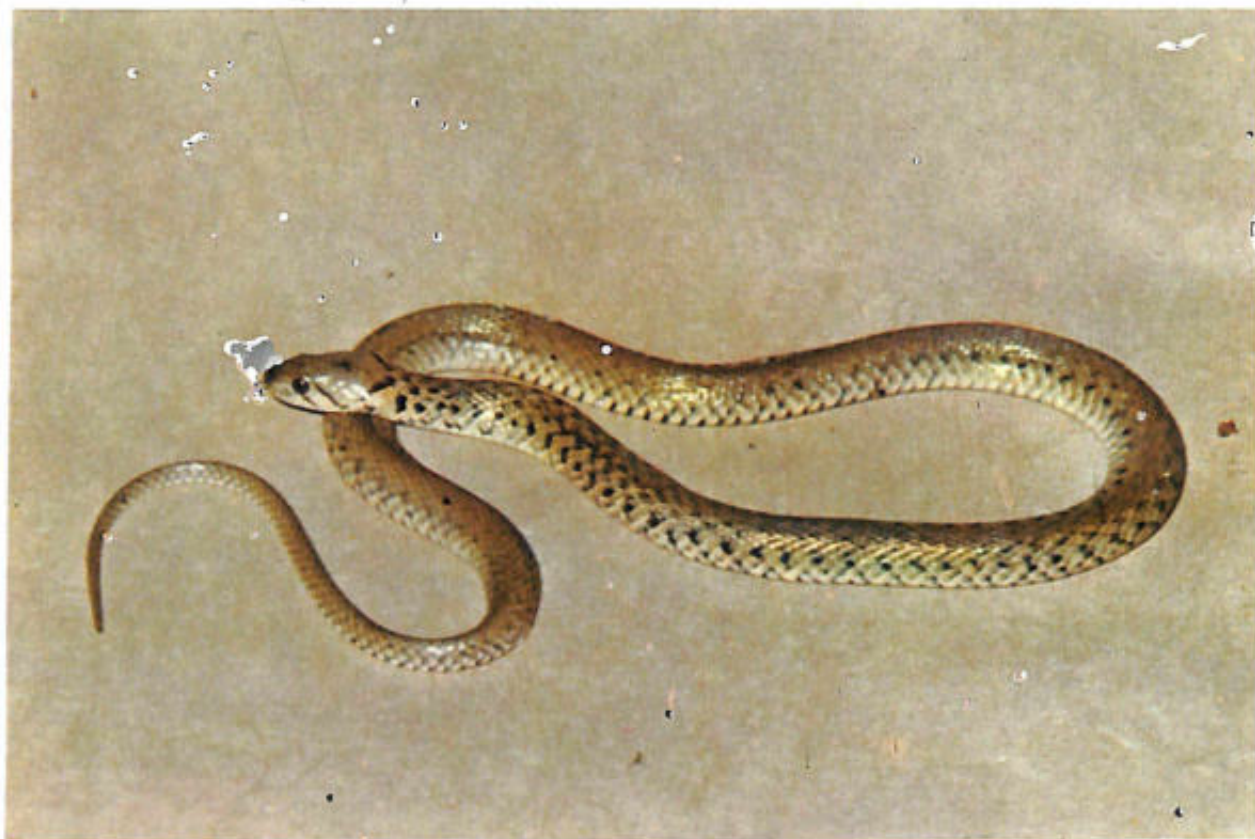
***Natrix piscator* (Schneider)**

Common Names—Common Scaled Water Snake, Fishing Snake, Grass-Flower, Kuan-Yin Snake

Description: Total length—18 to 32½-in. (20 to 39-in., Maki; 14½ to 33-in., Wang and Wang); tail—5 to 7¾-in. or approximately one quarter to one third of

length. Medium size snake; body—moderately stout and round; scale counts—19-19-17; tail—long, gradually tapered and drawn out to moderate filament, terminat

Nonpoisonous



Natrix piscator

ing with pointed chitinous spur.

Dorsal contour of head—oval to slightly triangular; nose — narrow, moderately tapered with round tip; nostril—small, on upper part of nose, barely visible from dorsal view; eye—medium size, dark gray to gray black, heavy but uniform deposit of black pigment interspersed with dirty yellow; iris—round, jet black, surrounded by broad ring of bright to dirty yellow; head—flattened, slightly expanded posteriorly but not distinct from neck; dorsal shields—large, smooth, glossy; upper head — light gray to dark or olive gray except for irregular, frequently indistinct pattern of black near mid-line and posterior end of parietals; most specimens possess two posteriorly directed oblique black lines near eye, anterior line extends from lower edge of eye to mouth, posterior line from a point back of eye to corner of mouth, the latter may join with black line forming a broad "V" on

upper part of neck; upper labials—lighter than upper head; tongue — dark gray to black, branches darker than stem.

Upper body and tail—gray brown to olive, bearing spots of varying size, varying intensity of blackness and irregular arrangement on dorsal and lateral surfaces; usually 50 to 70 vertical designs or black spots on sides extending upward from latero-ventral line, variable in prominence but usually more distinct in anterior two-thirds of body; "V" on neck may be followed posteriorly by a line of spots (which tend to be square) on each side of vertebral line, these tend to alternate with vertical designs on side, creating a roughly checker-board effect; scales on lower part of sides, usually lighter than dorsal body and may be tinged with yellow, orange, salmon or occasionally red; posterior quarter to third of body and tail have few or no black designs; body scales—moderate to light keels, three

to five outer rows without keels, slightly rough to touch, moderately glossy in appearance.

Ventral head—dirty white to cream, may be tinted with yellow, salmon or red, depending on overall coloration of individual snake; ventral body—three to six anterior scales dirty white to cream or tinted same color as ventral head, remainder of ventrals with horizontal bands due to black pigmentation along anterior margin, involving a fifth to a third of each scale; horizontal lines more prominent in mid and posterior parts of body; subcaudals—with pigmented borders, therefore distinct; ventral scales—large, smooth, glossy, 127 to 148 (125 to 150, Maki; 130 to 151, Wang and Wang); anal scale—divided; subcaudals—66 to 82 pairs (65 to 90, Maki; 59 to 88, Wang and Wang).

Natrix piscator is characterized by its great diversity in coloration; therefore, it is difficult to select a representative specimen. Specimens in the NAMRU-2 collection have ranged from uniform tan or dirty yellow without apparent markings to individuals with distinct body designs, vividly tinged with bright yellow or red. Different color variations are not necessarily associated with particular localities on Taiwan.

Distribution: *N. piscator* is one of the most common snakes on Taiwan and it occurs in all areas at lower altitudes. Its distribution is extensive, encompassing mainland China, Southeast Asia in general, the Malaya Archipelago, Sumatra, Celebes, Borneo and islands of the Indian Ocean.

Habitat and Habits: *N. piscator* occurs in wooded, grassy and cultivated areas at



Natrix piscator

the lower altitudes, especially around rice paddies and along the banks of irrigation systems and streams. It may be active during daylight hours but it is more frequently seen at night when on the move in search of food. This snake is encountered frequently in yards or along the drainage ditches of Taipei and other cities. A number of specimens have been taken around homes and a few have accidentally gained entrance. This snake is active the year around, even in northern Taiwan where temperatures are quite low during winter months. *N. piscator* is aggressive and may be moderately nervous when first confronted in its habitat. It will usually strike and bite if tormented. However, some individuals have made reasonably gentle pets. It adapts well to captivity. This species lays eggs and feeds upon amphibians, loaches and, occasionally, on smaller snakes.

***Natrix stolata* (Linnaeus)**

Common Names—Flower Snake, Land God, Yellow Banded Water Snake, Yellow Neck Water Snake

Description: Total length—22 to 27½-in. (20 to 24-in., Maki; 17½ to 19½-in., Wang and Wang); tail—4½ to 6½-in. or approximately one-fifth to one-quarter of length. Medium to small snake; body—slender; scale counts—19-19-17; tail—

long, tapers gradually to a filament and sharp point.

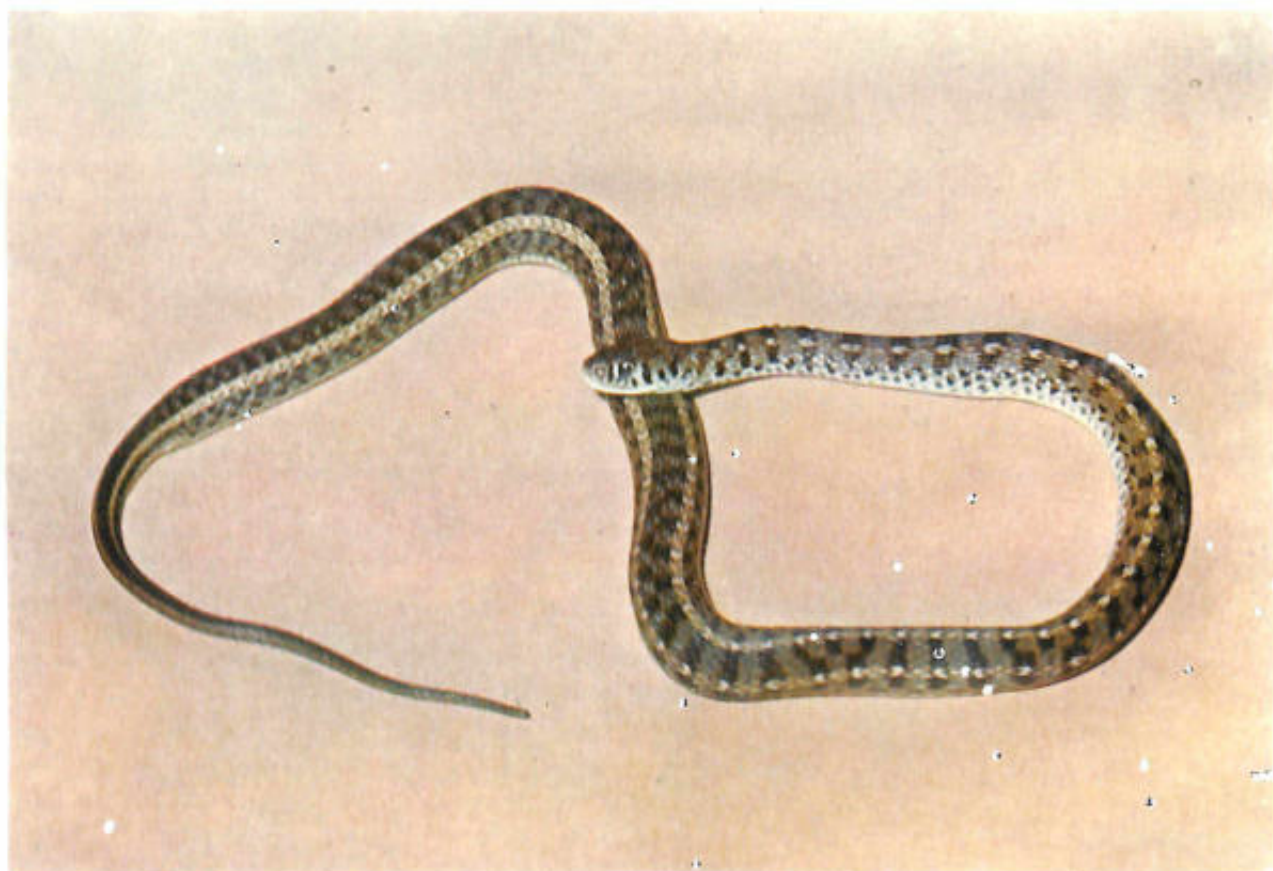
Dorsal contour of head—elongate oval to slightly triangular; nose—narrow, moderately tapered to broad round end; nostril—medium size, high on side of nose, barely

Nonpoisonous

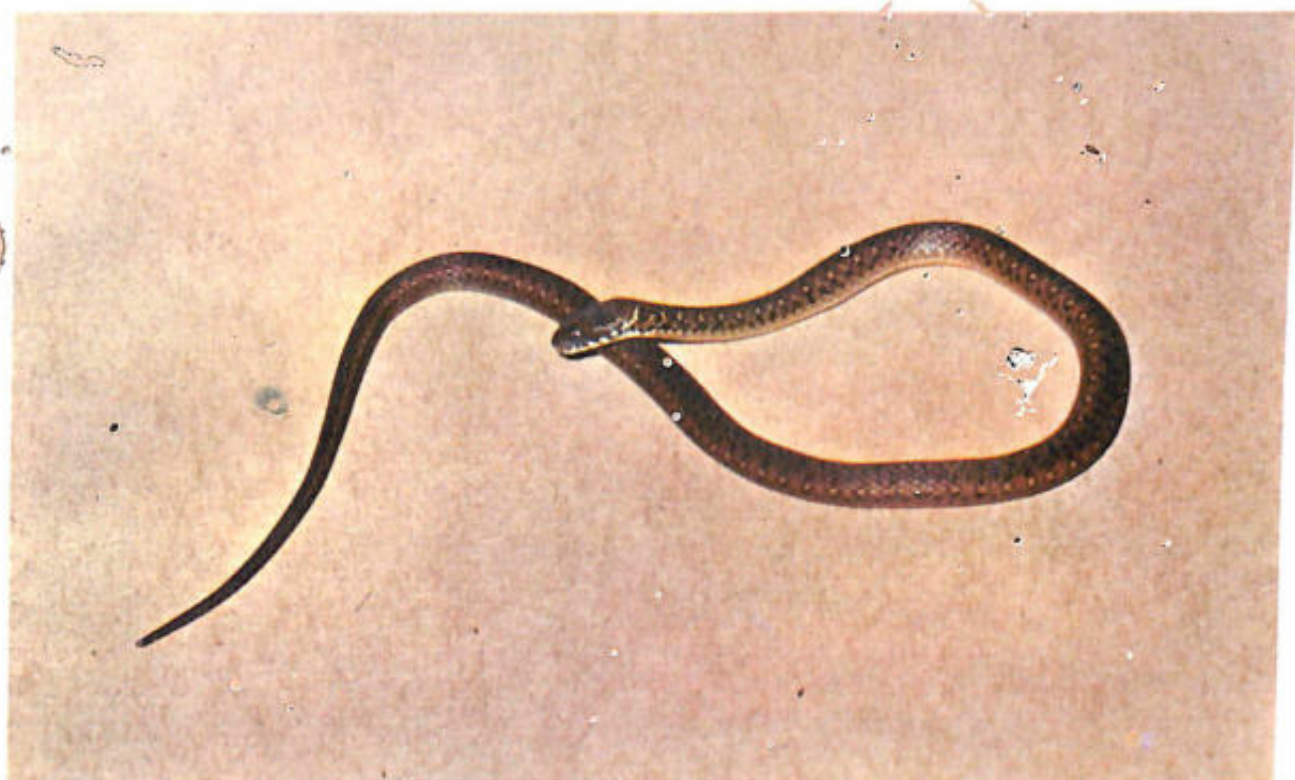
visible from dorsal view; eye—medium to large, dappled yellow and black, outer part of eye black, blending into yellow around iris; iris—round, jet black, surrounded by narrow band of light to medium yellow; head—flattened posteriorly, slightly expanded posteriorly but not distinct from neck, supraocular scale moderately well developed forming a ridge above and a short distance anterior to eye; dorsal shields—large, elongate, olive brown, usually prominent due to black borders of varying width, smooth, velvet texture but not glossy, iridescent in sun-light; upper head—medium to olive brown with irregular deposit of black on small as well as large scales, black pigment may form outline of a broad "V" on back of head and neck; vertical line of black midway between nostril and eye; other vertical or oblique lines below and behind eye; usually cream

or yellow area anterior to and posterior to eye; upper labials—well marked with black along sutures or on posterior margin of each scale, lighter than upper head due to areas of light to dirty yellow which may extend onto sides of neck; tongue—stem black, branches gray.

Upper body—variable, gray to olive and medium brown with designs of black as well as varying shades of light brown and gray flecked with white; a pair of light brown parallel stripes, (involving one to three rows of scales) on upper part of body, extending unbroken to mid point of tail or beyond; scales of longitudinal light stripe may possess black margins and usually a lighter spot at intersection of black bars and longitudinal stripe; 60 to 75 bars or black designs varying in intensity of blackness, continuity and arrangement, some arranged as checkerboards across vertebral



Natrix stolata

*Natrix sauteri*

line; checker-board-like designs variable in prominence, occur also below longitudinal stripes for greater part of body; all designs become less distinct on posterior quarter of body and tail; upper tail—darker brown than body; body and tail scales—keeled, dull, rough to touch, outer row of scales without keels.

Ventral head—cream to bright yellow; ventral body—neck region yellow, involving 9 to 12 scales; body posterior to neck white to light gray with black spots or areas of scattered dark pigment on lateral quarter of scales; faint longitudinal line near latro-ventral junction formed by regularly placed areas of pigment on ventral scales, tend to disappear in posterior part of body; underside of tail—usually plain, light gray; ventral scales—large, smooth, glossy, 148 to 153 (142 to 155, Maki; 62 to 82, Wang and Wang); anal scale—divided; subcaudals—68 to 72 pairs (65 to 82, Maki; 62 to 82, Wang and Wang).

Distribution: Records show that *Natrix stolata* occurs over the entire island of Taiwan from sea level to medium altitudes and as high as Mt. Ali (Maki, 1931). This species also occurs throughout southeast China, Burma and other parts of Southeast Asia.

Habitat and Habits: *Natrix stolata* is fairly common and is usually obtained from wooded and grassy areas, especially in moist well-protected valleys. It is found in agricultural as well as in nondeveloped areas. Several specimens have been taken under logs or piles of debris. In spite of its name, i. e. water snake, it is not necessarily associated with water and has been captured inside the homes of indigenous peoples in low lying areas. In contrast to some species of *Natrix*, *N. stolata* has a gentle disposition and as a rule will not strike or attempt to bite. According to Maki (1931) this snake feeds on amphibians and lays eggs.



Natrix stolata



Natrix sauteri

Natrix sauteri (Boulenger)

Common Names—Sauter's Ground or Water Snake

Description: Total length—14½-in. (9½ to 17-in., Maki; 28½-in., Wang and Wang); tail 3¾-in. or approximately one quarter of length. Small snake; body—medium stout to slender, round; scale counts—17-17-17; tail—long, tapers gradually from narrow base to drawn out filament and sharp tip.

Dorsal contour of head—slightly triangular; nose—moderately tapered to narrow round end; nostril—small, inconspicuous, on side of nose; eye—medium to large, brown, dappled with coarse black pigment; iris—round, jet black with light brown margin; head—flattened posteriorly, convex anteriorly; dorsal shields—large, indistinct due to dull and velvety texture of surface and coloration; upper head—uniform dark gray brown, light line extending upward and posteriorly from corner of mouth, ending one or two scale rows from mid-dorsal line on neck; upper labials—some with distinct areas of white, broad areas of black along sutures.

Upper body—dark gray brown, mottled with black and a few scales of light brown; inclined broad, dark red longitudinal

band, (involving two or three scales) on each side of body, extending from neck posteriorly to tail, longitudinal band interrupted by regularly spaced small spots of tan, these with irregular borders of black; outer row of scales and upturned ventrals lighter than dorsal body; body scales—dull, rough to touch, moderately keeled, scales near vertebral line have heavier keels.

Ventral head—dirty white, mottled, distinct areas of black along sutures of lower labials, these appear as continuations of dark markings along sutures of upper labials; ventral body—white to light cream, prominent narrow longitudinal dark line near latero-ventral junction, formed by a dark brown to black spot on each ventral scale, line extends full length of body and along greater part of tail; underside of tail—uniform light cream, gray; ventral scales—large, smooth, glossy, 128 (123 to 131, Maki; 129, Wang and Wang); anal scale—divided; subcaudals—50 pairs (68 to 92, Maki; 72, Wang and Wang).

Distribution: Available records indicate this snake has been taken in a dozen or so localities along the western side of the

Nonpoisonous

central mountain range, from Taipei south to Tainan. According to Pope (1935) it occurs also in Kwangsi, Kwangtung, Fukien and Szechwan Provinces of mainland China.

Habitat and Habits: *N. sauteri* is not common in recent collections. It occurs in wooded, moist and protected areas up to

medium altitudes in the mountains. It has been found under logs and in piles of organic debris in grassy valleys. According to Pope (1935) this snake is oviparous, i. e. an egg layer. It is gentle in disposition, will make every attempt to escape but apparently does not attempt to bite when handled.

Natrix suriki Maki

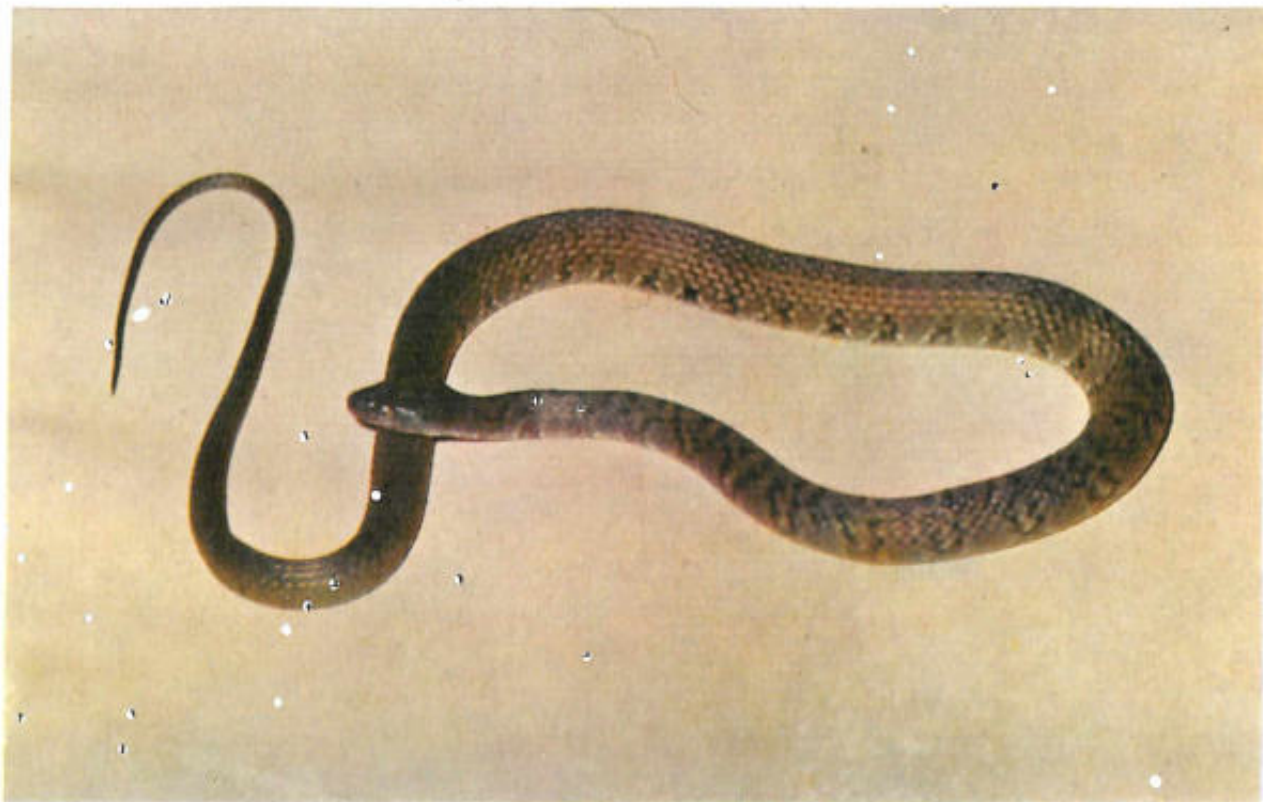
Nonpoisonous

Common Name—Ground Snake, White-Stomach Snake

Description: Total length—21 to 30-in. (13½ to 31½-in., Maki); tail—5¼ to 9½-in. or approximately a fifth to a quarter of length. Medium size snake; body—moderately stout, round; scale counts—19-19-17; tail—long, fairly stout, gradually tapered to sharp tip.

Dorsal contour of head—oval to slightly triangular; nose—moderately tapered to

round end; nostril—small, inconspicuous, on side but near top of nose; eye—medium to large, yellow, darkened by coarse diffuse black pigment; iris—round, slightly off center (toward upper part of eye), black surrounded by ring of dull yellow; head—flattened posteriorly, convex anteriorly, slightly broader than but not distinct from neck; dorsal shields—large, smooth, glossy; upper head—uniform dusty gray to



Natrix suriki



olive gray; upper labials—slightly lighter than upper head due to light gray mottling, scales indistinct due to uniformity in coloration; tongue—flesh color, darkened by diffuse black pigment.

Upper body and tail—gray to dark gray; some specimens with small ill-defined spots arranged to form faint narrow irregular crossbands of darker gray; some specimens with larger but faint ill-defined designs (33 to 35) on sides of body, these involve one to four scales at latero-ventral line, broaden on upper side of body, tend to fade dorsally to even fainter markings which may be united with similar designs on opposite side; diffuse lighter gray present in central part of some designs; tail designs—very faint, cannot be counted with accuracy; body and tail scales—keeled, moderately glossy and moderately rough to touch.

Ventral head—dirty white to light cream gray; lower labials—slightly darkened by gray or diffuse black; ventral body—dirty white to light gray with ill-defined areas or bands of slightly darker gray; most specimens with dark gray or black, irregular shape and irregular size crossbands which may be continuous or partly united with designs on sides of body; posterior body and under part of tail darker due to greater abundance of dark pigment;

ventral scales—large, smooth, glossy; 141 to 146 (142 to 153, Maki); anal scale—divided; subcaudals—66 to 73 pairs (68 to 70, Maki).

Natrix suriki is closely related to *N. annularis* but differs from the latter in its dull coloration and possession of less distinct markings on body and tail. There are also minor characteristic differences in scales surrounding the eyes.

Distribution: *N. suriki* is endemic to Taiwan but is closely related to other species which occur in mainland China and other parts of Asia. All specimens in our collections were taken on the western side of the central mountain range. Records indicate, however, (Maki, 1931) that it may occur throughout the island.

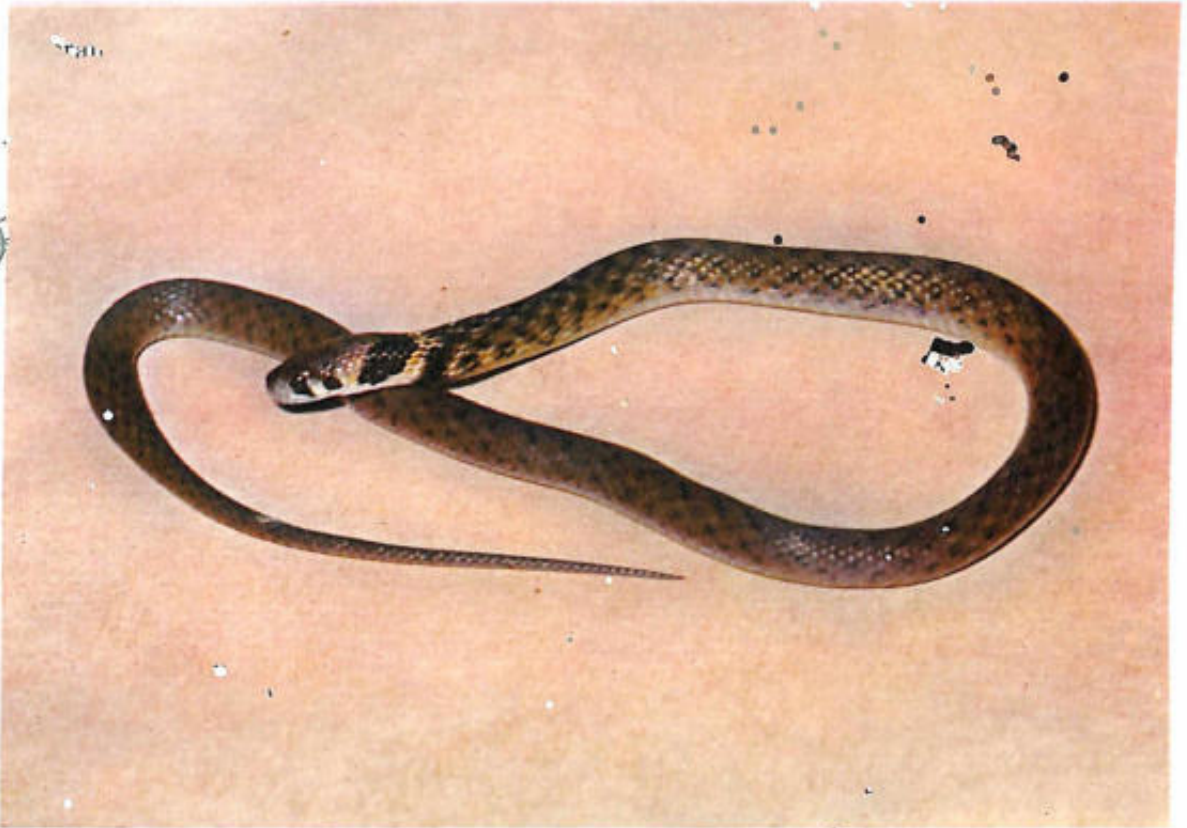
Habitat and Habits: This species is found in shrub and wooded valleys adjacent to agricultural areas which provide moist habitats and good coverage. Our specimens were found in low mountainous areas at 500 to 1,700 feet. In the laboratory this snake, as has been true with some other species of *Natrix*, frequently assumed a defensive attitude, struck and attempted to bite when prodded. It probably feeds on loaches and other small fish. Frogs were accepted as food in captivity.



