

A SURVEY OF THE SNAKES OF PHUKET ISLAND
AND THE ADJACENT MAINLAND AREAS OF
PENINSULAR THAILAND

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Summary

A survey of the snakes of Phuket Island and the adjacent mainland of Peninsular Thailand during the period January 1974 to October 1976 was made, primarily by the collection of road-killed specimens. Live snakes were also collected and a number of these were retained in captivity for observational purposes. One hundred and sixteen snake specimens are described by presenting their measurements and scale characters, whilst others are discussed in more general terms.

Thirty-six snake species are discussed, twenty-four of which occur on Phuket Island with the additional hypothetical presence of a twenty-fifth species at least.

A specimen possibly representing the first known hybridization between the two 'flying snakes' *Chrysopelea paradisi* and *C. ornata* is described, discussed and illustrated.

The sea snake *Hydrophis spiralis* is recorded as occurring in Thailand waters for the first time.

The snakes *Boiga jaspidea* and *Elaphe flavolineata* are recorded in Thailand for the second time only. The third Thailand locality for *Dryophiops rubescens*; and the third Thailand record of the sea snake *Laticauda colubrina*, are discussed.

The northern distributional limits of seven snake species, and the southern distributional limits of four species are redefined in view of the specimens examined and described in this study. The zoogeographical significance of these distributional extensions is briefly discussed. These new distributional data are considered indicative of a lack of herpetological exploration in the area studied and emphasise the need for further similar work.

Information concerning the general biology, ecology and behaviour of the snake species is presented, including the first breeding data for *Calliophis maculiceps*.

The value of collecting and preserving road-killed snake specimens is stressed in view of the considerable amount of scientifically useful data so obtained for relatively little time and expense involved.

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Introduction

The present study is the result of casual collecting and observation during the period May 1974 to October 1976, whilst resident on Phuket Island, Peninsular Thailand. Whilst occasional trips to certain habitats such as good forest and mangroves were made in order to look for snakes this was very much the exception and not the rule. It should in fact be stressed that no intensive or extensive snake collecting has been carried out for the purposes of the present study. The data presented here are predominantly the result of my picking up snakes found freshly dead on roads subsequent to them being killed by vehicles; of the 116 specimens discussed here 58 (50%) were collected in this way. In addition to the 116 preserved snakes 37 (26 of which were road-killed) were examined closely and notes made concerning them, and numerous other bodies of the commoner species were examined but not specifically recorded. A vast amount of, often new and valuable, data concerning the snakes of Thailand are utterly wasted by leaving road-killed material to decompose. This is particularly regrettable with an animal group still little known, and shrouded by superstition and myth, such as the snakes. Of course this applies to all tropical and sub-tropical countries with better (i.e. faster) road systems, and it is hoped that this presentation of data so obtained encourages this worthwhile activity in other people and places. In this respect it should be noted that to stop and collect a car-killed reptile is remarkably economical in financial and scientific terms. One need only to consider the cost of an expedition to Peninsular Thailand in order to obtain the substantial collection described here.

During my residence on Phuket I have been fortunate indeed to have made the acquaintance of many interested and understanding people, prepared to give generously of their time and energy in order to participate in the accumulation of the present data. Without these people, fully acknowledged at the end of this work, this study would be far less comprehensive and in no way possible in its present form.

Very little previous herpetological collecting has been carried out on Phuket Island, as is illustrated by the remarkable fact that in a recent comprehensive review of the snakes of Thailand (TAYLOR, 1965), dealing

with 159 species and subspecies in 488 pages, Phuket is mentioned only twice. Ironically enough the two species described as occurring on Phuket in this review are the only two species of those now known to occur on Phuket not seen during the present study. In fact, due to the lack of previous collecting on Phuket, the records of all species presented here with the exceptions of *Agkistrodon rhodostoma* and *Liopeltis scriptus*, represent the first authenticated record for the province of Phuket. Moreover many of the species records represent significant, and zoogeographically interesting, extensions of known distributions (see Discussion and Appendix II).

Appendix I provides certain measurements and scale-count characters of all complete specimens collected during the present study. This provides comparative data for future taxonomic work, and some of the figures given for scale-counts represent an increase to the known variation of certain species characters as is indicated in the text and the appendix.

The Study Area

Phuket Island, together with a number of small nearby islands, constitutes Phuket Province; situated on the west coast of Peninsular Thailand between the Isthmus of Kra and the Malaysian border. The extreme northern tip of Phuket Island is little more than approximately 350 metres from the mainland coast of Phangnga Province and the two are connected by a road causeway which has existed since 1967. Prior to that time travel between the two provinces was by small ferry boats. Of course the narrow, but fairly deep and tidal, channel between the island and mainland is most unlikely to have represented a major, if any, zoogeographical barrier to snakes. That is to say that most, if not all, snake species found on the adjacent mainland could easily have reached Phuket by crossing the seawater channel by swimming or on floating matter. It is possible, however, that not all such potential 'invaders' would have found suitable conditions such as habitats and foods, or that they might have found the ecological niches required by them preoccupied by other competitor species.

Due to the infrequent and extremely opportunistic form of collecting on the mainland of Peninsular Thailand, limited to picking up the odd specimens from roads whilst travelling greater distances by car, the 'adjacent mainland' is rather extensive and ill-defined. As the Isthmus of Kra represents a major zoogeographical barrier (TWEEDIE, 1957), north of which few of the truly Malay Peninsula species are found I include only specimens collected to the northern limit defined by drawing a line across the peninsula from the Ranong area eastward to Lang Suan. No specimens were collected south of Phuket or the adjacent mainland province of Phangnga. The only locality exception to Phuket Province and this defined mainland area is Ko Surin, an island just south of the Burmese border, which I briefly visited during April 1976. All place names mentioned in the text concerning my specimens are included on the accompanying map (Fig. 1).

Methods and Results

Throughout the period of collecting and subsequent writing of this paper I have relied very heavily upon published accounts of the ophidian fauna of Thailand and Peninsular Malaysia (SMITH, 1926, 1930, 1943; TWEEDIE, 1957; TAYLOR & ELBEL, 1958; TAYLOR, 1965) and South Vietnam (CAMPDEN-MAIN 1970) for purposes of identification and for assessing current knowledge of species distributions and general biology. These publications have, thus, provided the basis for all my comparative notes and without them this study would not have been possible, as is acknowledged at the conclusion of this work.

In taking measurements and scale-counts of specimens (see Appendix I) the following conventions have been adhered to: scale rows counted at mid-body (mid way between snout and vent) by counting in a continuous diagonal line, as is illustrated in TWEEDIE (1957), this method being checked in the more difficult cases by counting diagonally to the vertebral scale and then diagonally down the opposite side in the opposite direction (as illustrated in CAMPDEN-MAIN, 1970); ventrals—counted forward from the last ventral (i.e. the scale next to the anal scale); total length and tail length taken by the use of a cord. The specimen numbers refer to those assigned to the specimens myself.

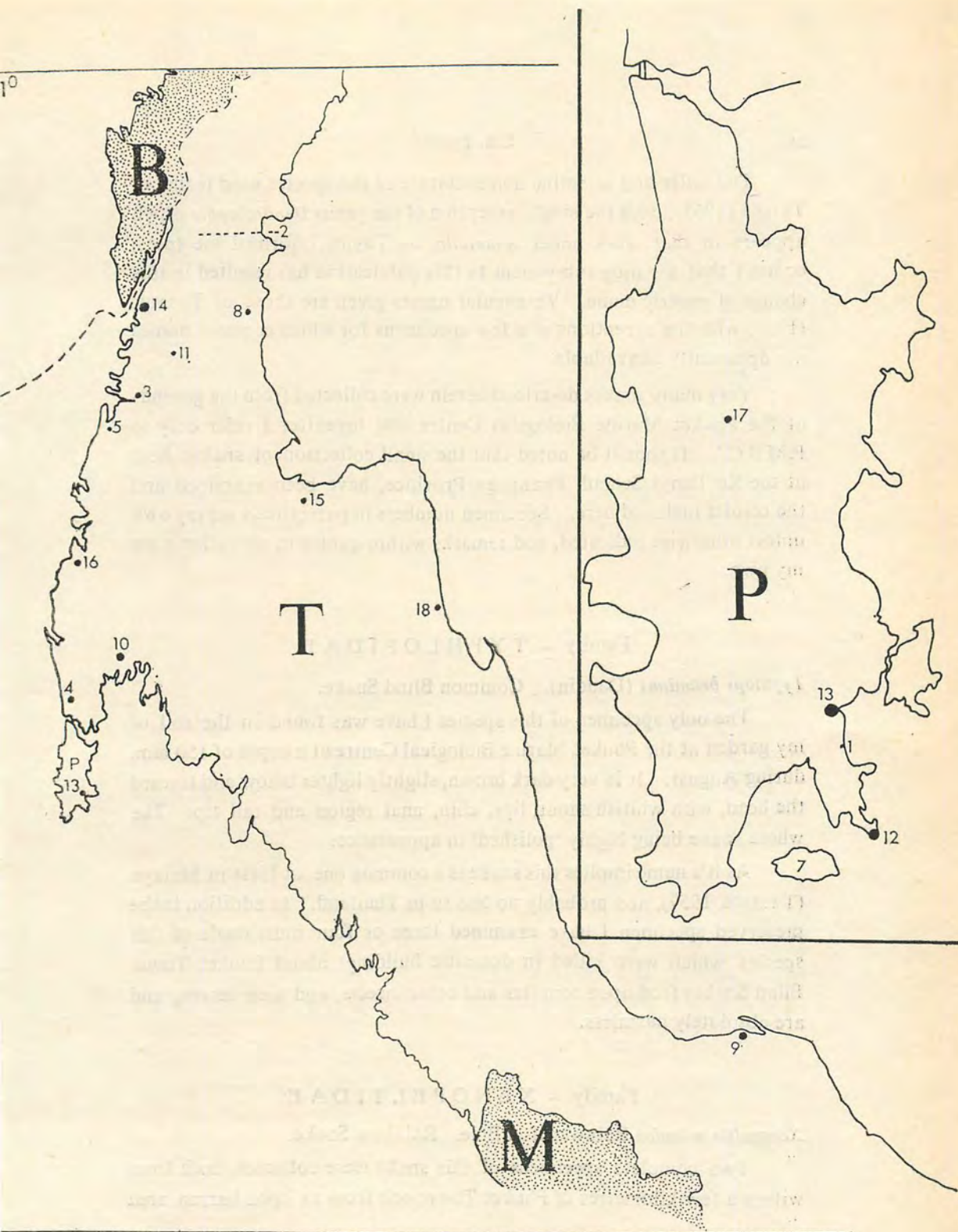


Fig. 1. Map of Peninsular Thailand, and Phuket Island (inset).

B = Burma; T = Thailand; M = Malaysia; P = Phuket

- | | | | | | |
|----------------|----------------|--------------|-------------------|-----------------|-------------------------|
| to Nam Bor | 4. Khok Kloi | 7. Ko Lon | 10. Phangnga | 13. Phuket Town | 16. Takua Pa |
| Isthmus of Kra | 5. Klong Nakha | 8. Lang Suan | 11. Phato | 14. Ranong | 17. Thalang |
| Capoe | 6. Ko Surin | 9. Pattani | 12. Phuket Marine | 15. Surat Thani | 18. Nakhon Si Thammarat |
| | | | Biological Centre | | |

The order and scientific nomenclature of the species used is that of TAYLOR (1965), with the single exception of the genus *Dendrolaphis* which appears in that work under *Ahaetulla*, as Taylor informed me (pers. comm.) that a ruling subsequent to this publication has resulted in this change of generic name. Vernacular names given are those of TWEEDIE (1957) with the exceptions of a few specimens for which common names are apparently unavailable.

Very many snakes described herein were collected from the grounds of the Phuket Marine Biological Centre and hereafter I refer only to P.M.B.C. . It should be noted that the small collection of snakes held at the Ko Panyi School, Phangnga Province, have been examined and the results included here. Specimen numbers in parenthesis are my own unless otherwise indicated, and remarks within quotes in parenthesis are my own.

Family — TYPHLOPIDAE

Typhlops braminus (Daudin). Common Blind Snake.

The only specimen of this species I have was found in the soil of my garden at the Phuket Marine Biological Centre at a depth of 150 mm. during August. It is very dark brown, slightly lighter below and toward the head, with whitish snout, lips, chin, anal region and tail tip. The whole snake being highly 'polished' in appearance.

As its name implies this snake is a common one, at least in Malaya (TWEEDIE, 1957), and probably no less so in Thailand. In addition to the preserved specimen I have examined three or four individuals of this species which were killed in domestic buildings about Phuket Town. Blind Snakes feed upon termites and other insects, and their larvae, and are absolutely harmless.

Family — XENOPELTIDAE

Xenopeltis unicolor Reinwardt in Boie. Rainbow Snake.

Two complete specimens of this snake were collected, both from within a few kilometres of Phuket Town; one from an open barren area

near a large fresh water pool was crossing a road at 1900 hours, and the other was found dead on a road in a suburban area with secondary scrub and rice fields. Both were typically coloured for the species and exhibited the extreme and colourful iridescence responsible for the snake's vernacular name.

