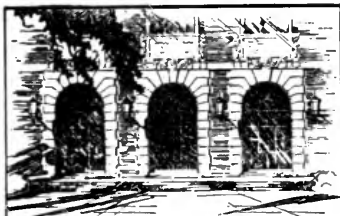




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# Notes on Snakes of the Genus *Calamaria*

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## INTRODUCTION

At the generic level, the snakes of the genus *Calamaria* are among the most readily recognized of the entire oriental fauna. Yet at the species level, they present a bewildering array of superficially similar forms that have been for the most part poorly defined. These notes are offered with the hope that our analysis of the literature and discussion of characters will define some of the species and suggest fruitful lines of attack for a generic revision.

The species discussed below are those in the collections of Chicago Natural History Museum (CNHM) with the addition of Bornean forms borrowed from other institutions. The emphasis on Borneo arises from our more general studies of the Bornean fauna. We are indebted to the following persons for the loan of material under their care: Mr. C. M. Bogert, American Museum of Natural History (AMNH); Mr. J. C. Battersby, British Museum (Natural History) (BM); Mr. Arthur Loveridge, Museum of Comparative Zoology (MCZ); Mr. M. W. F. Tweedie, Raffles Museum (RM); Miss Margaret Storey, Natural History Museum, Stanford University (SU); and Dr. D. M. Cochran, United States National Museum (USNM). We are grateful to Mr. Harry G. Nelson, Roosevelt University, Chicago, for identification of some food fragments, and to Dr. Rainer Zangerl, Chicago Natural History Museum, for photographic assistance. The drawings are the work of Miss Phyllis Wade, Chicago Natural History Museum.

## SPECIALIZATIONS OF THE GENUS CALAMARIA

According to published accounts (de Rooij, 1917; Taylor, 1922; Mertens, 1930; Pope, 1935) the snakes of the genus *Calamaria* are secretive, generally being found under logs and other debris on the ground.

The following characters define the external morphological divergence of *Calamaria* from the generalized, freely ranging colubrid stock: (1) no internasals; (2) prefrontals broadly in contact with supralabials; (3) reduction in size of nasal; (4) loreal absent (except in *C. tropica* Taylor); (5) reduction or loss of oculars; (6) reduction in size of eye; (7) reduction in number of labials; (8) parietals in contact with supralabials; (9) reduction in overall size; (10) reduction of tail. These characters add up to consolidation of head shields, proportional reduction of head and tail, and reduction of overall size; in short, the modifications commonly associated with burrowing snakes. Many of the same characters are found in *Atractaspis*, *Atractus*, *Typhlogeophis*, and *Sympholis*.

Different levels of specialization are shown by the various species of *Calamaria*. But all forms have in common most of the characters of the above list. Variation in the degree of reduction of the oculars and eye, the number of labials, the length of the snout, and the relative proportions of head shields indicate different degrees of specialization.

Within the genus the diameter of the eye may be slightly longer than, equal to or shorter than the distance of the eye from the mouth. We consider that the smaller the eye the more specialized the form. The reduction of eye size is associated with reduction in the preoculars. We have tabulated the characters of 80 currently recognized species (see check list) of *Calamaria*. Data were taken from the literature; the original descriptions were used for species not included in the major faunal works (de Rooij, 1917; Taylor, 1922; Pope, 1935; Smith, 1930, 1931, 1943). The relation between the presence of preoculars and the size of the eye in all species for which data are available is given in Table 1. It is clear from the table that the disappearance of the preocular is associated with the reduction in eye size.

Another character commonly mentioned in the literature is the ratio of the width of the frontal to the width of the supraocular. As the supraocular becomes smaller, the frontal becomes relatively wider. This ratio is also associated with eye size. As the eye becomes smaller the ratio increases (Table 2). The association of



TABLE 1.—ASSOCIATION OF PRESENCE OF PREOCULARS WITH SIZE OF EYE IN SPECIES OF CALAMARIA

Eye*	Observed numbers of species		Total	Calculated numbers of species	
	Preocular			Preocular	
	Present	Absent		Present	Absent
Greater... 13	0	13	10.2	2.8	
Equal... 23	4	27	21.2	5.8	
Less... 19	11	30	23.6	6.4	
Total... 55	15	70	55.0	15.0	

Chi square=8.62;  $n=2$ ;  $P=0.01$

\* "Greater," "equal," and "less" refer to eye diameter relative to distance of eye from mouth.

the reduction in eye size with the reduction of the preocular and the increase of the frontal-supraocular ratio suggests that the ocular region represents a morphological field that is becoming smaller as a whole.

The great majority of species of *Calamaria* have five or six supralabials, with the third and fourth entering the eye. About one-sixth of the species have four supralabials. All but one of these have the second and third supralabials entering the eye. Since most colubrids have more than six upper labials, those *Calamaria* with four labials are considered more specialized than those with five. The fact that the change from five to four is apparent in front of the orbit suggests that that is the position of the reduction. The reduction is a result either of a shortening of the snout or of a consolidation of the shields of the snout. Each of these processes seems to be important to burrowing snakes.

The reduction in the number of labials is independent of eye size (Table 3). The low value of chi square in Table 3 demonstrates that these two characters are distributed at random, relative to one another, and that, therefore, they represent different morphological fields with different selective relationships.

The deviation of *Calamaria* from the colubrid pattern of scutellation is accompanied by modifications of the skull (fig. 21). Some of these changes parallel the consolidation of the head shields. The discussion that follows is based on one skull each of *C. leucogaster*, *C. gervaisi*, *C. leucocephala* and *C. septentrionalis*.

In most non-specialized colubrids (as in *Coluber*, *Natrix*, *Elaphe*, and *Farancia*) the septomaxilla has a small postero-lateral projection that is widely separated from both prefrontal and nasal. In *Calamaria* the septomaxilla has a lateral wall, subequal in length to the

TABLE 2.—ASSOCIATION OF FRONTAL-SUPRAOCULAR RATIO WITH SIZE OF EYE  
IN SPECIES OF CALAMARIA

Eye	Observed numbers of species					Total	Calculated numbers of species					
	<i>Frontal width/supraocular width</i>						<i>Frontal width/supraocular width</i>					
	-2	2	2-3	3	3-4	4-4+	-2	2	2-3	3	3-4	4-4+
Greater.....	5	6	1	1	0	0	13	3.1	3.3	1.7	0.7	1.1
Equal.....	8	9	8	1	0	1	27	6.5	6.8	3.4	1.5	2.3
Less.....	4	2	9	7	4	5	31	7.4	7.4	3.9	1.8	2.6
Total.....	17	17	18	9	4	6	71	17.0	18.0	9.0	4.0	6.0

Chi square = 26.21;  $n = 10$ ;  $P < 0.01$

TABLE 3.—ASSOCIATION OF SUPRALABIAL COUNTS WITH SIZE  
OF EYE IN SPECIES OF CALAMARIA

Eye	Observed numbers of species		Total	Calculated numbers of species	
	<i>Supralabials</i>			<i>Supralabials</i>	
	4	5-6	4	5-6	
Greater....	0	13	13	2.6	10.4
Equal....	7	20	27	5.3	21.7
Less.....	7	24	31	6.1	24.9
Total....	14	57	71	14.0	57.0

Chi square = 3.74;  $n = 2$ ;  $P > 0.10$

longitudinal axis of the nasal. Posteriorly this broad wall abuts the prefrontal and dorsally has an extensive connection with the lateral border of the nasal. This relationship gives the septomaxilla the position of a strut between nasal and prefrontal and, presumably, adds rigidity to the snout. This rigidity has been noticed by G. Haas (1930, p. 156), who comments on the reduced movability of the transverse suture between the nasals and the frontals in *Calamaria linnaei*.

The walls of the brain case are also modified. The parietal and supraoccipital above and the basisphenoid and basioccipital below lack the surface sculpturing of most colubrid skulls. Instead, the brain case has been smoothed, broadened, and flattened.