Natrix suriki



Natrix swinhonis

*Natrix swinhonis****Natrix swinhonis* (Guenther)****Nonpoisonous****Common Names—Swinhoe's Grass, Water, or Ground Snake**

Description: Total length — $16\frac{3}{4}$ to 19-in. ($15\frac{1}{2}$ to $27\frac{1}{2}$ -in., Maki; $6\frac{1}{2}$ to $16\frac{1}{2}$ -in., Wang and Wang); tail— $3\frac{1}{2}$ to $4\frac{1}{4}$ -in. or approximately a fifth to a quarter of length. Small snake; body—moderately stout; scale counts—15-15-15; tail—moderately tapered, drawn out to medium filament with sharp tip.

Dorsal contour of head — oval; nose — moderately tapered, round to blunt at end; nostril—small, indistinct, on side of nose; eye—medium to large, dark gray brown; iris—round, jet black, surrounded by ring of gray; head—flattened posteriorly, slightly convex anteriorly, slightly wider than but not noticeably separated from neck; dorsal shields—large, smooth, glossy; upper head—uniform dark olive gray to olive brown with broad lighter brown area

across back of head; upper labials—variable, anterior scales gray, oblique black band below eye, larger black band on side of head above corner of mouth, sides lighter than upper part of head; tongue—dark gray, branches dirty white.

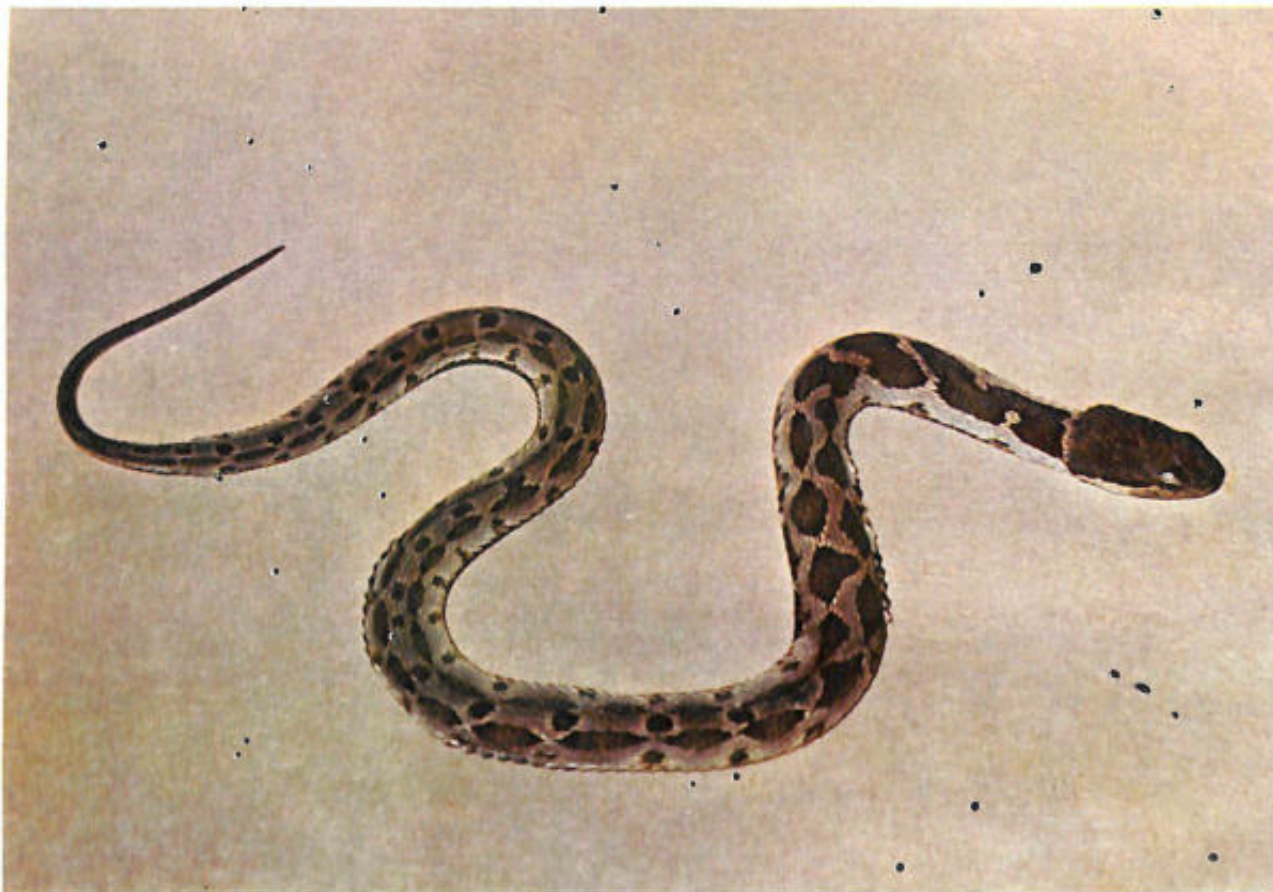
Upper body—dark gray brown with ill-defined to fairly prominent square areas of black, usually arranged in checkerboard fashion in anterior two-thirds of body; distinct black broadly "V" shaped band at back of head; upper tail—dark gray with small scattered spots of black; body scales—moderately keeled, exception in first and second rows; keeled scales continue onto upper part of tail, glossy, only moderately rough to touch.

Ventral head and neck—cream to dirty white; lower labials—may have very nd:

row borders of black pigment; ventral body—cream to light gray, mottled with deposits of coarse dark pigment, pigmentation progressively more intense posteriorly, pigment in diffuse narrow bands across anterior margin of scales; posterior quarter of body and tail mottled black; ventral scales—large, smooth, glossy, 127 to 136 (135 to 165, Maki; 130 to 143, Wang and Wang); anal scale—divided; subcaudals 52 to 61 pairs (52 to 74, Maki; 61 to 65, Wang and Wang).

Distribution: This species is supposedly restricted to Taiwan, but is closely allied with species of *Natrix* on the China mainland. The greater number in our collection were taken in the northern part of the island. Several specimens have been obtained at Hualien on the east coast.

Habitat and Habits: There is little information on this snake. Specimens in NAMRU-2 collections were taken in shrub and underbrush in low mountainous areas.



Macropisthodon rudis

***Macropisthodon rudis* Boulenger**

Common Names—False Viper, Pseudo 100-Pacer, False "Habu"

Description: Total length—27 to 36-in. (15 to 36-in., Maki; 6½ to 16½-in., Wang and Wang); tail—4 to 6-in. or approximately a fifth of length. Medium size snake; body—stout, slightly compressed or flat-

tened; scale counts—23-25-19; tail—tapers rapidly to medium filament with sharp tip.

Dorsal contour of head—broad, slightly triangular; nose—broad, moderately tapered to blunt or slightly round end; nostril—

Nonpoisonous

moderate size, on side near top of head; eye—medium to large, light brown or tan with scattered areas of black, anterior and posterior quarters of eye light brown; iris—slightly oval to round, black, surrounded by irregular ring of light tan; head—flattened posteriorly, slightly concave between eyes, wider than and moderately separated from neck, moderate round ridge from upper eye to end of nose; dorsal shields—large, but not distinct due to coloration and poorly developed sutures, *smaller scales, rough, heavily keeled, larger scales with distinct sculpturing or elevated ridges forming symmetrical designs*, scale over eye moderately well developed; upper head—dark dirty brown to chocolate, *prominent line of demarcation* where brown of upper head meets light brown, orange tinged sides of head, line of separation at lower margin of eye extends from tip of nose along side of head to neck; upper labials—very light brown, tinged with orange; tongue—large, dark gray, tips of branches light gray.

Upper body—brown to gray brown, may be tinged with bronze, interrupted by dark designs, variable in size, disposition and intensity of pigmentation, *eight to 13 irregular (some dumbbell shape) designs crossing vertebral line* in anterior half of body, designs extend half way down sides of body, tend to lose continuity in posterior part of body where they are replaced by roughly circular, separated designs along vertebral line, these continue onto tail where they become less distinct or may disappear; *other spots involving two to four scales occur on sides of body*, these may fuse on sides of posterior body and tail to form longitudinal lateral band; narrow, longitudinal light line near latro-ventral junction formed by light keels and light color scales of outer row; body and tail scales—heavily keeled, rough to touch, dull.

Ventral head—dirty yellow to dull orange gray; lower labials—slightly darker than chin shields; ventral body—variable, dull dirty orange at neck with scattered



Macropisthodon rudis

dark brown to brown black pigment, overall color progressively darker posteriorly with mottled or marbled appearance in posterior parts of body, dark pigment may be more intensive on outer fifth to one quarter of ventrals forming dark longitudinal lines which extend onto tail; underside of tail—dark brown to black; ventral scales—large, smooth, glossy, 137 to 147 (135 to 155, Maki; 150 to 152, Wang and Wang); anal scale—divided; subcaudals—50 to 53 pairs (46 to 65, Maki; 50 to 52, Wang and Wang).

Distribution: Although this snake is not common, records indicate that it occurs in mountainous areas throughout Taiwan. It has also been taken in Fukien, Yunnan and Szechwan Provinces of mainland China.

Habitat and Habits: *Macropisthodon* is known to occur in grassy and forested areas of medium to high mountains. A specimen of this species was caught in an open yard at Yang Ming Shan, adjacent to heavily wooded hillside. It is an egg layer and probably feeds on amphibians or smaller snakes. Upon irritation and excitement it may make every effort to act or appear as a poisonous snake. Just the head and neck, or the entire body, may be obviously flattened as the snake forms flat coils in a defensive mood. When flattened, the head

may be definitely triangular and thus have the general appearance of the 100-pacer or the "habu". Even the indigenous people of Taiwan confuse this species with the poisonous 100-pacer (*Agkistrodon acutus*). It is easily distinguished from the 100-pacer,

however, since it does not possess an upturned prominent snout.

Because of its rarity, *Macropisthodon* brings a good price on the local market for medicinal uses.

***Enhydris chinensis* (Gray)**

Common Names—Tang Water Snake, Chinese Rice Paddy Snake

Description: Total length—16½ to 23-in. (19 to 22-in., Maki); tail—2 to 3-in. or approximately one-eighth to one-seventh of length. Medium size snake; body—short, stout, usually somewhat flattened in living snake; marked flattening, body broader than height when snake assumes defensive attitude; scale counts—19-19-17; tail—short, tapers rapidly to blunt tip.

Dorsal contour of head—broad, slightly triangular; nose—broad slightly tapered to broad round end; nostril—small, inconspicuous, on top of nose; eye—small, beady, bulging, brown to dark gray brown, inconspicuous since it blends with color of upper head; iris—round, black, surrounded by brown ring; head—flattened posteriorly but convex anterior to eyes, slightly expanded posteriorly but not noticeably separated from neck; dorsal shields—large but not necessarily prominent due to coloration,

smooth, glossy; upper head—uniform gray brown to brown above except for faint mid-dorsal pattern of diffuse black pigment at junction of parietals and extending posteriorly onto neck; upper labials—lower half dirty yellow, mottled with gray brown, slightly lighter than upper head; tongue—stem red to flesh color with diffuse black pigment, branches gray to light gray.

Upper body and tail—gray brown to brown, scattered spots (involving one, two or three scales) of black pigment on dorsal and lateral surfaces, some aligned to form broken longitudinal lines which are more prominent on outer scales of body and along tail; scales of first row above ventrals usually possess dark pigment as well as areas of dull yellow, orange or dark salmon; longitudinal stripe, involving first to fourth scale rows, of dull yellow, orange, dark salmon or a combination of these, extends from head onto base of tail; body scales—smooth, very glossy, oily to touch.

Ventral head—dirty white to dark dirty yellow; lower labials, mental, chin plates and gulars—different parts of margins darkened by diffuse black pigment; ventral body—dirty white to dirty yellow, anterior half to two-thirds of each scale pigmented to form prominent dark crossbands from neck to anus; subcaudals—prominent due to black margins; ventral scales—medium size, smooth, glossy, 145 to 154 (143 to 153, Maki); anal scale—divided; subcaudals—37 to 47 pairs (40 to 49, Maki).

Distribution: Distribution of the Chinese rice paddy snake on Taiwan is not well known but most of the specimens have



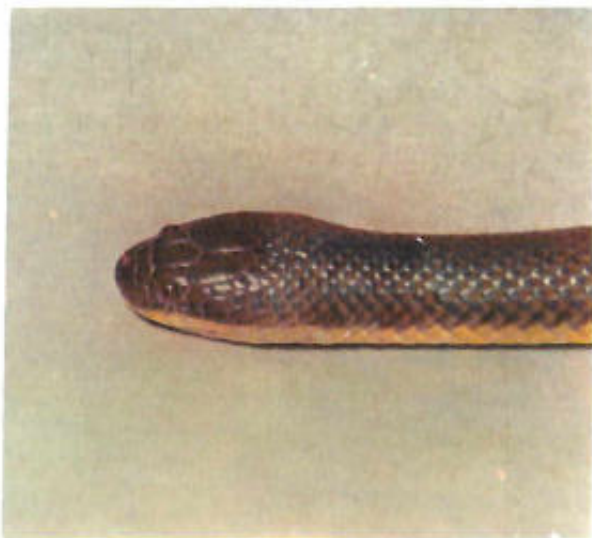
Enhydris chinensis

*Enhydrys chinensis*

been taken in Taipei Hsien on both sides of the Tamsui River between Taipei and Tamsui. It seems likely that its occurrence on the island is much greater than current collections indicate since this species is known to occur in several provinces of southern China and on Hainan.

Habitat and Habits: Most of the specimens in the NAMRU-2 collection were obtained in rice paddy and agricultural areas in lowlands or on mountain slopes below 500 feet. The Chinese rice paddy snake is most active at night and consequently is seldom seen except by persons making an effort to find it. This snake has been reported in yards at time of flood and, on these occasions, has gained entry into homes in the suburbs of Taipei. When first brought into captivity *E. chinensis* is prone to strike upon the slightest irritation but it soon becomes more docile. When prodded into activity, it may make false strikes with lateral and/or vertical jerks of the head,

accompanying quick vertical jumps of the body. It is difficult to capture in the wild when disturbed since it has a tendency to disappear or submerge into the soft mud

*Enhydrys plumbea*



Enhydris plumbea

of the rice paddies. It is an aquatic snake in the true sense of the word and seldom is seen out of water. This snake feeds upon fishes and amphibians. It bears its young alive.

Enhydris chinensis is similar to *E. plum-*

bea but differs in possessing scattered black spots on upper body, colored longitudinal stripe above latero-ventral junction and a dark ventral surface. When handled, this snake is likely to initiate a profuse flow of semi-fluid feces with a pungent odor.

***Enhydris plumbea* (Boie)**

Common Name—Common Rice Paddy Snake, Water Snake

Description: Total length—13 to 17½-in. (12 to 16-in., Maki; 5¾ to 28-in. Wang and Wang); tail—2 to 2½-in. or approximately a sixth of length. Medium to small snake; body—short, stout, somewhat flattened, may be much wider than thick when snake is on the defensive; scale counts—19-19-17; tail—short, tapers rapidly to blunt tip.

Contour of head—broad oval; nose—broad, short, slightly tapered to round end; *postril*—very small, inconspicuous, on upper surface of nose; eye—small, beady,

Nonpoisonous

bulging, on upper surface of head, dark brown; iris—black, inconspicuous; head—flattened posteriorly, convex anteriorly, wider than and slightly separated from neck; dorsal shields—large, smooth, glossy; upper head—uniform olive to dark olive green; upper labials—lower two-thirds dirty white or cream, distinct line of demarcation from upper head, extending from nose to corner of mouth and posteriorly along neck; tongue—red tinged with black, branches dark gray to black.

Upper body and tail—uniform olive to

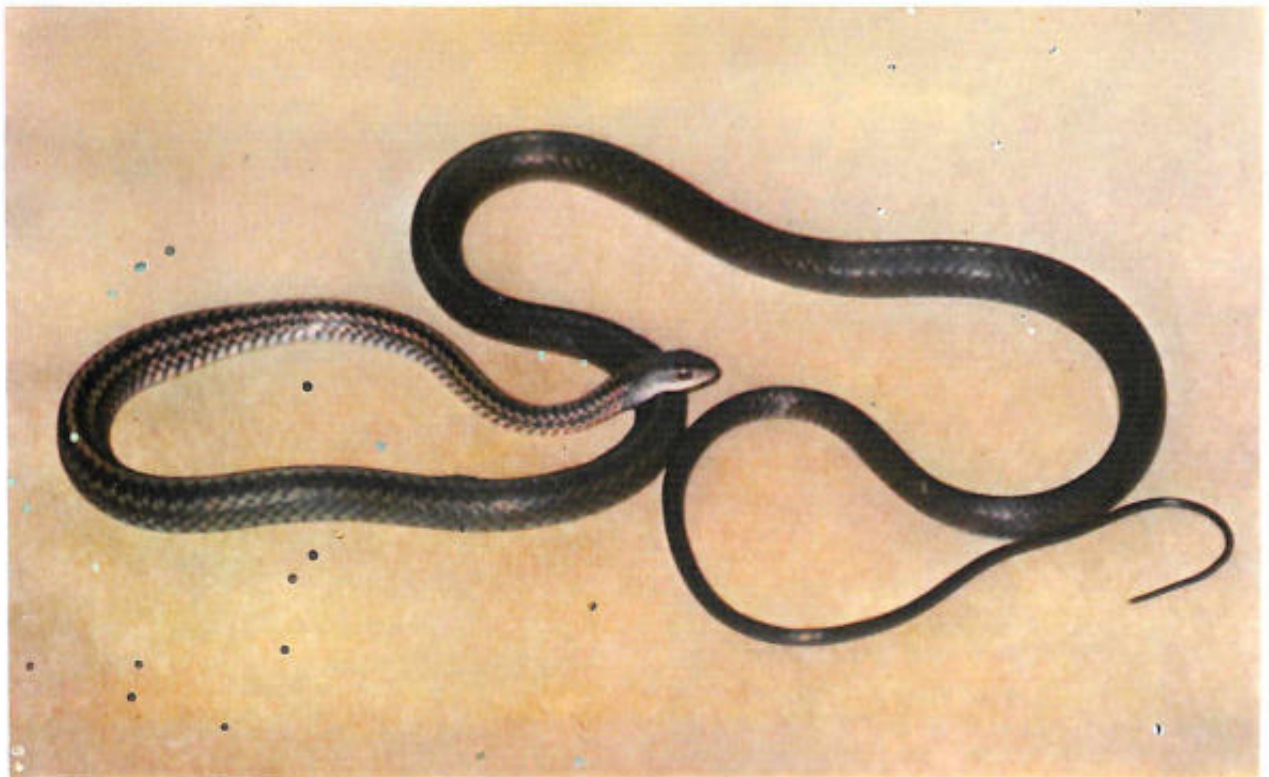
dark olive green, first to third scale rows dirty white to dirty yellow, may be very lightly tinged with salmon; outer scale rows exhibit variations depending upon extent of dark pigment on margins of individual scales; body scales—smooth, glossy, oily to touch.

Ventral head—white to cream; lower labials and mental—usually possess gray to dark gray margins; ventral body—gray white to light dirty yellow except for a few horizontal lines of gray or diffuse black on scales in posterior quarter of body; underside of tail—color same as body; subcaudals—fairly prominent due to narrow pigmented margins, these may form a dark mid-ventral line at junction of subcaudals; ventral scales—medium size, smooth, glossy, 127 to 130 (126 to 134, Maki; 118 to 136, Wang and Wang); anal scale—divided: subcaudals—34 to 37 pairs (23 to 47, Maki; 35 to 45, Wang and Wang).

Distribution: The rice paddy snake is common throughout Taiwan as well as in

many parts of Southeast Asia and down into the Malay Archipelago.

Habitat and Habits: As the name implies, this snake is common to rice paddy and wet agricultural areas, usually at lower altitudes. *E. plumbea* is frequently found in same habitat with *Natrix piscator*. It is unusually active at night. On rainy nights it may migrate into yards of homes near or adjacent to agricultural areas. *E. plumbea* has been found inside homes in Taipei and its suburbs. It bears its young alive and its food consists of loaches and amphibians. This snake will strike without provocation and in contrast to most species is capable of jumping or striking distances considerably greater than the body length. When excited or attempting to escape from an intruder, it moves rapidly by a series of erratic lateral jumps. At times the snake will land on its back or side, flip its body quickly and take off at 90 degrees from the original path of movement.



Zaocys dhumnica.

Zaocys dumnades (Cantor)

Nonpoisonous

Common Names—Big-Eye Snake, Taiwan Rat Snake,
Yellow Wind Snake, Sword-Over-the-Mountain, Garter Snake,

Description: Total length—65 to 87½-in. (46 to 82-in., Maki; 16¼ to 19-in., Wang and Wang); tail—17¾ to 28-in. or approximately a third of length. Large snake; body—long, slender; scale counts—16-16-14; tail—long, tapers gradually to drawn out filament and sharp tip.

Dorsal contour of head—oval; nose—moderately tapered to broad, round end; nostril—medium size, distinct, in concavity on side of nose; eye—very large, dark gray to black dappled dirty yellow to tan; iris—round, black, tends to blend with rest of eye although surrounded by ring of dirty yellow; head—flattened posteriorly, slightly convex anteriorly, wider than and moderately separated from neck; dorsal shields—large, well-defined by margins of black and wide sutures, well-developed supra ocular scale and ridge from eye to nostril; upper head—usually olive gray to dark gray with narrow margins of black on scutes; upper labials—light to dirty yellow, scales below eyes lighter than others; tongue—large, gray, branches darker gray or even black.

Upper head—olive to dark olive green, usually with blue cast, overall coloration diffuse due to scattered dark pigment and dark borders on scales; posteriorly body more uniform dark gray brown; yellow to yellow gray stripe, (involving two scale rows), on vertebral line, from head to a point beyond mid-body, gradually fades posteriorly to merge with uniform olive or olive brown of upper body; vertebral line bordered by prominent black longitudinal lines, (involving two or three scales) which also fade near mid-body; latter lines followed ventrally by second less distinct longitudinal yellow gray line, (involving two rows of scales) then a narrower line of black, one scale row in width anteriorly and two posteriorly, and finally a yellow gray line just above latero-ventral junc-

tion; body scales—large, dull to slightly glossy in appearance; two rows of strongly keeled scales at vertebral line, two rows with weaker keels more strongly developed in posterior half of body; tail—keeled scales at base but these diminish rapidly toward end of tail.

Ventral head and neck—white to gray; ventral body—light anteriorly, progressively darker gray or blue gray posteriorly, tinged with dirty yellow; outer fifth of scales darker gray; posterior ventrals may stand out due to pigment along the margins; underside of tail—subcaudals distinct due to dark borders; ventrals—large, smooth, iridescent, 195 to 202 (191 to 204, Maki; 189 to 208, Wang and Wang); anal scale—divided; subcaudals—140 to 144 pairs (126 to 188, Maki; 136 to 142, Wang and Wang).

There are distinct color variations for *Zaocys*. Young specimens are usually dark in color and lack the distinct longitudinal lines characteristic to adults. Some larger specimens in the NAMRU-2 collection also have been very dark with indistinct longitudinal lines.



Zaocys dumnades

Distribution: *Zaocys* is fairly common on Taiwan. It is widely distributed, its vertical range extending from near sea level up to the high mountains near Mt. Ali (Wang and Wang, 1956). This or closely allied species of *Zaocys* are found across the mainland of China and in the Himalayas.

Habitat and Habits: Most individuals have been obtained in grassy, wooded areas and in agriculturally developed, as well as in nondeveloped localities. It seems to prefer the lower mountain slopes and

may be found in protected valleys with grass or low shrub. *Zaocys* lays eggs and is known to feed on amphibians as well as rodents. It is a highly nervous snake, rapid in movement and, therefore, seen only infrequently by the casual observer. This snake makes quick erratic movements when cornered but does not necessarily attempt to bite.

Asian rat snakes of this genus are related to *Ptyas* and may attain a length of 12 feet in Burma and Malaya (Schmidt and Inger, 1957).

***Ptyas korros* (Schlegel)**

Common Names—Delicate Design Snake, Flower-in-the-Mountain

Description: Total length—39½ to 65½-in. (55 to 63-in., Maki; 27¼-in., Wang and Wang); tail 7½ to 20½-in. or approximately a quarter to a third of length. Long snake; body—slender; scale counts—15-13(11 to 15)-11; tail—long, gradually drawn out to fine filament, distal quarter or third of tail fragile and, therefore, frequently missing.