This is quite a common species on Phuket, as I have frequently examined road casualties about the town. Due to this snake being very predominantly a nocturnal species (CAMPDEN-MAIN, 1970) individuals are mostly killed at night and are, thus, usually beyond preservation and/or close examination when found.

The live caught snake (64) was quiet when handled and made no attempt to bite, but produced a strong unpleasant musky odour presumably as a form of defense. SMITH (1943) wrote of this snake, "I never knew one attempt to bite when handled, but when excited it could vibrate it's short tail with extraordinary speed, so rapidly that at times I have believed I could hear the movement. It's food consists of other snakes, small rodents, and frogs; birds have also been recorded in it's diet".

Family B O I D A E

Subfamily PYTHONINAE

Python reticulatus (Schneider). Reticulated Python.

Of this snake SMITH (1943) writes "The Reticulated Python is the largest snake living today, the South American Anaconda running it closely for second place. Authentic measurements of specimens that have been killed show that it reaches a length of 27 or 28 feet. The young when born measure from 600 to 759 mm. in length."

The Reticulated Python is apparently still common on Phuket Island, but larger individuals would appear to be very rarely seen now, presumably due to human predation (see below). Whilst I have seen only two specimens in the wild I have seen numerous snakes in the possession of local men who collect them to sell, at a set price per metre, for their skins. These men inform me that they catch many snakes in

rubber plantations, where I would have thought cover was rather lacking for pythons. The largest specimen I have seen was caught very close to my home where it was found in a chicken pen, apparently attempting to eat chickens. It measured approximately 3.30 metres and was in immaculate condition, having reached this size without scar or blemish. It is unfortunate that, from my experience, this snake is never left unmolested. Any specimens found are sold, directly or indirectly, to the skin trade where they are usually very poorly prepared and sold to local people and tourists as a not very attractive or long-lasting curio. Whilst, on very rare occasions, an individual is found raiding domestic stock, a population of pythons is undoubtedly very effective in locally controlling rats and other animals considered vermin by man.

I have taken only one specimen (116) of this snake, for the purpose of recording measurements of Phuket individuals. It was brought to me by a local man who stated it was collected in Phuket Town suburbs. It is a young snake, of typical colouration, and its measurements and scale-counts were taken from it alive. These are given in Appendix I. I have kept this particular snake in captivity for three months where it has both fed extremely readily on rats, mice and ducklings and become quite docile allowing itself to be handled freely. This behaviour in captivity is not, according to CAMPDEN-MAIN (1970), typical for he found most individuals refused food and remained aggressive. I have also examined one preserved specimen taken in Phangnga Province.

Family — COLUBRIDAE

Subfamily — ACROCHORDINAE

Acrochordus granulatus (Schneider). Granular-scaled Water Snake.

The only specimen of this snake I have was taken in a trawl net from the sea just off a fringing coral reef in the vicinity of the P.M.B.C. at 2000 hours on the 16 October during fine weather. The depth of the trawl is unknown. A second specimen is housed in the Ko Panyi School collection which was taken in the Gulf of Phangnga.

The specimens match the description and illustration provided by TAYLOR & ELBEL (1958) and TAYLOR (1955) well. It is a very widespread snake about Thailand, India, Ceylon, Indo-China, Malaya and the Indo-Australian Archipelago as far as Australia and Philippines where it frequently occurs near river mouths and close off-shore. It is apparently a fish eating species and, unlike the true sea snakes to which it bears a superficial resemblance, is not dangerous to man.

Subfamily COLUBRINAE

Gonyosoma oxycephala (Boie in Boie). Red-tailed Racer.

I have no preserved specimens of this snake, nor have I seen it on Phuket Island. I have, however, caught an individual over two metres in length, which was found curled in the outer foliage of a large fig tree ten metres above the ground, at Phangnga (just west of the town) beneath a vast forested limestone massif typical of that area. I retained this snake in captivity for several weeks, during which it remained exceedingly aggressive continuously giving an impressive inflated threat posture and striking repeatedly if approached closely. During the threat display the throat and anterior body is very much inflated and laterally compressed. This both exposes the black scale edges and makes the snake appear much larger. I find this display (and a similar one performed by *Elaphe radiata*; see below) far more impressive and intimidating than the display of the Common Cobra.

Writing of the Red-tailed Racer SMITH (1943) wrote "A thoroughly arboreal snake, extremely active and swift in it's movements; the few I handled never became tame and were always ready to strike at the slightest provocation". According to LIM (1956) it feeds on rats and squirrels.

A second individual, measuring 1860 mm., examined 69 kilometres north of Takua Pa, Peninsular Thailand in July contained 12 eggs in early development which measured from 1×1 to 4×2 mm.

Elaphe radiata (Schlegel). Copperhead Racer.

If road kills are indicative of the relative abundance of snake species (at least the more active, and predominantly diurnal ones) then the Copperhead Racer would appear to be one of the most numerous

species on Phuket. The large number of car-killed specimens I have examined may, however, merely reflect the more active and roving nature of this snake. Details of six specimens I have preserved, predominantly young ones, are given in Appendix I. All of these specimens were collected in or about Phuket Town in suburban habitats with the notable exception of specimen 75. The latter individual was collected approximately 20 kilometres west of Phangnga Town on the Phangnga-Phuket road. This snake contained a complete young rat measuring 90 mm. from snout to vent. Another two snakes, both approximately two metres in total length, from Phuket Island were found to contain one adult rat each. An individual 1748 mm. in total length (tail 333 mm.) found 15 kilometres north of Phuket Town on 13 July contained 9 yolky eggs measuring on average 48×14 mm. An additional specimen over two meters in length found 23 kilometres north of Thap Sakae during the last week of September contained 7 yolky eggs measuring on average approximately 35×15 mm.

I encountered an adult individual (total length 1515 mm.) of this snake in a most unusual situation in July whilst on a boat trip to islands off Phuket. The snake was swimming strongly in open sea some 50 metres offshore from a very small island. When chased by the boat it swam quickly and strongly towards the neighbouring island which was over a kilometre away. In catching it I noticed that the snake was partly inflated, at least anteriorly, and whilst this may have been in threat (see below) it could possibly have been an aid to buoyancy while swimming. Another specimen was collected from within an old automobile tyre lying on the end of the P.M.B.C. pier-head. The pier is a long and narrow one and I feel it is most unlikely the snake travelled along it, but rather approached the pier-head from the water. Thus, the Copperhead Racer appears to be an accomplished swimmer that not too infrequently takes to water.

I have kept several, adult and young, individuals of this species in captivity and have found it's disposition as did SMITH who wrote (1943), "When cornered, it adopts a menacing attitude, throwing the fore-parts of it's body into a series of loops and opening the mouth widely. One that I kept never grew accustomed to being handled, and after four

months was nearly as wild and fierce as on the day it was captured. Young ones that I have kept were more gentle and soon became tame." The threat/defensive postures of this snake are extremely vigorous and intimidating.

The Copperhead Racer occurs throughout the lowlands of Thailand, is diurnal, and feeds mostly upon small mammals.

Elaphe flavolineata (Schlegel). Common Malayan Racer.

I have preserved the head and neck of an individual of this species collected from the road thirty five kilometres south of Takua Pa on the main north-south highway, in December. The snake was found dead by a small stream in good forest with secondary growth and clearings, on the coast. The colouration of this individual was similar to that described for the species by TAYLOR (1965), and measured approximately 1020 mm in total length.

It is regrettable that the complete specimen was not suitable for preservation, due to damage, as my field notes describe the anal and subcaudal scales as divided. This does not agree with TWEEDIE (1957) and TAYLOR (1965) who state that the anal is an undivided scale. The dorsal scales are in 19 rows approximately 120 mm behind the head, this being in agreement with the above mentioned two authors.

As its vernacular name implies this snake is common on the southern Malay Peninsula, while Takua Pa is nearing the most northerly limit of its known range which, according to Wall (*in* SMITH, 1930) is Tenasserim, Burma. TAYLOR (1965), however, states that the only previous record of this species in Thailand is for the most southern province of Narathiwat. My Takua Pa record would, thus, appear to be both the second and the most northern one for this snake within Thailand.

Ptyas korros (Schlegel). Indo-Chinese Rat Snake.

Fourteen specimens of this snake are described in Appendix I. These were collected from various localities about Phuket Island, predominantly the southern half; with the exceptions of specimens 38 and 74 from

Phangnga Town, 81 from 20 kilometres directly north of Phuket on the adjacent mainland northbound highway, and 91 from approximately 40 kilometres north of Lang Suan on the east peninsular coast. All were taken from cultivated regions in the vicinity of rice fields, rubber plantations or suburban and urban areas. This snake would appear to be particularly abundant for I have examined the bodies of very many snakes in addition to the preserved specimens. It is widespread in Thailand as TAYLOR (1965) includes both the extreme northern and southern provinces of Chiang Mai and Narathiwat respectively in his province locality list.

All my specimens were of typical colouration when found, being predominantly greyish, greyish-brown or brown dorsally within the known variations given in TWEEDIE (1957), TAYLOR (1965) and CAMPDEN-MAIN (1970). As pointed out by the former author the dorsal colouration is bluish-grey when the epidermis is shed. All of these snakes exhibit characters typical of the species, as are described by the afore-mentioned authors, with the single and notable exception of specimen 107 which is most interesting. This individual, whilst being a typical *P. korros* in colouration and scale characters (see Appendix I), has the scales of certain dorsal scale rows conspicuously keeled. The central six dorsal scale rows have central keels to each scale which become apparent approximately 300 mm down the body length and continue to just onto the tail (i.e. behind the vent). This keeling is very strong on the central rows, slightly less so on the next and are still very faintly visible on the third from central-most scale rows. Keeling of this kind is typical of *Ptyas carinatus* and, together with the higher ventral and lower subcaudal scale counts and even rather than odd numbers of scale rows, is a means of discriminating that species from *P. korros*. In view of this specimen the presence of keeled dorsal scales is not, therefore, necessarily indicative of *P. carinatus*. The ventral and subcaudal scale counts are, however, different according to TAYLOR (1965) (see Appendix I).

The Indo-Chinese Rat Snake grows to over two metres in total length and is apparently often mistaken for the King Cobra (see under *Naja naja*). According to LIM (1974) it would appear to be a potentially beneficial snake as figures presented by him show that nearly 24 per cent of 42 snakes examined contained rat remains. Moreover, results from

experimental feeding of five individuals indicated that they ate a total of 1328 rats; on average eating 5.11 rats per snake a week. Using these figures LIM calculated that a snake in nature might predate 1.2 rats per week. CAMPDEN-MAIN (1970) also lists birds, lizards and snakes as foods, and notes that in captivity a strong preference for frogs and toads was shown.

Specimen 10 was found to contain 6 fresh yolky eggs measuring approximately 33×11 and specimen 68 contained 5 eggs measuring on average 39×18 mm. Another snake contained the complete large body of the skink *Mabuya novemcarinata* (Anderson) which measured 127 mm from snout to vent.

Ptyas carinatus (Gunther). Keeled Rat Snake.

I have a single specimen (70) of a snake which I have identified to this species, taken on the peninsular mainland 61 kilometres north of Phuket Island. In all characters, and colouration, it matches the descriptions of *Ptyas carinatus* available to me (SMITH 1930, TWEEDIE 1957, TAYLOR 1965; CAMPDEN-MAIN, 1970) with the exception that its subcaudal scale number is a little high (see Appendix I), and it lacks any sign of keels on the scale "row each of the mid-dorsal line" (TWEEDIE, 1957), or "four to six median scale rows" (TAYLOR, 1965), or "scales keeled in even numbers of rows" (CAMPDEN-MAIN, 1970). I can see no trace of keels on any scales of this small specimen and its size, in addition to the fact that the snakes skin has sloughed in preservative thus resulting in new very soft ill-defined scales, may account for this. The species is "the largest of the Asiatic Colubrids and grows to over twelve feet" (TWEEDIE, 1957). It occurs widely in Thailand, but I have no evidence of its presence on Phuket Island. It is placed in the genus *Zaocys* by TWEEDIE (1957) and CAMPDEN-MAIN (1970); but TAYLOR (1965) follows WALL (1926) in uniting this genus into *Ptyas* for reasons summarised in the former work.

According to TAYLOR (1965) this snake is "much used for food", presumably by man. It would appear also to be very beneficial snake to man in view of its own eating habits. In experimental feeding of five individual snakes LIM (1974) found that 1694 rats were eaten in a year at an average of 6.52 rats per snake a week and from these results he calculated that one snake might consume 1.3 rats a week in the wild.

Lycodon capucinus Boie. Common Wolf or House Snake.

An extremely common snake on Phuket Island, being frequently found domestically as described by TAYLOR (1965), and implied by its vernacular names. I have observed numerous individuals of this species on Phuket additional to the specimens described in Appendix I, most of them being found in domestic buildings, rotten fence posts and walls. The only exception to these situation are two specimens, one of which was collected on Ko Lon, an Island off Phuket, found on a steep shore slope in secondary forest behind a beach crest; and another found lying on a coastal rocky ledge within the splash zone of a high tide swell. With the single exception of the Ko Lon specimen all snakes were taken from the grounds of the P.M.B.C. All were similar in colouration to that given for the species by TAYLOR (1965), with the smaller specimens being perhaps a little paler and browner.