But far more radical are the changes that have taken place in some of the bones used in engulfing food. The typical snake has a long squamosal (about equal to the length of the skull behind the frontal), closely applied to the dorso-lateral portion of the parietal anteriorly but free from and superior to the occipital region posteriorly. Usually (as in *Coluber*, *Elaphe*, *Natrix*, and *Farancia*) the squamosal projects beyond the foramen magnum. The quadrate is as long as or longer than the squamosal and, when the mouth is closed, slopes backward and outward from its articulation with the posterior end of the squamosal. The length, position, and freedom of movement of these bones are necessary to the great mobility of the mandible.

In *Calamaria* the squamosal is reduced to a tiny sliver no longer than the dorsal width of the quadrate. Instead of lying on the dorso-lateral surface of the parietal, the squamosal lies on the side of the skull and is closely applied for its entire length to the prootic and may even overlie part of the exoccipital. The quadrate, closely pressed against the side of the skull and oriented vertically, is shorter than the depth of the brain case; its dorso-ventral axis is subequal to its dorsal width. The posterior edge of the quadrate lies anterior to the level of the foramen magnum. The shortening and the changed positions of the squamosal and the quadrate in *Calamaria* must reduce the amplitude of jaw movement.

The pterygoid of *Calamaria* is also shortened, probably in association with the changed position of the quadrate. Whereas the pterygoid in colubrids usually projects far beyond the level of the foramen magnum, in *Calamaria* it ends at that level or anteriorly.

The shortening of these three bones may be viewed as part of the process of consolidation. With the confinement of the ends of

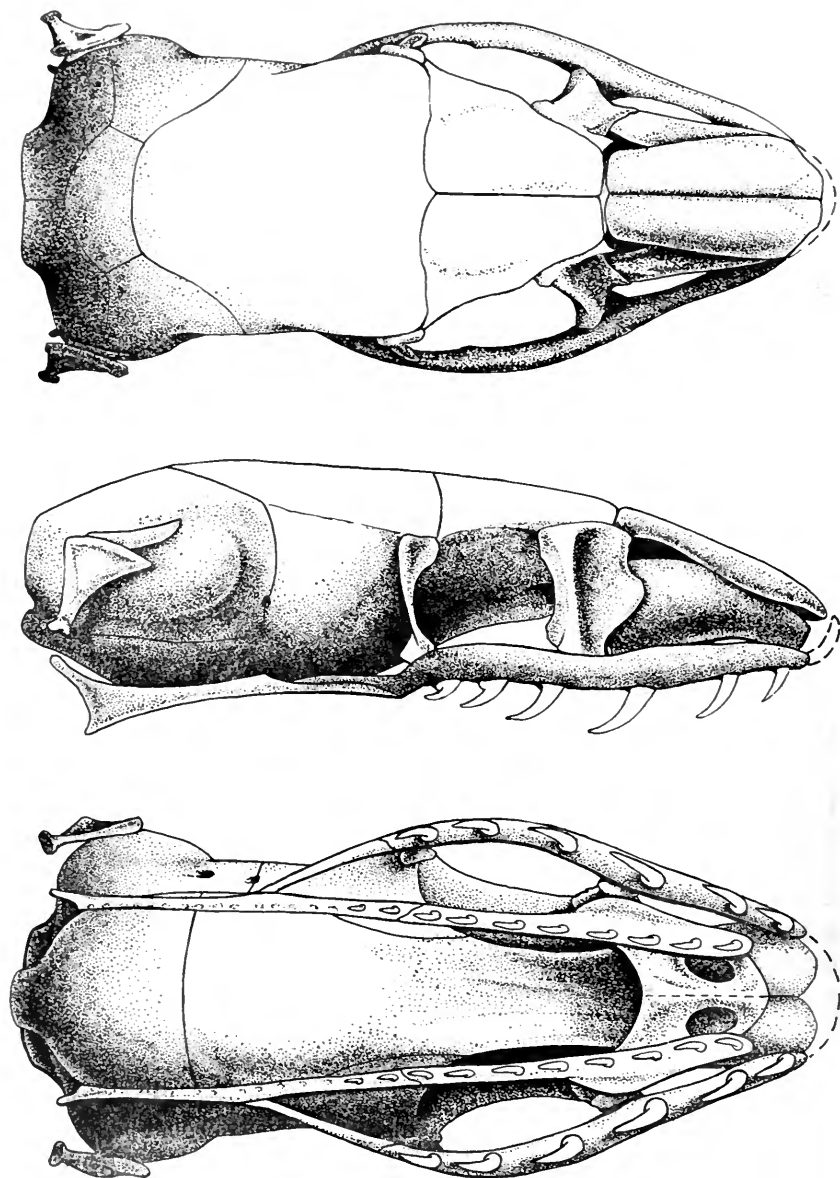


FIG. 21. Skull of *Calamaria leucogaster* (CNHM 71598); actual length 7 mm.

the pterygoid and squamosal to the limits of the brain case and the pulling in of the quadrate against the skull, some of the "loose ends" of the skull have been eliminated and the three bones have been given added protection.



FIG. 22. Maxilla of *Calamaria leucogaster* (CNHM 71598); actual length 5 mm. First tooth missing.

One additional specialization of *Calamaria* is unique. The maxillary teeth of all but two of the species examined are greatly broadened at the base and compressed laterally (figs. 22-24). Near the apex of the enlarged base is a small, oval, translucent area. The pulp cavity (fig. 24) has two branches, one running out into the

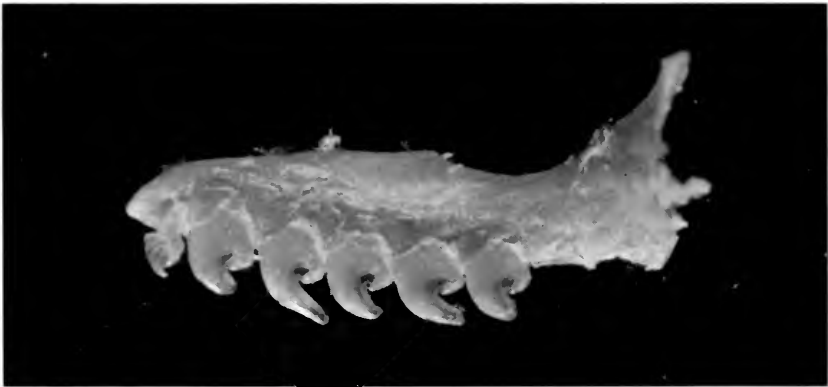


FIG. 23. Maxilla of *Calamaria septentrionalis* (CNHM 7139); actual length 3.5 mm. Last two teeth missing.

shaft and the other curving into the posterior part of the base. From the saddle between these two branches, fine pulp canals run into the oval, translucent "window." The small amount of pulp in this region is apparently responsible for its transparency.

Two levels of maxillary tooth specialization are found in the species we have examined. The less modified condition occurs in *schmidti*, which has seven, widely spaced, unmodified ophidian teeth, and in *leucogaster*, in which only the last two of its seven maxillary teeth are slightly enlarged at the base (fig. 22). The more specialized condition is characteristic of all the others. In these last, all of the maxillary teeth are modified as illustrated. There is no space between successive teeth, and all are enlarged at the base.

The other dentigerous bones have typical ophidian teeth (fig. 25).

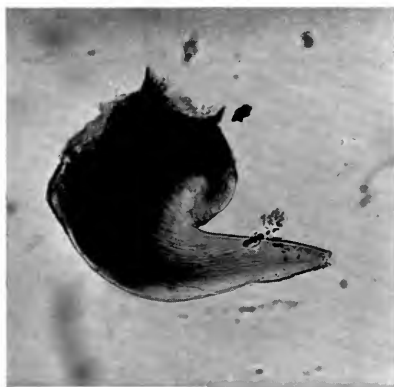


FIG. 24. Maxillary tooth of *Calamaria gervaisi* (CNHM 15025), greatly enlarged; cleared and stained with eosin.