Dorsal contour of head—narrow, oval to slightly triangular; nostril—moderate size, on side of nose; eye—large, dirty yellow to brown, heavily dappled or mottled



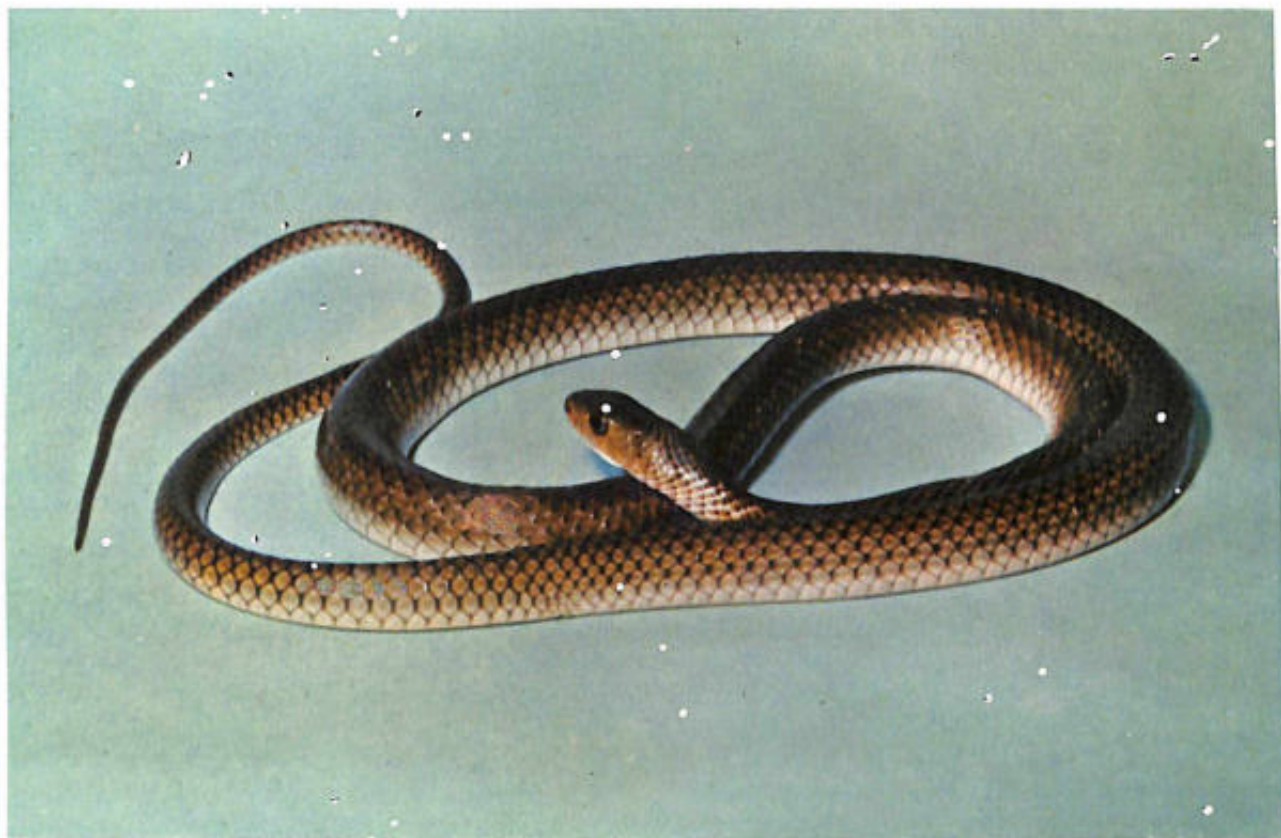
Ptyas korros

Nonpoisonous

with coarse black pigment; iris—round, jet black, surrounded by narrow ring of dirty yellow; head—flattened or slightly convex, very slightly expanded posteriorly, neck indistinct; moderate rounded ridge from upper eye to nostril; dorsal scutes—large, smooth, iridescent in sunlight; upper head—uniform dark olive brown, light areas of dirty yellow to salmon yellow (involving several scales) anterior to and/or posterior to eye; lower labials—lower part lighter than upper head; tongue—large, stem and branches dark gray to blue black, branches darker than stem.

Upper body and tail—uniform dark olive to gray brown except for small areas of cream and areas of black pigment on individual scales, contrast of darkened margins renders individual scales prominent, arrangement of dark areas forms patterns from which the common name "delicate design" snake is derived. These may form indistinct stripes on side of body, usually four to five in number, and more prominent in posterior half of body; body and tail scales—large, smooth in appearance and smooth to touch, moderately glossy.

Ventral head—creamy white to yellow; lower labials and mental—light to bright yellow; ventral body—variable, usually yellow in neck region and anterior fifth to quarter of body, gradually merging with



Ptyas korros

lighter yellow, dirty white or light gray yellow posteriorly, posterior body and tail may be tinged with salmon; ventral scales—large, smooth, iridescent, 163 to 171 (160 to 177, Maki; 168, Wang and Wang); anal scale—divided; subcaudals—114 to 130 pairs (122 to 145, Maki; 75, Wang and Wang).

Distribution: This snake is fairly common and has been taken from all parts of Taiwan. *P. korros* is also common in many of the provinces of mainland China and Pope (1935) states that it occurs from the eastern Himalayas southward throughout Southeast Asia and into the Malay Archipelago.

Habitat and Habits: *Ptyas korros* has been captured in medium to high shrub and in grassy wooded areas. It seems to prefer hillside or low mountainous habitats only a few hundred feet above sea level. Maki (1931) reports specimens from an

altitude of 3,000 feet. This snake may be fairly nervous when captured but may be handled with little danger of biting after



Ptyas mucosus

a few days. It adapts well to captivity and feeds on mice or amphibians. *P. korros* may whip about and thrash its body violently

in an attempt to escape from the captor's hands. It is presumably an egg layer (Pope, 1935).

***Ptyas mucosus* (Linnaeus)**

Nonpoisonous

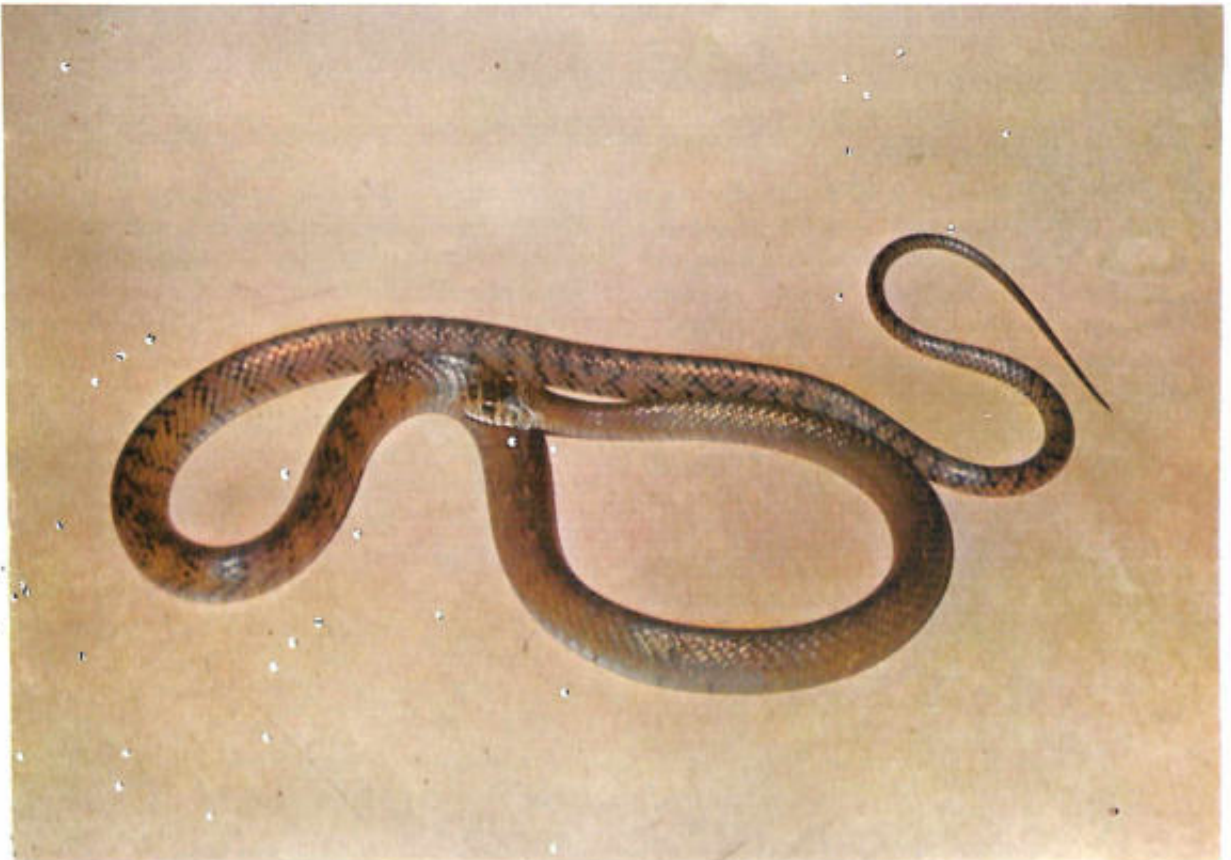
Common Names—South Snake, Oriental Rat Snake, Grass Beauty, Mountain Snake

Description: Total length—55 to 102½-in. (56½ to 93½-in., Maki; 32 to 76¼-in., Wang and Wang); tail—14¾ to 20¾-in. or approximately a fifth to a quarter of length. Large snake; body—slender to moderately heavy; scale counts—17-17-14; tail—long, tapers gradually to tip.

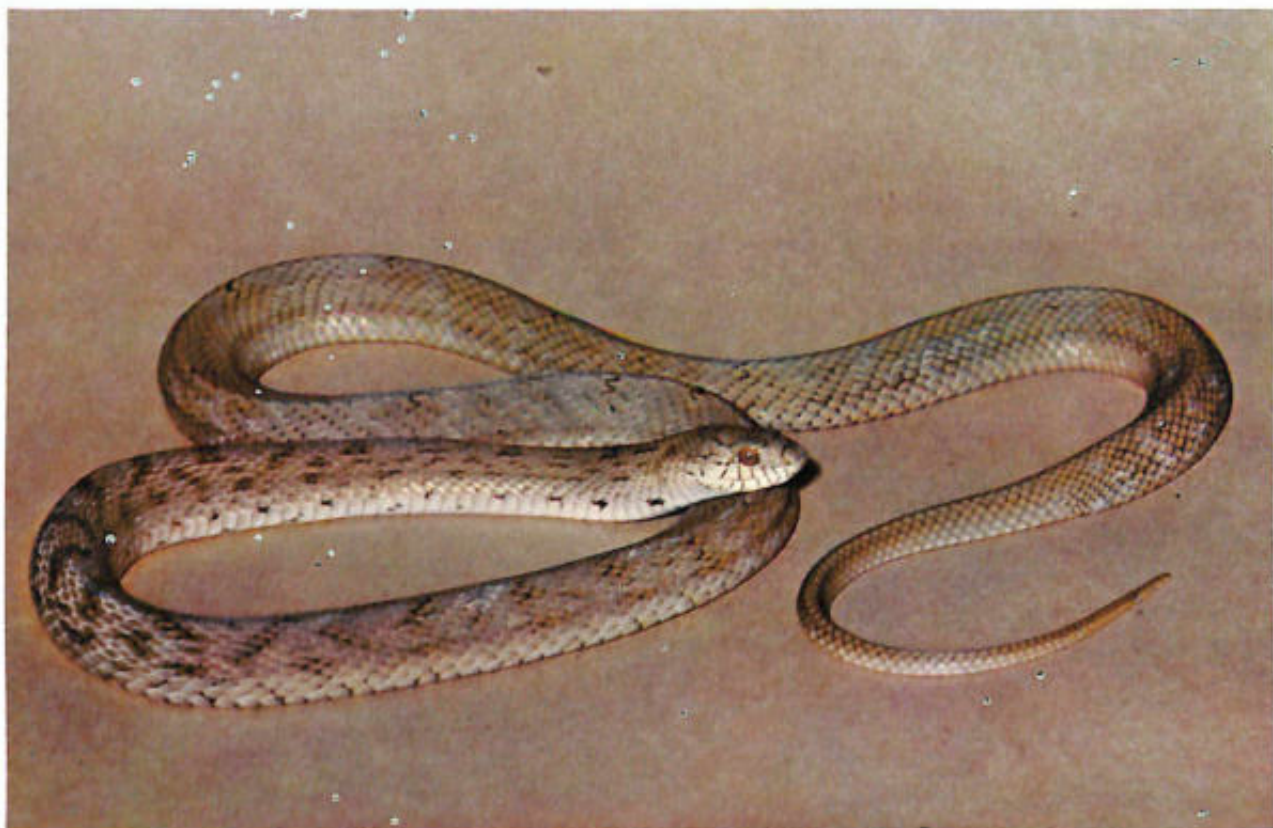
Dorsal contour of head—oval to slightly triangular; nose—moderately tapered to round end; nostril—large, prominent, on side of nose; eye—large, dark brown to brown black dappled with dirty yellow to tan; iris—large, round jet black, surrounded by ill-defined ring of dirty yellow; head—slightly convex, slightly wider than but

not distinct from neck; supra-ocular scale forms laterally protruding shelf over eye, shelf becomes rounded on nose; dorsal scutes—large, distinct, smooth, glossy; upper head—uniform light to dark brown; upper labials—distinct due to line of black pigment on posterior margin of each scale; sides of head and upper labials—lighter than upper head; tongue—large, black to blue black, branches may be dark gray.

Upper body and tail—light to dark brown, some scales with dark brown or black margins, these scales arranged in various designs, majority tend to form irregular ill-defined narrow bands around



Ptyas mucosus



Elaphe carinata

body and tail; anterior third to half of body usually uniform brown with little or no black pigment; scales with dark pigmented areas become more distinct and numerous posteriorly; body scales—large, smooth, glossy, five to six rows weakly keeled scales near vertebral line in posterior third to half of body; *keels may be pigmented forming very fine longitudinal, parallel lines of black.*

Ventral head—cream to light gray; *lower labials—distinct due to black posterior margins which appear as extensions of similar areas of pigmentation of upper labials; mental and chin plates—usually without pigment but posterior chin shields and surrounding gulars possess distinct black posterior margins; ventral body—cream to light gray in neck region; four to ten anterior ventrals with black posterior margins, ventrals in anterior third to half of body may be black only in outer fields of*

each scale, brown or brown black pigment extends in sawtooth fashion down from sides of body; pigmented areas on posterior margins of ventrals progressively larger and darker in posterior part of body; *underside of tail—subcaudals distinctly marked dark brown to black; ventral scales—large, smooth, glossy, 193 to 198 (187 to 213, Maki; 195 to 198, Wang and Wang); anal scale—divided; subcaudals—109 to 120 pairs (95 to 143, Maki; 115 to 120, Wang and Wang).*

Distribution. The rat snake is found throughout Taiwan and has been taken on the Pescadores. It is widely distributed on mainland China (Pope, 1935) and ranges from Afghanistan southward through South and Southeast Asia and into the Malay Archipelago.

Habitat and Habits: *Ptyas mucosus* occurs in medium to low mountainous wooded areas in a variety of habitats. It is active

during daylight hours and has been observed in shrub several feet above ground. This snake moves rapidly in the wild and is very excitable. In captivity it strikes on the slightest provocation and in our laboratory individuals continued to manifest such an attitude, injuring or bruising their noses for weeks as a result of objects passing glass-fronted cages. The Taiwan *P. mucosus* seems always on the defensive. When captured, it whips about violently and

makes every attempt to bite and wrap itself tightly around the captor's arms or body. In captivity it will eat smaller snakes and rodents. It lays eggs.

This species brings a good price on the market since it produces skins sufficiently large to use in making shoes and handbags. In India it is recognized as the Greater Indian Rat Snake and according to Ditmars (1957) is the longest of Colubrine snakes in the Old World.

***Elaphe carinata* (Guenther)**

Nonpoisonous

Common Names—Taiwan Stink Snake, Stinking Goddess, Stinking Green Snake, Keeled Snake

Description: Total length—48 to 104½-in. (31 to 68½-in., Maki; 24½ to 74-in. Wang and Wang); tail—10½ to 20¼-in. or approximately a fifth of length. Large snake; body—moderately heavy or stout; scale counts—23-23-19; tail—long, gradually drawn out to moderate filament and tip.

Dorsal contour of head—elongate, slightly triangular; nose—moderately tapered to blunt or round end; nostril—moderate size, on side of nose; eye—large, light brown to rusty brown, dappled with very fine flecks of dark brown; iris—round to vertically oval, jet black, surrounded by ring of golden orange; head—flat posteriorly, convex anterior to eyes, broader than and moderately separated from neck; dorsal shields—large, distinct due to black pigment in sutures and along margins, smooth but not glossy; upper head—olive gray to olive brown; upper labials and other scales on side of head—distinct due to black pigment in and along sides of sutures; upper labials—slightly lighter than upper head; tongue—flesh color to red, stem usually red, branches dark gray to black.

Upper body—olive yellow to olive brown, most of scales distinct due to black pigment on margins, some specimens uniform in color, however, others possess ill-defined cross markings (involving one to

three scales) on back or ill-defined bands due to combination of scales with black margins and areas with black skin between scales, in other areas white skin may show between scales; posterior half of body and tail more uniform in appearance; body scales—heavily keeled, rough to touch, dull in appearance; tail scales—only moderate keels on terminal half.

Ventral head—white to cream; lower labials—usually well marked with black pigment on anterior margins; ventral body—neck cream white to light gray, pigment progressively greater and more intensive toward mid and posterior part of body; pigmented areas irregular in size and shape



Elaphe carinata

but spots on outer quarter of third of scales tend to form broken longitudinal lines, outer fields of ventrals dull gray to gray brown; underside of tail—variable, pigment when present has tendency to occur on posterior and inner borders of paired subcaudals; ventral scales—large, smooth, glossy, 213 to 220, (209 to 221, Maki; 210 to 230, Wang and Wang); anal scale—divided; subcaudals—88 to 99 pairs (78 to 97, Maki; 81 to 98; Wang and Wang).

In young individuals the head may be less distinctly marked than in adults. There is a minimum of black pigment along sutures of head shields and the body scales may lack the black margins so characteristic to adults. Some specimens may have one or two light brown longitudinal stripes (involving one or two scale rows) on sides of body and extending onto tail. Ventral scales may have little or no pigment in the juveniles.

Distribution. *Elaphe carinata* is one of the more common snakes found through-

out Taiwan. The larger specimens in the NAMRU-2 collection have been taken in the southern part of the island. We also found this species on Lan Yu and in the Pescadores. This snake occurs in a number of provinces of eastern China.

Habitat and Habits. The Taiwan stink snake is usually associated with the lower altitudes of mountainous areas. A number of individuals have been captured or observed in shrub and wooded areas. In the wild it is active and moves fast. Although Pope (1935) describes the *E. carinata* to be docile, many of the specimens taken on Taiwan have been vicious, strike readily and attempt to bite. Some specimens held in captivity for months remain aggressive and cannot be handled with ease. This snake has well developed anal glands, emitting a nauseous secretion which permeates the laboratory, allowing detection and even species recognition from some distance. In captivity *E. carinata* feeds upon smaller snakes and occasionally rodents. *E. carinata* lays eggs.

Elaphe porphyracea (Cantor)

Common Name—Red Bamboo Snake

Description: Total length—25 to 33½-in. (23¾ to 41¾-in., Maki); tail—4 to 6-in. or approximately a seventh or a sixth

of length. Medium size snake; body—long, streamlined, round; scale counts—19-19-17; tail—tapers gradually to moderate filament and sharp tip.

Dorsal contour of head—narrow, elongate oval; nose—narrow, long, slightly tapered to blunt or round end; nostril—medium to small, on side of nose; eye—medium size, red brown flaked with black, areas of tan in upper and lower parts of eye; broad, black, diffuse horizontal band across middle of eye, band appears as continuation of prominent dark band behind eye; iris—jet black, only moderately differentiated from horizontal band; head—slightly concave posteriorly and anteriorly, expanded only slightly posteriorly, therefore, neck not distinct; dorsal shields—large, smooth, glossy and iridescent but not necessarily distinct due to coloration and poorly marked sutures; upper head—dark



Elaphe porphyracea

Nonpoisonous


Elaphe porphyracea

red or rusty brown with *three distinct black longitudinal lines*, one extending posteriorly from each eye to join a transverse band on neck, a third line located on mid dorsal part of head extending from posterior union of parietals anteriorly to end of nose; upper labials—slightly lighter in color than upper head; tongue—red, darkened by diffuse black, branches dark gray to black.

Upper body and tail—red to rusty or bronze brown, iridescent, darkened by scattered or diffuse fine black pigment; some specimens with overall gray purple cast, especially a few days prior to shedding skin; lower sides, i.e. upturned ventrals and one or two rows of scales lighter than dorsal body; *two very narrow longitudinal black lines of varying width and continuity*, separated by three to five scales on upper body, extending length of body and to tip of tail; *11 to 14 transverse bands (involving six to ten scale rows)* on body; bands

variable in shape, completeness and coloration, anterior bands usually more distinct; black lines (involving one or two scale rows) form anterior and posterior limits of each band; a second, narrow, light rusty red or dull orange line may be present in front of anterior black line and behind posterior black line of each band, space within band variable, may be darker or may be lighter than upper body; *one to three bands on tail*, the first at base of tail; body and tail scales—smooth, glossy and iridescent.

Ventral head and neck—white to very light gray; lower labials—may be tinged with rusty orange; ventral body—uniform white to very light yellow gray, upturned ends of ventral scales dusty red to pink; underside of tail—light gray to light yellow gray, distal third darker, tinged with red brown of upper tail; ventral scales—large, smooth, glossy, 202 to 208 (201 to 214,





Elaphe taeniurus

Maki; 194 to 206, Wang and Wang); anal scale—divided; subcaudals—47 to 71 pairs (61 to 75, Maki; 47 to 74, Wang and Wang).

This species demonstrates a considerable range in coloration. Young specimens may be bright pink to red with prominent bands

of dark gray or black. In the young the bands may not possess the light anterior and posterior margins characteristic of adults and the longitudinal lines of the upper body may be very prominent.

Distribution. This snake is not common in the NAMRU-2 collection. It has been collected by us along the east and west coasts of the northern third of Taiwan. However, previous records (Maki, 1931; Wang and Wang, 1956) indicate that *E. porphyracea* probably is to be found all around the island. The same species has been taken in a number of the provinces of mainland China, in Thailand and other countries of Southeast Asia.

Habitat and Habits. Most specimens taken were found in wooded, well-vegetated mountainous areas below an altitude of 1,200 feet. In captivity our specimens were docile, did not assume a defensive attitude or attempt to bite, even upon prodding. Pope's studies (1935) indicate that this species, at least in mainland China, probably feeds largely upon small mammals.

***Elaphe taeniurus* Cope**

Common Name—Taiwan Beauty Snake

Description: Total length—66 to 103-in. (57 to 94-in., Maki; 20 to 81¼-in. Wang and Wang); tail—12 to 21¼-in. or approximately a fifth of length. Large snake; body—moderately heavy or robust; scale counts—23-25-19; tail—long, tapers gradually to moderate filament and tip.

Dorsal contour of head—roughly triangular; nose—tapers to round or slightly blunt end; nostril—moderate size, on side near tip of nose; eye—medium to large, olive gray to dirty yellow darkened by fine diffuse black pigment, *broad gray black to black horizontal band across eye, band appears as continuation of prominent dark band behind eye*; iris—round, jet black with ring of dull yellow; head—flattened posteriorly, convex anteriorly, wider than and moderately separated from neck;

dorsal shields—large, prominent, smooth, glossy; upper head—olive yellow to dark olive gray, some specimens may be tinged with brown, *prominent black band width of eye, extending from eye near to corner of mouth*; upper labials—prominent, cream to light dirty yellow, tinged with dirty orange, distinctly separate from upper head; tongue—large, black to blue black stem darker than branches.

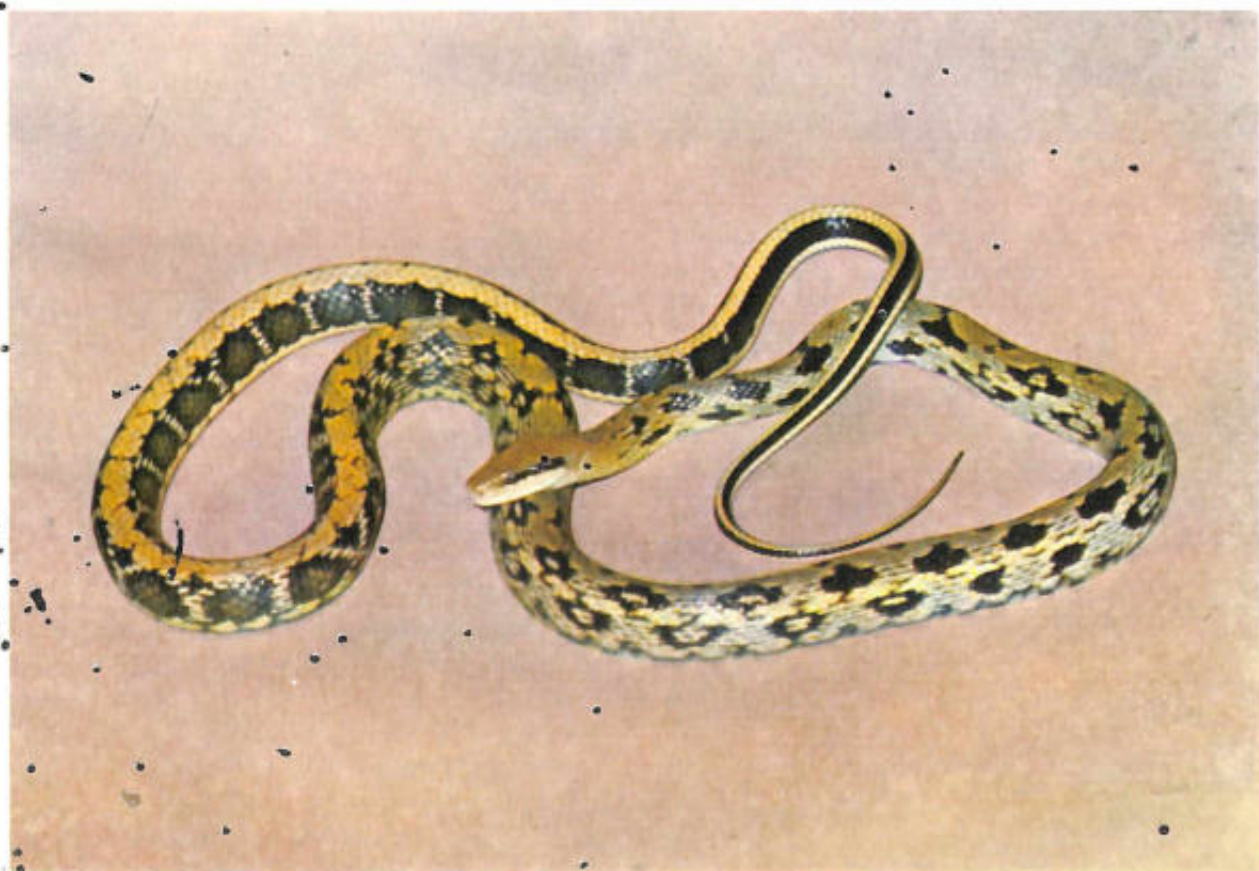
Upper body—general color of olive yellow to yellow gray tinged with varying shades of green and black, numerous irregularly shaped designs and longitudinal bands, the latter more prominent on posterior parts of body and tail; neck uniform olive, no designs; 20 to 30 pairs of black designs of varying shape, size and intensity of blackness and irregularly placed on up-

Nonpoisonous

per surface of anterior two-thirds of body. Paired designs usually separate anteriorly and then connect with bands of variable width across back, forming a "ladder" pattern in some specimens; connecting cross-bands fade out posteriorly and there is a *broad vertebral olive yellow band which extends to end of tail*; anteriorly a series of roughly square or rhomboidal black designs on sides of body, separated by three or four scales, tend to alternate with spots on upper body creating checkerboard effect; some of upper and lower spots with cream or olive yellow centers; lateral or lower spots less distinct, may coalesce with adjacent spots or gradually fade out posterior to mid body; further back, however, *sides of body marked with prominent broad dark longitudinal band which extends to end of tail*, on posterior third of body longitudinal stripe may have narrow indistinct vertical lines formed by white areas,

on several adjacent scales, vertical lines separated by four or five scales and cease at anus; *another distinct line of olive to yellow occurs below the broad longitudinal dark band and also extends to tail*. The posterior part of body and tail, therefore, is marked with three distinct longitudinal yellow lines; body scales—glossy, smooth in appearance but there are eight to ten rows of weakly keeled scales near vertebral line.

Ventral head—white to cream, some scales lightly tinged with dirty orange; ventral body—cream on neck merging into shades of darker gray yellow posteriorly, few small irregular gray or gray black designs anteriorly followed by more numerous and progressively darker designs posteriorly; most of designs in outer quarter or third of scales; posterior designs more uniform in size and position forming a solid longitudinal band in posterior third


Elaphe taeniurus



Liopeltis major

of body and out to end of tail, leaving a distinct longitudinal mid ventral yellow band which also extends to tip of tail; ventral scales—large, smooth, glossy, 249 to 252 (243 to 258, Maki; 253 to 262, Wang and Wang); anal scale—divided; subcaudals—110 to 118 pairs (104 to 122, Maki; 101 to 113, Wang and Wang).