The measurements of 12 specimens are given in Appendix I. An additional snake taken at P.M.B.C. measured 542 mm in total length with a tail of 108 mm, but was subsequently discarded.

This harmless and attractive little snake is often the cause of needless concern when found in dwellings, as it so frequently is. Its general lavender-brown flecked with whitish colouration, yellowish-white nape and lip markings and a somewhat pointed head make this snake easily identifiable. No live specimen I have collected has attempted to bite, not that a bite from this species could be in any way dangerous to man. Its frequency in human dwellings is apparently due to the availability of small lizards and geckoes in such situations, upon which it appears to feed (TAYLOR, 1965).

When discovered this snake coils itself tightly in defence; if actually disturbed it may vibrate the tail tip very rapidly, and if handled may emit a foul-smelling odour. SMITH (1943) records that when the young are born (3 to 11 eggs being laid) they measure from 140 to 180 mm in length.

Liopeltis scriptus (Theobald),

I have not encountered this species at all. It is, however, one of only two species which TAYLOR (1965) records from Phuket Island by

stating that, "In Thailand the species is known from Sai Yoke, Kanchanaburi Province, Khao Luang and Ronpibon, Nakhon Si Thammarat; Pulau Panjang (Island), Phuket. It has not been reported outside Thailand except Burma (Martaban), the type-locality." SMITH (1943) knew of only six specimens.

Due to the lack of very much literature on this species of restricted range I present here, for the sake of comparative purposes, some observations from TAYLOR (1965). "Diagnosis: Small snake, reaching about half metre in length; scales in 13 smooth rows throughout body; eight supralabials, third and fourth entering eye; anterior temporal longer than secondary temporals; a narrow black-edged broken cream band across occiput, preceding a dark neck band; supralabials cream with some black along certain sutures. — The ventrals are known to vary between 122 and 145, the subcaudals, 87 to 103. — Measurements in mm: Snout to to vent, 203; tail, 152; total length, 355; width of head, 6.3; length of head, 12."

Dendrolaphis (Ahaetulla).

Whilst my specimens of this genus are few I have had to spend a considerable time in deciding upon their correct identifications. This task has been made somewhat easier by the fact that I am following the nomenclatural usage of TAYLOR (1965) only throughout this work. I must note, however, that I have found the key, diagnosis, and species descriptions sections for this group of snakes in TAYLOR's work extremely difficult to use due, apparently, to the inconsistent emphasis or use of specific characters in the different species accounts. I found this to be particularly the case in the comparative descriptions of *D. formosa* and *D. cyanochloris*. For example, the apparently important difference in which the supralabials enter the orbit in the two species is given under 'Diagnosis' for *D. cyanochloris* but within the 'Description of species' for *D. formosa*. There are inconsistencies between characters in the generic key and those given in species accounts. For example; in the key for *A. formosa* the eye is described "as long as its distance from rostral" whereas in the diagnosis for that species it reads "equal to its distance from front of nostril". Possibly the latter is a typographical error. My

impression is that this group of snakes is in need of a thorough revision, based on the accumulation of all available material in one place for comparative purposes. I have, however, managed to designate the six specimens of this group I have to names provided by TAYLOR (1965) with some degree of certainty. In using his key, however, I found that some snakes appeared to be intermediate in certain characters, or that whilst a given specimen exhibited characters attributed to a particular species another of it's characters appeared to be that of a different species. In view of these problems the apparently constant and more significant characters of TAYLOR (1965), used in my determinations, are given under the species accounts below. The identifications of members of this genus must, therefore, be considered tentative until a revision of the group is available. It should be noted that no trouble was experienced in identifying specimens of *D. caudolineata*.

Dendrolaphis caudolineata Gray. Striped Bronze Back.

Three specimens of this beautiful species were collected on Phuket; one from the north of the island only eight kilometres south of the extreme northern point (24) and two from the suburbs of Phuket Town (67 and 102). The former two snakes were found dead on a road, and the latter was killed by a gardener. This last specimen, collected in November, contains eight eggs measuring, on average, 32×12 mm.

The species is a southern one, not extending far north of the Isthmus of Kra, and is therefore of typical Malay Peninsula distribution; not occurring on Continental Thailand. The most northern Thailand locality appears to be Thap Li, on the south Burmese border (SMITH, 1930).

Dendrolaphis formosa (Boie). Elegant Bronze Back.

A single specimen (128) of this species was collected from a small ornamental garden tree in Phuket Town where it was basking in direct sunlight.

In identifying this snake to *D. formosa* I have particularly noted, amongst others, TAYLOR's (1965) characters of "scales in fifteen rows, more than a single labial entering orbit (see Taylor's key: p. 809); nine supralabials, three labials border orbit." With regard to the latter charac-

ters, however, this snake shows particularly intermediate characters as mentioned in the comments given above for the genus as a whole. TAYLOR (1965) describing the species from BOULENGER (1912) gives "normally nine, rarely eight supralabials, fifth and sixth enter orbit (rarely fourth also)". This is perfectly true of the right-hand side of my specimen, the fourth of nine labials very nearly touching the orbit. On the left side, however, the snake has ten labials, with the sixth and seventh bordering the orbit and the fifth just touching it anteriorly. Thus this specimen has the characters of *D. cyanochloris* (see text for that species) on one side of its head, and those of *D. formosa* on the other. The ventral scale count is, however, within the range of *D. formosa* and certainly not that of *D. cyanochloris* (see Appendix 1). The two black lines which may be present along each side of the posterior side of the body of *D. formosa* (TWEEDIE, 1957; TAYLOR, 1965) are faintly apparent in this specimen, but the ventral colouration is not "yellowish-green anteriorly, dull green or brown on the body and tail" (TWEEDIE, 1957) or "greenish" (TAYLOR, 1965), but is a splendid iridescent pearly colour with only faintest hint of yellowish on throat and anterior body and greenish on the tail.

The characters separating *D. formosa* and *D. cyanochloris* as given by TAYLOR (1965) seem to me to be most inadequate.

This species is confined to the southern peninsula area according to TAYLOR (1965) being known from the three southern-most provinces of Narathiwat, Yala and Pattani. This distribution, however, probably reflects the occurrence of previous snake collectors and not of the snakes themselves for, as discussed below (see Discussion), species commonly found in Peninsular Malaysia and extreme southern Thailand might be expected to extend northwards to the Isthmus of Kra area. Thus, whilst this Phuket record constitutes a considerable northward extension of the species known range, it is not an altogether unexpected one.

Dendrolaphis cyanochloris (Wall).

I have a single specimen (1) collected at the Buddhist Temple Cave of Suwan Ku, twelve kilometres west of Phangnga Town, Phangnga Province where it was found in a small garden bush during a light rain shower. In designating this snake to *D. cyanochloris* I have relied heavily upon

TAYLOR's characters, taken from WALL (1921) and SMITH (1943), particularly the following: "normally nine, rarely eight or ten supralabials, fourth touching edge of orbit, fifth and sixth bordering orbit — three supralabials bordering orbit, fourth very slightly so — ventrals and outer scale rows pale greenish or yellowish — lips and lower jaws yellowish", with the addition of his scale count figures of "ventrals, 189 — 211; subcaudals, 135 — 159". In fact, of my *Dendrolaphis* specimens this is the only one that fits *D. cyanochloris* on scalation characters, with its ventral count 213 being only two more than the variation given by TAYLOR (1965); see Appendix I. It is, thus, with some degree of confidence that I apply the present name, despite the fact that TAYLOR, (1965) gives the distribution in Thailand as "the northwestern part".

In addition to giving northwestern Thailand as the distributional range of this species TAYLOR (1965) also lists Tenasserim, Burma within its range, which is approximately a mere 160 kilometres north of Phangnga; and the Andaman and Nicobar Islands, of which the latter group is further south than Phangnga. Thus, there would appear to be no reason why this snake should not be expected as far south as Phangnga Province, although it considerably extends the known range of the species within Thailand.

Dendrolaphis ahaetulla (Linnaeus). Painted Bronze Back.

A single specimen of this snake was found on the road just north of Tha Sala (south of Surat Thani), eastern Peninsular Thailand. It is assigned to this species as it possesses, amongst others (see Appendix I), the conspicuous characters of "a yellow or cream stripe on first two scale rows, bordered above and below by a black line; vertebral scales not broader than outer scale rows" (TAYLOR, 1965). The species is apparently widespread in Thailand and can probably be expected to occur in every province.

SMITH (1943) found that this arboreal snake appeared to feed entirely on frogs, and he never found other foods in snakes he examined. Moreover in captivity his snakes would only take frogs. Thus, the species would seem to be a specific predator to the tree-frog groups.

Subfamily — NATRICINAE

Natrix flavipunctata (Hallowell). Checkered Keelback.

As I am following the nomenclature of TAYLOR (1965) these snakes appear under the above name; which species includes snakes previously recognised as *N. piscator flavipunctata* (SMITH, 1943), with conspicuous black markings about the face, head and neck (see TAYLOR, 1965 for details). Thus, TAYLOR (1965) gives the name *N. piscator* to snakes very similar indeed to *N. flavipunctata*, which differ from the former only in lacking the black markings about the head and apparently average slightly larger in size. It should be noted, therefore, that the vernacular name Checkered Keelback used here is that given by TWEEDIE (1957) for Malayan populations of *N. piscator*. I have no personal opinion in the matter of the correct nomenclature for the populations concerned, and follow Taylor's usage for consistency within this work.

All specimens for which details are given in Appendix I were collected from Phuket Town, P.M.B.C., or the road between the two with the exception of three individuals. Specimen 76 was collected at Khok Kloi, Phangnga Province; specimen 86 from 67 kilometres south of Surat Thani; and specimen 98 from 103 kilometres east of Takua Pa on the road to Surat Thani. The specimens I have are of very predominantly typical colouration, the only noteworthy variation being in the amount of black spotting dorsally.

As pointed out by SMITH (1943) and TAYLOR (1965) this snake is extremely common and widespread in Thailand as indeed it is on Phuket Island. It is a snake completely harmless to man but, despite its abundance and the frequency with which it is encountered, people still remain afraid of it as they do of most harmless snakes. This fear is probably often self-perpetuating, for when afraid of a snake most people attempt to kill it. This usually brings about defensive postures and displays, fierce in appearance, by the snake which impresses the tormentor as to the dangerous nature of his snake adversary. SMITH (1943) writing of the Checkered Keelback records "It is diurnal in its habits and is extremely active in its movements; it bites fiercely when first caught but is quickly tamed." and "When cornered in the fields I have seen it spring at the aggressor, the whole snake leaving the ground in its fury."

This species is particularly common about rice fields and I have collected many, also in addition to the described specimens, in this habitat. I have also, however, collected specimens from hilly areas, suburban areas, and from my coastal hill-top garden which has no rice fields or marshy areas in very close proximity. The snake feeds upon frogs and fish.

Rhabdophis subminiatus (Schlegel). Red-necked Keelback.

A very abundant and frequently encountered snake on Phuket and a species that I have examined many more individuals of than the eleven specimens listed in Appendix I. All these specimens were collected in, or close to, Phuket Town with the exceptions of 31 and 77 which were taken on Phuket Island 27 kilometres north of the town; and just south of Khok Kloi, Phangnga Province respectively. Snakes were most frequently found in suburban gardens, rice fields and rubber plantations adjacent to wet areas, and open grassy situations.

Ventral scale counts (see Appendix I) of specimens 58a and 77 total 121 and 122 respectively and these numbers represent a greater range of variation of the character than was previously recorded; as TWEEDIE (1957) gives a range of 132–175 and TAYLOR (1965) a range of 137–164 for the nominate subspecies and 157–173 for the north-western high altitude form *R. s. helleri*.

This species is considered by some to be a member of the genus *Natrix* to which it was assigned by SMITH (1943) and TWEEDIE (1957). All the specimens I have collected and seen in southern Thailand are of the widespread race *R. s. subminiatus* as described by TAYLOR (1965); having a distinct black bar below the eye and neck with a vermilion band and yellowish venter.

Specimens 58a and 58b, and 59a with 59b, were all collected from the same garden lawn in Phuket; the first two on 12th November and the second two on the 14th November 1974. They were not seen to be courting or mating but this local abundance may well have been due to some breeding activity at that time. I have frequently seen this snake elevate its head and flatten the neck, cobra-like, to make more conspicuous the red neck colouration, as described by TAYLOR (1965). As a result of this defensive posture I have had people actually believe this harmless little snake to be a cobra!

Rhabdophis nigrocinctus (Blyth).

The single specimen of this snake (53) was collected from the main north-south highway, 47 kilometres north of Ranong in September. It was found, freshly dead, in a hilly wooded area with some cultivation and grassy patches. This snake is widespread in Thailand and has been taken in Chiang Mai, Chumphon and Chanthaburi, but not in Malaya (TWEEDIE, 1957; TAYLOR, 1965).