The function of the specialized teeth is obscure. The diet of *Calamaria* consists largely, if not exclusively, of earthworms. Fourteen individuals, belonging to eight of the eighteen species studied, contained earthworms. There were no marks on the food remnants to indicate how the teeth were used. Other earthworm feeders among oriental colubrids—*Natrix nuchalis*, *Achalinus spinalis*, *Ophiodrys major*, and *Trirhinopholis styani* (Pope, 1935)—have the simple, conical, rather widely spaced teeth characteristic of snakes—an indication that the unusual teeth of *Calamaria* may not be an adaptation to food itself.

Instead, G. Haas' description (1930, p. 157) of the skull movements of *C. linnaei* causes us to speculate that the modified teeth may constitute an adaptation to facilitate food ingestion. Though not commenting on the form of the maxillary teeth, Haas concludes that the maxilla is capable only of very limited movement in a longitudinal direction. Rather, during protraction of the pterygo-

palatal arch, the maxilla is swung laterally so that the tooth row, which at rest is oriented obliquely inward, is rotated on its longitudinal axis. Haas suspects that this swinging action of the maxilla functions to push the prey, whose soft body tends to be squeezed



FIG. 25. Mandible of *Calamaria septentrionalis* (CNHM 7139); actual length 8.5 mm.

out laterally by the pressure of jaw and palate, in toward the center of the mouth so that it can pass the gape.

Assuming Haas to be correct, it seems clear that the broadening of the base of each maxillary tooth would increase the effectiveness of the maxilla by increasing the surface it could bring to bear on the prey. Furthermore, since Haas states that the turning of the maxilla is stronger posteriorly, we are presented with a functional explanation for the observation that apparently the posterior maxillary teeth were the first to become broadened (as in *leucogaster*).

#### EVALUATION OF CHARACTERS

Since 80 species of *Calamaria* are now recognized, part of the difficulty of identifying these snakes lies in the number of species to be compared. Unfortunately, some authors give the impression of extreme haste in describing new forms; it almost seems that the mass of forms to be compared discouraged any comparison. But most of the trouble arises from inadequate definition of the species in the literature. In general, the literature fails to evaluate the characters. The significance of a range of fifty ventrals, for example, is not examined. Indeed, many authors have neglected to sex their snakes, thus rendering their counts even less useful.

The characters most often used to distinguish the species are: (1) the number of supralabials; (2) the contact or separation of the mental and first chin shields; (3) the ratio of frontal width to supra-

ocular width; (4) the diameter of the eye relative to its distance from the mouth; (5) the presence or absence of a preocular; and (6) the number of ventrals (see Boulenger, 1894, and de Rooij, 1917).

The number of supralabials varies from four to six. The difference between five and six is merely a difference in the method of counting and depends upon whether the small scale following the large fifth labial is included in the count; in either case the same labials enter the eye and the same labial (fifth) is the largest. No significance can be attached to the difference between five and six labials and no forms are so distinguished. The distinction between four and five labials, however, is important. All forms with five (or six) labials have the third and fourth scutes entering the orbit, whereas all those with four labials have the second and third entering the orbit, with the exception of *lowi* in which only the third enters it.

We have examined two or more specimens of each of fifteen species; the two largest samples were 47 (*vermiformis*) and 20 (*gervaisi*). No intra-specific variation in supralabial counts was observed, nor is there any mention of such variation in the literature. A form invariably has either four or five (or five or six) supralabials.

Almost as constant is the contact or separation of the mental and anterior chin shields. We have seen only one instance of intra-specific variation. Normally the first infralabials meet behind the mental in *C. leucogaster*, but one of the four examined has the mental narrowly in contact with the chin shields. Thus, this character on the whole is reliable in distinguishing species, but caution must be used when only a single specimen is available.

The ratio of frontal width to supraocular is subject both to individual variation and to errors in measurement. The ratio in the large series of *vermiformis* varied from  $1\frac{1}{2}$  to  $2\frac{1}{2}$ ; *gervaisi* varied from  $1\frac{1}{2}$  to 2; four *leucocephala* showed a range of 4 to 5. Clearly, a difference of 1 in this ratio can easily be accounted for by individual variation, but a difference of 2 or more, as in the comparison of *gervaisi* and *leucocephala*, is a matter of species differentiation. Keys (for example, Boulenger, 1894; de Rooij, 1917) that separate groups of species on the basis of the frontal being twice or less than twice as wide as the supraocular are not very helpful except in the extremes.

Much the same can be said for eye size. There are species with extremely small eyes and those with moderately large eyes. Some intra-specific variation is evident but it never includes the extremes



of the genus. In general, only when species occupy different ends of this scale can they be distinguished on the basis of this character.

The presence or absence of a preocular is relatively constant. The notable exception in our experience is the series of *leucocephala*. One of the four seen has no preocular on either side of the head; a second has a preocular on one side only; the other two have a preocular on both sides. But when present the preocular is very small and the prefrontal has a broad contact with the eye. Apparently the preocular is in the process of disappearing in *leucocephala*. In species with moderately large preoculars, the absence of this scale is probably a rare anomaly.

The range of ventral counts reported in the literature is presented uncritically for the most part. Even Boulenger (1894), one of the few authors to sex his specimens, failed to analyze the counts; for example, he gave 153–210 as the range of ventral counts for *vermiformis* but did not comment on this range or determine it for a single series. Analysis of our sample of *vermiformis* (snakes from the Malay Peninsula, Sumatra, Borneo, and the Philippine Islands) provides an estimate of what is probably near the maximum intra-specific variation for the genus. The total range of ventrals for our 22 males is 53 (144–196) and for the 25 females 81 (137–217). Even if only Bornean snakes are considered, the range for 12 females is 64 (137–200). It is only when analysis is limited to a single locality that the variation is not unusually great; for example, our Bornean sample includes five males and five females from Mount Kina Balu; their ventral counts are, respectively, 154–165 and 170–180, ranges that are very narrow in contrast to the total range for the species. Similarly, although the four Sumatran males examined have a ventral range of 31 (166–196), three from a single locality vary only from 191 to 196; seven Sumatran females from scattered areas have a ventral range of 39 (179–217), whereas four from one locality have a range of only 9 (209–217).

This pattern of wide intra-specific variation coupled with narrow local variation is also found in other species. In *gervaisi*, the total ventral range of 22 females from Luzon, Negros, and Mindanao is 39 (142–180); but nine from Montalban, Luzon, show a range of only 9 (158–166). Five males of *borneensis* vary from 152 to 169, yet four from one locality have a range of only 11 (159–169).

Given such wide intra-specific variation, ventral counts are of little use in distinguishing forms. It is only when allopatric populations differ by more than 50 ventrals that any significance can be

attached to the difference. On the other hand, in dealing with closely related sympatric species, a difference of 20 ventrals can be accepted as an inter-specific difference if both samples come from the same restricted area and if the sexes are handled separately.

Although the absolute variation in subcaudal counts must be smaller because of the numbers involved, relatively they show the same range as the ventrals. The range of 81 ventrals in *vermiformis* equals 37 per cent of the maximum count (217). The subcaudals of our 25 female *vermiformis* vary from 14 to 20; this range of 7 is equal to 35 per cent of the highest count. Yet despite this wide intra-specific variation, there is much inter-specific differentiation in caudal counts (see Table 4). However, because of a very sharp sex dimorphism, subcaudal counts are worthless unless the sex is determined.