Although exceptions occur, the coloration and patterns of *Elaphe taeniurus* are fairly constant throughout life.

Distribution. The beauty snake is one of the most common and best known species of nonvenomous snakes on Taiwan. It is found throughout the island and has a wide distribution in Southeast Asia. It has been collected from the eastern Himalayas, Assam, Burma and in a number of provinces of mainland China. Pope (1935) has stated that this snake may have been carried into northern China by man.

Habitat and Habits: *Elaphe taeniurus* is well adapted to a wide range of habitats, occurring around human dwellings as well as in heavily wooded areas. It may be found in protected grassy areas and has been observed in shrubs several feet above the ground. It is quite agile, moves fairly fast on the ground or in shrub and is difficult to catch in the wild. Since it feeds on small rodents, it is not surprising that farmers have reported seeing this reptile in their homes. This snake is docile, adapts well to captivity and becomes accustomed to man soon after capture. It may assume a defensive attitude and emit low hissing sounds when first confined but on no occasion has it bitten handlers in our laboratory. If one were to consider a snake as a pet, there is little doubt that the beauty snake would be the ideal choice.

Due to its size and striking coloration *E.*

taenijurus occupies a small but significant niche in commerce and in the everyday activities of the Chinese. The skin is used ex-

tensively for shoes and ladies' handbags and the flesh is considered a delicacy with medicinal properties.

Liopeltis major (Guenther)

Common Names—Taiwan Green Snake, Smooth Green Snake, Green Vine Snake

Description: Total length—34 to 41½-in. (28 to 41-in., Maki; 24½ to 40-in., Wang and Wang); tail—9 to 11-in. or approximately a quarter to a third of length. Medium size snake; body—slender; scale counts—15-15-15; tail—long, tapers gradually to filament and sharp tip.

Dorsal contour of head—narrow, oval to slightly triangular; nose—moderately tapered to narrow round tip; nostril—small, on side of nose near tip; eye—medium to large, light dull yellow to light tan, dappled by diffuse black pigment; iris—round, jet black, surrounded by ring of light brown; head—flattened, slightly expanded posteriorly but not distinct from neck; dorsal shields—large, smooth, glossy; upper head—uniform dark green; upper labials—lighter green than upper head; tongue—dull red, stem darkened by diffuse black pigment, branches dark gray to black.

Upper body—uniform dark green without designs, first to third scale rows lighter green than dorsal body; upper tail—uniform dark green, usually smooth, dull glossy, some specimens may have two to five rows of keeled scales near vertebral line.

Ventral head and neck—light yellow to yellow green; lower labials—slightly darker than chin shields; ventral body—light to yellow green, may be more yellow in anterior part of body; ventral scales may be rendered more distinct by narrow posterior margin of tan or gray brown; underside of tail—uniform yellow green, may be darker than ventral body; ventral scales—large, smooth, glossy, 161 to 180 (163 to 177, Maki; 172 to 177, Wang and Wang); anal scale—divided; subcaudals—86 to 94 pairs (70 to 96, Maki; 87 to 89, Wang and Wang).

Nonpoisonous

The common green snake may be and has been confused with the bamboo snake (*Trimeresurus*). It is not necessary to be a trained observer, however, to differentiate the two species. The poisonous bamboo snake, unlike *Liopeltis*, possesses a moderately heavy body, short tail and triangular head covered entirely with small, keeled, dull scales. The body of *Liopeltis* is without designs, whereas the bamboo snake usually has white or a combination of red and white stripes near the latero-ventral junction. The tail is usually tinged brick red.

Distribution. The common green snake is found over the greater part of Taiwan. The same species is common to provinces of southeast China and its distribution extends south into Vietnam.

Habitat and Habits. The Taiwan smooth green snake has been observed in grassy, wooded and usually fairly well-protected moist areas. It has been taken in hillside shrub as well as in bamboo thickets, rice paddies and gardens in agricultural



Liopeltis major



Liopeltis major

of body and out to end of tail, leaving a distinct longitudinal mid ventral yellow band which also extends to tip of tail; ventral scales—large, smooth, glossy, 249 to 252 (243 to 258, Maki; 253 to 262, Wang and Wang); anal scale—divided; subcaudals—110 to 118 pairs (104 to 122, Maki; 101 to 113, Wang and Wang).

Although exceptions occur, the coloration and patterns of *Elaphe taeniurus* are fairly constant throughout life.

Distribution. The beauty snake is one of the most common and best known species of nonvenomous snakes on Taiwan. It is found throughout the island and has a wide distribution in Southeast Asia. It has been collected from the eastern Himalayas, Assam, Burma and in a number of provinces of mainland China. Pope (1935) has stated that this snake may have been carried into northern China by man.

Habitat and Habits: *Elaphe taeniurus* is well adapted to a wide range of habitats, occurring around human dwellings as well as in heavily wooded areas. It may be found in protected grassy areas and has been observed in shrubs several feet above the ground. It is quite agile, moves fairly fast on the ground or in shrub and is difficult to catch in the wild. Since it feeds on small rodents, it is not surprising that farmers have reported seeing this reptile in their homes. This snake is docile, adapts well to captivity and becomes accustomed to man soon after capture. It may assume a defensive attitude and emit low hissing sounds when first confined but on no occasion has it bitten handlers in our laboratory. If one were to consider a snake as a pet, there is little doubt that the beauty snake would be the ideal choice.

Due to its size and striking coloration *E.*

taenijurus occupies a small but significant niche in commerce and in the everyday activities of the Chinese. The skin is used ex-

tensively for shoes and ladies' handbags and the flesh is considered a delicacy with medicinal properties.

Liopeltis major (Guenther)

Common Names—Taiwan Green Snake, Smooth Green Snake, Green Vine Snake

Description: Total length—34 to 41½-in. (28 to 41-in., Maki; 24½ to 40-in., Wang and Wang); tail—9 to 11-in. or approximately a quarter to a third of length. Medium size snake; body—slender; scale counts—15-15-15; tail—long, tapers gradually to filament and sharp tip.

Dorsal contour of head—narrow, oval to slightly triangular; nose—moderately tapered to narrow round tip; nostril—small, on side of nose near tip; eye—medium to large, light dull yellow to light tan, dappled by diffuse black pigment; iris—round, jet black; surrounded by ring of light brown; head—flattened, slightly expanded posteriorly but not distinct from neck; dorsal shields—large, smooth, glossy; upper head—uniform dark green; upper labials—lighter green than upper head; tongue—dull red, stem darkened by diffuse black pigment, branches dark gray to black.

Upper body—uniform dark green without designs, first to third scale rows lighter green than dorsal body; upper tail—uniform dark green, usually smooth, dull glossy, some specimens may have two to five rows of keeled scales near vertebral line.

Ventral head and neck—light yellow to yellow green; lower labials—slightly darker than chin shields; ventral body—light to yellow green, may be more yellow in anterior part of body; ventral scales may be rendered more distinct by narrow posterior margin of tan or gray brown; underside of tail—uniform yellow green, may be darker than ventral body; ventral scales—large, smooth, glossy, 161 to 180 (163 to 177, Maki; 172 to 177, Wang and Wang); anal scale—divided; subcaudals—86 to 94 pairs (70 to 96, Maki; 87 to 89, Wang and Wang).

Nonpoisonous

The common green snake may be and has been confused with the bamboo snake (*Trimeresurus*). It is not necessary to be a trained observer, however, to differentiate the two species. The poisonous bamboo snake, unlike *Liopeltis*, possesses a moderately heavy body, short tail and triangular head covered entirely with small, keeled, dull scales. The body of *Liopeltis* is without designs, whereas the bamboo snake usually has white or a combination of red and white stripes near the latero-ventral junction. The tail is usually tinged brick red.

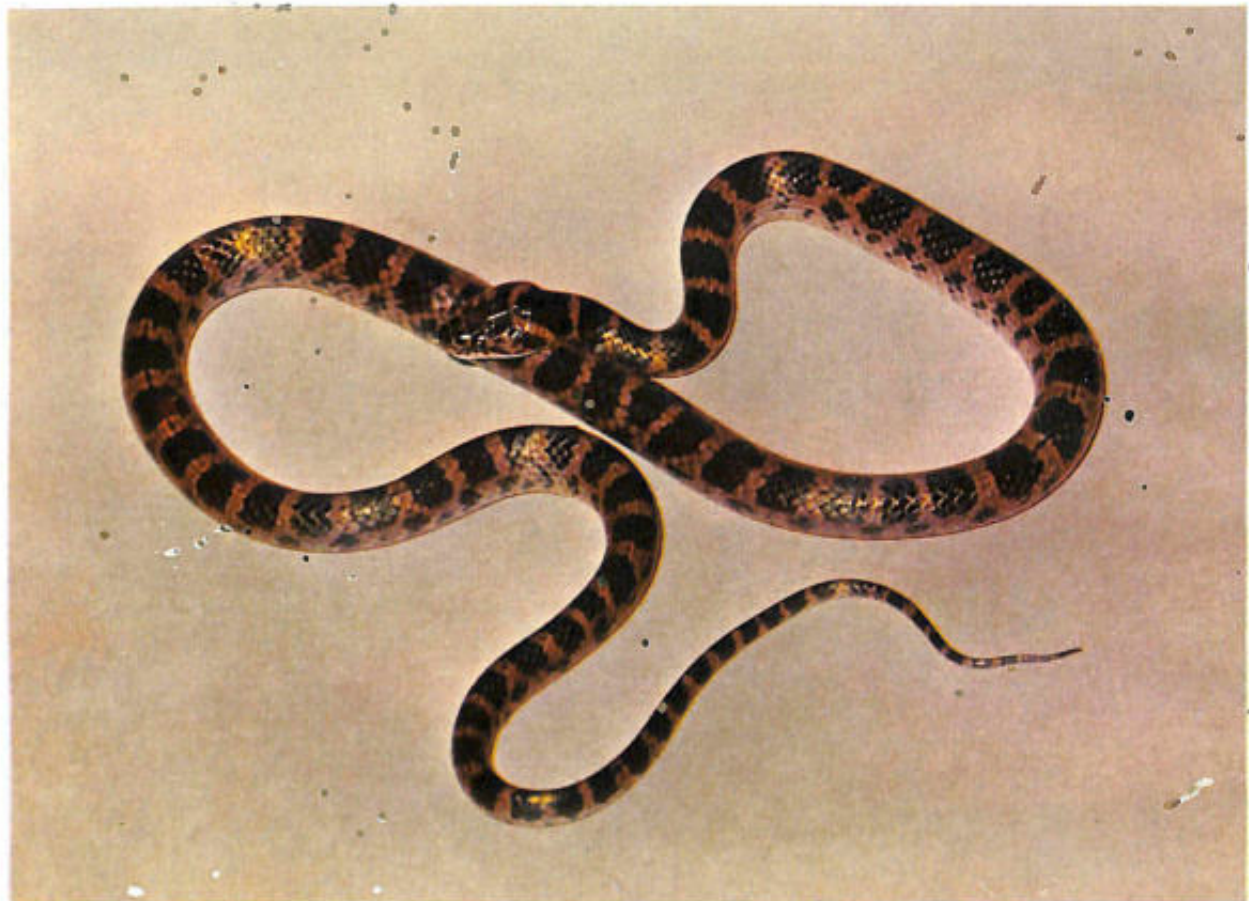
Distribution. The common green snake is found over the greater part of Taiwan. The same species is common to provinces of southeast China and its distribution extends south into Vietnam.

Habitat and Habits. The Taiwan smooth green snake has been observed in grassy, wooded and usually fairly well-protected moist areas. It has been taken in hillside shrub as well as in bamboo thickets, rice paddies and gardens in agricultural



Liopeltis major





Dinodon rufozonatum

areas. *Liopeltis* has been captured in Tien Mou, Yang Ming Shan and other suburbs of Taipei adjacent to farm lands. Most of the specimens in the NAMRU-2 collection have been taken in fairly rough hillside localities at altitudes below 2500 feet.

When first captured, *Liopeltis* may be

nervous but it soon becomes docile and as a rule may be handled safely. It seldom strikes or attempts to bite. This species is frequently seen during daylight hours. The green vine snake has eaten worms while in captivity. It lays large white eggs.

***Dinodon rufozonatum* (Cantor)**

Common Names—Red Banded "Krait," Banded Red Snake

Nonpoisonous

Description: Total length—26 to 45-in. (15 to 43¼-in., Maki; 25¼ to 39¼-in., Wang and Wang); tail—5 to 8-in. or approximately a fifth to a sixth of length. Medium size snake; body—slender to moderately stout, round; scale counts—17-17-15; tail—slender, tapered gradually, drawn out to moderate filament.

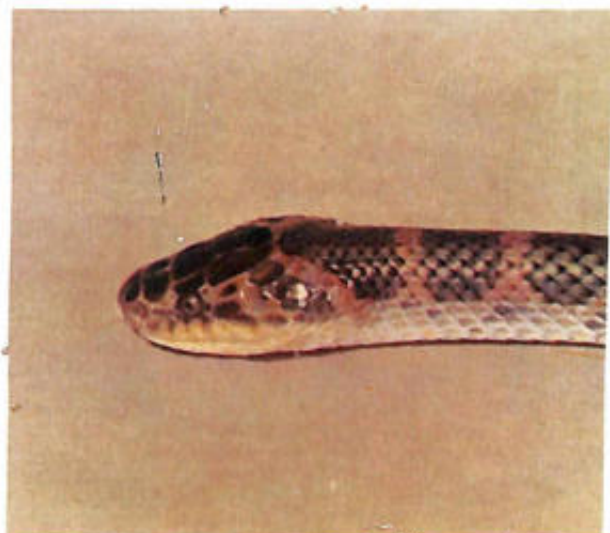
Dorsal contour of head—broad, roughly

triangular; nose—slightly tapered to round end; nostril—small, on side of nose; eye—medium size, near top of head, *bulging*, dark brown to black; iris—black, inconspicuous; head—flattened posteriorly, convex anteriorly, slightly wider than but not distinct from neck; dorsal shields—large, smooth; upper head—usually uniform dark brown to black, some of shields may pos-

sess. irregular margins of red brown; inverted "V" of red brown at back of head; upper labials—lower two-thirds dirty white, gray or light brown; tongue—stem, salmon color; branches, dirty white.

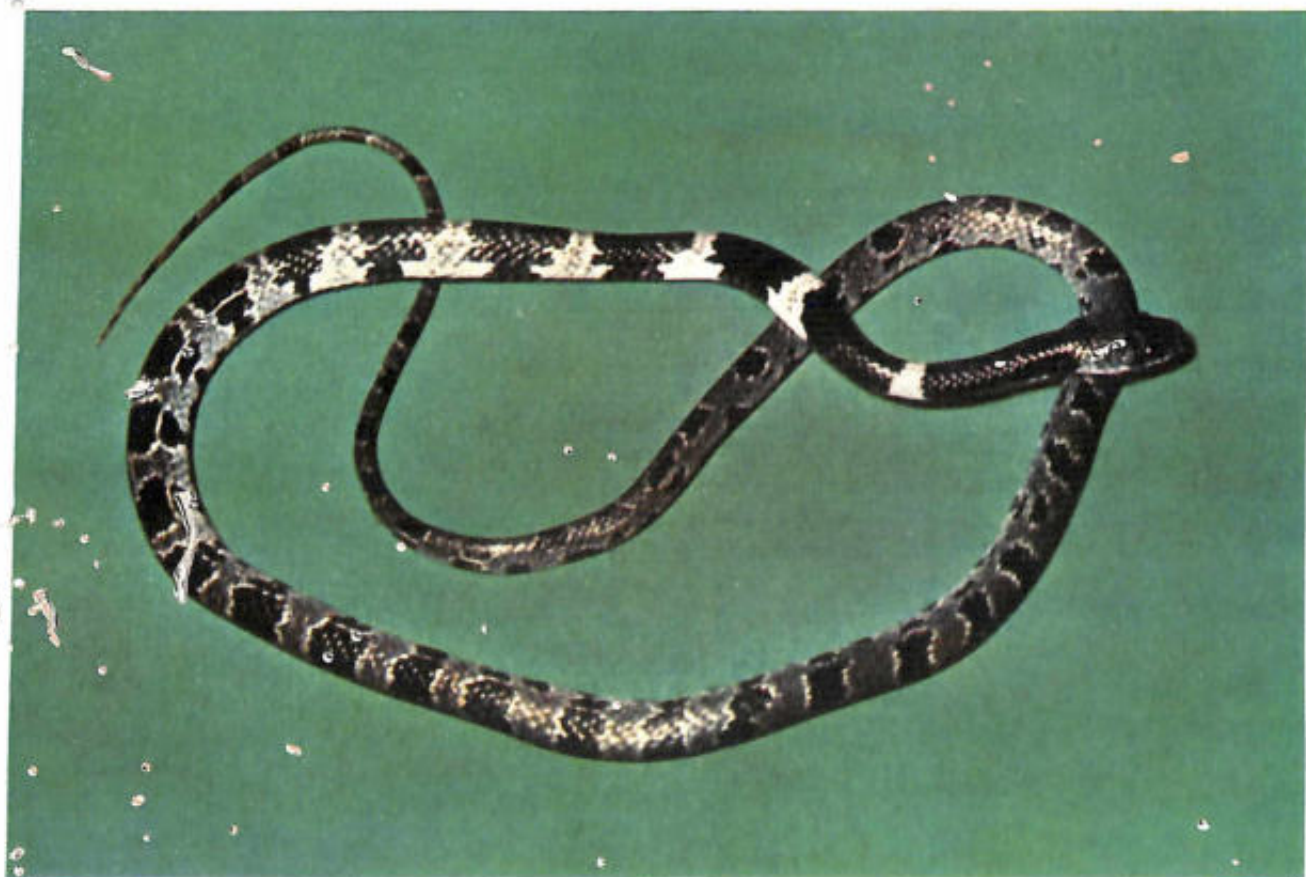
Upper body and tail—red brown; 53 to 64 (51 to 62, Maki) dark brown to black crossbands along vertebral line and upper 40 per cent of body; 16 to 23 (21 to 35, Maki) crossbands on tail; longitudinal line of spots, variable in shape, size and distribution, below and alternating with dorsal crossbands to give indistinct checkerboard appearance; spots involve three or four rows of scales; body scales—smooth, glossy or iridescent.

Ventral head—dirty cream to dirty white; lower labials and mental—patches of black pigment varying in size, intensity of pigmentation and disposition; ventral body—white to light gray, areas of pigment



Dinodon rufozonatum

on outer fields of upturned scales; pigment more scattered, irregular and more intense near anus; ventral scales—large, smooth,



Dinodon septentrionale

Snakes of Taiwan

glossy, iridescent, 198 to 211 (189 to 212, Maki; 182 to 203, Wang and Wang); anal scale—entire; subcaudals—68 to 81 pairs (71 to 87, Maki; 62 to 84, Wang and Wang).

There are color variations of this species. Some individuals have a dull red or gray brown appearance with indistinct crossbands. The young are much darker in color and possess much more pronounced designs than in the mature snakes.

Distribution. *Dinodon rufozonatum* is a fairly common species and widely distributed on Taiwan. It has also been collected from a number of provinces of mainland China as well as from Korea and Manchuria (Pope, 1935).

Dinodon septentrionale (Guenther)

Common Name—White Plum Blossom Snake

Description: Total length—22 to 40¼-in. (17¾ to 40¼-in., Maki; 14¾ to 42½-in., Wang and Wang); tail—5½ to 10½-in. or approximately a quarter of length. Medium size snake; body—long, very slender, round; scale counts—17-17-15; tail—long, very slender, tapers from narrow base to thin filament and sharp tip.

Dorsal contour of head—broad, roughly rectangular; nose—broad, tapered slightly



Dinodon septentrionale

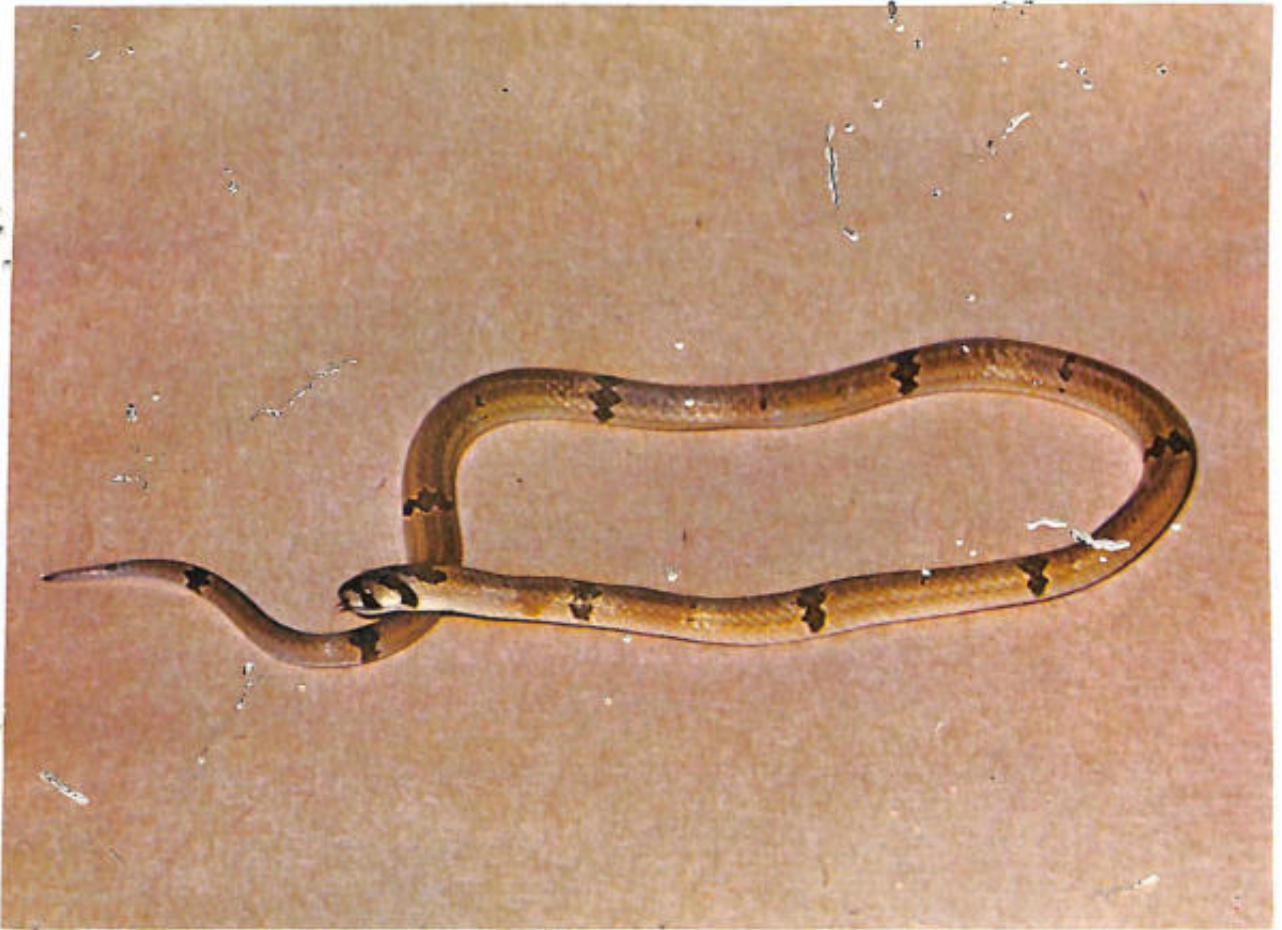
Habitat and Habits. On Taiwan, this snake is found in habitats which range from rice paddies on lower mountain slopes to wooded areas at heights of 4,000 feet. Most specimens have been taken in habitats associated with rice paddies or small streams. This species lays eggs and its food consists of frogs, loaches and, probably, smaller snakes. It is nocturnal in its habits. As a rule, *Dinodon rufozonatum* will not strike or bite. When injured or tormented, this snake may play dead or roll itself into irregular coils.

The common name, "red banded krait," is a misnomer. The species is nonpoisonous.

Nonpoisonous

to blunt end; nostril—medium to large, on side near top and tip of nose, visible from dorsal view; eye—medium size, near top of head, bulging laterally, dark gray to black; iris—round, black; head—flattened posteriorly, convex anteriorly, wider than and moderately separated from neck; dorsal shields—large, but may not be prominent due to coloration and indistinct sutures; upper head—usually uniform gray brown to brown but may have indistinct broad band of lighter brown across back of head; upper labials—lower two-thirds light gray to white, clearly differentiated from upper head; tongue—flesh color, branches tinged with gray.

Upper body and tail—dark gray brown to chocolate, 36 to 44 (34 to 45, Maki) brown to brown black crossbars with margins of tan on body; anterior bands on body broad and distinct; bands progressively narrower and less distinct posteriorly, some broken or irregular posteriorly, 16 to 25 bands on tail; scales of body and tail—several rows of weakly keeled scales on upper part in anterior fifth of body, keels better developed and involve more scale rows posteriorly, keeled scales extend onto

* *Oligodon ornatus*

tail, moderately glossy and moderately rough to touch.

Ventral head and neck—dirty white to light gray, some specimens with diffuse black pigment on mental and inner margins of lower laterals; ventral body—light gray or tan with scattered spots of diffuse gray brown pigment which increases progressively toward posterior half of body, pigment scattered but more concentrated at outer ends of ventrals, the latter forming a longitudinal stripe at latero-ventral junction; underside of tail—mottled, dark gray to brown, some specimens with faint crossbands continuous from upper tail; ventral scales—large, smooth, glossy, 214 to 217 (216 to 233, Maki; 219 to 223, Wang and Wang); anal scale—single; subcaudals—103 to 156 pairs (97 to 116, Maki; 101 to

108, Wang and Wang).

Bands of body and tail tend to be more distinct in juveniles than in adults.

Distribution. Only limited numbers of *D. septentrionale* have been taken on Taiwan. However, according to Maki (1931) and Wang and Wang (1956), this snake is not rare and may even be common in some areas in the southern part of the island. Various subspecies of *Dinodon* occur from Burma and eastern Himalayas to eastern China.

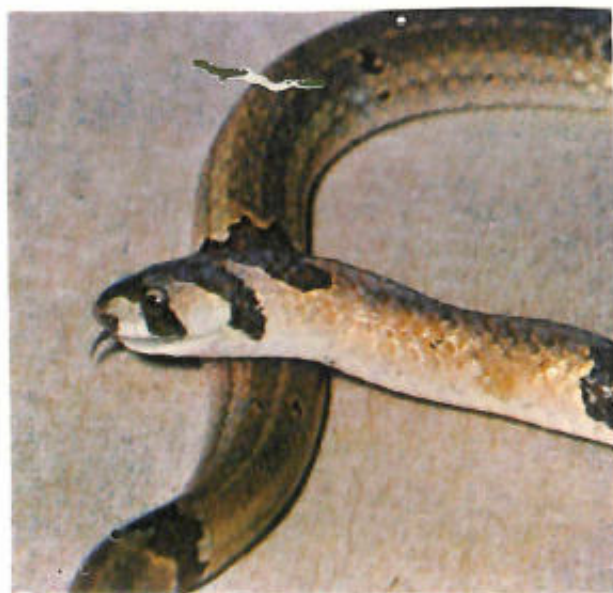
Habitat and Habits: Due to a scarcity of study material there is little information on habits of *D. septentrionale*. It has been taken in low mountainous wooded areas and several specimens have been taken in shrub adjacent to rice paddies and gardens.

Oligodon ornatus Van Denburgh

Common Names—Red Belly Pine Root Snake

Description: Total length -- $15\frac{3}{8}$ -in. ($5\frac{1}{2}$ to 19-in., Maki, 7-in., Wang and Wang); tail -- $2\frac{3}{8}$ -in. or approximately one-fifth to one-sixth of length. Small snake; body—stout, round; scale counts —15-15-15; tail—tapering rapidly in distal third to sharp tip.