The dorsal scales of my specimen are in 19 rows which agrees with previous observations; whilst the ventral and subcaudal scales are subject to geographical variation within the species (SMITH, 1943; TAYLOR, 1965). My count of 152 ventral scales for this specimen agrees with SMITH's (1943) range of 150–157 for the peninsular Thailand populations, as opposed to 161–170 for the northern Thailand snakes or 156–164 for southeastern Thailand individuals. The subcaudal count of 86 for my specimen is, however, in complete disharmony with Smith's numbers of 72–82 for peninsular Thailand; 74–84 for southeastern Thailand; and 83–96 for northern Thailand populations. In colouration my specimen is apparently typical of snakes from peninsular Thailand (SMITH, 1930).

Whilst the locality of the present specimen is no more than about 50 kilometres south of Chumphon, the present distributional record would appear to be the most southerly record of this species.

Subfamily — BOIGINAE

Boiga cyanea (Dumeril, Bibron & Dumeril). Green Cat Snake.

All ten Phuket specimens described (Appendix I) were collected from Phuket Town or from a few kilometres north or south of it. All were typically coloured for the species in life, being olive green with a greyish or bluish hue dorsally. The chin and throat whitish changing to yellowish on ventrals and which is stronger anteriorly, becoming whitish further down the body. The ventral scales with a yellowish or pale greyish posterior edging and the undertail usually slightly greenish.

As pointed out by TAYLOR (1965) this snake tends to become bluish in preservative. An additional specimen I examined from the Ko Panyi school collection was collected in Phangnga Province and is included in Appendix I.

All Phuket specimens were found in urban or suburban areas, the latter consisting of dwellings, rubber plantations and cultivated gardens etc.. In addition to the snakes collected I have examined perhaps five to ten other car-killed individuals on Phuket. Thus, the snake would appear to be fairly common, particularly in view of its predominantly nocturnal habits and despite SMITH's (1943) statement that "in spite of its wide distribution, [it] is nowhere common."

When encountered this snake remains sluggish and makes no attempt to escape but may, if approached closely, give a defensive display by opening its mouth wide to show the contrasting black lining of its mouth. According to CAMPDEN-MAIN (1970) it will bite viciously if given the opportunity. The same author describes the snake as "almost entirely arboreal, being found on the ground only rarely and usually at night." Of my ten specimens four were found dead on roads, which they were presumably crossing when killed. Moreover, two of these were found freshly dead during late afternoon and would appear, therefore, to have been killed during diurnal terrestrial activity. The remaining six snakes were found whilst active on the ground, three during the daylight hour 0830–0930 and the remainder during the dark hours 2000–2215.

SMITH and KLOSS (1915) give the food of the Green Cat Snake as small mammals and snakes. To these prey I add birds, as specimen 80 was found to contain the partly digested remains of a sparrow, *Passer* sp.; and the Ko Panyi specimen contained a small bird, almost certainly a wagtail, *Motacilla* sp. In addition to these natural prey birds, specimen 132 contained the body of a domestic chicken chick, *Gallus gallus*, of about a week old. In its snake eating habits it is apparently catholic in the extreme. SMITH and KLOSS (1915) examined a male specimen which contained a female of its own species larger than itself! A specimen retained in captivity by SMITH (1930) "ate in succession one *Oligodon*

taeniatus, two *Agkistrodon rhodostoma* (juveniles) and two *Trimeresurus gramineus*." The Green Cat Snake has enlarged grooved fangs in the rear of the jaw which carry poison from venom glands, but it is not considered dangerous to man.

The presence of this snake on Phuket extends the known range of the species significantly southward of the zoogeographically important barrier of the Isthmus of Kra. The previous southern-most record of this species was from Ko Phangan in the Gulf of Siam (SMITH, 1943), some 260 kilometres northeast of Phuket. This wider distribution enhances the possibility (TWEEDIE, 1957) of the species being found in the north of Peninsular Malaya.

Boiga dendrophila (Boie). Yellow-ringed Cat Snake or Mangrove Snake.

I have not seen this species on Phuket Island but have seen a single large individual at the Khlong Nakha forest reserve, some 80 kilometres south of Ranong. The snake was curled in the upper foliage of a rain forest tree about 10 metres above a stream. By climbing the tree the snake was disturbed and it behaved exactly as described as typical of the species by TAYLOR (1965) who writes; "*Dendrophila* is perhaps somewhat aquatic as they are almost invariably found in the vicinity of streams or along coast-lines where there are mangrove swamps [an available habitat on Phuket]. They often bask in the trees near the edge of streams and occasionally three or four may be seen in a single tree. If disturbed they may take a dive into the water and swim below the surface until they reach shore, or they may take temporary refuge under some submerged object."

It is remarkable that whilst TAYLOR (1965) repeatedly refers to BRONGERMA's work on this species (1934) he states of it's food simply that it is "reputed to eat fish almost exclusively."; whereas BRONGERMA in fact gives the names of four snakes and three lizard genera (including the eggs of one) that it has been known to eat. CAMPDEN-MAIN (1970) gives the impressive generalised food list for this snake as small mammals,

birds, snakes, lizards, frogs and slugs. SMITH (1916) records an individual eating a specimen of *Chrysopelea ornata* some 100 mm larger than itself. More remarkable is the record by LIM (1973) of a 1678 mm long snake eating an adult Lesser Mouse-deer, *Tragulus javanicus*.

As pointed out by TWEEDIE (1957) and CAMPDEN-MAIN (1970) this snake can possibly be confused with the very venomous Banded Krait, *Bungarus fasciatus*, due to the superficially similar black and yellow banded colouration found in both. In fact the two snakes have little else in common. The yellow bands of *B. dendrophila* are far narrower than the black areas whereas in *B. fasciatus* both colours are equally extensive and the bands encircle the rather triangular body. In the former species the tail is long and tapering whereas the latter has a short blunt tail almost appearing to have been cut off.

This record of *Boiga dendrophila* at Khlong Nakha represents a new northern limit to the known range of the species as the most northerly point it had previously been recorded from was Nakhon Si Thammarat. It is an expected find as animal species predominantly of Malay Peninsula distribution which are found in Thailand only in the southern peninsula provinces can usually be expected to ultimately be found to occur northward to the Isthmus of Kra (see Discussion).

Boiga jaspidea Dumeril, Bibron & Dumeril. Jasper Cat Snake.

A single individual of this species was collected from within Elephant Mountain Cave, Phangnga, Phangnga Province; a tunnel-shaped cave with a stream running through it, which runs beneath a vast limestone massif. The vicinity of the cave entrance consists of secondary growth, cultivation and grassland, with good unspoilt vegetation on the face of the limestone. The snake was found approximately 50 metres inside the cave and was dying of back wounds, presumably inflicted by a predator or man.

As this is a particularly rare snake in Thailand (see below) I quote here my description of the live snake directly from my field notes. "Dorsal: Head rich brown with dark brown-black symmetrical markings edged whitish. Ridge of back from head backward for approximately 200 mm russet; rest of snake purplish-grey with russet, cream and black

markings and marbling. Dorso-laterally large whitish spottings with russet and blackish peppering; below these whitish marks a series of broken black spots in line. Ventral: Chin whitish spotted black, to sulphur-yellow throat extending back approximately 260 mm then fading to dirty creamish which becomes increasingly peppered with greys, russets and purple until very dense on tail. Pupil round, edged deep red. Iris creamish, marbled brown and black.

TWEEDIE (1950, 1957) described this snake as rare and the least common of the five cat snakes in Peninsular Malaya. In Thailand the species is previously known from only a single specimen, taken at Na Pradoo, Pattani (TAYLOR, 1965). Elsewhere it is known from Borneo, Java and Singapore. Thus, the Phangnga specimen represents the second specimen known from Thailand and extends the known range of the species some 350 kilometres north-west in a direct line from Pattani, and approximately 180 kilometres in a directly northward line.

Dryophis prasinus Boie. Grass-green Whip Snake.

I have seven specimens (five complete) of this species, all from the road between Phuket Town and the P.M.B.C. or my garden; with the exception of one from 2 kilometres north of Phuket Town (79) and one from 3 kilometres east of Phato, near Ranong (90). All snakes were taken from areas of cultivation and secondary growth near human dwellings with the exception of the Phato specimen which was in hill forest with a little agricultural activity only. Whilst specimens vary in the hue of green, and the difference in the degrees of saturation of this colour between the head and the body, all were typically light green with a yellow line along each side; and a reddish tail in the larger specimens.

I have kept a number of this species in captivity and have found small specimens quiet and docile as SMITH (1943) describes the species. The largest specimen (120) I kept, however, was very pugnacious and would strike at the slightest provocation. This snake, like *Dryophiops rubescens*, has a habit of holding the tongue out and motionless for periods of time. SMITH (1943) obtained a female from southeast Thailand on July 1st. which contained 6 young, near birth, averaging 240 mm in length.

Dryophis nasutus (Lacepede). Long-nosed Grass-green Whip Snake.

I have not found this species on Phuket or the adjacent areas of western Peninsular Thailand. I am, however, familiar with the species, having collected it at Ob Luang Gorge, 17 kilometres west of Hot, northern Thailand; and I have kept specimens obtained in Bangkok in captivity.

It is noteworthy that I have examined a specimen of this snake species which I found dying on the road 32 kilometres north of Thap Sakae, eastern Peninsular Thailand, as TAYLOR (1965) writes of it, "it is not known whether it reaches down into the peninsular any great distance." Unfortunately I did not collect the specimen concerned, which measured 762 mm in total length, but this record does confirm the presence of the species on the peninsula. Moreover this would appear to represent the most southerly limit to the known range of the species, as it is not known from Peninsular Malaysia (TWEEDIE, 1957). Note that Thap Sakae is some 50 kilometres north of 11 degrees north and is, therefore, off the map (Fig. 1).

Dryophiops rubescens (Gray). Keel-bellied Whip Snake.

The only specimen of this beautiful snake I have was collected, and kindly presented to me, by Mr. A. Bisson in the garden of Chartered Bank House, Phuket Town on 3 October 1976; where it was found in the foliage of an arboreal creeper. It is the only individual of the species I have examined.

Due to the very few Thailand specimens of this snake, and the interesting nature of this distributional record (see below) I give here a full description of the live snake in addition to its measurements and scale counts (Appendix I).

Body generally grey-russet dorsally with browner edges to scales. Irregular black smudgy spots and blotches throughout. Tail slightly browner than rest with interstitial skin of anterior half of body creamy-green, and of posterior half of body brick-russet. Crown greyish with dark brown markings and fine yellow lines. A darker brownish-black eye-stripe from snout tip through eyes and onto neck, finely flecked with yellow. Upper lip yellowish-white spotted black. A distinct chocolate-

brown broad line running backwards from behind each eye, and joining eye-stripe on neck, and a central broad line from mid-crown onto neck. Nape conspicuously russet. Ventral colouration: lips, throat and chin whitish, with yellow tinge at rear mouth with fine black spottings on lips and side of throat. Behind head pale yellowish-grey, changing to greyish and by one third down the body length to dark pinkish-grey finely flecked and speckled blackish becoming darker posteriorly. A very obscure pale yellowish marbling on the extreme outer edge of each ventral scale which, when viewed along the entire snake, forms a very indistinct line throughout the body length. Iris brownish-gold and pupil slightly horizontally slitted and edged golden. Tongue bright red-orange with blackish-brown tips.

It is particularly noteworthy that this genetically monotypic species has the ventrals and subcaudals keeled and notched as in species of *Chrysopelea* and *Dendrolaphis*. In both these genera this is considered an extreme adaptation to climbing and, at least in the former, to 'flying' or gliding descending 'flight'. I note, therefore, that the live *Dryophiops* would often compress the body dorso-ventrally and hollow the ventral surface when handled, as do *Chrysopelea* snakes when similarly treated. Whether this adaptation in *Dryophiops* is purely for climbing, or is also used for gliding descents, remains to be seen.

My specimen made no attempt whatever to bite when handled. It continuously held its tongue out, however, which is bright orange-red tipped blackish-brown and is almost certainly so coloured so as to enhance this defensive posture; particularly as, when very disturbed, the snake enhances the striking tongue colour by widely gaping the mouth open towards its enemy. It is noteworthy that the African Vine Snake, *Thelotornis kirtlandi*, exhibits a remarkable instance of convergent evolution, assuming there exists no true affinity, by having an identically coloured tongue which it holds out for prolonged periods of time as does *Dryophiops rubescens*. In the African snake, however, this habit has been attributed, apparently without direct evidence, to use in attracting birds and other prey (FITZ SIMONS, 1970). I consider this explanation unlikely, as the warning nature of the colour red as an indicator of a distasteful or stinging insect is well known. In this respect COTT (1940) writes of

red warning colouration "Shown to advantage in combination with black these colours occur time and time again in the make up of aposematic Coleoptera, Hemiptera, Hymenoptera and other groups." In view of the black tip of these snakes' tongues the red/black aposematic colouration situation fits this case well. It might be argued that the red tongue could at least attract birds that feed from flowers such as sunbirds (Nectarinidae) which feed on flower nectar, particularly that of red and other brightly coloured ones (SKEAD, 1967). The tongue of these snakes would, however, seem too small to function in this way and in any case this would seem a rather limiting adaptation and, thus, most unlikely.