TABLE 4.—POSITION OF REDUCTION TO FOUR DORSAL SCALE ROWS IN CERTAIN SPECIES OF *CALAMARIA*

Number of specimens given in parentheses

Species	Position*	Males		Females	
		Position	Total subcaudals	Position	Total subcaudals
<i>leucogaster</i> . . . . .				4-8 (4)	16-18 (4)
<i>gervaisi</i> . . . . .	6-11 (3)		16-19 (6)	2-10 (16)	11-16 (22)
<i>griswoldi</i> . . . . .	9-12 (4)		16-17 (4)	9-10 (3)	14-16 (3)
<i>lumbricoidea</i> . . . . .	4-5 (2)		19-22 (2)	5 (1)	17 (1)
<i>vermiformis</i> . . . . .	2-9 (22)		19-27 (22)	0-7 (25)	14-20 (25)
<i>grabowskyi</i> . . . . .	16-19 (2)		26-27 (2)	14-18 (2)	22-23 (2)
<i>suluensis</i> . . . . .				9 (2)	23-25 (2)
<i>pendleburyi</i> . . . . .	9 (1)		18 (1)	12 (1)	17 (1)
<i>lautensis</i> . . . . .	8 (1)		19 (1)	6 (1)	12 (1)
<i>leucocephala</i> . . . . .	12-15 (2)		34-37 (2)	8-12 (2)	26-29 (2)
<i>septentrionalis</i> . . . . .	0 (1)		18 (1)	0 (2)	10-11 (2)
<i>borneensis</i> . . . . .	6-9 (4)		22-24 (5)	4 (3)	16-19 (3)
<i>schmidti</i> . . . . .				6-7 (2)	14 (2)
<i>lowi</i> . . . . .	4-6 (2)		19-20 (2)	3-5 (2)	14 (2)

\*Position located in terms of subcaudals, counting forward from terminal scute.

Another character, not discussed in the literature, has been useful in distinguishing certain species. The number of dorsal scale rows on the tail is usually reduced to four shortly before the terminal scute. The point at which the reduction to four scale rows occurs, as located by the number of subcaudals counted forward from the terminal scute, is relatively constant within species (Table 4). The position of this reduction seems to depend more on the shape of the

tail than on its length, as is shown in Table 4 by a comparison of *grabowskyi* with *vermiformis* and of *lautensis* with *septentrionalis*. The data of Table 4 demonstrate that it would be difficult to identify a single specimen on the basis of this character alone, but it is useful in substantiating conclusions arrived at on the basis of other characters. We refer to the comparisons of *griswoldi* with *vermiformis grayi* (see p. 184) and of *grabowskyi* with *suluensis* (see p. 191).

#### TAXONOMIC SECTION

#### *Calamaria leucogaster* Bleeker. Figures 21, 22.

*Calamaria leucogaster* Bleeker, 1860, Nat. Tijds. Ned. Indië, 21: 293—Ampat-Lawang, Sumatra.

*Calamaria brookii* Boulenger, 1895, Ann. Mag. Nat. Hist., (6), 15: 329.

*Calamaria brookei* de Rooij, 1917, Rept. Indo-Austr. Arch., 2: 166.

*Descriptive notes.*—Four females; total length 178–208 mm.; tail 0.06–0.08 of total; ventrals 146–155; subcaudals 16–18; supralabials 5, third and fourth entering eye; infralabials 5, first three pairs in contact with anterior chin shields; oculars 1+1; position of reduction to 4 dorsal scale rows, counting subcaudals forward from terminal scute 4–8; maxilla with 7 conical teeth.

*Discussion.*—One (CNHM 67279) differs from the others in having a narrower snout and in having the mental in contact with the chin shields instead of being separated by the first infralabials. The latter distinction has been thought significant in distinguishing species of *Calamaria*. This is the only example of individual variation in this character that we have found. The first infralabials of CNHM 67279 are only narrowly separated. Otherwise all four snakes are so similar that we must place them in the same species. Especially significant is the agreement in maxillary dentition (see discussion, p. 174).

The differences between *leucogaster* and *brookii* as determined from Boulenger's descriptions (1894, 1895), which were based upon examination of the types, are: (1) frontal of *leucogaster* twice as wide as supraocular, three times as wide as supraocular in *brookii*; (2) snout of *leucogaster* pointed, no description for *brookii*; (3) subcaudals of *leucogaster* 14–17, of *brookii* 23.

As noted above, one of our snakes (CNHM 67279) has a more pointed snout than the others. In this character, therefore, it resembles *leucogaster*. But the frontal of this specimen relative to the supraocular, said to be wider in *brookii*, is wider than the others.

Accordingly, our material shows a recombination of these supposedly diagnostic characters. The differences in subcaudals can be attributed to sex dimorphism; the type of *brooki* is a male, whereas Boulenger (1894) gives no counts for male *leucogaster*.

In Boulenger's descriptions, these two forms also differ in coloration. The difference lies in the apparent absence of longitudinal dark lines in *leucogaster*. But de Rooij (1917), who also examined the type of *leucogaster*, notes that eight dark longitudinal lines are present. Boulenger mentions only five in *brooki* plus a dark upper edge on the outer scale rows. If that dark edge be counted as an additional line, the total in *brooki* is raised to seven. The median band in our material is split into two by a light mid-dorsal line. Otherwise the agreement between our snakes and Boulenger's description of *brooki* is so close that we assume we are dealing with the same form, and, therefore, that the differences in the mid-dorsal stripe can be explained as individual variation.

Since none of the distinctions between *leucogaster* and *brooki* stand up under analysis we must place the latter in synonymy. This conclusion is supported by the collection of both nominate forms from Matang, Sarawak (de Rooij, 1917, pp. 164, 166).

*Localities and specimens examined.*—NORTH BORNEO: Jesselton District: Mount Kina Balu, Kiau, 3,000 feet (RM 320).

SARAWAK: First Division: Santubong, Sungai Ja'ong (CNHM 71598-99). Fifth Division: Lawas (CNHM 67279).

### ***Calamaria gervaisi* Duméril and Bibron. Figure 24.**

*Calamaria virgulata* (non Boie) Eydoux and Gervais, 1837, in Guér. Mag. Zool., 1837, Cl. 3, pl. 16, figs. 7-10.

*Calamaria gervaisi* Duméril and Bibron, 1854, Erp. Gén., 7: 76—Java [in error, see remarks, p. 182].

*Descriptive notes.*—Twenty specimens; supralabials 5, third and fourth entering eye; infralabials 5 or 6, first pair not in contact behind mental, first 3 pairs (18), 4 pairs (1), or  $\frac{2}{3}$  pairs (1) in contact with anterior chin shields; oculars 1+1; maxilla with 8 or 9 modified teeth; for ventral and subcaudal counts see Table 5.

Luzon: Two males; total length 190-207 mm.; tail 0.07-0.08 of total. Nine females; total length 140-269 mm.; tail 0.04-0.05 of total. Position of reduction to 4 dorsal scale rows, counting subcaudals forward from terminal scute 2-7 (mean 5.1).

TABLE 5.—GEOGRAPHIC VARIATION IN *CALAMARIA GERVAISI*

Numbers in parentheses are numbers of specimens

	CNHM specimens				CNHM specimens plus literature records					
	Ventrals ♂	Ventrals ♀	Subcaudals ♂	Subcaudals ♀	Collar Present	Collar Absent	Ventrals ♂	Ventrals ♀	Subcaudals ♂	Subcaudals ♀
Luzon . . . . .	151-2 (2)	158-66 (9)	16-17 (2)	11-13 (9)	...	(11)	151-2 (2)	158-71 (11)	16-17 (2)	11-13 (11)
Negros . . . . .	...	171-77 (2)	...	14-15 (2)	...	(2)	158-65 (3)	169-80 (6)	18-19 (3)	14-15 (6)
Mindanao	145 (1)	142-54 (5)	19 (1)	14-16 (5)	(7)		145 (1)	142-54 (5)	19 (1)	14-16 (5)

Negros: Two females; total length 244–296 mm.; tail 0.05–0.06 of total. Position of reduction to 4 dorsal scale rows, counting subcaudals forward from terminal scute 5–6.

Mindanao: One male; total length 179 mm.; tail 0.09 of total. Five females; total length 158–258 mm.; tail 0.05–0.07 of total. One unsexed. Position of reduction to 4 dorsal scale rows, counting subcaudals forward from terminal scute 7–11 (mean 9.1).