Dorsal contour of head—broad, roughly triangular; nose—short, tapers rapidly to round end; nostril—small, inconspicuous, on side of nose; eye—medium size, dappled light brown, with scattered black pigment; iris—round, black, with narrow ring of orange red; head—thick, convex dorsally, only slightly wider than neck; dorsal shields—large, smooth but only moderately conspicuous due to texture and coloration; upper head—light brown with *distinct designs of dark to chocolate brown bordered by light brown, usually symmetrical in arrangement*; thick armed “^” at back of head, apex round and on interparietal suture; a second thick-armed “^” on head, arms directed posteriorly and obliquely behind eyes to corner of mouth, apex continuous with dark brown triangular design



Oligodon ornatus

Nonpoisonous



Oligodon formosanus

covering dorsal surface of nose; upper labials—dirty white to light brown, prominent broad vertical band below eye involving three upper labials; tongue—flesh color flecked with black pigment, branches darker than stem.

Upper body—light brown with *irregular shaped but regularly arranged designs (spots, bands and partial bands)*; eight dark brown prominent sawtooth bands (involving two to four scales with borders of light brown and extending ventrally near to latero-ventral junction, evenly separated and alternating with spots of dark brown which form partial bands; upper tail—one distinct band plus dark brown tip; body scales—smooth, moderately glossy.

Ventral head—white to light gray, some of lower labials, some of gulars and chin plates with areas of dark pigmentation; ventral body—white to light gray with scattered spots (tend to be square) of prominent black pigment forming irregular designs which are arranged on sides of

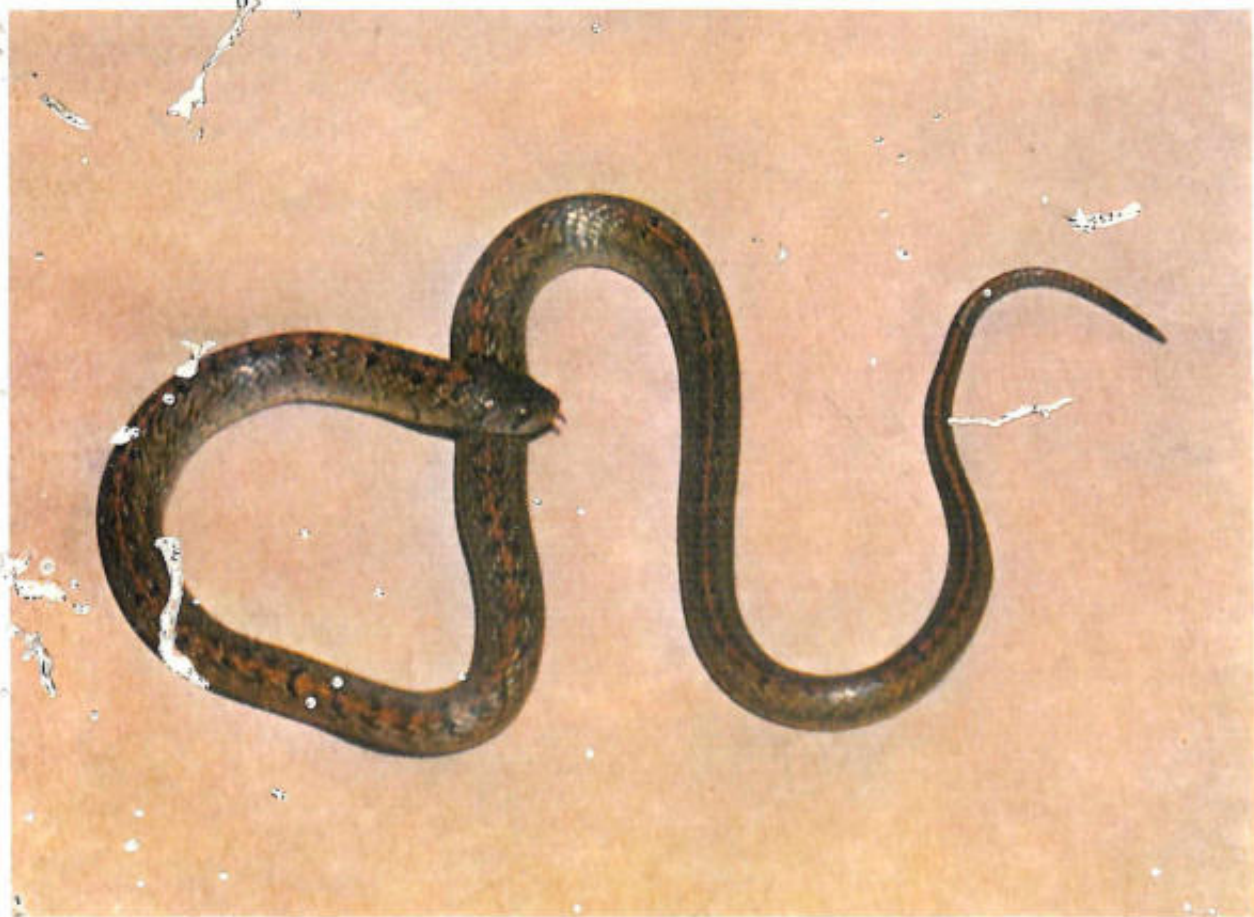
prominent orange-red midventral line extending from neck region onto tail; under-side of tail—designs of ventral body extend onto anterior half of tail, distal half white; ventral scales—large, smooth, glossy, 161 (156 to 173, Maki; 160, Wang and Wang); anal scale—divided; subcaudals—38 pairs (32 to 39, Maki; 27, Wang and Wang).

In general morphological features this species is similar to *Oligodon formosanus*. *Oligodon ornatus* may be differentiated from the latter, however, by body designs and coloration. *O. ornatus* is characterized by a distinct orange red longitudinal stripe along the midventral line and distinct but irregularly shaped bands across the back. *O. formosanus* on the other hand has a broad vermilion mid-dorsal stripe and faint

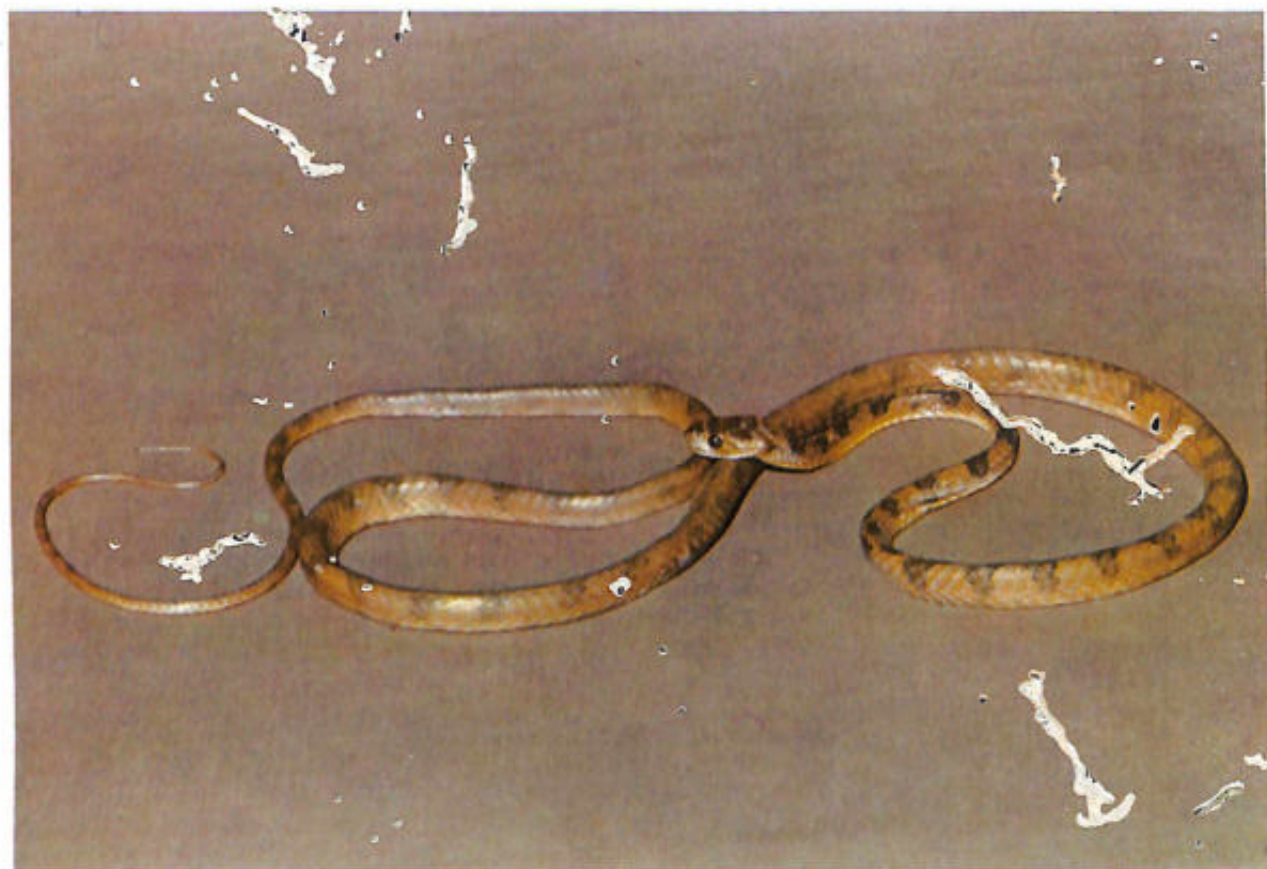
bands across top of body. The latter apparently is much more common and therefore more likely to be encountered than *O. ornatus*.

Distribution. Records describing the distribution of this species on Taiwan are limited. Maki (1931) and Wang and Wang (1956) indicate that *Oligodon ornatus* is found from sea level to the medium mountain heights of Mt. Ali. According to Pope (1935) this snake is well known from the Fukien Province of mainland China.

Habitat and Habits. Since this species is uncommon and has not been taken very often, there is little information on its habits and its habitat preferences. In Pope's (1935) account relating to *Oligodon* it has been stated that this snake feeds upon the eggs of other reptiles.



Oligodon formosanus



Oligodon formosanus (Guenther)

Boiga kraepelini

Nonpoisonous

Common Names—Taiwan Leopard Snake, Red Back Pine Root Snake

Description: Total length—18 to 27¾-in. (17½ to 27¾-in., Maki; 9¼ to 25¼-in., Wang and Wang); tail—3¼ to 5-in. or approximately a fifth or six of length. Medium to small snake; body—moderately stout; scale counts—19-19-17; tail—medium stout, tapering rapidly to blunt tip.

Dorsal contour of head—broad, roughly triangular; nose—tapers rapidly to blunt end; nostril—small, on side of nose; eye—medium size, cream to dappled gray with scattered black pigment; iris—round, black, with narrow ring of cream to yellow; head—thick, convex dorsally, approximately same width as neck; dorsal shields—large, smooth but not conspicuous due to texture and coloration; upper head—gray brown mottled with black pigment, designs of different shape, size and color-

tion, usually symmetrical in arrangement; thick-armed “^” at back of head, apex at interparietal suture, median design on frontal scale, oblique design from parietals postero-laterally and parallel with arms of the “^” on back of head, irregular-shaped designs above eyes; there may be also a broad flattened “^” anterior to and between eyes; designs vary, usually have black margins with a second light brown or tan border; upper labials—dirty white with irregular designs of gray brown and scattered diffuse pigment; prominent broad oblique streak from eye to mouth; tongue—flesh color, branches darker than stem due to scattered black pigment.

Upper body—gray brown to brown, dark salmon or vermillion, vertebral stripe (involving two or three scale rows) from

neck to end of tail; 50 to 70 faint to medium dark brown bands (involving one to three scale rows) over top of body, these broken at mid dorsal or vertebral line and extend down sides, more prominent in anterior part of body; upper tail—gray brown, plain or with a few indistinct lines or bands; body scales—smooth, moderately glossy.

Ventral head—white to light gray; lower labials—usually with narrow margins of dark gray; ventral body—light gray to light yellow with scattered irregular gray or medium brown gray designs varying in size; semicircular or pyramidal designs with base on posterior margin and in outer fields of ventral scales, designs may be on alternate or contiguous scales and tend to be more prominent in anterior half of body, these may be arranged to form two longitudinal broken lines; gray brown on sides of body extends onto upturned ends of ventral scales; some specimens have an indistinct longitudinal light line below, parallel to and adjacent to latero-ventral junction; underside of tail—variable, frequently tinged with pink or salmon; some specimens uniform light gray, in others there are

deposits of darker gray along inner junction of subcaudals forming a mid ventral stripe for a half or two-thirds the length of tail; ventral scales—large, smooth, glossy, 163 to 171 (161 to 173, Maki; 156 to 173, Wang and Wang); anal scale—entire; subcaudals—44 to 51 pairs (39 to 59, Maki; 44 to 53, Wang and Wang).

Distribution: As suggested by the specific name (*formosanus*), this species was first described from Taiwan (Maki, 1931). Although not common in the NAMRU-2 collection, records indicate that it probably occurs over the entire island. *O. formosanus* also occurs (Pope, 1935) in the provinces of China opposite Taiwan and into Southeast Asia.

Habitat and Habits: *O. formosanus* frequents wooded, moist areas on the lower mountain slopes. It has been taken in agricultural areas as well as in the vicinity of human habitations. A number of our specimens were taken at night indicating that this snake is probably nocturnal in its habits. As a rule, it has a gentle disposition, seldom strikes or makes an attempt to bite. One of 15 specimens, however, did bite the handler and held on tenaciously.

***Boiga kraepelini* Stejneger**

Common Names—Taiwan Tree Snake, Big-Head Snake, Taiwan Square-Head Snake

Description: Total length—45 to 57½-in. (31 to 50-in., Maki; 44½ to 64¼-in., Wang and Wang); tail—12½ to 15½-in. or slightly more than a quarter of length. Long, slender snake; body—laterally compressed, height greater than width; scale counts—21-21-17; tail—long, tapers gradually from narrow base to small drawn out filament.

(Dorsal contour of head—broad, almost square posteriorly, roughly triangular anteriorly; nose—broad, tapered moderately to blunt or slightly round end; nostril—medium size, conspicuous, on side near tip of nose; eye—very large, bulging from head, clearly visible from dorsal view, dirty yellow to yellow copper, dappled with coarse diffuse black; iris—vertically elongate oval or elliptical, black, surrounded

Nonpoisonous



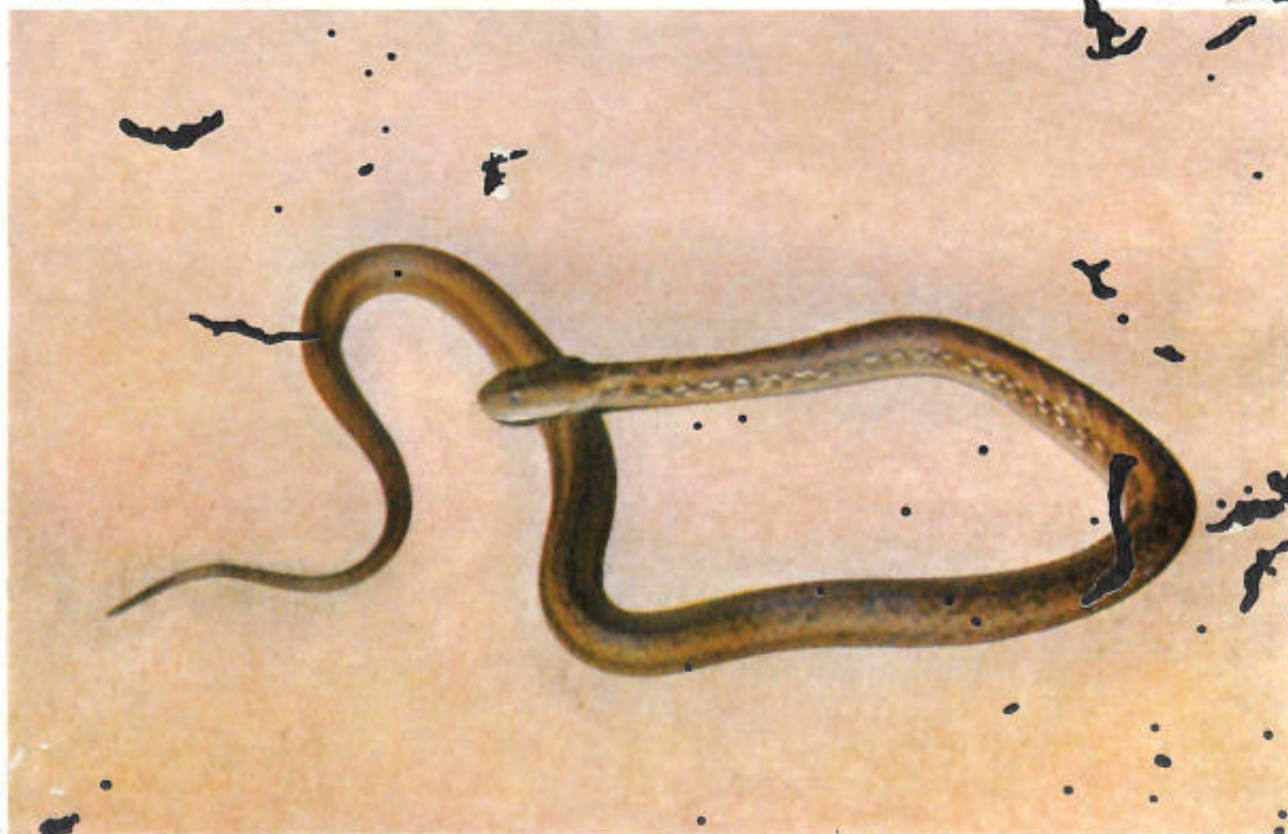
Boiga kraepelini

by ring of dirty yellow; head—flattened posteriorly, slightly convex anteriorly, twice width of neck and distinctly separated from neck; dorsal shields—broad, large, prominent, smooth, dull; upper head—usually uniform brown to copper brown, some specimens have a dull rusty lateral stripe, one-half the diameter of eye, extending from eye to corner of mouth; supra labials—lighter than upper head, sometimes mottled with white to dirty yellow; tongue—flesh color, darkened by scattered flecks of black, branches lighter than stem.

Upper body and tail—variable; amber or brown to copper brown, some specimens darker due to diffuse black pigment on scales; 49 to 50 (48 to 55, Maki) brown to diffuse black, irregular designs on body, some extend from near latero-ventral junction over back, others stop at vertebral line, designs usually more prominent in anterior third of body; designs may be bordered with black, designs on sides alternating in

some areas thus giving a checkerboard appearance from dorsal view; tail—designs similar to those on body but less distinct at base, fading progressively toward tip of tail, designs difficult to count, range from 30 to 40 (31 to 45, Maki); body scales—smooth, slightly glossy, outer one to three scale rows on body and tail usually tinged with deep salmon or bronze.

Ventral head—white to light gray, mental and lower labials slightly pigmented with diffuse light brown, concavity in lower edge of rostral, obvious in ventral view; ventral body—usually uniform in color, light to yellow gray tinged with rust or salmon, the latter more pronounced on outer quarter of each ventral scale, mixed with white to give marbled effect; light areas on ventral scales, arranged to form longitudinal line near latero-ventral junction, posterior half of body darker salmon; underside of tail—similar but deeper salmon or rust than on ventral body; ventral



Psammodynastes pulverulentus

scales—large, smooth, glossy, 239 to 247 (232 to 250, Maki; 212 to 241, Wang and Wang); anal scale—divided; subcaudals—142 to 151 pairs (140 to 158, Maki).

There are color variations for this species which are quite marked in immature snakes. Although a majority of *Boiga* are of the red brown to bronze type, others have an overall color of gray to gray brown with prominent dorsal designs of dark brown or chocolate, bordered by light gray.

Distribution. While not common in collections, *B. kraepelini* apparently is widely spread on Taiwan. It also occurs on the mainland of China opposite Taiwan (Fukien, Kiangsi, etc.) and other species of the genus are found in Southeast Asia and the Malay Archipelago. Keelung is

given as the type locality for the species.

Habitat and Habits: *Boiga* is an arboreal species occurring at low as well as moderately high altitudes. According to Maki (1931), it has been taken at Mt. Ali. It is found in areas of shrub and forest. One specimen was captured in a tree approximately 25 feet above the ground. A few individuals have wandered into yards adjacent to wooded areas. Two specimens have been taken in homes on Yang Ming Shan, one after it had entered a bird cage and swallowed three out of five Formosan chestnut-bellied munia (*Lonchura*). On a few occasions *Boiga* has taken mice as food although it has a definite preference for birds. *Boiga* lays eggs.

***Psammodynastes pulverulentus* (Boie)**

Nonpoisonous

Common Names—Taiwan Leopard Snake, Mock Viper

Description: Total length—17½ to 25-in. (13 to 24-in., Maki; 15¾ to 20-in., Wang and Wang); tail—3½ to 5½-in. or approximately a fifth of length. Medium to small snake; body—slender; scale counts—17-17-15; tail—slender, tapers rapidly from narrow base to moderate filament and sharp tip.

Dorsal contour of head—elongate oval to slightly triangular; nose—tapers moderately to narrow round tip; nostril—small, on side near tip and top of nose; eye—large, medium to dark brown, dappled and flecked with light brown; iris—broadly elliptical on vertical axis; head—flattened posteriorly, concave between eyes, approximately twice width and therefore distinctly separated from neck, slight bulge over eye in lateral view due to well-developed scale over eye, prominent angular ridge from upper eye to end of snout; dorsal shields—large, but frequently not prominent due to coloration and velvety texture; upper head—light brown to rusty or dark brown with longitudinal configurations, variable in arrangement and prominence, usually converging posteriorly; dark brown "Y", base of arms at posterior margin of

parietals, extending posteriorly along mid-dorsal line, arms of "Y" extend forward onto ridge between eye and snout; a second smaller "Y" of lighter brown to gray brown may be present between arms of larger "Y"; dark brown longitudinal oblique designs extend posteriorly from region of eye; upper labials—lighter than upper head, mottled with white, dirty yellow or tan; tongue—dark brown to black; teeth—long, well



Psammodynastes pulverulentus

Snakes of Taiwan

developed, resembling fangs in upper jaw.

Upper body and tail—light to dark brown or even chocolate, tinged with scattered, diffuse, deep red and/or scattered deposits of diffuse dark brown to black; darker pigment may be condensed to form small spots and ill-defined, irregular bars over back, bars as a rule more prominent on anterior half of body; less distinct, irregular and scattered designs of pigment on sides of body; upper tail—light to medium brown; body scales—smooth but not glossy.

Ventral head—white to light gray, mottled with gray to black; lower labials—deposits of black on scales form longitudinal line roughly parallel with similar lines on some of gulars; ventral body—light gray to dark gray brown, mottled with brown or gray pigment, pigment concentrated in outer fields of ventrals to form longitudinal line from head to anus, lines extend onto but less distinct on tail; ventral scales—medium size, smooth, glossy, 168 to 173 (161 to 175, Maki; 167, Wang and Wang); anal scale—entire; subcaudals—60 to 65 pairs (47 to 79, Maki; 62 to 68, Wang and Wang).

Psammodynastes is recognized as a

***Amblycephalus formosensis* Van Denburgh**

Common Names—Taiwan Chunk-Head Snake, Ridged Snake

Description: Total length— $23\frac{1}{2}$ to $25\frac{1}{2}$ -in. ($7\frac{3}{4}$ to $25\frac{1}{4}$ -in., Maki; $21\frac{1}{4}$ -in., Wang and Wang); tail—5 to $5\frac{1}{2}$ -in. or approximately a quarter to a fifth of length. Medium size snake; body—slender, *slightly compressed laterally so that depth is greater than width*; scales—15-15-15; tail—slender, gradually tapered and drawn out to a moderate filament and tip.

Dorsal contour of head—elongated oval to roughly rectangular; nose—broad, short, round to blunt at end; nostril—small, on side of nose; eye—medium size, light brown or yellow brown with scattered streaks of diffuse black pigment; iris—black, oval to elliptical, tilted forward on longitudinal axis, without definite ring or border; head—flattened posteriorly, convex ante-

snake with very broad ranges in coloration. Some of the specimens taken on Taiwan are very dark chocolate with scarcely any head or body designs evident.

Distribution: Records indicate that the “mock viper” is widely distributed over Taiwan, apparently up to moderate heights. Maki (1931) states that this snake is common above 4,500 feet. It also occurs in many areas in Southeast Asia and Malaysia, including Sumatra, Celebes and Borneo.

Habitat and Habits. *Psammodynastes* is fairly common. Most of the NMVU-2 specimens have been taken in wooded areas on lower mountain slopes and in wooded valleys adjacent to developed lands. It has been found under stones or piles of debris. The “mock viper” delivers its young alive and feeds on lizards and small amphibians (Pope, 1935). It is easily excited, moderately aggressive in captivity, does not hesitate to strike and will attempt to bite.

This snake is recognized as a “mock viper” due to general characteristics of head and eyes which may resemble those of some of the vipers. It is not dangerous to man.

Nonpoisonous



Amblycephalus formosensis

*Amblycephalus formosensis*

riorly, thicker than neck, broader than and distinct from neck; dorsal shields—large, smooth, glossy; upper head—light brown with scattered irregular spots of black, deposits somewhat concentrated forming dark margins on some of dorsal shields; distinct line extends posteriorly from eye to meet dark design on neck and oblique black lines which extend posteriorly behind parietals, overall designs on head form a "W", a second line extends from lower eye to corner of mouth; upper labials—lighter than upper head, with scattered flecks of black; tongue—dark gray to black, branches darker than stem.

Upper body and tail—light brown to brown, with flecks of black pigment on each scale; 45 to 55 irregular crossbars of black usually broken or interrupted at vertebral line, crossbars vary in shape and intensity of blackness; tail—10 to 20 crossbars similar to those on body but less distinct; body scales—smooth in appearance

and touch, glossy; however, five to seven rows near vertebral line of posterior half of body possess poorly developed keels.

Ventral head—dirty white to cream with scattered spots of black pigment, chin plates large; ventral body—slightly darker than ventral head, mottled with large spots of black, some spots in outer fields of scales tend to form longitudinal lines; ventral tail—similar to ventrals of body but darker due to numerous spots of pigment, subcaudals indistinct; ventral scales—medium to large, smooth, glossy; 180 to 185 (163 to 182, Maki; 158 to 178, Wang and Wang); anal scale—entire; subcaudals—72 to 76 pairs (73 to 80, Maki; 75 to 83, Wang and Wang).

This snake with its large head and elliptical pupils, at a glance, may be mistaken as a venomous species.

Distribution. This species is represented by only a few specimens in collections



Bungarus multicinctus

made on Taiwan. Most of these have been taken on the western side of the central mountain range. The NAMRU-2 specimens were obtained at 1500 feet, south of Taipei. Wang and Wang (1956) have given Mt. Ali also as a collection site for *Amblycephalus formosensis*. A closely related snake is found in Fukien Province of mainland China and several other species of the genus are widely distributed from the Himalayas across China and southward into the Malay Archipelago.

***Bungarus multicinctus* Blyth**

Common Names—Taiwan Banded Krait, Umbrella Snake, 100-Segment Snake

Description: Total length — $29\frac{1}{2}$ to $55\frac{1}{2}$ -in. ($11\frac{3}{4}$ to $66\frac{1}{2}$ -in., Maki; $9\frac{1}{2}$ to $53\frac{3}{4}$ -in., Wang and Wang); tail — 4 to $6\frac{3}{4}$ -in. or approximately one-seventh of length. Medium size snake; body—moderately stout; scale counts—15-15-15; tail—tapers gradually to blunt end with well de-

Habitat and Habits. Because of a paucity of materials, little is known about this species on Taiwan. The NAMRU-2 reptiles were taken in gardens, in moist, cultivated areas adjacent to shrub and woodlands on low mountain slopes. These snakes made no attempt to bite when brought into the laboratory. According to Pope (1935), *Amblycephalus* probably feeds upon garden slugs and other invertebrates. It supposedly is an egg layer.