The Keel-bellied Whip Snake is found throughout Peninsular Malaysia from Singapore to Kedah and Kelantan (TWEEDIE, 1957) and has previously been recorded in Thailand only from Na Pradoo, Pattani and the nearby Bukit Beysar (Mt.), (TAYLOR, 1965), and Narathiwat Province (SODERBERG, 1967). The specimen from Phuket discussed here thus represents a considerable extension of this snake's known range northward and redefines the northern distributional limit of its range (see Discussion).

Psammodynastes pulverulentus (Boie). Mock Viper.

Of two specimens of this species (see Appendix I) one was collected live in June at the Botanical Park area, Thalang, Phuket; from among the roots covering a damp rocky slope at the edge of a stream in good dense forest. The second snake was found on the main north-south road 9 kilometres north of Kapoe (south of Ranong) during September, in grassland with patches of woodland in a forest-fringed valley. The dorsal colouration of these fresh specimens was within the marked variability of this species described previously (SMITH, 1943; TWEEDIE, 1957; TAYLOR, 1965; CAMPDEN-MAIN, 1970); being brown with irregular lighter patches edged blackish and both had the delicate and rather complex head markings of the species. Both specimens exhibited the same ventral colouration; the chin and throat being very dark brown sparsely spotted white centrally and the darker throat colour fading into bright orange-yellow slightly peppered brown for the anterior third of the body length. The remaining posterior ventral area being dark brown and slightly paler on the tail.

This species is typical of forest, and is reported to be a highland one "usually not occurring much below 2000 feet, although it may reach sea level" (TAYLOR, 1965), and it should be noted, therefore, that my two specimens were taken at little more than one or two hundred feet above sea level. Moreover, the highest point on Phuket Island is only 1736 feet above sea level, and the vast majority of the land mass is of considerably lower elevation.

I retained the Phuket specimen in captivity for seven months during which it fed frequently on house geckoes and sloughed its skin complete twice. As did TWEEDIE (1957) and TAYLOR (1965) I found this snake extremely pugnacious indeed and it repeatedly struck at the slightest provocation throughout its period of confinement.

CAMPDEN-MAIN (1970) writes of the Mock Viper "Although *P. pulverulentus* has grooved fangs in the rear of jaw and has venom glands, it is not considered dangerous to man. The enlarged teeth in the front of the jaw should not be mistaken for fangs, as they are not grooved or hollow, nor are they connected with venom ducts." SHAW (cited in SMITH, 1943) saw one strike a *Natrix* (= *Rhabdophis*) *subminata* which died in sixteen minutes. The Mock Viper is viviparous, and is reported to feed upon frogs and lizards. My specimen 54 proved to contain an unidentifiable gecko.

The species has been collected from Chiang Mai and from Narathiwat provinces (TAYLOR, 1965) and thus is found throughout Thailand north to south.

Chrysopelea paradisi Boie. Paradise Tree Snake.

The Paradise Tree Snake is a common snake on Phuket and I have examined numerous road-killed specimens in addition to those for which details are provided in Appendix I. All nine specimens were collected from Phuket Town and its suburbs, or from the grounds of the P.M.B.C. In addition to car-killed snakes several were collected from cultivated gardens and three were taken from within houses, where they apparently hunt house-dwelling geckoes. Specimen 110 in fact made itself apparent by falling at my feet from the rafters of my kitchen whilst in the act of

trying to overcome, and presumably eat, a fairly large individual of the Torkay or Giant Gecko, *Gekko gekko*. Similar battles involving these two reptile species have previously been described (TWEEDIE, 1957).

The scalation of my specimens is within the known variation of the species (TWEEDIE, 1957; TAYLOR, 1965) with the single exception of specimen 34 which is peculiar in having both the last and second last ventrals (in addition to the anal) divided.

This splendid snake is often encountered, feared and killed by local people. The snake will bite as a rule if handled, but it is a rear-fanged species with a slow-acting mild poison; and in the very unlikely event of an individual actually administering venom to a human the bite would not constitute any danger at all. It is remarkable, therefore, that many people living in close proximity to, and presumably thus quite familiar with, this snake consider it a great danger; and upon seeing me handle it (and being bitten by it) describe to me all kinds of terrible demise I might suffer. The snake's peculiar scalation and lovely colouration make it an unmistakable species, and one that should not cause concern whatever.

Specimens 108 and 109 (see Appendix I) were found on a road where a family of people were cropping mango trees. Both snakes were obviously killed by man and I suspect, therefore, that they were found in the mango trees. Possibly they were courting or mating, and in this respect it is noteworthy that specimen 108 contained five eggs each measuring approximately 15×8 mm; thus providing a breeding record for May, during which the snake was collected. In writing of the very closely related *Chrysopelea ornata* SMITH (1943) states "Pairing in Bangkok takes place in June. From 6 to 12 very elongate eggs are laid at a time." The female 108 also contained the partly digested, but easily identifiable, remains of a medium-sized skink. A complete specimen of a small gecko, probably *Hemidactylus frenatus*, was found in specimen 37.

Chrysopelea ornata (Shaw). Golden Tree Snake.

I have examined one specimen of this species, in the collection of the Ko Panyi School, which was taken in Phangnga Province. Unfortunately the specimen is very badly broken up and I am unable to obtain

measurements or many scale details from it. It is, however, perfectly typical of the species in markings and colouration. The record of this species in Phangnga Province is noteworthy as it would indicate a strong possibility that it might also be expected to occur on Phuket Island, (see below), although I have not found it there.

Chrysopelea paradisi X *C. ornata* hybrid?

I have a single specimen (72) collected in Phuket Town during April which may represent an aberrant individual of *Chrysopelea paradisi* or *C. ornata*. Although having examined some twenty to twenty-five *Chrysopelea* specimens on Phuket not one typical *C. ornata* was involved. It would seem likely, therefore, that if this individual is indeed aberrant in its characters it would be of *C. paradisi* stock in origin. It is most noteworthy, however, that the characters of this specimen appear to be completely intermediate between the two distinct species (see Fig. 2). It must be considered possible, therefore, that *C. ornata* may occur on Phuket and that perhaps this interesting individual represents the first known hybrid between the two species. Certainly there would appear to be no reason why *C. ornata* should not occur on Phuket, other than due to the competitive pressure from *C. paradisi*, as the species is a widespread one occurring from the extreme north of Thailand to as far south as Pattani (TAYLOR, 1965). Moreover, a specimen of typical *C. ornata* from Phangnga Province is in the collection of the Ko Panyi School (see above). In view of the very close proximity of this province to Phuket Island, separated by only a few hundred metres of sea water, it would seem very likely that *C. ornata* does, if only infrequently, occur on Phuket. Of a southern distribution *C. paradisi* is found throughout the Malay Peninsula and "extending up the west coast as far north as Mergui [Burma]." Thus, the two species have an extensive overlap of range from approximately Mergui, Burma to Parit Buntar in Perak within which one might expect to find hybrids if they exist.

This unique specimen was coloured typically of *C. ornata*, being generally light yellow-green with black markings and lacking the red colouration of *C. paradisi*. It is far blacker than normal *C. ornata*, however, due to the far more extensive black edging to individual scales which is more prevalent dorsally than dorso-laterally (see Fig. 2).

In addition the central black line on individual scales of the outer, or first, scale rows is absent except for the slight suggestion of it on the more anterior third of the body length; but is present on the tail as in normal *C. ornata*. Another most odd and interesting feature of this specimen is the anal scale, which is divided and divided again (i.e., having three sutures). The latter anomaly (Fig. 2) could conceivably be the result of a hybridisation between the two parent species as both exhibit a divided anal which may, as a result of hybridisation, have become genetically repeated in the resultant offspring.

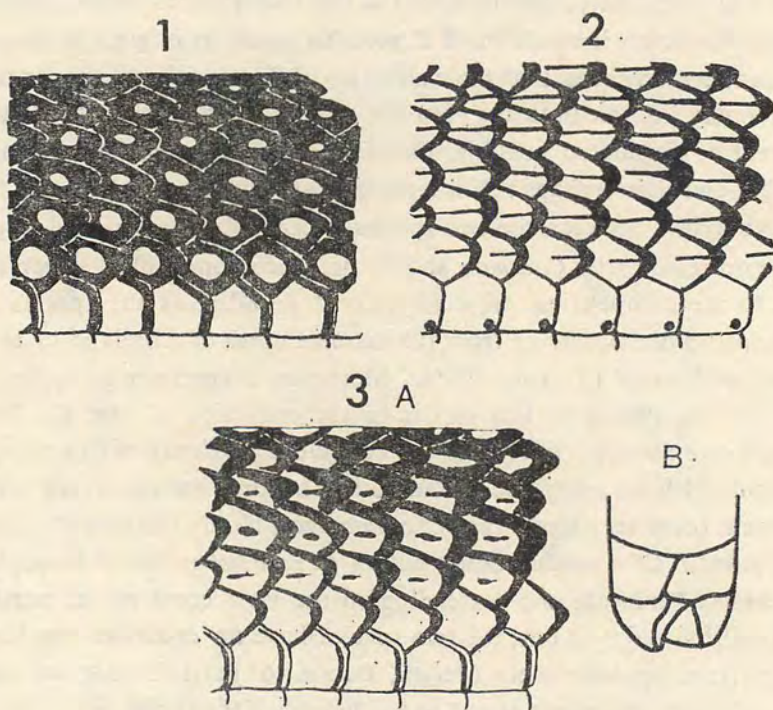


Fig. 2. Stylised side view at mid-body of :

1. *Chrysopelea paradisi*, 2. *C. ornata* (both after Tweedie (1957)), and 3A a possible hybrid *C. paradisi* X *C. ornata*. 3B shows the last, divided, ventral scale and the oddly multiple-divided anal scale of the possible hybrid (see text).

Subfamily — HOMALOPSINAE

Homalopsis buccatta (Linnaeus). Puff-faced Water Snake.

I have a very young specimen (121) of this species, which was collected from the rocky edge of a stream torrent in good forest east of Thalang, central Phuket Island. This snake was typically coloured for the young of the species being very similar to that illustrated by TAYLOR (1965: Fig. 79). An adult snake (62) was collected near Klong Nakha, 80 kilometers south of Ranong in lowland rain forest with some clearings and dwellings. It was found swimming slowly down-stream in a clear shallow slow-moving river with a stony substrate. This snake was very dark blackish-brown dorsally, with a slight olive hue in some lights, and most markings obscured. Throat almost whitish and ventrals very pale yellow; subcaudals mostly blackish, with pale yellow flecks. The outer three scale rows were very pale yellow with the usual greyish-brown to blackish ventral markings extending onto the first and second scale rows.

In addition to these specimens I have examined one other which I found dead on a road of suburban Phuket Town at the end of September. The remains of a fishing net about it's neck, and severe wounds about it's head, suggested that it was killed by fisherman on the near-by extensive marshy area. This snake was extremely stout and measured 1331 mm in total length, with a tail of 218 mm. In colouration it was similar to the larger specimen described above. Upon cutting it open I found it to contain extensive fatty deposits posteriorly. Possibly this fat is put on during the wet monsoon season when the snake's aquatic food is abundant, and is subsequently utilised during the following dry season when foods are sparser. The time of year that I examined this snake would support this hypothesis.

The young individual (121) was retained in captivity for five weeks during which it fed frequently upon large tadpoles. Upon my placing 6 or 8 tadpoles in an inch of water within the snake's cage it would immediately eat them one after another. Any movement from a tadpole would stimulate the snake to strike instantly after which it would always

wiggle rapidly backward through the water to the edge of the tank and then and then beneath a ledge, rapidly swallowing the prey as it went.

Cerberus rhynchops (Schneider). Dog-faced Water Snake.

I have one specimen only, collected at Ao Nam Bor mangrove forest, Phuket Island where it was dug from mud at a depth of 150 mm. during a study of mangrove macrofauna (FRITH *et al* in press) during July 1974. It is a very young individual, which attempted to burrow further into the mud when disturbed. In fresh colouration it was typical of this species, and identical to that described by TWEEDIE (1967).

Other than this specimen I have examined a specimen from the Koh Pannyi School collection collected from the Gulf of Phangnga (see Appendix 1). I have seen the species myself at Phangnga; when I watched an adult lying still or moving very slowly while semi-submerged at the muddy edge of a mangrove-fringed estuary. This snake was apparently hunting mud-skipper fish, *Boleophthalmus boddarti*. SMITH (1943) states that fish constitute this snake's diet.

Family — ELAPIDAE

Bungarus fasciatus (Schneider). Banded Krait.

This snake I am very familiar with, having retained a large individual in captivity which I obtained in Bangkok. I have never seen, or heard of, a specimen on Phuket Island but this may be due to the nocturnal and retiring habits of the snake. I have, however, examined one road-killed specimen, approximately 600 mm. in total length, 9 kilometres north of Kapoe. This very feared and potentially dangerous snake (although very reluctant indeed to bite) is sometimes confused with the harmless Yellow-ringed Cat Snake by laymen. For an explanation of distinguishing characters see the text for the latter species above.

Naja naja (Linnaeus). Cobra.