*Discussion.*—On the basis of a greater number of ventrals, Taylor (1917) distinguished the Negros population as the subspecies *g. iridescens*. Our material bears out the difference in this character. The Mindanao population apparently differs from both the Luzon and the Negros populations in the same character (see Table 5). Furthermore, the Mindanao animals have a yellow collar, which is not found in any of our Luzon or Negros snakes and is not mentioned by either Boulenger (1894, p. 338) or Taylor (1922, p. 186). The Mindanao series also differs from the others in the position of the final scale row reduction (see above).

If the Negros population is recognized as a distinct subspecies, probably the Mindanao population should be also. But a decision on the definition of subspecies must wait for additional material from scattered localities.

The type locality of *gervaisi* is obscure. Duméril and Bibron (1854) state that Eydoux and Gervais collected their snake, the type of *gervaisi*, in Java. Eydoux and Gervais (1837) give no locality, but the other reptiles that they specifically state having collected are all from Manila. The figure of Jan and Sordelli (1865) of the type shows a *Calamaria* without a light collar and with a uniform venter. This combination is characteristic of the Luzon population, so the type probably came from Luzon. All subsequent authors (Günther, 1858; Boulenger, 1894; Taylor, 1922) restrict *gervaisi* to the Philippines. De Haas (1950) does not include it in the fauna of Java.

Earthworms were found in the guts of three snakes from Luzon and two from Mindanao.

*Localities and specimens examined.*—PHILIPPINE ISLANDS: Luzon: Manila (CNHM 15025–31, 15033–35); Montalban (CNHM 15036). Mindanao: Mount McKinley, 3,000 feet (CNHM 53374–76); Mount Apo, 2,800 feet (CNHM 53377); Tagum, sea level (CNHM 53378–80). Negros: Dumaguete (CNHM 57308); Bais, Mabaha (CNHM 61625).

**Calamaria lumbricoidea** Boie

*Calamaria lumbricoidea* Boie, 1827, Isis, 20: 540—Java.

*Descriptive notes.*—Two males; total length 428–468 mm.; tail 0.06–0.07 of total; ventrals 186–190; subcaudals 19–22. One female; total length 505 mm.; tail 0.05 of total; ventrals 192; subcaudals 17.

Supralabials 5, third and fourth in contact with eye; infralabials 5, first three pairs in contact with anterior chin shields, first pair not in contact behind mental; oculars 1+1; position of reduction to 4 dorsal scale rows, counting subcaudals forward from terminal scute 4–5; maxilla with 10–11 modified teeth.

In coloration these agree with Boulenger's description (1894).

Reasons for separating *griswoldi* from *lumbricoidea* are given below.

*Localities and specimens examined.*—JAVA: Benkeng, near Serang (AMNH 71513). No other data (MCZ 25894).

SUMATRA: No other data (USNM 56439).

**Calamaria griswoldi** Loveridge

*Calamaria lumbricoidea griswoldi* Loveridge, 1938, Proc. Biol. Soc. Washington, 51: 43—Luidan River, Bundu Tuhan, Mount Kina Balu, North Borneo.

*Descriptive notes.*—Four males; total length 236–425 mm.; tail 0.06 (4) of total; ventrals 166–179; subcaudals 16–17. Three females; total length 375–467 mm.; tail 0.05–0.06 of total; ventrals 183–190; subcaudals 14–16.

Supralabials 5, third and fourth entering eye; infralabials 5, first pair not in contact behind mental, first three pairs in contact with anterior chin shields; oculars 1+1; position of reduction to 4 dorsal scale rows, counting subcaudals forward from terminal scute 9–12; maxilla with 10 modified teeth.

*Discussion.*—These animals, two of which are topotypes, agree in all significant details with Loveridge's description.

There is little difficulty in separating *griswoldi* from *vermiformis*, *lumbricoidea*, or *grayi*. Superficially the dorsal coloration of *griswoldi* is much like that of *grayi* and the similarly striped "high altitude" form of *vermiformis*, but in *grayi* and *vermiformis* the light area covers only the edges of the mid-dorsal scales, forming very narrow light lines, whereas in *griswoldi* the lateral fourths of each scale are light, forming mid-dorsal stripes equal to half the width of the dark interspaces. The immaculate yellow or white venter of *griswoldi* is radically different from the boldly marked one of *grayi*

and *vermiformis*. The ventral coloration of *griswoldi* is like that of *lumbricoidea*, but the latter is uniformly dark mid-dorsally, with a yellow stripe running the length of the outer one or two scale rows.

The eye of *griswoldi* is distinctly larger than the eyes of the other forms, its diameter being at least equal to its distance from the mouth but usually larger. The eye diameter is usually smaller than its distance from the mouth in the other forms, but may be equal to that distance.

The reduction to 4 dorsal scale rows occurs opposite the ninth to twelfth subcaudal from the tip of the tail in *griswoldi* (mean of 7 snakes=9.7). In *vermiformis* the range of this point is 0-9 subcaudals from the tip (only one with more than 7; mean of 39=4.3), in *grayi* 3-6 (mean of 8=5.0), and in *lumbricoidea* 4-5 (mean of 3=4.7).

Conceivably, if the total number of subcaudals were decreased, the distance of the final reduction from the tip of the tail in terms of subcaudals should become less and less, all other things being equal. But the difference between *griswoldi* and the others in this distance is independent of total subcaudal count as *griswoldi* has fewer subcaudals.

Subcaudal counts of *griswoldi* are lower than those of the other three forms. Observed ranges for males are: *griswoldi* 16-17 (four); *vermiformis* 19-26 (seventeen), only one with less than 22; *lumbricoidea* 19-22 (two); *grayi* 22-27 (four). Observed ranges for females are: *griswoldi* 13-16 (four, including the type); *vermiformis* 14-20 (twenty-one), only four with less than 17; *lumbricoidea* 17 (one); *grayi* 15-18 (four), only one under 17.

Ten *vermiformis* from the type locality of *griswoldi* (Mount Kina Balu) differ from the latter in ventral counts. The five males of this series of *vermiformis* have ventral counts of 154-165 and the females counts of 170-180. Two male *griswoldi* have 170 and 179 ventrals and five females (including the type series) a range of 183-192. This difference between the two species does not hold up in other parts of the geographic range of *vermiformis*, which has a total spread of 144-196 in the males and 137-217 in the females.

Though originally described as a subspecies of *lumbricoidea*, *griswoldi* differs from the latter sufficiently in eye size, position of caudal scale reduction, scale counts, and coloration to warrant recognition as a distinct species.

The male from Lumu Lumu, Mount Kina Balu, identified by Smith (1931) as *vermiformis*, is *griswoldi*, as is clear from its coloration and counts.



One snake contained an entire earthworm (78 mm. total length) of the subfamily Megascolecinae. The gut of the earthworm was full of wood fragments but held no mineral particles. Apparently, the earthworm was feeding in a decaying log and was caught there by the snake.

*Localities and specimens examined.*—NORTH BORNEO: Jesselton District: Mount Kina Balu, Bundu Tuhan, 4,500 feet (USNM 130238-39); Mount Kina Balu, Lumu Lumu, 5,000 feet (BM 1929.12.22.112); Mount Kina Balu, Tenompok, 4,700 feet (RM 18949, RM no number); Mount Kina Balu (BM 95.11.7-25); Ranau (USNM 134114).

### *Calamaria vermiformis* Duméril and Bibron

*Discussion.*—We place *bruegeli* in the synonymy of *vermiformis* because the differences noted by Mertens are within the range of individual variation. According to Mertens, the frontal of *bruegeli* is twice as wide as the supraocular; Boulenger (1894) states that the frontal of *vermiformis* is not twice as broad as the supraocular. Our own specimens span this minor difference. The other distinction noted by Mertens is the relatively broader rostral of *bruegeli*. Due to the differences of methods of measuring and individual variation in our specimens this distinction does not warrant recognition of a new species. Furthermore, the counts and other characters of *bruegeli* agree with the original description of *vermiformis* and with our material.