Poisonous

veloped chitinous tip.

Contour of head—broad oval; nose—broad, slightly tapered to broad round end; nostril—medium to large, on side but near top of nose, clearly visible from dorsal view; eye—small, bead-like, blue black, indistinct since it blends with dark head.

iris—round, blue black, blends with rest of eye; head—flattened posteriorly, convex anteriorly, slightly wider than but not distinct from neck; dorsal shields—large but not necessarily distinct due to color of head and indistinct sutures, smooth, glossy; upper labials—mottled gray, lighter than upper head; tongue—red to flesh color, stem red, branches diffuse gray; fangs—short (1/16 to 1/8-in.), rigid, located in upper jaw between eye and nose.

Upper body—*banded with distinct black and white bands*; 34 to 45 (38 to 50, Maki) *black bands on body*, most anterior band is usually a continuation from back of head, fourth to eighth anterior bands broader than posterior bands, bands tend to be regular in shape, round near latero-ventral junction; narrow bands vary from white to mottled gray; tail—eight to 15 (10 to 16, Maki) *black bands*, the last at end of tail; body and tail scales—smooth, glossy; *a row of hexagonal scales* (from one and a half to twice the size of body scales) along vertebral line, from head to anterior tail.

Ventral head and neck—dirty white or clouded with diffuse gray pigment; lower labials—may possess longitudinal narrow bars of pigment on inner margins; ventral body—dirty white to clouded gray anteriorly, progressively darker posteriorly, dorsal bands extend onto outer fifth to third of ventrals, involving three to eight scales; *underside of tail—dark bands, continuation of dorsal bands, separate or partly fused*; ventral scales—large, smooth, glossy, 205 to 216 (204 to 218, Maki; 201 to 216, Wang and Wang); anal scale—entire; subcaudals—*not divided*, 44 to 48 (40 to 51, Maki; 38 to 48, Wang and Wang).

There is a wide range in coloration in the krait. The bands of some specimens may be light gray to light blue gray, i.e. not the prominent black of typical specimens. In other individuals the bands are practically nonexistent and may be a light tan. Several days prior to shedding skin the dark bands of the krait may take on

a dull gray appearance. Bands tend to be more distinct in young snakes.

Distribution. The banded krait is very common and one of the most widely recognized of the snakes on Taiwan. It apparently occurs in all areas of the island at lower altitudes, perhaps below 2,000 feet. The same species occurs on Hainan and is widely distributed in the provinces of southeastern China. Other species of this genus are found in Southeast Asia and the Malay Archipelago.



Bungarus multicinctus

Habitat and Habits. *Bungarus multicinctus* occurs in a variety of habitats but is more common in low wooded, bamboo and grassy areas near to or associated with water. It is a nocturnal snake frequently seen in rice paddies or along the irrigation ditches of agricultural areas. It may be unusually active on rainy nights, frequently seen crossing roads in agricultural districts. Kraits occur within the limits of cities and have been reported on a number of occasions around homes in Taipei. This krait feeds upon amphibians, loaches and other snakes. It is an egg layer.

As a rule, *B. multicinctus* is docile and does not strike or attempt to bite even with moderate prodding. Specimens captured in rice paddies at night have attempted to escape the captor's hands. On a few occasions has this species assumed

a really defensive attitude. Professional snake catchers on Taiwan recognize the krait as poisonous. However, on more than one occasion the author has stood beside a dealer who thrusts hands into a box half filled with kraits to remove several choice specimens. It should be noted that the individual behaviour patterns of snakes vary just as they do for other animals. Over a period of three years, two or three of several hundred kraits handled in the NAMRU-2

laboratories have been vicious and struck angrily when teased.

B. multicinctus produces *neurotoxic venom*. It holds third place (Lin, 1954) in the frequency of bites to man listed for the poisonous snakes of Taiwan. From the standpoint of mortality rates, however, it is listed as second. Based upon old records the mortality rate has been established at approximately 18 per cent.

***Naja naja* (Cantor)**

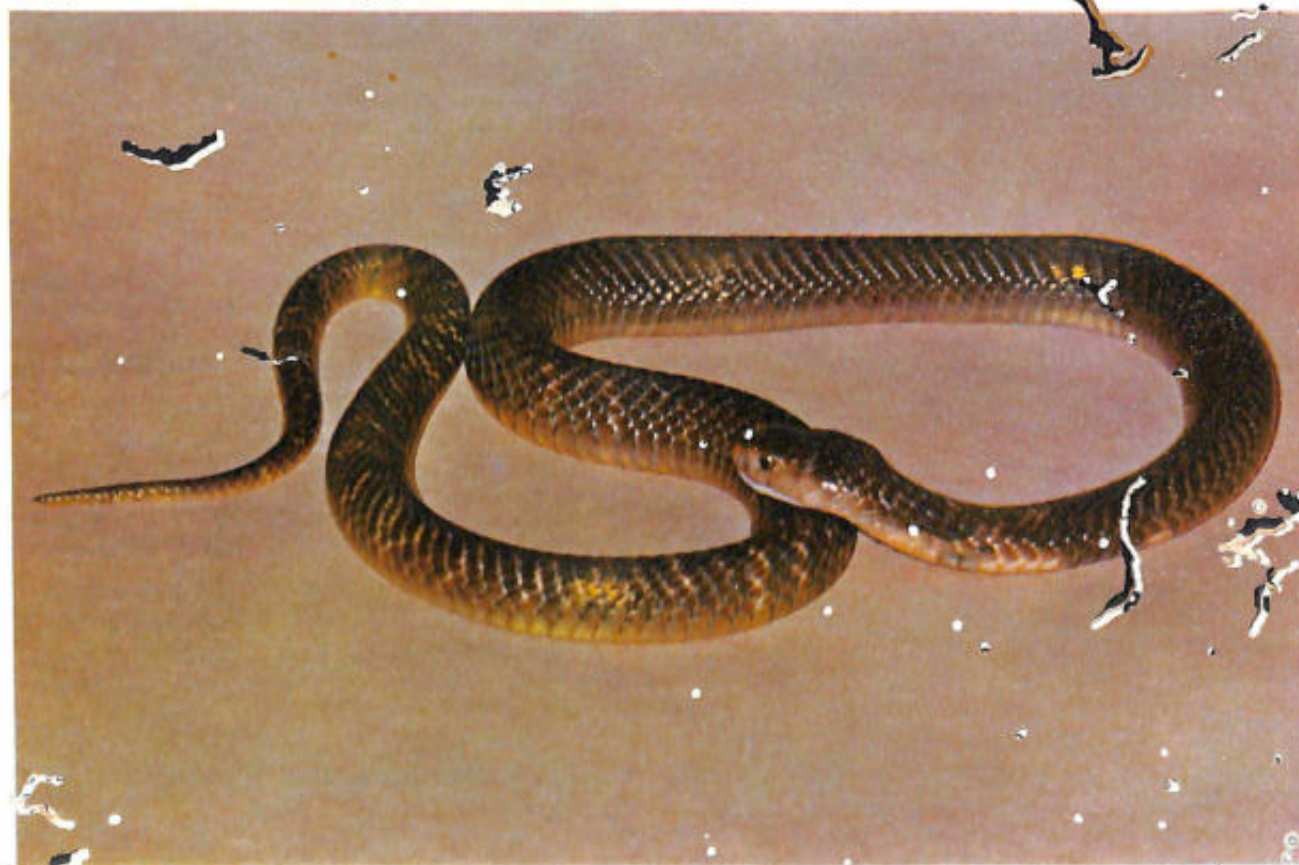
Common Names—Chinese Cobra, Taiwan Spectacle Cobra

Description: Total length—38 to 47½ in. (42 to 64 in., Maki; 18½ to 43¼ in., Wang and Wang); tail—6¼ to 8 in. or approximately a sixth or seventh of length. Medium to large snake; body—moderately heavy, slightly flattened; may be considerably flattened when angry or "hooded;"

scale counts—21-21-15 (may be more than 21 scales at neck); tail—short, moderately stout, tapers gradually to blunt tip.

Dorsal contour of head—broad, roughly triangular; nose—wide, upper part tapers quickly to round end; nostril—very large, conspicuous, on side of nose; eye—

Poisonous



Naja naja



medium size, dark dirty yellow dappled with dark gray black to blue black; iris—round, jet black; head—flattened posteriorly, convex anteriorly, thick, slightly wider than but not distinct from neck; dorsal shields—large, smooth, glossy, distinct; upper head—light gray tan to dark gray black, usually same color as upper body; upper labials and sides of head—lighter than upper head; tongue—dark gray to blue black, stem may be lighter in color than forks; fangs—rigid, short to medium length ($\frac{1}{8}$ to $\frac{1}{4}$ in.) located anterior to middle of upper jaw.

Upper body and tail—light gray tan to dark gray black, usually uniform in color except for a "mask" or spectacle-like designs on hood or expanded part of neck and irregularly spaced, ill-defined vertical lines on body. The "spectacle" or "mask" of Chinese cobras vary, ranging from partial, ill-defined designs in light gray tan specimens to distinct patterns in black or dark gray specimens; patterns may not be readily apparent in a calm, "nonhooded" individual; "mask" or "spectacle" is a wide transverse gray or black margined band which crosses the hood, fairly typical specimen bears a central spot (may be connected with dark margins of band) or "nose piece" of the "spectacles" plus dark spot in each lateral field; hood band may be variable in color and in contrast with remainder of dorsal body; white or light gray vertical lines, when present, number 20 to 30 on body and there may be five to eight similar lines on tail, these lines formed by light areas on scales (involving one or two scale rows), lines irregular in distribution (i.e. separated by three to eight scales, some are indistinct, some are broken and some may unite at vertebral line to form a chevron ($\wedge$)).

Ventral head and neck—white to light gray; ventral body—variable; in light specimens, dirty white to light gray with scattered irregular size and irregular shape designs or areas of gray to gray tan; these are more prevalent on outer quarter or third of ventral scales; four to seven scales



Naja naja

partly or entirely pigmented dark gray to gray brown to form a transverse band posterior to region of hood; dark specimens, similarly marked with darker pigment; underside of tail—uniform white to light gray; if mottled, designs lighter than upper body; ventral scales—large, smooth, glossy, some may have light gray posterior border, 165 to 175 (166 to 178, Maki; 166 to 176 Wang and Wang); anal scale—entire; subcaudals—43 to 48 pairs (41 to 51, Maki; 44 to 49, Wang and Wang).

Color variations for the Taiwan cobra cover a broad range. The designs on the hood are variable, ranging from partial figures to non-symmetrical patterns with varying degrees of fusion of the spectacles with dark margins of the transverse band. Distinctiveness of vertical lines of body varies from light to dark specimens and may be very prominent in immature dark individuals. During the course of study on a large series of cobras one specimen was obtained in which pigmentation was at a minimum. The snake was actually white to dirty white in color. Such aberrant forms are rare but unusual coloration may be misleading to persons only slightly familiar with snakes.

Distribution. Records are incomplete but indications are that this snake may be found anywhere on the island at low alti-



Calliophis maclellandi

tudes. The Taiwan cobra apparently is more common in the west central and southern parts of Taiwan. A few specimens, however, have been captured at Yang Ming Shan and Peitou or other suburbs of Taipei. The same species occurs commonly on Hainan and in a number of the southeastern provinces of mainland China.

Habitat and Habits. *Naja naja* occurs in many habitats ranging from fairly close

associations with human habitations to agricultural lands and the low wooded or shrub areas, usually below 2,000 feet. The cobra adapts well to captivity, eats small rodents or birds and lays eggs. In captivity it is moderately aggressive, strikes ineffectively at moving objects and appears to be only fairly accurate in striking its prey. The cobra is a moody snake. It may be calm on some days but on others it may be aggressive, raise the anterior part of the body, flare its hood in a defensive stand and hiss softly when tormented.

The Taiwan cobra is dangerous since it has a potent *neurotoxic* venom. According to Lin (1954), the cobra holds fourth place in the frequency of bites recorded for the five poisonous species of snakes of greatest concern on Taiwan. From the standpoint of mortality rates among people bitten, the cobra is third.

Cobras are slaughtered by the thousands on Taiwan since the skin can be used for shoes, belts and pocketbooks. The flesh is used in preparation of medicinal soups or may be dried and ground to powder for use by Chinese herb practitioners. The gall bladder finds a ready market. It is noted as a cure for eye ailments.

***Calliophis maclellandi* (Reinhardt)**

Common Names—Taiwan Coral Snake, Red-Ringed Snake

Description: Total length— $16\frac{3}{4}$ to $18\frac{1}{2}$ -in. (8 to $23\frac{1}{2}$ -in., Maki; $8\frac{1}{2}$ to $20\frac{1}{2}$ -in., Wang and Wang); tail—2 to $2\frac{1}{4}$ -in. or approximately an eighth or ninth of length. Small snake; body—slim, round; scale counts—13-13-13; tail—short, moderately stout, tapers gradually from broad base to stubby end with chitinized point.

Dorsal contour of head—broad oval; nose—wide, short, slightly tapered to broad round end; nostril—inconspicuous, on side of nose; eye—medium size, dark gray to black, indistinct since it blends with surrounding dark area of head; iris—circular, black; head—flattened, broader than but

only slightly separated from neck; dorsal shields—large, smooth, glossy, but not distinct due to shallow sutures and general coloration of head; upper head—distinctly marked with broad cream to white band across head back of eyes, anterior and posterior head brown black to black; upper labials—three scales below eye, black; posterior scales, continuation of broad band back of eye, white; fangs—small, rigid, in anterior part of upper jaw.

Upper body and tail—red to rusty brown, scales flecked with diffuse dark brown or black; 30 to 34 dark brown to black bands (27 to 37, Maki) involving

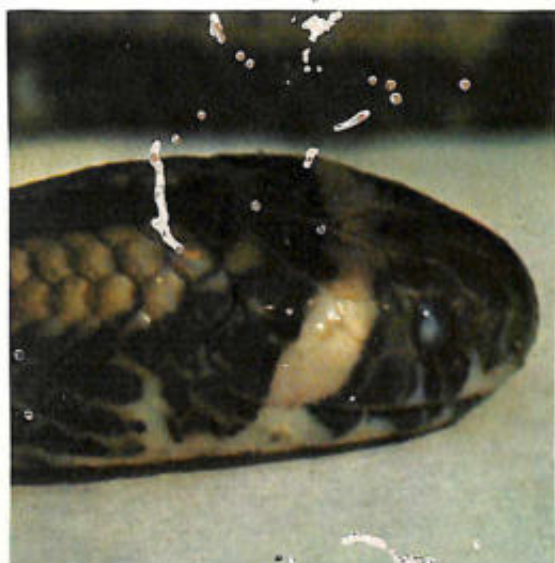
Poisonous

one or two scale rows) cross body, anterior and posterior margins of bands may be cream or light brown; tail—five or six bands (four to seven, Maki), posterior band short distance from end; body and tail scales—smooth, glossy, iridescent.

Ventral head—white to very light gray, mental and chin shields may have dark spots; ventral body—light gray with black designs (50 to 70) separate or partly fused, irregular in size and in shape, posterior design at anus; underside of tail—gray with distinct black bands, continuations of dorsal bands; ventrals—large, smooth, glossy, 219 to 229 (207 to 240, Maki; 209 to 239, Wang and Wang; anal scale—divided; subcaudals—36 to 39 (32 to 41, Maki; 34 to 40, Wang and Wang).

Distribution. Information for this species is based upon limited observations and only a few specimens. However, it probably occurs in mountainous areas throughout Taiwan. It also is known in the eastern provinces of China as well as in other countries of Southeast Asia.

Habitat and Habits. *Calliophis* has been captured in low mountainous wooded areas at 600 to 1,000 feet. A single living specimen was taken in a yard of a home in Yang Ming Shan, north of Taipei. This snake moves slowly, is quite docile and reluctant to bite. Pope (1935) in reviewing works of other authors states that this species feeds upon other snakes, especially



Hemibungarus sauteri

the blind snake, *Typhlops*. Unfortunately there is little information available on this uncommon species.

It is fairly well agreed (Pope, 1935) that the Asia coral snake, a distant relative of the kraits and cobras, although venomous, is of little danger to man due to secretive habits and rare occurrence. This is further supported by the collected records of Bei-Loo Chen (quoted by Keegan, 1956) showing that only three cases of bite by *Calliophis* were reported in Taiwan during the period from 1904 to 1938. It should be noted, however, (Keegan, 1956) that *Calliophis* is included in the list of snakes responsible for human deaths in Thailand.

***Hemibungarus sauteri* (Steindachner)**

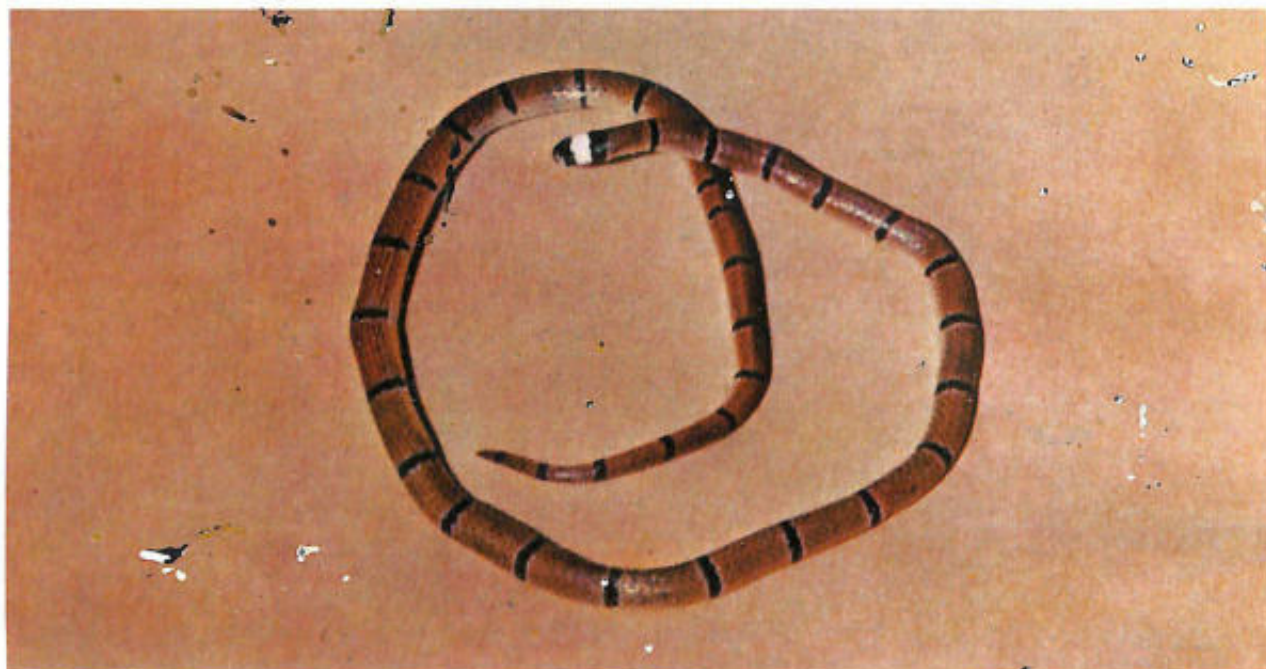
Poisonous

Common Names—Asia Coral Snake, Striped Red Snake

Description: Total length—24½-in. (16-in., Maki, 18 to 21¼-in., Wang and Wang); tail—2¼-in. or approximately a tenth of length. Medium to small snake; body—moderately stout, round; scale counts—13-13-13; tail—short, stout, tapers abruptly at end to strongly chitinated, rigid tip.

Contour of head—broadly rectangular to square; nose—short, broad, slightly

tapered to broad round end; nostril—inconspicuous, on side of nose; eye—medium size, dark gray to black, indistinct since it blends with dark color of head; iris—round, black; head—flattened posteriorly, convex anteriorly, slightly wider than but not separated from neck; dorsal shields—large, smooth but not distinct due to general coloration of upper head; upper head—dark brown black with broad cream or white band across head behind eyes; upper



Calliophis maclellandi.

labials—some white, some black, or mottled; *broad vertical white band involving last two upper labials*; fangs—small, anterior part of upper jaw.

Upper body—dark brown, crimson, iridescent; *distinctly marked with three dark longitudinal stripes from neck to tip of tail*, mid-dorsal stripe narrowest, involving one scale row and a half of the scales on adjoining row, broader lateral stripes involve scale rows one to three and part of upturned ventrals; *15 to 20 dark narrow bands* extending a half to two-thirds the way up the side from ventrals, these with partial borders of white; *five to six similar but less clearly marked bands on tail*; vertical bands on body and tail blend with and/or run through broad longitudinal lateral stripes; body and tail scales—smooth, glossy, iridescent.

Ventral head and neck—white to dirty white, mottled with black; lower labials—distinct lines of pigment at junction of anterior-most scales; ventral body—white to dirty white full length of body and tail,

irregular size and irregularly distributed spots or crossbands of black; ventral scales—large, smooth, glossy, outer upturned part black, 232 (249 to 269, Maki; 229 to 250, Wang and Wang); anal scale—divided; subcaudals—32 pairs (28 to 55, Maki; 29 to 31, Wang and Wang).

Distribution. This species is uncommon but it has been recorded from several widely separated localities on Taiwan (Maki, 1931; Wang and Wang, 1956). Similar species occur in the Ryukyu Islands and Pope (1935) states that the presence of *Hemibungarus* on Taiwan demonstrates the relationship of the faunas of these two areas with those in the Philippine Islands.

Habitat and Habits. There is only meager information on snakes of this genus. *Hemibungarus* is presumably nocturnal in its habits and occurs in wooded mountainous areas. It is a poisonous snake related to the cobras and kraits. However, due to its scarcity and habits, it poses no medical problems and bites have not been recorded for Taiwan.

Laticauda colubrina* (Schneider)*Poisonous****Common Name—Banded Yellow-Lip Sea Snake**

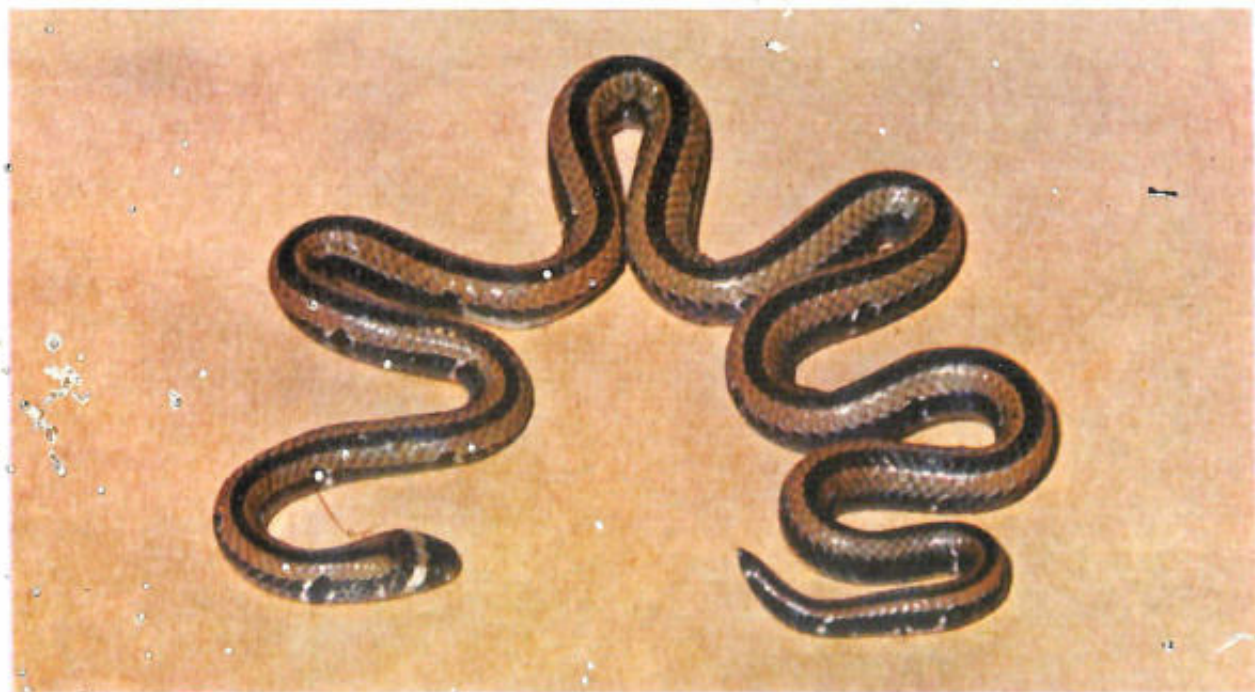
Description: Total length—34½ to 38-in. (38¾ to 46½-in., Maki); tail—3½-in. or approximately a ninth to a tenth of length. Medium to large snake; body—moderately stout; slightly compressed laterally, especially in posterior quarter; scale counts—(21 to 25 rows, Maki); tail—laterally compressed into prominent rudder-like organ, sides with large prominent scales.

Dorsal contour of head—broad, very slightly triangular; nose—short, broad, slightly tapered to broad, round end; nostril—small, on side of nose; eye—medium size, gray to blue gray, flecked with black; iris—round, black; head—flattened on top, only slightly wider than and not distinct from neck; dorsal shields—large, smooth, glossy, anterior yellow shields prominent due to dark sutures; upper head—distinctly marked, posterior scales black, anterior shields yellow, yellow extending to sides of head behind eyes; supra labials—lower half yellow, yellow extending posteriorly from

sides of nose to corner of mouth; tongue—flesh color, darkened by scattered black pigment, outer half of branches dirty white; fangs—medium size, rigid, in anterior part of upper jaw.

Upper body and tail—gray to blue gray, scales on upper body may possess cream color margins. Lower quarter to half of sides dirty white or cream-tinged with gray, scales may be prominent due to gray to gray brown borders; black, prominent bands with clearly defined borders on body and tail, 39 to 41 (38 to 54, Maki) on body (involving four to six scale rows) and three or four (four, Maki) bands on tail. Distal dark band much broader than others, bands on body fairly uniform in width but slightly narrower in neck region, first and second bands on neck fused with broad longitudinal band on sides of lower head; tail—terminates with narrow dirty white or cream band; body scales—smooth, very glossy, oily to touch.

Ventral head—prominent broad longi-

*Hemiburgarus sauteri*



Laticauda colubrina

itudinal stripe from mouth, extending posteriorly to join first two bands of body; ventral chin shields—dirty white to yellow; lower labials—black, frequently tinged with yellow; ventral body—dirty white to cream with black bands as continuation from sides of body, bands incomplete or variable in width and outline, involving one to four scales; light colored scales between dark bands may be prominent due to posterior and lateral margins of gray to gray brown; ventral tail—bands distinct; ventral scales—medium size, smooth, glossy, oily to touch, (225 to 245, Maki); anal scale—divided; subcaudals—none.

Distribution. Although *Laticauda colubrina* is recognized for its wide distribution across the Pacific and Indian Oceans, only a few specimens have been collected from the shores of Taiwan. Specimens in the NAMRU-2 collection were obtained from Lan Yu (Orchid Island), a small island 45 miles southeast of Taitung and at Oluanpi at the southern tip of the island.

Habitat and Habits. The banded yellow lip sea snake is associated with marine waters and rocky areas or coral along the

sea coast. Specimens taken at Lan Yu were removed from holes in outcroppings of coral exposed at low tide. Out of water *L. colubrina* is awkward but not as clumsy as its relative, *Laticauda semifasciata*. Its movements on land are slow and deliberate. As pointed out by other authors, there is considerable variance in opinion regarding the docility and disposition of this snake. All of the few specimens in our collection have been quite sluggish, docile and have shown little concern even when tormented repeatedly. These snakes have been credited (Keegan, 1960) with the possession of very potent venoms. However, to the author's knowledge there have been no deaths or even bites recorded for the peoples of Taiwan. Although marine in nature, individuals remain alive for several weeks in the laboratory without salt water.