The Cobra is a very abundant snake on Phuket Island and I have examined very many specimens, perhaps in excess of 100, during the study period. It is particularly noteworthy, therefore, that all snakes involved were Common Cobras, *Naja naja*. Despite the emphatic statements of numerous local people and a number of expatriate residents, to the contrary I feel confident that the King Cobra *Ophiophagus hannah* is not at present resident on Phuket Island. That is not to say that it could not, or did not, occur there. I suspect, however, that accounts I have heard of King Cobra being found in houses or biting people involved larger specimens of the Common Cobra. As pointed out by TAYLOR (1965) even the very common Indo-Chinese Rat Snake, *Ptyas korros*, has been emphatically described as the King Cobra. Moreover, I have met no person who has been aware of anyone attempting to systematically identify a possible King Cobra from Phuket. Those people I have met emphatic about the presence of King Cobra on Phuket, from personal experience or hearsay, lacked any ability to discriminate between the two cobra species when questioned. These cases are, I feel, simply a matter of a 'cobra story' being all the better for being a 'King Cobra story'; as indeed TAYLOR (1965) felt was the case with his amusing Rat Snake tale. Of course it is quite possible, in fact most likely, that the King Cobra is to be encountered in areas of the mainland adjacent to Phuket.

All cobras I have seen on Phuket have been particularly dark, being blackish or blackish-brown with a whitish or pale tan 'monacle' marking finely edged with black on the back of the 'hood'. The labials, chin, throat and the first twenty five or so ventrals creamish-white with the typical black spots and black band. The remaining ventral area usually dark purplish-grey with a creamish or grey tail and with strong iridescence.

A specimen I examined measuring 1320 mm. in total length contained at least 10 naked young rats and one toad, *Bufo melanostictus*, which measured 95 mm. from snout to vent. Specimen 112 also contained a toad of this species; and another individual, of 450 mm.

total length, was found attempting to swallow the same toad species in bright sunlight at 14.00 hours. In its rat eating habits the Common Cobra is extremely beneficial. Of 62 individual snakes examined by LIM (1974) in Malaysia 32.4% (20 snakes) contained rats. Furthermore, in experimental feeding of five cobras with rats (*Rattus tiomanicus*) 915 rats were eaten in 52 weeks, the average number of rats being taken each week by a snake being 3.52. In calculating how often a cobra in the wild predares rats LIM deduced that each snake would take 1.1 rats a week.

SMITH (1943) provides some useful information concerning growth rates of Common Cobra. He states that when born young measure 240-260 mm. in length; and refers to observations by Nicholson of young measuring one foot in July that measured on average two feet six inches by the following July, after which growth was slower with snakes reaching four feet ten inches by the end of four years.

It should be noted that the Common Cobra can spit venom some distance. LIM *et. al.* (1960) observed captive snakes which would spit upon live food animals and then follow this with a strike. Indeed one mouse spat upon, but not bitten, died within two minutes.

For those requiring an excellent and exhaustive account of the Common and King Cobras (under the names *Naja k. kaouthia* and *Ophiophagus hannah* respectively) with particular reference to Thailand, see SODERBERG (1973). It is noteworthy that of the 38 Thailand, provinces from which the former species is known and listed by SODERBERG (1973) Phuket is not included; and of 17 provinces similarly listed for the latter species Phuket is likewise lacking.

Calliophis maculiceps Gunther. Small-spotted Coral Snake.

A single specimen was collected from a garden lawn in the suburbs of Phuket Town on the 24 May 1976 at 06.30 hours. In addition to this specimen another snake, undoubtedly of this species, was described to me by Mr. A.P. Bisson who watched an approximately 300 mm. long individual crossing a road near his Phuket home in mid July.

The colouration of the live specimen was brick-reddish-brown dorsally with paler, nearly creamish, head colouration marked and spotted with the usual jet black crown markings, eye-stripe and lip spots. A series of paired, and a few additional (primarily anteriorly), very small black spots extending down the entire length of the snake dorsally, with a black band of three to four full scale lengths in width across the tail above the vent, and towards the tail tip. The black markings of this specimen are very similar to those on the snake illustrated in TAYLOR (1965: Fig. 94), and the black dorsal spots of my specimen are very little larger than on that figured snake (which TAYLOR describes as the smallest-spotted individual he had seen). SODERBERG (1967), however, observed that Peninsular Thailand specimens "seemed to have large spots as a rule". Ventrally my specimen was very bright red throughout and the subcaudals very bright pale blue the latter being spotted black, predominantly in the areas directly beneath the black dorsal tail bands. The brilliant ventral colour quickly faded in alcohol preservative, becoming a very pale fawn throughout the ventrals, and the subcaudals becoming a chalky white, within two months. Dorsally the specimen faded to a pale tan, more so anteriorly, and very predominantly lost the red suffusion.

This secretive and retiring snake uses its bright tail and posterior ventral colouration when disturbed as defensive/warning colouration by coiling the tail tightly and raising it to expose the red ventrals and blue subcaudals. The black tail markings help to enhance the effect of this posture (see Fig. 3).

This snake was retained in captivity for one month, being placed in a large glass aquarium tank with a heap of loose soft soil. Sometime between the afternoon of the 28th. and the early morning of the 29th. of May the snake laid two large elongate pure white eggs, which were not measured for fear of damaging them, 30 to 40 mm. deep in the soil. On subsequent examination of the eggs the snake was always found beneath the soil surface very close to them, despite the large area of soft soil available to it. Unfortunately the eggs subsequently dehydrated. Their dimensions can, however, be approximated in view of the snake's measurements (see Appendix 1) by examination of Fig. 3.

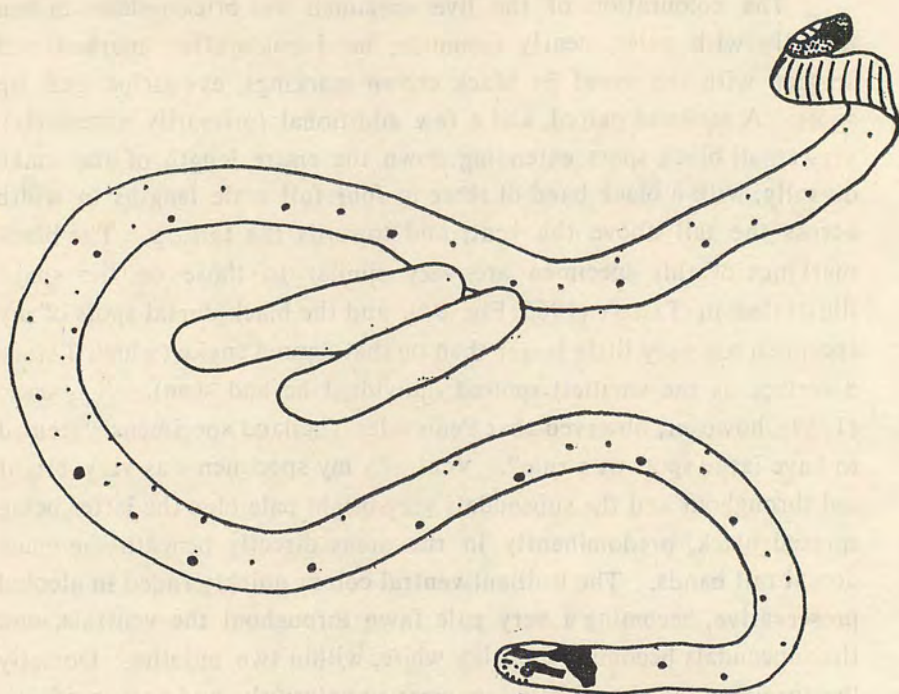


Fig. 3. Female Small-spotted Coral Snake, *Calliophis maculiceps*, in defensive posture with her two freshly laid eggs. Note that the pale blue undertail, with a black band across it, is indicated by stippling. The bright red ventrals are indicated by slightly curved vertical lines. (Drawn directly from a photograph.)

In his exhaustive review of this species SODERBERG (1973) gives the reproductive biology as unknown and as I can find no contradiction to this in the literature the above information would appear to represent the first known breeding record for *Calliophis maculiceps*. It is of particular interest therefore to point out that the production of only two eggs by my specimen is contrary to the known egg production of congeneric species. As admirably summarised by SODERBERG (1973) *C. maclellandi* has been repeatedly found in gravid condition; containing six (WALL 1912), fourteen (WALL 1926) and four (POPE 1935) eggs respectively.

Family – HYDROPHIIDAE

Subfamily – LITICAUDINAE

Laticauda colubrina (Schneider). Amphibious Sea Snake.

The first specimen (9) of this species I examined proved to be the second record of this snake for Thailand, and the first with a specific locality, as has been previously discussed in this journal (FRITH 1974). Subsequent to this specimen I have examined four others, three of which I have and one of which is in the collection of the Phuket Marine Biological Centre. All scale count results and measurements of these latter specimens are given in Appendix 1 for comparative purposes. All five snakes were collected live in close proximity to the Marine Biological Centre; one on a beach in June (9), one caught by hook and line as it swam past a reef edge in October (55), one found lying on a coral reef at a depth of 1.5 metres of water in August (124) and two found curled on the support structure of a pier above the water level in June (P.M.B.C. collection) and October (130).

It should be pointed out that this sea snake is unique in that it can be encountered on land not infrequently. It is the only sea snake that comes ashore, which the females do to lay eggs in rock crevices and similar situations (SMEDLEY 1931). It is also unique amongst the sea snakes in laying eggs, as all other species for which such information is known are viviparous.

Subfamily – HYDROPHIINAE

Hydrophis spiralis (Shaw).

I have, for bibliographical reasons, described three specimens and figured two of them, elsewhere (FRITH, this issue). These specimens, from the Koh Panyi School collection of snakes, were collected from the Gulf of Phangnga and they represent the first known occurrence of the species for Thailand. Their measurements and scale counts are included in Appendix I for comparative purposes, but for all other details concerning them see the paper in 'Notes' of this issue.

Family – CROTALIDAE

Agkistrodon rhodostoma (Boie). Malayan Pit Viper.

TAYLOR (1965) records that this snake has been collected from Phuket and that it would appear to occur throughout Thailand except in higher areas, I have not, however, encountered this species on Phuket and this may be due to a lack of intensive collecting in suitable habitats and situations.

It is a potentially dangerous snake to man, and with the Common Cobra, and possibly the Shore Pit Viper *Trimerusurus purpureomaculatus* (see FRITH & FRITH 1975), is one of the few terrestrial species that are significant to man in this respect on Phuket Island. The typical viper shape and characteristics together with its sluggish habit and preference for leaf-littered substrates, make it an easy snake to identify in the wild.

Writing of the bite of the Malayan Pit Viper SMITH (1943) states "Deaths have been recorded, but they are extremely rare and they appear to have been caused by septic conditions secondary to the bite. In the vast majority of the cases the symptoms are not severe and are quickly recovered from." The Pasteur Institute in Bangkok prepares anti venene specific for this snake. I have kept this species in captivity for over a year and have found it, as TWEEDIE (1957) pleasantly puts it, "rather an ill-tempered snake."

Trimerusurus purpureomaculatus (Gray & Hardwicke). Shore Pit Viper.

I have collected only one specimen (35) from Phuket which I found beneath the loose bark of a dead mangrove tree on a mangrove-fringed beach at Ao Nam Bor. I am informed by local people that it is a fairly common snake about coastal Phuket and some of the adjacent islands, and I have examined a stuffed specimen taken in a mangrove forest south of Phuket Town. In addition one specimen (105) of three collected from Koh Surin, just south of the Burmese border, was kindly given to me by Mr. W. Way and is described in Appendix I.

The Phuket specimen is very dark, being a uniform dark brown throughout with the, usually more conspicuous, darker markings only

slightly showing through dorsally and a little more so dorso-laterally. The venter of this individual is also very dark, being dark greyish-brown heavily spotted and speckled generally darker. The stuffed specimen, mentioned above, was very similarly coloured to this. The Koh Surin snakes, in contrast, were generally greyish with darker brown and russet markings dorsally, and with much lighter off-whitish underparts with a mustard yellow wash stronger, and spotted brown, on the outer edges of the ventrals; and the under-tail being predominantly dark brown with irregular greyish and yellowish spots.

I maintained the Phuket specimen in captivity for four weeks, during which it remained excessively pugnacious and fed continuously on house geckoes and young naked rats. The Koh Surin specimen was retained in captivity for five months during which it similarly remained aggressive but was fed exclusively on various species of frogs.

The symptoms resulting from a bite administered to the author by the snake collected from Phuket (35) have previously been described in this journal (FRITH & FRITH 1974).