The Philippine form, *grayi*, is obviously closely related to *vermiformis* in counts, habitus, and scale proportions. The ventral coloration of *grayi*—barred with black—is just like that of Bornean *vermiformis*. Most striking, however, is the agreement in juvenile pattern. Two young *grayi*, measuring 149 mm. (MCZ 25781) and 216 mm. (MCZ 25778), have the yellow heads and yellow rings typical of juvenile *vermiformis*, but the lined pattern of adult *grayi* is clearly visible in the dark interspaces.

Minor differences do distinguish the two populations. Most outstanding, of course, is the dorsal coloration, consisting in adult *grayi* of narrow light lines on a dark background and in adult Bornean *vermiformis* of a uniform, brown color. In other populations of *vermiformis*, for example, from the Malay Peninsula and Sumatra, occasional individuals have the “*grayi*” pattern.

The Philippine form seems to have higher ventral counts than the Bornean and Malayan populations but agrees with Sumatran *vermiformis* (see data below).

Excluding the last labial, each parietal of *grayi* is usually bordered postero-laterally by 4 scales; in only one of the eight seen was each parietal bordered by 3 scales. On the other hand, only one out of 23 Bornean *vermiformis* and one out of 11 Sumatran *vermiformis* have 4 scales in contact with each parietal; all the others have 3 scales bordering each parietal.

In view of the great similarity between *grayi* and *vermiformis*, we must consider them conspecific. However, the differences cited above between *grayi* and Bornean *vermiformis* justify the separation of these as distinct subspecies.

The remaining samples of *vermiformis* we have seen show a complex pattern of geographic variation. Some characters, such as ventral counts, apparently have intense local differentiation. The variation in ventral counts has been discussed in detail above (p. 177). To summarize, twelve females from Borneo range from 137-200, but within a restricted area five females have a ventral range of 11 (170-180). Similarly, five males from the same locality have counts of 154-165, whereas twelve males from scattered parts of Borneo have a range of 38 (144-181). Our Sumatran sample has the same pattern of variation.

Variation in coloration is independent of that in ventral counts and does not show the same amount of local differentiation. All fourteen Bornean adults (over 300 mm.) are medium to light brown above with the outer row or two of scales slightly lighter. Two out of four snakes from the Malay Peninsula and nine out of ten from Sumatra are dark brown or almost black above and have a sharply defined yellow or cream stripe on the two outer scale rows. The animals of the last two regions therefore, are distinctly bicolored, whereas those from all parts of Borneo have a uniform appearance.

The lined coloration of *grayi* forms the third major pattern of *vermiformis* and it is characteristic of all samples from the southern Philippines. This lined pattern also appears in the highlands of the Malay Peninsula (Tweedie, 1950) and is the coloration of two of the Malayan and one of the Sumatran snakes seen. We do not have sufficient material to be sure that whole local populations of the last two regions are characterized by this pattern.

Ventral coloration also varies geographically. The Bornean snakes have yellow under sides crossed by black bars occupying the complete widths of 2 to 4 ventrals; occasionally, a few of the cross-bars are broken up into alternating black squares. The same ventral pattern is found in two of the Malayan and three of the Sumatran

snakes. The two striped Malayan specimens have crossbars that cover 4 to 6 ventrals. The other seven Sumatran animals have the posterior four-fifths or more of the belly solid black with only a few narrow crossbars anteriorly.

The striped snakes from the Malay Peninsula and Sumatra have lower ventral counts (two males 154–157; one female 179) than observed in *grayi* (males 165–176; females 192–207). As noted above, *grayi* differs from the other striped *vermiformis* in the number of scales in contact with the parietals. The similarity of *grayi* to these striped individuals is probably the result of parallel mutation in similar genetic systems.

On the basis of the data now available we recognize the following forms of *vermiformis*:

### ***Calamaria vermiformis vermiformis* Duméril and Bibron**

*Calamaria vermiformis* Duméril and Bibron, 1854, Erp. Gén., 7: 85—Java.

*Calamaria bruegeli* Mertens, 1924, Zool. Anz., 60: 158—central Borneo.

*Descriptive notes.*—Borneo: twelve males; total length 160–436 mm.; tail 0.08–0.10 of total; ventrals 144–181 (mean  $161.0 \pm 3.1$ ; N=12); subcaudals 19–26 (mean  $23.2 \pm 0.5$ ; N=12). Twelve females; total length 120–642 mm.; tail 0.06–0.08 of total; ventrals 137–200 (mean  $172.4 \pm 4.5$ ; N=12); subcaudals 14–20 (mean  $17.6 \pm 0.6$ ; N=12).

Sumatra: four males; total length 154–449 mm.; tail 0.07–0.08 of total; ventrals 166–196 (mean 186.8); subcaudals 22–23 (mean 22.8). Seven females; total length 186–503 mm.; tail 0.05–0.06 of total; ventrals 179–217 (mean  $199.1 \pm 6.1$ ; N=7); subcaudals 16–19 (mean  $17.3 \pm 0.4$ ; N=7).

Malay Peninsula: two males; total length 168–410 mm.; tail 0.10 (two) of total; ventrals 154–157; subcaudals 22–24. Two females; total length 253–394 mm.; tail 0.06 (two) of total; ventrals 179–183; subcaudals 17 (two).

Supralabials 5 or 6, third and fourth entering the eye; infralabials 5 or 6, first three pairs in contact with anterior chin shields, first pair not in contact behind mental; oculars 1+1; frontal  $1\frac{1}{2}$  to  $2\frac{1}{2}$  times width of supraocular; excluding fifth labial each parietal bordered postero-laterally by 3 (37) or 4 (two) scales; position of reduction to 4 dorsal scale rows, counting subcaudals from terminal scute 0–9 (mean  $4.3 \pm 0.3$ ; N=39); maxilla with 10 modified teeth.

Color (in alcohol) varying with size; small specimens (up to 250 mm.) with yellow heads and narrow yellow rings around the dark

brown body; belly yellow barred with dark brown; large specimens (over 340 mm.) various (see above, p. 186), but usually brown above, belly with black crossbars.

*Discussion.*—A transition between these two color patterns is suggested by four specimens (234–375 mm.). The smallest of these has the yellow body rings narrowed and interrupted and the head somewhat darkened above. The largest of the four has a lighter head than usual for adults. Günther (1865) suggested that the yellow rings disappear in adults. Smith (1931) also comments on the difference of juvenile and adult coloration.

Earthworms were found in two specimens.

*Localities and specimens examined.*—NORTH BORNEO: Jesselton District: Mount Kina Balu, Bundu Tuhan, 4,500 feet (USNM 130252); Mount Kina Balu, Kiau, 3,000 feet (BM 1929.12.22.110–111; MCZ 43564–65; RM 168–17); Mount Kina Balu, Kenokok, 3,300 feet (MCZ 43566–69). Sandakan District: Sandakan (CNHM 15003).

SARAWAK: First Division: Matang (BM 1873.4.23). Second Division: Saribas (SU 8575). Fourth Division: Baram District (BM 97.3.4–5, 1902.11.25.16–17); Mount Batu Song, 1,000 feet (BM 92.10.7.8). Fifth Division: Lawas (CNHM 67278); Pa Brayong (CNHM 71646).

BORNEO: Tanjong (BM 96.2.17.11–12). No additional data (BM no reg. no.; BM 72.2.19–55; USNM 49802).

SUMATRA: Kaba Wetan (USNM 70945–51); Langkat (MCZ 37769–70); Pandangsoke, Bovenlanden (MCZ 20971); unknown locality (AMNH 2879).

MALAY PENINSULA: Pahang: Kuala Terla, 4,500 feet (RM 4/1938); Tanah Rata, 4,600 feet (RM 1930). Selangor: Bukit Lagong (RM 8827); Kepong Forest Reserve (RM 13880).