Keegan (1960) found this snake very common on Ishigaki, north of Taiwan, where the snake is taken in great numbers. Smoked sea snakes are shipped to Okinawa and Japan where they are considered nutritious and are recognized for their medicinal qualities.

Laticauda semifasciata* (Reinhardt)*Poisonous****Common Names**—Common Sea Serpent, Broad Band Blue Sea Snake

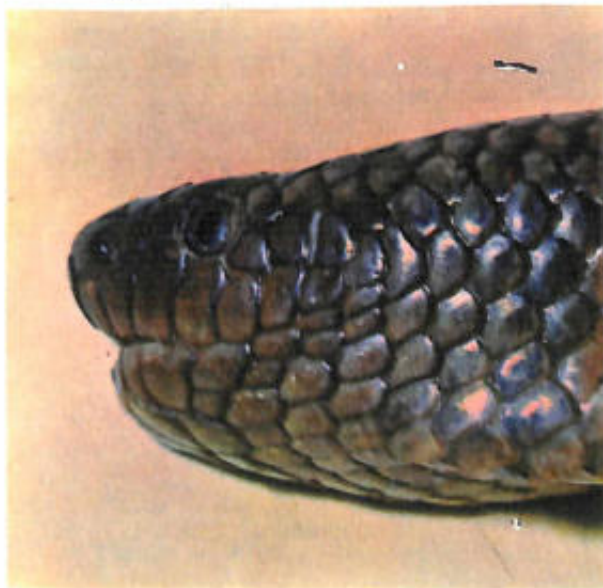
Description: Total length—36½ to 51-in. (24¾ to 47-in., Maki; 28¼ to 39½-in., Wang and Wang); tail—4¾ to 5¾-in. or approximately an eighth to a tenth of length. Large snake; body—stout or heavy, soft and flabby due to excessive fat, *moderately compressed (laterally) in posterior quarter*; scale counts — 23-23-21; tail — *compressed laterally into prominent rudder-like organ*, sides with large vertically elongated scales.

Dorsal contour of head—broadly triangular; nose—short, broad, moderately tapered to round end; nostril—medium size, on side of nose; eye—medium size, dark brown to black; iris—round, black, indistinct; head—flattened posteriorly, convex anteriorly, thick, approximately same width as and therefore not distinct from neck; dorsal shields—large, distinct, smooth; upper head—brown to olive black, frequently tinged with blue, usually with a broad band of lighter brown across head anterior to eyes. Some specimens also have lighter band across posterior part and extending down side of head, connected with narrow band (width of eye) directed posteriorly from eye; upper labials—large, pro-

minent, dark but may be slightly lighter than dorsal head; tongue—red to purple, outer half of branches white; fangs—medium size, rigid, in anterior part of upper jaw.

Upper body and tail—brown to gray brown, or gray black, frequently tinged with blue, dark specimens have diffuse black pigment on scales, pigment may be condensed to form dark margins on some scales; body and tail bands—*variable in prominence, range from indistinct gray brown to black, 36 to 38 (25 to 45, Maki) on body*; dark bands (involving three to five scales) on body, broadest at vertebral line, tapered or narrow near latero-ventral line (diamond shape from dorsal view) and may continue onto ventral body, *six to eight (five to seven, Maki) bands on tail*, usually uniform in width (involving four to six scales) and continuous around tail, last band extends to tip of tail; tail scales—those between bands may be plain or rendered distinct by black margins; body scales—smooth in appearance and glossy to the touch.

Ventral head—yellow to yellow gray, tinged with medium black, lateral neck scales (gulars) darker than those at center

*Laticauda colubrina**Laticauda semifasciata*

Snakes of Taiwan

of lower head; chin plates and lower labials—well-developed, prominent; lower part of rostral—deep, prominent notch or concavity; ventral body—yellow gray to blue gray; color uniform in specimens with indistinct upper body bands but vague bands involving three to five ventral scales appear on specimens with prominent upper body bands; underside of tail—bands more prominent than on body; ventral scales—medium size, much smaller in anterior than in posterior quarter of body, smooth, glossy; scales on posterior half to two-thirds of body with mid ventral keel or dividing line; 196 to 203 (178 to 200, Maki; 197 to 199, Wang and Wang); anal scale—divided; subcaudals—21 to 25 (30 to 35, Wang and Wang) from anus to beginning of mid ventral “fin” ridge of the outer tail.

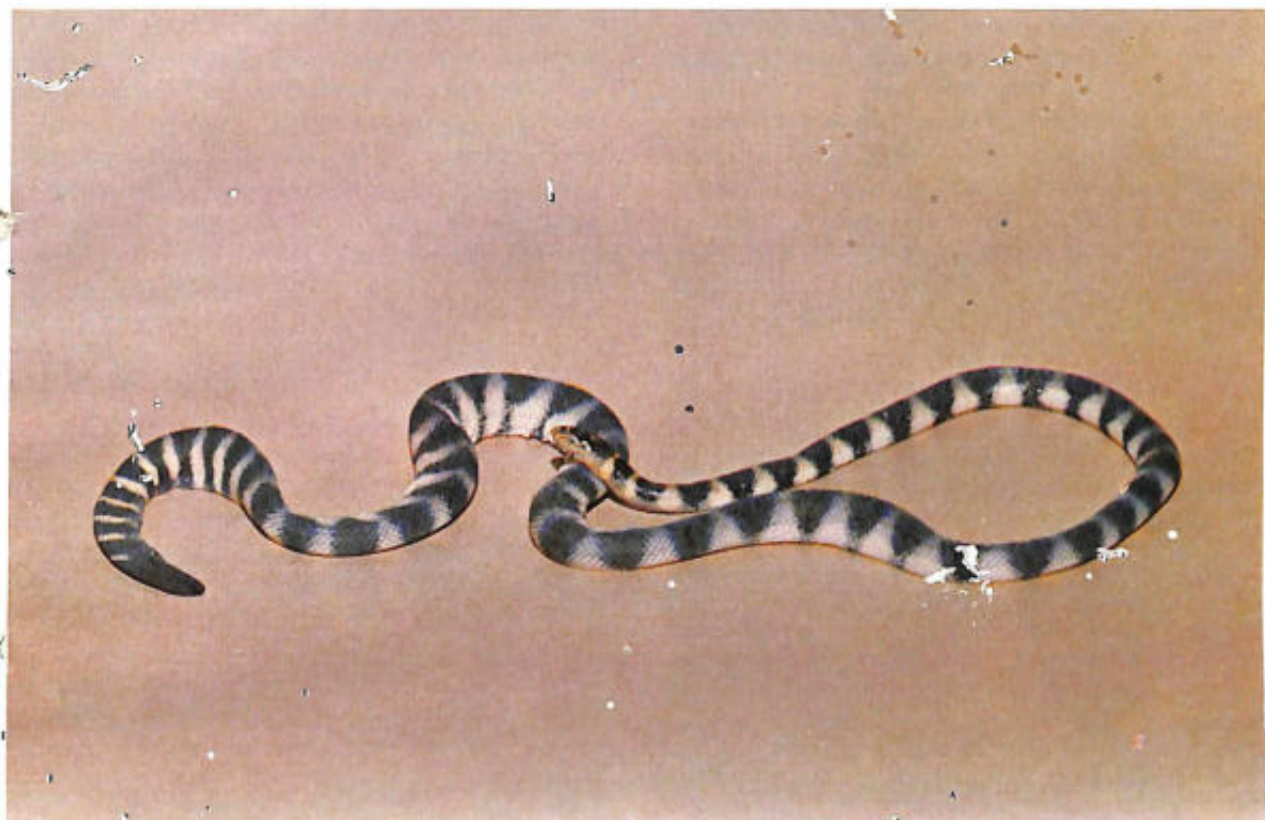
Distribution: *L. semifasciata*, the largest

of the sea snakes of this genus, is widely spread in the waters of the Pacific and Indian Oceans. Only limited numbers of this snake have been captured. The NAMRU-2 specimens were collected at Keelung, Tamsui, Taitung and on Lan Yu (Orchid Island), a small island east of southern Taiwan. Numbers of sea snakes, probably of this species, have been reported in waters a short distance from shore at different places around the island and in the Pescadores.

Habitat And Habits: This sea snake has been found in and around out-croppings of coral or in holes eroded in dead coral. Although *L. semifasciata* may be found in open water, it has a tendency to spend most of its time near shore. According to Ditmars (1957) this species seeks tide pools and flats to give birth to living young. Although there seems to be a great fear



Laticauda semifasciata

*Hydrophis cyanocinctus*

of sea snakes in general, this species has not struck or attempted to bite when captured in the wild or after being brought to the laboratory. On Orchid Island *L. semifasciata* and *L. colubrina* were handled with impunity. Boys took great delight in throwing living snakes into a group of girls or in draping them around the necks of smaller children.

This snake has been credited with possessing potent venom, but, to the author's

knowledge, there have been no records of death from the bite of this species among the hundreds of men who make their livelihood at marine fishing around Taiwan. It is of interest to note (Schmidt and Inger, 1957) that in prewar days this snake was captured in great numbers in the central islands of the Philippines by Japanese fisherman. *L. Semifasciata* was considered a delicacy and the meat was readily marketable in Japan.

***Hydrophis cyanocinctus* Daudin**

Poisonous

Common Name—Common Sea Serpent

Description: Total length—37½ to 50-in. (41 to 71-in., Maki; 70-in., Wang and Wang); tail—3½ to 5-in. or less than one-tenth of length. Medium to large snake; body—long, *anterior part of body smaller* than posterior half which is large and flabby due to excessive fat, tends to flatten due to body weight; scale counts—variable,

29(30)-35(43)-35(39); tail—*short, laterally compressed into fleshy rudder-like organ.*

Dorsal contour of head—oval; nose—broad, with round end; nostril—small but conspicuous, on top of nose, may be closed by dark membraneous flap; eye—small, near top of head, black finely flecked

Snakes of Taiwan

with yellow; iris—round, large, black; head—thick, convex posteriorly and anteriorly, slightly wider than and therefore not distinct from neck; dorsal shields—large, smooth, glossy; upper head—dark gray brown to mottled black with areas of dirty yellow; to light brown; upper labials—lighter than upper head, finely flecked with yellow; tongue—flesh colored, branches pink to dirty white; fangs—small, rigid, in anterior part of upper jaw.



Hydrophis cyanocinctus

Upper body—dull to dirty yellow, may be slightly tinged with orange or salmon; 55 to 60 (49 to 60, Maki) black to blue black crossbands of varying size, shape and intensity of pigmentation; bands usually broader at vertebral line, tapering ventrally to produce diamond shape design from dorsal view; bands connected ventrally by longitudinal stripe of dark gray or black; bands in anterior third of body tend to be more prominent than on rest of body; tail—five to seven bands similar to those on body, plus broad terminal band; body scales—weakly keeled, glossy scales on anterior quarter of body, scales progressively roughened posteriorly, well-developed but rounded keels at mid body; scales approximately equal in size except for slightly enlarged row of modified scales on mid-ventral line.

Ventral head and neck—gray to black, pigmented areas extend posteriorly to join mid ventral line of black or blue black; ventral body—variable, bands separated with areas of dirty yellow to dirty white or gray; ventrals—tuberculated, elliptical rhomboids and approximately twice the size of dorsal scales, 340 to 375 (299 to 362, Maki; 371, Wang and Wang); anal scale—divided into two pairs; subcaudals—two to three pairs plus 44 to 47 non-divided scales (37 to 56, Maki; 44, Wang and Wang).

Coloration and prominence of body designs vary considerably with age in this species. Although most snakes have a tendency to acquire dull hues of color and lose distinct designs a few days prior to shedding of skin, this condition is especially apparent with *H. cyanocinctus*. Furthermore, this sea snake, when out of water for several hours, may appear quite different from another individual of the same species which is in the water.

Distribution: This species is widely distributed in waters from the Persian Gulf to Japan. Its relative abundance in marine waters around Taiwan is uncertain. Reports seem to be variable and unreliable. Apparently *H. cyanocinctus* is encountered frequently by marine fishermen around Taiwan and the off-shore islands. It has been captured by fishermen from several villages along the west coast of central Taiwan. Specimens in the NAMRU-2 collection were taken at Tamsui, Keelung and in the Pescadores (Peng Hu) Islands.

Habitat and Habits: This sea snake has been observed frequently in the off-shore waters and at certain times of the year is removed from the nets of fishermen in considerable numbers. *Hydrophis* is definitely uncomfortable and out of place when out of the water. At times this sea snake makes a low rasping sound by rubbing keeled scales of one part of the body against another. It bears its young alive and presumably feeds upon marine fishes. *Hydrophis* usually does not strike, attempt to bite or even assume a defensive attitude.

However, one of the 15 specimens brought to the NAMRU-2 laboratory was vicious, active and struck freely when molested.

Although classed as poisonous, *Hydrophis* is not necessarily dangerous. As a rule, it does not attack man even when circumstances would seemingly demand defensive measures. In some fishing villages on Taiwan the people claim little fear of this

snake and state that it may be handled with little danger of being bitten. However, there must be a time, possibly during the mating season, when the temperament of this snake is quite different and bites can be expected. Although documented records are not available, fishermen in the Pescadores claim that a few deaths occur each year as a result of bites by *Hydrophis*.

***Pelamis platurus* (Linnaeus)**

Poisonous

Common Name—Yellow Bellied Sea Snake

Description: Total length—24 to 27¾-in (24 to 28-in., Maki; 25½-in., Wang and Wang); tail—2-1/2 to 3-in. or approximately an eighth of length. Medium size snake; body—eel-like in appearance, moderately heavy, vertically compressed so that height is greater than width, especially posterior half of body; dorsal body round and tapered ventrally to mid-ventral

ridge; skin loose due to excessive fat; scale counts — 47-52 (50)-47; tail — distinctly marked, flattened vertically with thin upper and lower margins, saddle-like.

Dorsal contour of head—elongate triangle, somewhat resembling crocodile; nose—long, narrow but moderately tapered to blunt round end; nostril—on top of nose, medium size, conspicuous; eye—medium



Pelamis platurus

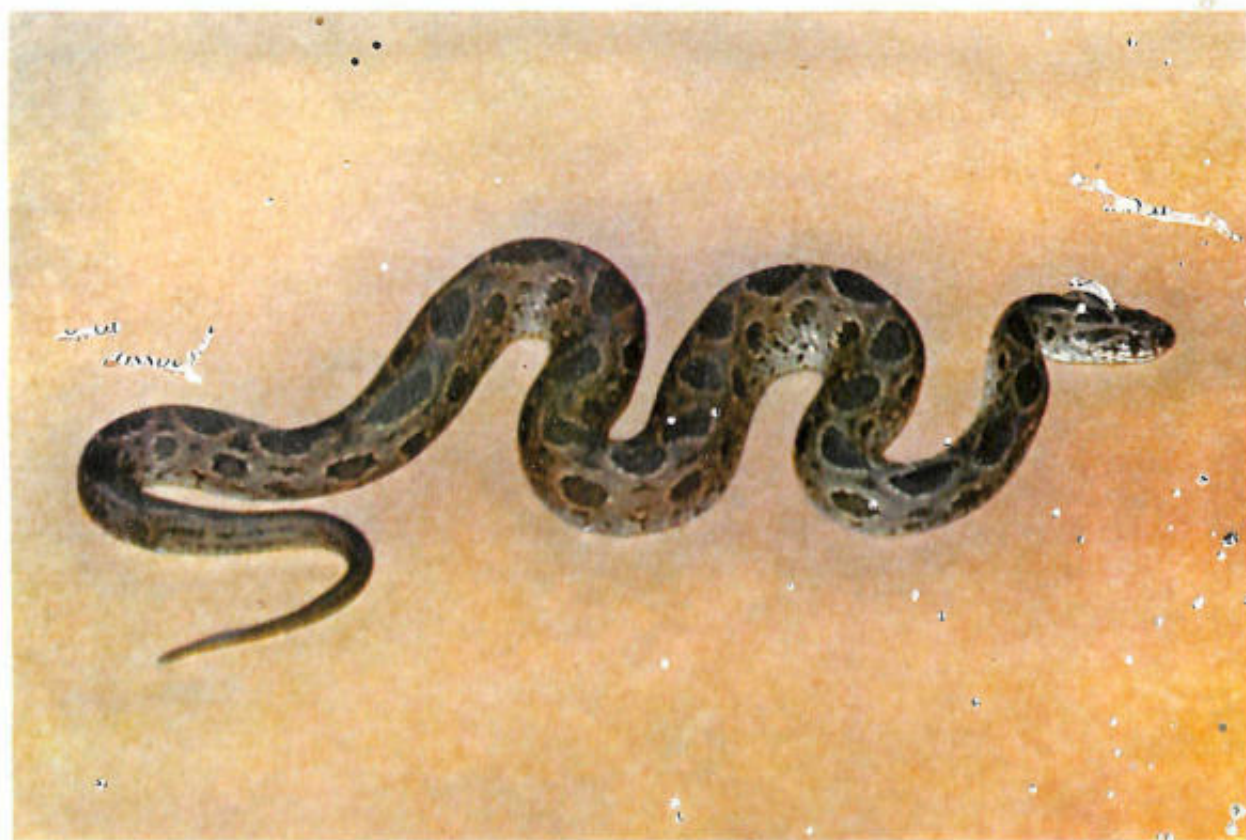


Pelamis platurus

size, dark brown or black, tends to blend with dark color of upper head; iris—round, black, surrounded by ring of diffuse yellow

to light brown; head—flattened posteriorly, slightly convex anteriorly, bulging slightly over eyes, posterior width greater than but only slightly separated from neck; dorsal shields—large, smooth but not necessarily prominent due to coloration and weak sutures, leathery to touch; upper head—uniform deep brown to gray black; upper labials—brown to dark dirty yellow, the line of demarcation extending onto sides of neck; tongue—small, poorly developed, seldom seen in living snake, branches white to dirty white; fangs—moderate size, rigid, in anterior part of upper jaw; not easily distinguished from adjacent enlarged teeth.

Upper body—15 to 17 scale rows (upper third to half of body) dark brown to velvet black, distinct line of demarcation between upper and lower body, line of separation straight to a point one to three inches anterior to anus where it may be come wavy; lower body—yellow to dark



Vipera russescii

dirty yellow; tail — irregular patterns of black forming five to eight bands, i. e. ovals, rough rectangles or partial bands with rounded ends; these dark designs extend down from upper margin of tail, alternating with similar bands extending upward from bottom; areas between bands cream to dirty yellow; *body scales*—hexagonal or quadrangular, approximately equal in size, no differentiation into enlarged ventrals, slightly roughened, not keeled, dull in appearance, leathery to touch; scales along mid ventral line form a ridge which is more prominent in posterior half of body.

Ventral head and body—dirty to medium bright yellow; ventral scales—approximately 312 to 324 scales along mid ventral line (counted with difficulty); anal scale—none (four pre-anal scales); subcaudals—approximately 45 scales along mid-line of tail.

In our experience, sub-adult individuals tend to be brighter in color than the larger snakes.

Distribution: This sea snake probably occurs in marine waters all around Taiwan but specimens in the NAMRU-2 collection were obtained from fishermen at Keelung and Tamsui on the northern coasts. It has been reported from the Pescadores. *Pelamis* has a wide distribution, occurring commonly in waters of Malayasia, in the Indian and Pacific Oceans, and ranging to



Vipera russelli

the west coast of Mexico and South America.

Habitat and Habits: *Pelamis* is a sea-dwelling species occasionally seen near shore but usually taken at sea by fishermen. It is an efficient swimmer but definitely handicapped out of water. On land its movements are awkward and similar to those of an eel. This snake is presumably a marine fish eater and has a fish odor. According to Pope (1935) *Pelamis* is ovoviviparous, bearing its young alive. Although poisonous, with venom of the neurotoxic type, it makes little or no attempt to bite in captivity. There have been no reports of bites on Taiwan in recent years.

***Vipera russelli* Shaw**

Common Names—Russell's Viper, Seven-Pacer, Chain Snake

Description: Total length—29½ to 39¼-in (20½ to 31½-in., Maki; 33-1/3 to 39-1/3-in., Wang and Wang); tail—3½ to 4¾-in. or approximately an eighth or a ninth of length. Medium size snake; body—stout, slightly flattened; scale counts—(variable), 29(30)-27(29)-21, usually 27 at mid-body; tail—short, tapers rapidly from wide base to moderate or blunt tip.

Dorsal contour of head—triangular; nose narrow above, moderately tapered to round

end; nostril—large, conspicuous, located in concavity on side of nose; eye—medium size, dark gray black, dappled with dirty yellow; iris—vertically elliptical, black with conspicuous gray to yellow border; head—anterior part more flattened than posterior part, scale over eye well developed, angular ridge from upper eye to nostril, head much wider than and distinct from neck; upper head—chocolate to dark brown black, three large prominent designs

Poisonous

Snakes of Taiwan

on head, one triangular design between eyes, two roughly symmetrical kidney shaped designs posteriorly; *dorsal scutes*—most scales equal in size; heavily keeled, rough; upper labials—white to cream mottled with dark pigment, some may have vertical or oblique bands varying in width and shape; tongue—dark gray to black, outer branches gray; fangs—large ($\frac{3}{8}$ to $\frac{5}{8}$ -in.), hinged from upper jaw.

Upper body and tail—brown to gray brown or chocolate, entire upper body with blotches or designs of variable size, shape and distribution; 23 to 28 (depending on fusion) prominent designs, usually with narrow gray to light brown borders along dorsal part of body, these usually extend midway onto tail as a broad longitudinal band; a second series of similar blotches on sides of body, these tend to alternate with dorsal designs; one longitudinal line of small designs of variable size and shape occur above and one below the lateral line of medium size blotches; body and tail scales—heavily keeled, rough, dull.

Ventral head and neck—white to very light gray, speckled with diffuse black pigment; chin plates and gulars—possess areas of black in posterior field of each scale, presenting an overall polka-dot appearance; ventral body—progressively darker

posteriorly due to flecks of dark gray or black pigment, one to five semicircular designs on ventrals, base of design on posterior edge of scale, these erratic in distribution but frequently arranged in checkerboard fashion; underside of tail—darker than body; subcaudals—varying quantities of gray or black pigment, margins white to light gray; ventral scales—very large, smooth, glossy, 158 to 168 (160 to 168, Maki; 157 to 169, Wang and Wang); anal scale—entire; subcaudals—40 to 46 pairs (42 to 54, Maki; 46 to 49, Wang and Wang).

Distribution. This snake, a true viper, has been collected in the southern third and on the eastern side of the central mountain range in Taiwan. Geographical races of *Vipera russelli* range from Ceylon northward through India and to the western Himalayas. It has been taken also in Kwang-tung Province of mainland China. Apparently those common to mainland Asia attain a larger size than the Taiwan form.

Habitat and Habits: Russell's viper occurs in medium to low mountainous wooded areas as well as on coastal plains. This snake is nervous and vicious for several weeks after brought into the laboratory. It assumes a coiled defensive stance but does not strike at moving objects or animals until they come into effective biting range. However, interviews with hunters and indigenous people indicate that this viper in the wild may be aggressive and strike without notice. When excited, the body vibrates and there is a low rasping sound made by rubbing of scales of one part of coiled body upon another. In the laboratory most individuals also make a low guttural hissing sound when annoyed. The Russell's viper in captivity feeds upon rodents. Snakes of the genus *Vipera* bear living young.

This viper differs from other poisonous snakes of Taiwan in possessing both *hematoxic* and *neurotoxic* venoms. There have been only a few bites reported, i.e. one or two per year (Lin, 1954), and, consequently, there are no reliable figures on



Agkistrodon acutus

mortality rates, at least for Taiwan. In India and other parts of Asia, it is considered

a dangerous species and mortality rates are high (Keegan, 1960).

***Agkistrodon acutus* (Guenther)**

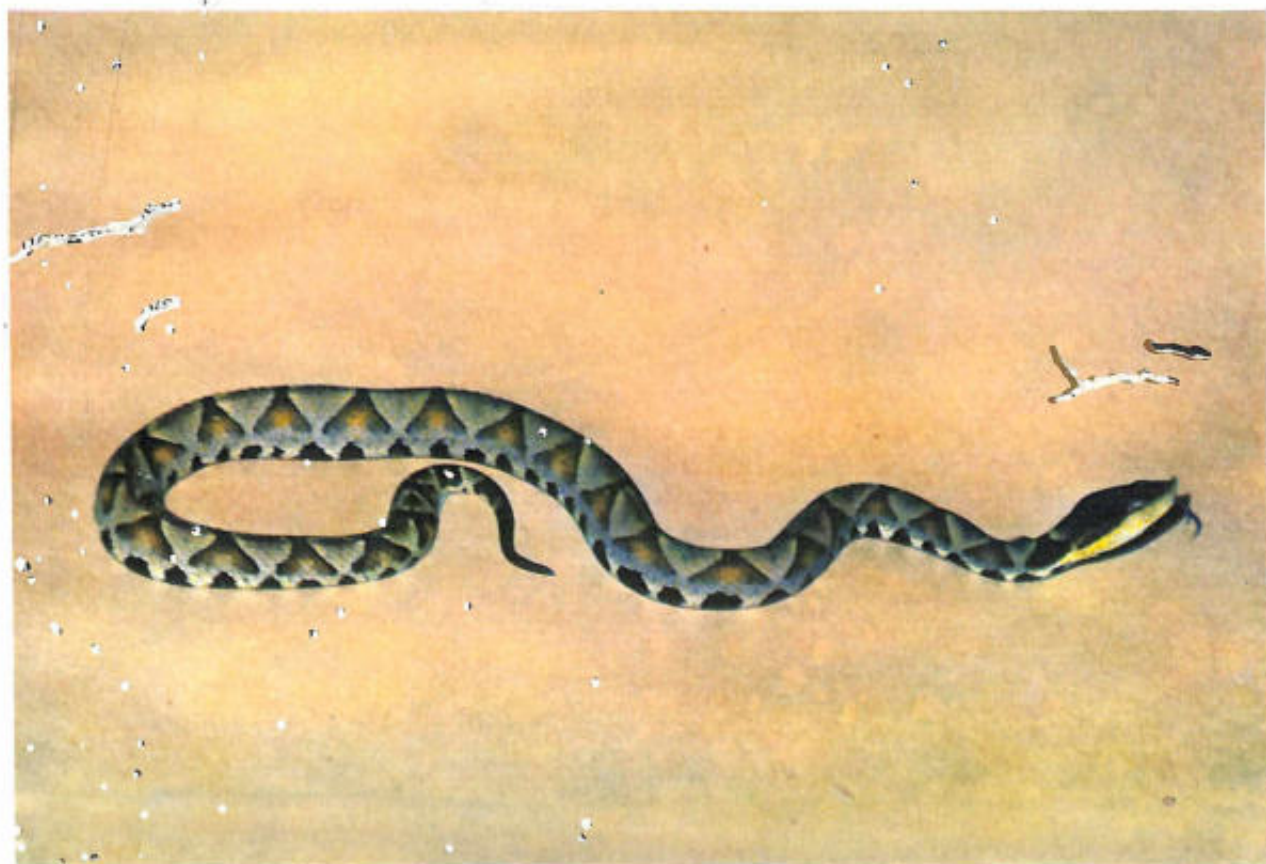
Poisonous

Common Names—100-Pacer, Five-Pacer, Snake of 100 Designs

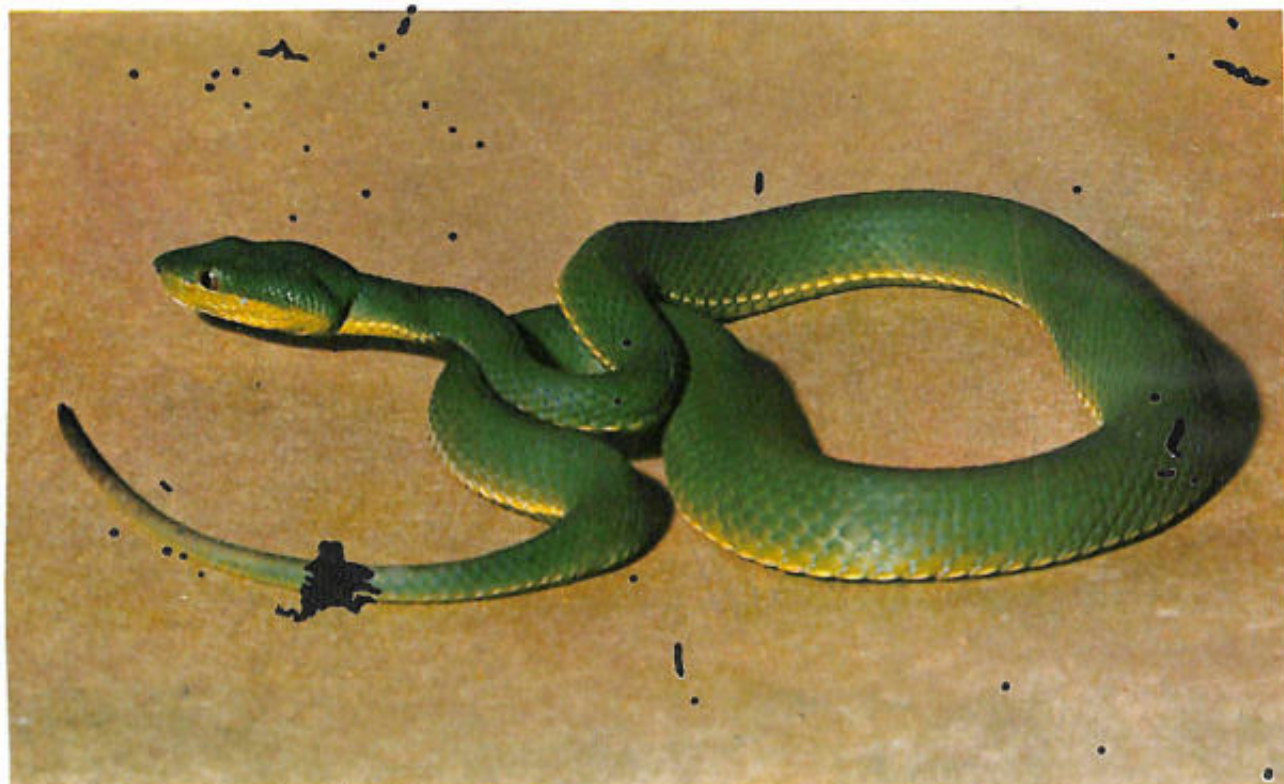
Description: Total length—37 to 47½-in. (20 to 49-in., Maki; 28¾ to 49¾-in., Wang and Wang); tail—5 to 7½-in. or approximately an eighth or a ninth of length. Medium size snake; body—stout, short, slightly flattened horizontally, height less than width of body; scale counts—21-21-17; tail—short, moderately thick, tapered to blunt tip with prominent, terminal chitinous scale.