DISCUSSION

During the present study twenty-two species of snake were found to definitely occur on Phuket Island or in its off-shore waters which, together with two species previously recorded as found on the island (TAYLOR 1965), makes a total of twenty-four snakes. In view of the extremely close proximity of Phuket Island to the adjacent mainland, however, species found during the present study only on the latter area may be expected to occur, if only infrequently, on Phuket Island. Thus the snake species *Gonyosoma oxycephalum*, *Elaphe flavolineata*, *Ptyas carinatus*, *Dendrelaphis cyanochloris*, *D. ahaetulla*, *Rhabdophis nigrocinctus*, *Boiga dendrophila*, *B. jaspidea*, *Chrysopelea ornata*, *Bugarus fasciatus* might well occur on Phuket. One can conclude, therefore that a not unreasonable hypothetical list of thirty-four snake species can be derived at for Phuket. Likewise those snake species found during the present study on Phuket but not on the adjacent mainland might well be expected on the mainland or its coastline. This involves twelve species which,

added to the above named mainland frequenting species gives a total of twenty-two snakes. This apparently odd situation, with more snake species on Phuket than on the adjacent mainland is due, of course, to the fact that I have dealt thus far only with those species found during the present investigation. In order to provide a more accurate figure for the snake species of Southern Peninsular Thailand (south of the Isthmus of Kra to the Malaysian border) I have made a survey of TAYLOR's review (1965). This results in a total of 65 species not found on the peninsular mainland during my casual collection there (see under Study Area). Add to these the fifteen species that I have examined from the peninsular mainland (the ten species found exclusively there, and named above, included); and the six species found only on Phuket which might, thus, be expected on the adjacent mainland and a total of eighty-six species results. This figure should no doubt be higher as a number of species (at least seven) known from north of the Isthmus of Kra (in particular the Bangkok area—doubtless as a result of heavier collecting there) are also recorded in Peninsular Malaysia (TWEEDIE 1957) and therefore very probably occur on Peninsular Thailand. For present purposes, however, I have included only species confirmed to be present in Thailand south of the Isthmus of Kra. Thus, of the 150 species of snake recorded for Thailand (TAYLOR 1965) 86, or over half (57.3%), occur in the southern peninsula area.

It should be noted that I have, above, considered it possible that ten snake species I found on the mainland area adjacent to Phuket Island might well be expected to occur on the latter. The possibility that a percentage of the some sixty-five additional species known to occur on Southern Peninsular Thailand (see above) might be found on Phuket must, therefore, be acknowledged.

The high percentage of the Thailand snake fauna found within the relatively small area of the country south of the Isthmus of Kra is no doubt due, to some extent, to the fact that the area involved is where the Continental Asia and the Malay Peninsula faunas (see TWEEDIE 1957) meet. It is generally accepted that the borders of these two faunal areas meet at the Isthmus of Kra. An examination of the faunal affinities of

the snake species now known to occur on Southern Peninsular Thailand is beyond the scope of the present study, and may form the basis of a future work. It is, however, pertinent to point out here the significance of some of the extensions to snake species distributions, both northward and southward (see Appendix II), resulting from the present work.

Appendix II indicates those snakes for which a new northern or southern limit to the known range within Thailand has been defined herein. The distributions of seven species of snakes of the Malay Peninsula ophidian fauna have been extended northward, but not to a point north of the Isthmus of Kra. Thus they are still unknown north of the Malay Peninsula zoogeographic area. The ranges of four snakes of the Continental Asia ophidian fauna have been extended southward; two to localities closer to the Isthmus of Kra and, thus, to what must be the actual southern limit of their ranges; and two of them, *Dendrelaphis cyanochloris* and *Boiga cyanea*, to Phuket Island which is considerably south of the Isthmus of Kra and, thus, well into the Malay Peninsula zoogeographical area.

Of the northward range extensions none are unexpected;— *Elaphe flavolineata* has previously been found in southern Burma (TAYLOR 1965) and thus can be expected to occur in Thailand northward at least to the Isthmus of Kra. *Dendrelaphis formosa*, *Boiga dendrophila* B. *jaspidea* and *Dryophiops rubescens* are species that were previously known from relatively few specimens in the southern-most provinces of Thailand only. The extension of their ranges northward to the Phuket area is not, however, unexpected and they shall probably prove to occur north to the area of the Isthmus of Kra.

The two sea snakes *Laticauda colubrina* and *Hydrophis spiralis*, as a result of studies on Phuket and adjacent areas (FRITH 1974 and this issue,) have for the first time been definitely added to the fauna of Thailand. In view of their sea dwelling habit they can, of course, be expected to be found still further north on the Thai and Burmese coasts.

In view of the above redefined northward and southward limits to ranges of terrestrial snakes, closer to the Isthmus of Kra than previously known, the Isthmus is further emphasised as a major zoogeographical

barrier; at least in terms of ophidians. The exceptions of *Dendrelaphis cyanochloris* and *Boiga cyanea*, which are Continental Asia species now reported some way south of the Isthmus of Kra, may represent the result of a southward colonization of the peninsula in more recent times, possibly as a result of habitat changes due to deforestation and associated cultivation. Certainty this is a common phenomenon with a number of bird species of the area (D. Wells, pers. comm); and in this respect it may not be altogether coincidence that these two snakes are very predominantly arboreal and, particularly the latter, eat birds.

To conclude this discussion it should be noted that range extensions of a number of other snake species, not dealt with thus far, might be expected as a result of further herpetological exploration of the area. For example the terrestrial snakes *Pareas margaritophorus*, *Xenodermus javanicus*, *Sibynophis melanocephalus*, *Oligodon purpurascens*, *Macrophisthodon rhodomelas*, *M. flaviceps*, *Boiga drapiezii*, *B. nigriceps*, *Maticora bivirgata*, *M. intestinalis*, *Trimeresurus monticola* and *T. wagleri* might, in view of their known distributions in Southern Peninsular Thailand (TAYLOR (1965)), be expected to be found further northward, perhaps to the Isthmus of Kra. On the other hand, however, there are a number of species recorded from only a single, or small, number of extreme southern Thailand province localities which may well be snakes of very limited and or isolated range. These probably include: — *Typhlops trangensis*, *T. muelleri*, *Python curtisi*, *Pareas hamptoni*, *P. laevis*, *Pseudorabdion longiceps*, *Calamaria vermiformis*, *C. leucocephala*, *Calliophis grasillis*, *Trimeresurus sumatranus*.

The first breeding record of *Calliophis maculiceps*, discovered during the present study, is of interest inasmuch as the small number of two eggs involved is notably less than that previously found in congeneric species. The possibility that this particular snake is peculiar in this respect cannot be overlooked, and the need for further breeding data for this species should be noted.

That the snakes of Southern Peninsular Thailand, certainly the western side, have lacked previous examination is obvious from the new data discovered during the present study and presented here. In fact

little snake work has been carried out on the Thailand Peninsula as a whole except at the few specific localities of Nakhon Si Thammarat, Pattani and now Phuket. Indeed a number of snakes included in the fauna of Thailand are represented by only one or two specimens from this area, and in some cases only the type exists. There is, thus, a considerable need for data from elsewhere both north and south of the Isthmus of Kra, Peninsular Thailand.

ACKNOWLEDGEMENTS

The data presented in this study are to some extent the result of the kindness, co-operation, and interest of a number of people I have been fortunate enough to know and live with on Phuket Island. With the exception of only one or two all of these people had no experience in handling snakes, dead or alive, prior to meeting me. All of them have, however, contributed greatly to the present work by providing me with, or calling my attention to, snake specimens which have much enhanced the value of this study and, equally important, given those concerned a better understanding of snakes. To these helpful friends and colleagues, listed here alphabetically, I extend my sincere thanks:

Mr. H. Abbinck, Mr. A.P. Bisson, Mr. & Mrs. K. Bustraen, Mr. B. Christensen, Mr. H. Ditlev, Captain D. Eagleston, Mr. N. Griffin, Mr. V. Hansen, Mr. & Mrs. M. Hendrickx, Mr. & Mrs. J. Kamsteeg, Mr. Banjong Mianmanus, Mr. & Mrs. J. Nybroe, Mr. & Mrs. Boonlert Phasuk, Mr. J. Simpson, Mr. C. Smith, Mr. J. Sutherland, Miss Ratsuda Tantasiriwong, Mr. J. Van Noorden, Miss P. Vermeer, Mr. & Mrs. B. Westerweel, Mr. W. Way and Mr. & Mrs. S. Wium-Anderson.

To Mr. Boonlert Phasuk, Jette Nybroe, Sripin Christensen and Mrs. Ratchanee Sirivejabandhu I am most grateful for access to, and help with, the fine library of the Phuket Marine Biological Centre.

For permission to examine snake specimens in collections under their supervision I thank Mr. Boonlert Phasuk, Miss Ratsuda Tantasiriwong, Drs. Lim Boo-Liat and Niphan Ratanaworabhan, and the Principle of the Ko Panyi School, Phangnga Province. My sincere thanks is due to Dr. E. N. Arnold of the Reptile Section, British Museum of Natural History for kindly providing me with important and otherwise unavailable literature; and to Dr. G. Zug of the Division of Rep-

tiles and Amphibians, Smithsonian Institution for kindly sending me the last available copy of CAMPDEN-MAIN's Field Guide to the Snakes of South Vietnam.

Dr. and Mrs. Joe T. Marshall Jr. and Mr. J. Sutherland generously provided hospitality and accommodation during my visits to Bangkok which were often used to consult specimens and literature, for which I am most grateful.

I wish to acknowledge here the published works of CAMPDEN-MAIN, SMITH, SODERBERG, TAYLOR and TWEEDIE, as fully cited in the list of references. These major works on the snakes of South-east Asia provided the basis for the present work without which the task would have been far more difficult, and less fruitful.

I owe my greatest debt of gratitude to my wife Dawn who, having arrived in Thailand with me to confront her first live snake, has assisted and encouraged me in every possible way throughout the study; and has, all too often, been thrust out of a moving vehicle into a dark wet night in order to locate a snake, only to subsequently have to tolerate its presence about the house. In addition she took upon herself the tedious task of typing the first draft of this paper. This study has, at least in terms of field work and its final production, occupied as much of her time and effort as it has my own.

REFERENCES

- BOULENGER, G.A. 1912. *A Vertebrate Fauna of the Malay Peninsula from the Isthmus of Kra to Singapore, including the Adjacent Islands. Reptilia and Batrachia.* London.
- BRONGERSMA, L.D. 1934. Contributions to Indo-Australian herpetology. *Zool. Meded. Leiden*, **17**: 161-252.
- CAMPDEN-MAIN, S.M. 1970. *A Field Guide to the Snakes of South Vietnam.* Smithsonian Institution. Washington.
- COTT, H.B. 1940. *Adaptive Coloration in Animals.* Methuen. London.
- FITZSIMONS, V.F.M. 1970. *A Field Guide to the Snakes of Southern Africa.* Collins. London.
- FRITH, C.B. 1974. Second record of the sea snake *Laticauda colubrina* in Thailand waters. *Nat. Hist. Bull. Siam Soc.* **25**: 209.
- FRITH, C.B. 197. The sea snake *Hydrophis spiralis* (Shaw); a new species to the fauna of Thailand. *Nat. Hist. Bull. Siam Soc.* **26**: 263-316.
- FRITH, C.B. & FRITH, D.W. 1975. A case of snake bite by the Shore Pit Viper, *Trimeresurus purpureomaculatus* (Viperidae). *Nat. Hist. Bull. Siam Soc.* **26**: 159-163.

- FRITH, D.W., TANTANASIRIWONG, R. & LUVIRA, O. Zonation and abundance of macro-fauna on a mangrove shore, Phuket Island, Southern Thailand. *Phuket Mar. Biol. Res. Centre Bull.* **10** : 1-37.
- LIM, Boo-Liat. 1956. The Natural Food of Some Malayan Snakes. *Malay Nat. J.* **10** : 139-144.
- LIM, Boo-Liat. 1973. Unusual predators of mouse-deer. *Malay. Nat. J.* **26** : 170.
- LIM, Boo-Liat. 1974. Snakes as natural predators of rats in an oil palm estate. *Malay. Nat. J.* **27** : 114-117.
- LIM, Boo-Liat, WATERS, J.P.J., and OMAR, Abdul Rahman Bin. 1960. Observations on Some Captive Snakes. *Malay. Nat. J.* **14** : 181-187.
- POPE, C.H. 1935. The Reptiles of China. Turtles, Crocodilians, Snakes, Lizards. *Nat. Hist. of Central Asia*, **10**, American Mus. Nat. Hist., New York.
- SKEAD, C.J. 1967. *Sunbirds of Southern Africa*. South African Bird Book Fund. Cape Town.
- SMEDLEY, N. 1931. Oviparity in a Sea-snake (*Laticauda colubrina*). *Bull. Raffles Mus.* **5** : 54-59.
- SMITH, M.A. 1916. On a collection of reptiles and batrachians from peninsular Siam. *J. Nat. Hist. Soc. Siam* **2** : 148-171.
- SMITH, M.A. 1926. *Monograph of the sea-snakes Hydrophiidae*. British Museum, 1926 London.
- SMITH, M.A. 1930. The reptilia and amphibia of the Malay Peninsula from the Isthmus of Kra to Singapore, including the adjacent islands. (A supplement to G.A. Boulenger's Reptilia and Batrachia 1912). *Bull. Raffles Mus.* **3** : 1-149.
- SMITH, M.A. 1943. *The Fauna of British India, Ceylon and Burma, including the whole of the Indo-Chinese Subregion. Reptilia and Amphibia. vol. 3, Serpentes*. London.
- SMITH, M.A. and KLOSS, B.K. 1915. On reptiles and batrachians from the coast and islands of south-east Siam. *J. Nat. Hist. Soc. Siam* **1** : 237-249.
- SODERBERG, P. 1967. Notes on a collection of Herpetological Specimens Recently Donated to the Centre for Thai National Reference Collections. *Nat. Hist. Bull. Siam. Soc.* **22** : 151-166.
- SODERBERG, P. 1973. On Eleven Asian Elapid Snakes with Specific Reference to Their Occurrence in Thailand. *Nat. Hist. Bull. Siam. Soc.* **24** : 203-317.
- TAYLOR, E.H. 1965. The Serpents of Thailand and Adjacent Waters. *Univ. Kansas Sci. Bull.* **45** : 609-1096.
- TAYLOR, E.H. and ELBEL, R.E. 1958. Contribution to the herpetology of Thailand. *Univ. Kansas Sci. Bull.* **38** : 1033-1189.
- TWEEDIE, M.W.F. 1950. Notes on Malayan reptiles, 2. *Bull. Raffles Mus.* **23** : 191-199.
- TWEEDIE, M.W.F. 1957. *The Snakes of Malaya*. Second Edition. Government Printing Office. Singapore.
- WALL, F. 1912. Breeding of Maccllelland's Coral Snake (*Callophis maccllellandi*). *J. Bombay Nat. Hist. Soc.* **21** : 693.
- WALL, F. 1921. Hatching of Cobras (*Naja tripudians*) with Remarks on the Oodont, Genitalia, etc. *J. Bombay Nat. Hist. Soc.* **28** : 553-556.
- WALL, F. 1926. Snakes Collected in Burma in 1925. *J. Bombay Nat. Hist. Soc.* **31** : 558-566.