### ***Calamaria vermiformis grayi* Günther**

*Calamaria grayi* Günther, 1858, Cat. Snakes Brit. Mus., p. 6—Philippine Islands.

*Descriptive notes.*—Four males; total length 149–358 mm.; tail 0.05–0.10 of total; ventrals 165–176 (mean 170.8); subcaudals 22–27 (mean 24.0). Four females; total length 216–590 mm.; tail 0.04–0.06 of total; ventrals 192–207 (mean 199.8); subcaudals 15–18 (mean 17.0).

Excluding fifth labial, each parietal bordered postero-laterally by 4 scales in all but one animal; position of reduction to 4 dorsal scale rows, counting subcaudals from terminal scute 3-6 (mean  $5.0 \pm 0.4$ ;  $N=8$ ); other counts as in *v. vermiformis*.

*Discussion.*—Günther (1858) considered *grayi* to be related to *lumbricoidea* Boie. Reasons are given above for relating it instead to *vermiformis*.

*Localities and specimens examined.*—PHILIPPINE ISLANDS: Basilan: near Isabelita (MCZ 43649). Mindanao: Cotabato Province, Saub (MCZ 25778-80; USNM 120811); Davao Province, Mount Apo, 2,800 feet (CNHM 53373); Lanao Province, Lumbatan (CNHM 15010). Leyte: Cabalian (MCZ 25781).

### *Calamaria grabowskyi* Fischer

*Calamaria grabowskyi* Fischer, 1885, Arch. Naturg. Berlin, 51: 50, pl. 4, fig. 1—Telang and Tameanglajang, Dusson Timor District, Borneo.

*Descriptive notes.*—Two males; total length 320-340 mm.; tail 0.09-0.10 of total; ventrals 159-175; subcaudals 26-27. Two females; total length 278-280 mm.; tail 0.08-0.09 of total; ventrals 152-183; subcaudals 22-23.

Supralabials 5, third and fourth entering eye; infralabials 5, first pair not in contact behind mental, first three pairs in contact with anterior chin shields; oculars 1+1; position of reduction to 4 dorsal scale rows, counting subcaudals forward from terminal scute 14-19; maxilla with 9 modified teeth.

Color (in alcohol) above dark brown with small black spots scattered over dorsal scales; center of scales of outer row light yellow, lower edge of first scale row and adjacent edges of ventrals dark brown; ventrals uniform yellowish in anterior eighth of body, followed by ventrals with black anterior edge limited at first to a median strip then widening to form complete dark transverse bars across width of belly; posterior ventrals uniform yellow; under side of tail yellow with a distinct median longitudinal dark stripe; head above dark brown with black spots; upper lip yellowish; head below yellowish, the anterior labials edged with black.

*Discussion.*—These four snakes are so similar to descriptions (Fischer, 1885; Boulenger, 1894) of *grabowskyi* in coloration, in ventral and subcaudal counts, and in the arrangement of the head shields that we have no doubts about their identification. It should be noted, however, that a number of named forms resemble *grabowskyi* in these characters. Among these forms are *simalurensis*,

*elegans*, *prakkei*, and *suluensis*, all of which differ from *grabowskyi* in lacking dark ventral bars.

*Localities and specimens examined.*—SARAWAK: Third Division: Rejang River, Sarekei (CNHM 67277). Fourth Division: Bario (RM no numbers). Fifth Division: Lawas District, Pa Brayong (CNHM 71600).

### **Calamaria suluensis** Taylor

*Calamaria suluensis* Taylor, 1922, Snakes Phil. Isls., p. 189—Cagayan Sulu.

*Descriptive notes.*—Two females; total length 257–295 mm.; tail 0.09–0.11 of total; ventrals 148–168; subcaudals 23–25; supralabials 5, third and fourth entering eye; infralabials 5, first pair not in contact behind mental, first three pairs in contact with anterior chin shields; oculars 1+1; position of reduction to 4 dorsal scale rows, counting subcaudals forward from terminal scute 9 (two); maxilla with 7–8 modified teeth.

*Discussion.*—These snakes agree remarkably with the only known specimen of *suluensis*, a female having 154 ventrals and 25 subcaudals. Like our specimens, *suluensis* is brown above with scattered dark spots. The outer row of scales is white. A dark brown stripe covers the lower edge of the outer scale row and the adjacent edges of the ventrals. The head is brown with dark spots above, the upper lip is yellow, and the lower lip and chin are yellow with brown spots. The belly is uniformly yellow.

As indicated in the discussion of *grabowskyi*, *suluensis* is similar to it, and to *simalurensis*, *elegans*, and *prakkei*. The ventral counts of *suluensis* (females 148–168) are higher than those of *simalurensis* (136, sex unknown), *elegans* (133, sex unknown), and *prakkei* (126–144, sex unknown), but without additional data for sexed animals these differences cannot be evaluated.

In addition to the striking distinction in ventral coloration, *suluensis* (as we understand it) differs from *grabowskyi* in the following characters:

In *grabowskyi* the postocular is elongate, higher than wide, its height equal to its distance from the mouth, and as high as the preocular. In *suluensis* the postocular is squarish, its height about one-half its distance from the mouth, and about two-thirds as high as the preocular.

The parietals of *grabowskyi* are only equal in length to the frontals, whereas in *suluensis* the parietals are one and one-half times the length of the frontal.

The reduction to 4 dorsal scale rows takes place in *grabowskyi* opposite the fourteenth to nineteenth subcaudal and in *suluensis* opposite the ninth subcaudal, in both cases counting the subcaudals from the terminal scute.

*Localities and specimens examined.*—NORTH BORNEO: Sandakan District: Sandakan (CNHM 63573). Kudat District: Bongon (BM 1906.5.23.5).

### **Calamaria pendleburyi** Smith

*Calamaria pendleburyi* Smith, 1931, Bull. Raffles Mus., no. 5, p. 27—Kiau, Mount Kina Balu, North Borneo.

*Descriptive notes.*—One male; total length 241 mm.; tail 0.08 of total; ventrals 136; subcaudals 18. Two females; total length 250–252 mm.; tail 0.07 (one) of total; ventrals 144–147; subcaudals 17 (one).

Supralabials 5, third and fourth entering eye; infralabials 5, first pair not in contact behind mental, first three pairs in contact with anterior chin shields; oculars 1+1; position of reduction to 4 dorsal scale rows, counting subcaudals forward from terminal scute 9–12; maxilla with 8 modified teeth.

*Discussion.*—Available descriptions of *margaritophora*, *sumatrana*, and *curta* indicate forms similar to *pendleburyi*. These forms have in common a longitudinal light stripe along the outer row of scales, the first infralabials not in contact behind the mental, the frontal about twice as wide as the supraocular, a moderate-sized eye, and less than 160 ventrals.

*Localities and specimens examined.*—NORTH BORNEO: Jesselton District: Mount Kina Balu, Bundu Tuhan, 4,500 feet (USNM 130237); Mount Kina Balu, Kiau, 3,000 feet (RM 146.17, paratype); Mount Kina Balu, Tenompok, 4,700 feet (RM 18820).

### **Calamaria lautensis** de Rooij

*Calamaria lautensis* de Rooij, 1917, Rept. Indo-Austr. Arch., 2: 163, fig. 66—Pulau si Laut, Cocos Island and Simalur.

*Descriptive notes.*—One male; total length 142 mm.; tail 0.09 of total; ventrals 140; subcaudals 19. One female; total length 224 mm.; tail 0.06 of total; ventrals 154; subcaudals 12.

Supralabials 5, third and fourth entering eye; infralabials 5, first three pairs in contact with anterior pair of chin shields, first pair of infralabials in contact behind mental; oculars 1+1; position

of reduction to 4 dorsal scale rows, counting subcaudals forward from terminal scute 6-8; maxilla with 6-8 modified teeth.