Dorsal contour of head—broad triangle; nose—rapidly tapered to knobbed tip, i. e. prominent turned up snout; nostril—moderate size, on side of nose at base of snout; eye—medium size, near top of head, light

brown to brown, dappled, upper third lighter than lower part; iris—narrow, vertical, black, bordered with yellow; prominent pit midway between eye and nostril; head—flattened posteriorly but convex anteriorly and between eyes, much wider than and distinct from the neck; dorsal shields—large, broad, dull, tuberculated surface; smaller scutes on back of head strongly keeled; upper head—uniform rich dark brown to chocolate brown, prominent dark brown oblique stripe extending from eye posterior to and beyond corner of mouth; upper labials and sides of head—cream to light yellow, with areas of scatter-



Agkistrodon acutus



Trimeresurus stejnegeri

ed brown pigment; tongue—black; fangs—large, retractable, located in fleshy sheath in anterior part of upper jaw.

Upper body and tail—multicolored, varying shades of dull gray, brown and chocolate; 19 to 22 dark triangular designs on side of body, apex of each directed dorsally, usually uniting at vertebral line with similar design from opposite side, triangles may be staggered or show varying degrees of confluence; designs tend to be more triangular at mid body than on neck or posteriorly, base of triangular designs usually on second or fourth row of scales, these rows frequently tinged with salmon or light copper; anterior designs may be less distinct since dark brown of triangles tend to blend with dull gray brown background, posterior designs may be bold due to greater contrast with background of light brown; upper tail—five or six dark designs, which form broadly fused triangles, bands over top, posterior third of tail dark brown to black; body scales—from parietals to tip

of tail, rough in appearance and touch, strongly keeled, dull.

Ventral head—yellow to dirty white; lower labials, chin plates and some of gulars—scattered small distinct specks of black pigment; ventral body—white to light cream, irregular areas of designs involving one or several ventrals) of black from neck to mid-tail; a series of larger designs occurs at fairly regular intervals near latero-ventral junction, the black pigment extending onto the first or second scale rows; underside of tail—varying areas of pigmentation, usually a mid-ventral line of black from anus to posterior third of tail; ventral scales—large, smooth glossy, 160 to 166 (152 to 169, Maki; 158 to 176, Wang and Wang); anal scale—entire; subcaudals—51 to 56 pairs (51 to 54, Maki; 49 to 54, Wang and Wang).

Distribution: Records and literature indicate that the 100-pacer occurs in central and south Taiwan and up the coast to Hualien. This species also occurs in the

eastern provinces of mainland China and south into Viet Nam.

Habitat and Habits: The 100-pacer has been reported from mountainous and forested areas, especially on the lower mountain slopes or rocky hills with small valleys offering ideal protection. This species is an egg layer (Maki, 1931). In captivity the 100-pacer typically remains in a coiled position ready to strike at any time. However, they seldom strike unless prey comes within effective range. *A. acutus* will attempt to bite when molested or teased. A few individuals have fed upon rodents in captivity.

***Trimeresurus stejnegeri* Schmidt**

Common Names—Taiwan Bamboo Viper, Bamboo Snake, Red-Tail Snake

Description: Total length—20 to 29½-in. (18½ to 31¾-in., Maki; 9½ to 30½-in., Wang and Wang); tail—4 to 6-in. or approximately one-fifth of length. Medium size snake; body—stout or robust; scale counts—21-21-15; tail—small, moderately tapered to medium point.

Dorsal contour of head—broad, roughly triangular; nose—tapered to round tip; nostril—small, on side near tip and top of nose, prominent pit (pit viper), three to five times size of nostril between eye and nostril; eye—medium size, high on head, forms slight bulge on upper head; distinctly rusty brown or brick red, flecked with cream; iris—vertically elliptical, black, with narrow margin of cream or light orange; head—flattened, much broader than and therefore distinct from neck, prominent angular ridge from upper eye to end of nose; dorsal shields—no true shields, head covered with small scales; upper head—medium to dark green, frequently with white or light cream line extending from lower edge of eye posteriorly over corner of mouth, and onto sides of neck (line variable, a sexual characteristic, usually more prominent in male), in males white line may be bordered with brick red or rust; tongue—flesh color, darkened by diffuse black pigment, end of branches dirty white;

The 100-pacer is one of the more dangerous snakes of Taiwan because of its body size and large hinged fangs which permit effective delivery of large quantities of venom. Venom is of the hemotoxic type, affecting the vascular or circulatory system. This species is well respected and usually recognized by all indigenous people as one of the most venomous of snakes. Statistically (Lin, 1954) *A. acutus* is rated fifth in the number of bites to man by the six statistically significant species of poisonous land snakes on Taiwan. It, however, is listed as first in mortality.

Poisonous

upper labials—light to bright yellow; fangs—long, moveable, in fleshy sheath in anterior part of upper jaw.

Upper body—uniform dark green to chartreuse, frequently dull in appearance, white or cream line or a combination of this and a brick red line, (involving first and second scale rows) above latero-ventral junction; white line only in females, white on upper part of each scale of first row; in males with both white and red lines, white occurs on upper half of scale,



Trimeresurus stejnegeri

*Trimeresurus mucrosquamatus*

red on lower half; lateral lines on body are variable, may extend full length of body and onto tail, or may occur only on parts of body; upper tail—variable, may be same green as rest of upper body, but usually tinged with dull diffuse rusty red, color more intensive along vertebral line and distal quarter or third of tail; body scales—rough, with well-developed keels, dull in appearance.

Ventral head—light yellow green to bright green, no designs or mottling; lower labials—slightly darker than chin shields; ventral body—uniform bright green lighter than dorsal body, anterior third of ventral body tends to be slightly lighter than rest of under body; ventral scales may be rendered distinct due to narrow white posterior margins; underside of tail—subcaudals clearly differentiated by narrow white margins, distal quarter to third of tail tinged with dull, diffuse rusty red; ventral scales—large, smooth, glossy, 156 to 172 (158 to 169, Maki; 158 to 167, Wang and Wang); anal scale—entire; subcaudals—63 to 72 pairs (53 to 73, Maki; 59 to 73, Wang and Wang).

Trimeresurus stejnegeri is characterized in part by its sexual dimorphism. Differences in body markings, i.e. the white and

brick red lateral lines, have led to confusion in the taxonomy of the bamboo vipers. Maki (1931) and Wang and Wang (1956) recognized three subspecies of *Trimeresurus gramineus* for Taiwan. A study of the body markings of snakes in the NAMRU-2 collection indicates that there probably is only one species found on the island. There are variations in the coloration and degree of development of the lateral lines in both the males and females. In general, however, the males of *T. stejnegeri* are characterized by the presence of white and brick red lines on the body. Females, on the other hand, have only a white or cream colored line. The length or completeness of line(s) along the sides of the head, body and tail varies with individuals. Pope in 1935 acknowledged this difficulty among taxonomists who have taken sexual differences in coloration as an indication of different subspecies. Mao (1962) has recently given a more detailed account of color variations as related to sexual dimorphism in *T. stejnegeri*.

Distribution: The bamboo snake is found throughout Taiwan. Although it has been reported from Mt. Ali (Maki, 1931), it occurs more commonly at the lower altitudes of wooded, shrub and mountainous areas. It is associated with green vegetation and according to local people frequently is found in bamboo thickets or hedge rows surrounding the fields in agricultural areas. The same or a closely related species of *Trimeresurus* occurs on the island of Hainan and in the eastern provinces of mainland China.

Habitat and Habits: *Trimeresurus stejnegeri* is an arboreal snake frequently observed in green shrub several feet above the ground. It has a prehensile tail which assists somewhat in its movements. Many specimens have been captured by our collectors or by farmers in bamboo, in citrus trees and low brush on hillsides with alternating fields or rice paddy. A few have been taken in the bushes along streams in deep valleys on the eastern coast of Taiwan. In the wild this snake is unusually active at night. In

its natural habitat it probably subsists on frogs and field mice. The viper adapts fairly well to the laboratory although it is often quite vicious and strikes readily at moving objects during the first week of confinement. When coiled and in a defensive attitude, it may vibrate its tail as a means of warning. In keeping with their arboreal habits, some of the specimens in a cage seek the highest point of attachment and may hang by their prehensile tail for hours. This species bears its young alive.

The bamboo viper produces *hemotoxic* venom. Although recognized as a poisonous reptile, the bamboo snake is not greatly feared by farmers. Collectors have been observed to handle this species freely, if not carelessly, but seldom experience bites. Since this snake is closely associated with the activities of field workers, it holds first position in the list of frequency of snake bites. The mortality rates for bites by *Trimeresurus stejnegeri* (Lin, 1954) are estimated at one or two per cent for Taiwan.

Trimeresurus mucrosquamatus (Cantor)

Poisonous

Common Names—Taiwan "Habu," Turtle-Designed Snake

Description: Total length — $31\frac{1}{4}$ to $50\frac{1}{2}$ -in. ($14\frac{3}{4}$ to $43\frac{1}{2}$ -in., Maki; $14\frac{3}{4}$ to $45\frac{3}{4}$ -in., Wang and Wang); Tail— $5\frac{3}{4}$ to 9-in. or approximately one sixth to one seventh of length. Medium size snake; body—moderately stout to slender; scale counts—usually 29-27-21 but variable; tail—medium size, tapers quickly to thin filament and sharp tip:

Dorsal contour of head—broad, distinctly triangular; nose—triangular, tapers quickly to narrow but round tip; nostril—small, inconspicuous on side near top and tip of nose, large triangular pit between nostril and eye; eye—medium size, high on head, light brown to tan dappled with cream which blends well with color of head, horizontal brown to brown black band of diffuse pigment across middle of eye, this in line with dark brown band posterior to eye; iris—vertically elongate oval or elliptical, black, surrounded by well-defined band of yellow; head—distinctly flattened, much wider than and distinctly separated from neck, well-developed scale (supra-ocular) above eye, angular ridge from upper eye to end of nose; dorsal shields—no true shields, head covered with small scales, giving beaded appearance; upper head—brown to dark brown, with longitudinal patterns of darker brown of varying intensities; prominent dark band extends from eye to corner of mouth; a second pair of longitudinal designs extends

from nostril over eye and posteriorly, parallel with band back of eye; a third pair of bands, irregular in width, disposition and degree of fusion extend from level of posterior eye into region of mid dorsal line and posteriorly to join with design(s) on neck; sides of head lighter than dorsal surface; upper labials—dirty white to tan; tongue—dark gray to black, stem lighter than branches; fangs—large ($\frac{1}{4}$ to $\frac{5}{8}$ -in.), movable, in sheath in anterior part of upper jaw.

Upper body—light brown to brown with many designs of chocolate to brown black; 40 to 60 dark areas or designs meet at, or cross, the vertebral line; 15 to 20 designs on tail; some designs separate, some coalesce with mates from opposite side of body, in some specimens designs alternate in position along vertebral line giving checkerboard effect from dorsal view; spots have tendency to form broad wavy band along vertebral line on posterior body and tail; other dark designs involving three to six scale rows and separated by three to six rows of scales form longitudinal broken line on each side of body, these tend to be in line with designs on upper body and may extend onto ventrals; dorsal and lateral dark spots may or may not have narrow margins of cream or light brown, margins when present usually more prominent on patterns along vertebral line; in some specimens entire body may be tinged with a

Snakes of Taiwan

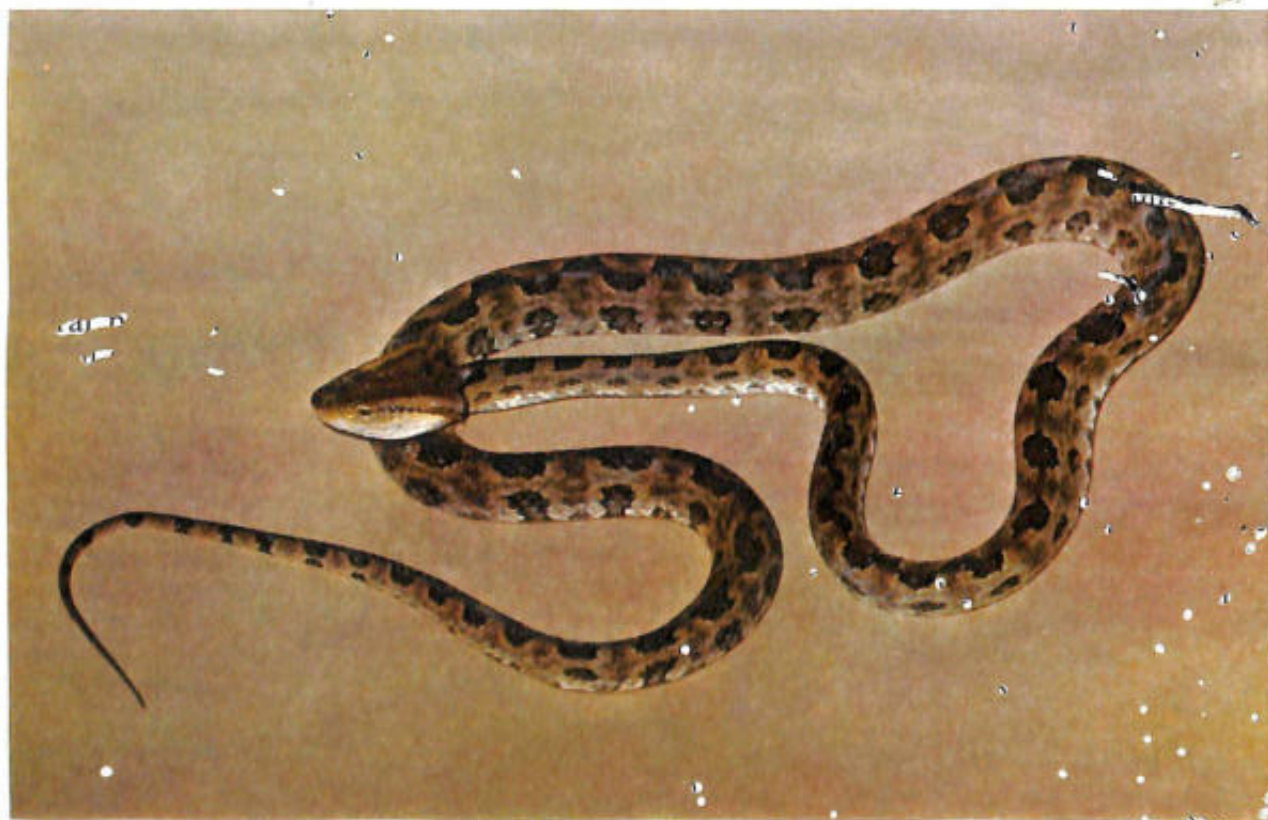
bronze or deep salmon; body and tail scales—dull, rough to touch, heavily keeled, first or second scale rows may be smooth or weakly keeled.

Ventral head—dirty white to diffuse light gray; mental, lower labials, and adjacent gulars—may be shaded by varying quantities of scattered black pigment, some specimens with light to medium dark spot on lower jaw involving two to four of posterior lower labials and adjacent gulars; ventral body—dusky light gray brown, gradually darker toward posterior part of body, entire lower surface conspicuously mottled with diffuse gray to diffuse gray brown spots, spots may be square and arranged roughly as a checkerboard or dark designs may be arranged to form moderately broad irregular longitudinal lines; underside of tail—similar to body, usually darker, with more prominent mottling; ventral scales—large, smooth, glossy, 205 to 214 (200 to 219, Maki; 203 to 228, Wang and Wang);

anal scale—complete; subcaudals—80 to 94 pairs (78 to 95, Maki; 79 to 98, Wang and Wang).

Distribution. The habu is very common and widely distributed on Taiwan. It also occurs in the provinces of southeast China.

Habitats and Habits. *Trimeresurus mucrosquamatus* is readily recognized by the indigenous peoples of the island. It occurs in a number of habitats but seems to be more common at lower altitudes in mountainous or hillside areas with grass, low shrub and moderate forest. It has been reported from Mt. Ali (Maki, 1951) at approximately 6,000 feet. There is one report of a number of habus in a small cave near Taitung. The snakes seek refuge in the cave during the hottest part of year. The habu frequents agricultural areas, has been captured around human habitations and, therefore, is of greater potential danger than some of the other venomous snakes.



Trimeresurus mucrosquamatus

This snake occurs within the city of Taipei and one specimen has been taken inside a western-style house. Many specimens have been received from residents of Tienmu, Peitou and Yang Ming Shan, just outside the city.

Like most snakes, the habu may be seen during the day but is more active and on the move at night. This species is less active than some of the other snakes. It will strike when cornered in its natural habitat but normally becomes quiet after a few days in the laboratory. The habu varies considerably in disposition; some are vicious and

strike when tormented, others are quite docile and sluggish. In captivity, *T. mucrosquamatus* eats small rodents and birds.

The habu produces hemotoxic venom and is equipped with well-developed fangs which hinge from the upper jaw. Statistics based upon figures of Omura (Lin, 1954) indicate that *T. mucrosquamatus* is second in the number of human bites. An average of 116 bites per year was recorded in Taiwan for the period from 1923 to 1932. The mortality rate was approximately 7.3 per cent.

Note on the Cultural and Economic Importance of Snakes in Taiwan

Snakes play a colorful part in the folklore of the Orient, as well as of the Occident. The Chinese, perhaps in particular, are devoted to reptilian myths and fantasies such as the numerous legends concerning the dragon, a beast without clearly defined terrestrial relations but with a number of serpentine characteristics.

Dragons have little place in our more workaday world, but the snakes of Taiwan provide the basis for a small but busy industry. The most conspicuous product is ornamental snake skin for shoes, handbags, billfolds, belts, canes and even neckties! Tourist purchases of both finished articles and prepared skins have increased sharply over the past few years. Exports, mostly to Hong Kong, have also risen. Taiwan lacks the large species found in some other parts of the world but the size is ample and the quality sufficiently good to bring premium prices. Most of the skins are dyed after tanning.

Among commonly used skins for shoes and handbags are the beauty snake (*Elaphe taeniurus*), the Oriental rat snake (*Ptyas mucosus*) and the rough-scaled or Taiwan stink snake (*Elaphe carinata*). Smaller snakes, such as the cobra (*Naja naja*) and

the krait (*Bungarus multicinctus*) provide covers for belts. The latter is often used for walking sticks and canes. Neckties and other smaller snake skin products can be made from any of these species. Skins to cover a pair of shoes range in price from US\$1.50 to \$2.50, and a necktie may be obtained for as little as 65¢.

As far as local consumption is concerned, skins are of minor consequence. The meat is widely consumed as a food boasting tonic qualities. Certain internal organs are highly prized for medicinal purposes. All medium to large cities in Taiwan enjoy the services of at least one snake shop or "institute" catering to various community demands. Snake soup, heavily flavored with ginger and spices, is a standard dish in such shops and nearby restaurants. This is most popular during the winter months but sells the year round at 10c to 25c per bowl. Snake soups are traditionally credited with unusual nutritional properties which promote good health.

The gall bladder, usually removed shortly after the snake has been killed, is considered even more efficacious. The normal procedure is for the intending customer to look over the caged stock kept in the snake

Snakes of Taiwan

shop and select an individual snake he considers ideal. The individual thus honored is then dispatched and the raw gall bladder is served and swallowed whole, along with a small glass of rice wine. The price varies considerably; gall from an uncommon species is more expensive and, as might be expected, considered to possess greater healing powers than that of an ordinary snake.

A translated advertisement of a local snake shop proclaims that snake gall eaten raw is "good for the heart and eyes, serves as an excellent liver tonic, relieves general pains and cures rheumatism and arthritis." Again, the gall bladder of a krait or cobra mixed with dried poisonous snake powder "counteracts poisons, cures rheumatism, heals cutaneous sores and prevents malnutrition." If taken together with "refined" snake oil, it is "good for pneumonia, insures virility, improves vision and brightens the eyes." If raw gall bladder lacks appeal, another choice is offered in the form of wine in which a poisonous snake has been preserved. This is certified to produce approximately the same results. Such wine, complete with snake, sells at from US\$2.50 to \$3.00 for a large bottle.

After skinning and the removal of the gall bladder and other viscera, the body, if not used immediately in snake soup, is frequently wound into a flat coil and dried in the sun. Dried snake stores well and also lends itself to grinding into a powder, which can then be made into pills or used in various combinations with other ingredients. These concoctions have an extensive public following. At least one shop selling "snake pills" has printed a brochure in praise of their product. Included are a num-

ber of testimonials from users which outdo the claims of the proprietors. Some state that the pills provide tremendous energy—even violent exercise fails to make them tired after taking the pills. One testifier goes on at length to extoll snake powder mixtures, which, he says, "Make stronger muscles and bones, encourage development of new blood, initiate the growth of cells and, through constant use, improve the mental and physical processes of the human body. One can expect to have a spirited and longer life."

It is paradoxical that the snake, a leading contender for the bottom position in any animal popularity poll while living, should rank so high if deceased and separated into its component parts. It is not, however, a phenomenon peculiar to China or the Orient. Not so many years ago, snake oil was a household remedy in the United States. Today, there is a growing interest in snake venoms for medicinal use. It is not out of the question that modern science may be able to find valid reasons for the faith which has been placed in the remedies described here.

No accurate estimate can be made of the numbers of snakes used each year in Taiwan or shipped to other areas in the Orient. All that can be said is that the business volume is substantial. A survey of dealers and exporters familiar with the trade conducted with Hong Kong indicates that from 10,000 to 15,000 living snakes are shipped there monthly. Local consumption is probably much higher. In spite of this trade, there seems little likelihood that Taiwan will run out of snakes for a considerable time to come.



BIBLIOGRAPHY

This is a limited bibliography listing the papers referred to in the present pamphlet. Also included are other sources from which additional information on the biology of snakes, taxonomy, treatment of snake bite, etc., may be obtained.

- Anon., 1962. Poisonous Snakes of the World. Department of the Navy, Office of Naval Operations, ONI Study 3-62.
- Chen, J. T. F., 1956. *A Synopsis of the Vertebrates of Taiwan*. (In Chinese). 19 pp.
- Dasch, D., 1952. *Snakes on Taiwan*. Mimeographed pamphlet. MSA. Taiwan 13 pp.
- Dumars, R. L., 1957. *Snakes of the World*. Macmillan Company, New York. 205 pp.
- Halstead, B. W., 1959. *Dangerous Marine Animals*. Cornell Maritime Press, Cambridge, Maryland. 146 pp.
- Keegan, H. L., 1960. "Antivenins Available for Treatment of Envenomation by Poisonous Snakes, Scorpions and Spiders." *Venoms*, pp. 413-438.
- Keegan, H. L., 1960. *Some Venomous and Noxious Animals of the Far East*. Department of Entomology, 406th Medical General Laboratory, U.S. Army Medical Command, Japan. 46 pp.
- Lin, C.-C., 1954. *Venomous Snakes in Taiwan*. Mimeographed pamphlet. 8 pp.
- Maki, M., 1931. *Monograph on Snakes of Japan*. Dai-ichi Shobo, Publisher, Tokyo, Japan. 240 pp.
- Mao Shou-hsian, 1962. Color Variations of Taiwan (Formosa) Many-banded Rait. *Herpetologia* Vol. 17; pp. 275-277.
- Mao Shou-hsian, 1962. Sexual Dimorphism of Taiwan Bamboo Viper. *Bulletin of the Institute of Zoology*. (Academia Sinica Vol. 1., No. 1).
- Pope, C. H., 1935. *The Reptiles of China*. American Museum of Natural History, 604 pp.
- Schmidt, K. P. and Inger, R. F., 1957. *Living Reptiles of the World*. 287. Hanes House, New York. 287 pp.
- Stejneger, L., 1907. *Herpetology of Japan and Adjacent Territory*. Smithsonian Institution, U.S. National Museum Bulletin No. 58; 577 pp.
- Swaroop, S. and Grab, B. 1954. Snakebite Mortality in the World. *Bulletin of World Health Organization* No. 10; pp. 35-76.
- Tu, T. M., 1959. *Recent Achievements of the Taiwan Venomous Snakes Research Laboratory. Aid to Recognition of Venomous Snakes in Taiwan and Recommendations for First Aid Treatment of Bites*. (English summary) Chia-yi, Taiwan; 11 pp.
- Wang, C. S. and Wang, Y. M., 1956. The Reptiles of Taiwan. *Quarterly Journal of Taiwan Museum* Vol. 9; 86 pp.



Printed by China Color Printing Co., Inc.
Taipei, Taiwan

Design and Layout: C. E. Knight and W. D. Smith

Photographs: Capt. Robert E. Kuntz, MSC, USN