APPENDIX I

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Measurements¹ and scalation² details of snake specimens collected from Phuket Island and the adjacent peninsular mainland of Thailand.

Species ³	Specimen ⁴ number	Total length	Tail length	Scale rows	Ventral scales	Subcaudal scales	Anal ⁶ scale	Notes ⁵
<i>Typhlops braminus</i>				20	—	—	—	
	28	77	2	20	—	—	—	
<i>Xenopeltis unicolor</i>				15	173-196	24-31		
	64	738	76	15	180	33	D	
	104	c707	67	15	c179	27+	D	
<i>Python reticulatus</i>				70-80	297-332	75-102		
	116	1160	143	73	313	91	S	Examined alive
<i>Acrochordus granulatus</i>				89-100	—	—		
	56	474	55	c90	—	—		
	KPS	753	62	c96	—	—		
<i>Elaphe radiata</i>				19	222-250	82-108		
	6	1707	364	19	234	105	S	
	27	385	76	19	232	97	S	
	75	1101	201	19	230	98	S	
	97	441	87	19	232	98	S	
	103	411	77	19	242	93	S	
	115	394	79	19	230	93	S	
<i>Ptyas korros</i>				15	160-187	120-147		
	4	1314	457	15	174	122+	D	50th & 61st ventrals only half scales.
	5	1239	448	15	163	138	D	
	10	1214	—	15	162	—	D	Head & skin to anal only preserved.
	29	975	124	15	174	35+	D	
	33	1508	502	15	168	129	D	
	34a	864	307	15	166	140	D	
	38	1907	639	15	173	135	D	Subsequently discarded.

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	68	1152	421	15	167	130	D	
	74	1047	151	15	172	33+	D	Last ventral only a half scale.
	81	1537	557	15	174	142	D	
	91	1304	490	15	167	141	D	
	99	1086	301	15	166	84+	D	
	107	1688	585	15	172	130	D	
	122	1253	431	15	163	125+	D	
<i>Ptyas carinatus</i>				14 or 16	208-215	110-118		
	70	1005	241	16	213	120	D	
<i>Lycodon capucinus</i>				17	188-205	61-71		
	7	445	78	17	200	69	D	
	25	415	88	17	202	73	D	
	73	363	73	17	191	75	D	
	78	442	82	17	199	73	D	
	88	432	80	17	203	73	D	
	95	371	79	17	192	76	D	
100a	414	79	17	190	75	D		
100b	432	85	17	186	73	D		
100c	448	89	17	186	77	D		
101	336	58	17	200	75	D		
114	516	103	17	188	73	D		
123	453	79	17	201	73	D		
<i>Dendrelaphis caudolineata</i>			13	171-188	100-112			
	24	1287	330	13	181	109	D	
	67	937	245	13	176	109	D	
	102	1262	324	13	178	108	D	
<i>Dendrelaphis formosa</i>			15	174-205	132-158			
	128	982	330	15	178	139	D	
<i>Dendrelaphis cyanochloris</i>			15	186-211	135-159			
	1	1002	318	15	213	151	D	
<i>Dendrelaphis ahaetulla</i>			15	167-200	127-164			
	85	929	288	15	171	127	D	
<i>Natrix flavipunctata</i>			19	122-158	70-97			
	23	403	112	19	128	71	D	

Species	Specimen number	Total length	Tail length	Scale rows	Ventral scales	Subcaudal scales	Anal scale	Notes
	42	849	234	19	125	78	D	
	60	c713	c188	19	137	72	D	
	63	546	128	19	127	54	D	
	66	580	170	19	124	73	D	
	76	231	55	19	137	66	D	
	82	773	172	19	135	63	D	
	86	782	174	19	136	61	D	
	98	629	188	19	126	77	D	
<i>Rhabdophis subminiatus</i>				19	132-175	65-89		
	31	663	162	19	140	69	D	
	39	611	151	19	147	72	D	
	58a	479	130	19	121	75	D	
	58b	516	131	19	143	66	D	
	59a	631	167	19	144	77	D	
	59b	505	136	19	144	73	D	
	77	521	150	19	122	77	D	
	83	523	87	19	142	40+	D	
	84	567	74	19	142	29+	D	
	92	471	72	19	143	35+	D	
	118	486	131	19	142	74	D	
<i>Rhabdophis nigrocinctus</i>				19	150-170	80-97		
	53	648	174	19	152	86	D	
<i>Boiga cyanea</i>				21	237-257	144-158		
	8	1204	287	21	245	130	S	
	32	1470	332	21	250	131	S	
	40	1181	286	21	237	121	S	
	57	1165	379	21	243	130	S	Last ventral scale divided.
	69	1562	309	21	247	101+	S	
	71	819	319	21	240	100+	S	Last ventral only half a scale.
	80	1331	301	21	249	129+	S	
	93	1266	278	21	240	135	S	

	94	1327	293	21	244	118+	S	Last ventral only half a scale.
	132	1372	228+	21	251	72+	S	
	KSP	986	165	21	258	74+	S	
<i>Boiga jaspidea</i>				21 or 23	243-267	140-166		
	21	821	227	21	260	157	S	
<i>Dryophis prasinus</i>				15	194-235	151-207		
	79	1271	449	15	222	192	D	
	87	744	209	15	231	136	S	
	90	1525	572	15	223	196	S	
	119	1717	472	15	c218	106+	—	Some ventrals & anal scale missing.
	120	1666	529	15	199	169	D	
<i>Dryophiops rubescens</i>				15	186-200	111-136		
	129	635	165	15	189	98+	D	
<i>Psammodynastes pulverulentus</i>				17	146-175	44-71		
	3	440	76	17	163	53	S	
	54	323	53	17	170	54	S	
<i>Chrysopelea paradisi</i>				17	198-238	106-139		
	30	970	265	17	226	128	D	Last ventral scale divided.
	34	1045	280	17	222	126	D	Last & 2nd last ventral scale divided.
	37	1202	329	17	227	133	D	Last ventral scale divided.
	108	1125	329	17	221	133	D	Last ventral scale divided.
	109	893	242	17	228	132	D	Last ventral scale divided.
	110	1104	257	17	222	113	D	Last ventral scale divided.
	117	904	252	17	224	137	D	Last ventral scale divided.
	125	857	185	17	224	116	D	Last ventral scale divided.
	127	999	259	17	223	130	D	Last ventral scale divided.
	131	1191	326	17	216	134	D	Last ventral scale divided.
<i>C. paradisi</i> X <i>C. ornanta</i> ?	72	1196	316	17	221	134	D	Last ventral scale divided, anal scale divided & divided again (see Fig.).
<i>Homalopsis buccata</i>				37-47	158-176	70-106		
	62	840	179	40	162	66	D	
	121	229	60	42	159	83	D	
<i>Cerberus rhynchops</i>				21-25	137-159	50-68		
	22	201	40	23	146	56	D	

Species	Specimen number	Total length	Tail length	Scale rows	Ventral scales	Subcaudal scales	Anal scale	Notes
<i>Naja naja</i>				17-23	161-200	42-75		
	65	751	114	21	186	58	S	
	89	407	62	21	188	59	S	
	96	551	88	21	188	63	S	
	112	391	59	21	187	58	S	2nd to last ventral only half a scale.
	126	554	88	21	187	56	S	Last ventral scale divided.
<i>Calliophis maculiceps</i>				13	174-203	21-32		
	111	312	25	13	211	26	D	
<i>Laticauda colubrina</i>				21-25	213-246	27-47		
	9	417	81	—	—	—	D	Last ventral scale divided.
	55	517	53	24	228	36	D	Last ventral scale divided.
	124	488	59	23	228	43	D	Last ventral scale divided.
	130	914	112	23	225	45	D	Last ventral scale divided.
	PMBC	c1400	130	25	231	36	D	Last ventral scale divided.
<i>Hydrophis spiralis</i>				33-38	295-362	—		
	KPSI	1462	103	35	331	47		46 black bands on snake.
	KPS2	815	58	35	340	45		50 black bands on snake.
	KPS3	720	47	33	316	42		41 black bands on snake.
<i>Trimeresurus purpureomaculatus</i>				25 or 27	160-183	56-76		
	35	392	61	29	262	61	S	
	105	724	137	25	267	69	S	

Notes. 1. Measurements in millimetres.

2. The known range of each scale character (from SMITH 1926, TWEEDIE 1957, TAYLOR 1965) is given in boldface type.

3. For family and subfamily groupings of these species see Appendix II.

4. Numbers are those given specimens by the author. PMBC = from the P.M.B.C. collection. KPS = from the Ko Panyi School collection.

5. Ventral scales counted from head backwards; thus the last ventral scale is that scale next to the anal scale.

6. D = divided, S = Single.

APPENDIX II

A list of snake species found during the present study with an indication of their zoogeographical distribution on Continental and/or Peninsular Thailand, and on Phuket Island.

Family, subfamily and species	Distribution ¹	Range extension ²	Notes ³
TYPHLOPIDAE			
<i>Typhlops braminus</i>	C,M	P.	
XENOPELTIDAE			
<i>Xenopeltis unicolor</i>	C,M	P.	
BOIDAE			
PYTHONINAE			
<i>Python reticulatus</i>	C,M	P.	
COLUBRIDAE			
ACROCHORDINAE			
<i>Acrochordus granulatus</i>	C,M	P.	
COLUBRINAE			
<i>Gonyosoma oxycephala</i>	C,M		
<i>Elaphe radiata</i>	C,M	P.	
<i>E. flavolineata</i>	M	N	Second Thailand record
<i>Ptyas korros</i>	C,M	P.	
<i>P. carinatus</i>	C,M		
<i>Lycodon capucinus</i>	C,M	P.	
<i>Liopeltis scriptus</i>	C	P.	
<i>Dendrelaphis caudolineata</i>	M	P.	
<i>D. formosa</i>	M	N	P.
<i>D. cyanochloris</i>	C	S	
<i>D. ahaetulla</i>	C,M		
NATRICINAE			
<i>Natrix flavipunctata</i>	C,M	P.	
<i>Rhabdophis subminiatus</i>	C,M	P.	
<i>R. nigrocinctus</i>	C	S	
BOIGINAE			
<i>Boiga cyanea</i>	C	S	P.
<i>B. dendrophila</i>	M	N	

<i>B. jaspidea</i>	M	N	Second Thailand specimen
<i>Dryophis prasinus</i>	C,M		P.
<i>D. nasutus</i>	C		S
<i>Dryophiops rubescens</i>	M	N	Third Thailand locality. P.
<i>Psammodynastes pulverulentus</i>	C,M		P.
<i>Chrysopelea paradisi</i>	M		P.
<i>C. ornata</i>	C		P? see text
HOMALOPSINAE			
<i>Homalopsis buccatta</i>	C,M		P.
<i>Cerebrus rhynchops</i>	C,M		P.
ELAPIDAE			
<i>Bungarus fasciatus</i>	C,M		
<i>Naja naja</i>	C,M		P.
<i>Calliophis maculiceps</i>	C,M		P.
HYDROPHIIDAE			
LATICAUDINAE			
<i>Laticauda colubrina</i>	M	N	Third Thailand record. P.
HYDROPHIINAE			
<i>Hydrophis spiralis</i>	M	N	First Thailand record.
CROTALIDAE			
<i>Agkistrodon rhodostoma</i>	C,M		P.
<i>Trimeresurus purpureomaculatus</i>	M		P.

1. C = a primarily continental distribution, occurring on Continental Thailand and not usually extending down the peninsula below the Isthmus of Kra.
M = a primarily Malaysian distribution, occurring on the Malay Peninsula and not usually extending up the peninsula above the Isthmus of Kra.
2. New geographical limits of species distributions are indicated by N (= a new northern limit to the species range, in Thailand) and S (= a new southern limit to the species range, in Thailand).
3. The letter P. indicates that the species was found on, or has been previously recorded from, Phuket Island. It should be noted that 24 snake species definitely occur on Phuket Island.