*Discussion.*—Superficially this snake resembles many described forms (*crassa*, *suluensis*, *tropica*, *pendleburyi*, *stahlknechti*, *margaritophora*, *prakkei*, *sumatrana*, *elegans*, *simalurensis*, *muelleri*, *bicolor*, and *lautensis*) with low ventral and subcaudal counts, with moderate-sized eye, and with frontal about twice the width of the supraocular. In coloration these forms have in common an incomplete neck band, light centers to the outer row of scales, and ventrals with dark outer ends. Only *bicolor* and *lautensis* have the first infralabials in contact behind the mental. Using this character we have tentatively limited identification to these two forms and have eliminated *bicolor* on the basis of the size of the eye (smaller in *bicolor*) and the relative width of the frontal (broader in *bicolor*).

The gut of one specimen contained an earthworm.

*Localities and specimens examined.*—NORTH BORNEO: Jesselton District: Mount Kina Balu, Bundu Tuhan, 4,500 feet (USNM 130236); Mount Kina Balu, Tenempok, 4,700 feet (RM 295).

### **Calamaria everetti** Boulenger

*Calamaria everetti* Boulenger, 1893, Proc. Zool. Soc. London, 1893: 525—Sarawak.

*Descriptive notes.*—Two females; total length 168-295 mm. (latter with incomplete tail); tail 0.11 (one) of total; ventrals 151-171; subcaudals 20 (one); supralabials 5, third and fourth entering eye; infralabials 5, first infralabials in contact with each other, first three infralabials in contact with anterior chin shields; oculars 1+1; position of reduction to 4 dorsal scale rows, counting subcaudals forward from terminal scute 11; maxilla with 8-9 modified teeth.

These specimens agree completely with the original description.

The Bornean snake was found on the ground in a large clearing.

*Localities and specimens examined.*—NORTH BORNEO: Kina-batangan District: southeast end of Dewhurst Bay (CNHM 63572).

PHILIPPINE ISLANDS: Palawan: Brooke's Point, Kabalnecan, 1,400 feet (CNHM 53381).

### **Calamaria brachyura** Boulenger

*Calamaria brachyura* Boulenger, 1895, Ann. Mag. Nat. Hist., (6), 16: 481—Mount Kina Balu, North Borneo.

*Descriptive notes.*—One female; total length 258 mm.; tail 0.03 of total; ventrals 205; subcaudals 10; supralabials 5, third and



fourth entering eye; infralabials 5, first pair in contact behind mental, first three pairs in contact with anterior chin shields; oculars 1+1; position of reduction to 4 dorsal scale rows, counting subcaudals forward from terminal scute 3; maxilla with 8 modified teeth.

In coloration agreeing with the original description except for the absence of yellow spots on the prefrontals.

Found under a log in a cut-over forest.

*Locality and specimen examined.*—NORTH BORNEO: Sandakan District: Sapagaya Forest Reserve, 50 feet (CNHM 63571).

### **Calamaria leucocephala** Duméril and Bibron

*Calamaria leucocephala* Duméril and Bibron, 1854, *Erp. Gén.*, 7: 83—type locality unknown.

*Descriptive notes.*—Two males; total length 210–322 mm.; tail 0.16 (two) of total; ventrals 143–150; subcaudals 34–37. Two females; total length 337–343 mm.; tail 0.10 (two) of total; ventrals 161–169; subcaudals 26–29.

Supralabials 5, third and fourth entering eye; infralabials 5, first pair in contact behind mental, first three pairs in contact with anterior chin shields; oculars 1+1 and 0+1; position of reduction to 4 dorsal scale rows, counting subcaudals forward from tip of tail 8–15; maxilla with 10 modified teeth.

*Discussion.*—These specimens agree with all published descriptions of this form. The preocular, when present, is very small. In one specimen it is lacking on both sides, and in a second is present on the left side only. Both of these snakes are females. In all four animals the prefrontals enter the orbit.

One specimen contained the remnants of an earthworm.

*Locality and specimens examined.*—Locality uncertain, probably Singapore Island (CNHM 69976–79).

### **Calamaria pavementata** Duméril and Bibron

*Calamaria pavementata* Duméril and Bibron, 1854, *Erp. Gén.*, 7: 71—Java.

*Descriptive notes.*—One male; total length 244 mm.; tail 0.09 of total; ventrals 160; subcaudals 21; supralabials 4, second and third entering eye; infralabials 5, first pair in contact behind mental, first three pairs in contact with anterior chin shields; oculars 1+1; position of reduction to 4 dorsal scale rows, counting subcaudals forward from terminal scute 5; maxilla with 8 modified teeth.

*Locality and specimen examined.*—INDO-CHINA: Annam: Bana (CNHM 11528).

**Calamaria septentrionalis** Boulenger. Figures 23, 25.

*Calamaria septentrionalis* Boulenger, 1890, Proc. Zool. Soc. London, 1890: 34—Kiukiang and Hong Kong.

*Descriptive notes.*—One male; total length 168 mm.; tail 0.07 of total; ventrals 160; subcaudals 18. Two females; total length 277–342 mm.; tail 0.03 (two) of total; ventrals 179–180; subcaudals 10–11.

Supralabials 4, second and third entering eye; infralabials 5, first pair in contact behind mental, first three pairs in contact with anterior chin shields; oculars 1+1; dorsal scale rows reduce from 6 to 1 abruptly at end of tail; maxilla with 8 modified teeth.

Two specimens had eaten earthworms.

*Locality and specimens examined.*—CHINA: Anhwei Province: Ningkwo (CNHM 7139–41).

**Calamaria borneensis** Bleeker

*Calamaria borneensis* Bleeker, 1860, Nat. Tijds. Ned. Indië, 21: 296—Sintang, Borneo.

*Descriptive notes.*—Five males; total length 135–279 mm.; tail 0.09–0.11 of total; ventrals 152–169 (mean 160.8); subcaudals 22–24. Three females; total length 184–360 mm.; tail 0.06–0.08 of total; ventrals 173–182; subcaudals 16–19.

Supralabials 4, second and third entering eye; infralabials 4, first pair not in contact behind mental, first two pairs in contact with anterior chin shields; oculars 1+1; position of reduction to 4 scale rows, counting subcaudals forward from terminal scute 4–9; maxilla with 8–9 modified teeth.

Color (in alcohol) dark grayish brown above with black crossbars or spots mid-dorsally, lateral scale rows lighter; belly yellowish with varying amounts of black in the form of checkers.

*Discussion.*—A single specimen from Kuching differs from the above coloration in having longitudinal dark lines above and on the lateral edges of the ventrals and in lacking the dark transverse markings. Except for the lateral dark lines and a median longitudinal dark line under the tail this snake is uniformly yellow below.

Most of this series differ from descriptions of *borneensis* (Boulenger, 1894; de Rooij, 1917) in the presence of the dark transverse

markings of the back. However, the distinctive, prominent snout, the checkered belly, and the counts support the identification. It is clear that this form is closely related to *linnaei* but differs from the latter in the shape of the snout, which in *linnaei* is rounded and does not project (Boulenger, 1894) and in the subcaudal counts. Boulenger (1894) gives the subcaudal counts of twelve female *linnaei* from Java as 9–15, of which only two have more than 12.

Javan *linnaei* show the same variation in coloration (Boulenger, 1894) as is indicated for *borneensis* by a comparison of our material with the description given by Boulenger.

*Localities and specimens examined.*—SARAWAK: First Division: Kuching (RM, no number). Fourth Division: Long Mujan (RM 41, 44, 48–49, 73, 75; SU 8569).

**Calamaria buchi** sp. nov. Figure 26.

*Type.*—Chicago Natural History Museum no. 71697, a female, from Dalat, Viet Nam, Indo-China. Altitude 1,500 feet. Collected by Father Buch in 1953.

*Diagnosis.*—A *Calamaria* with the eye about equal to its distance from the mouth; 4 supralabials, the second and third entering the eye; preocular present; frontal about twice as wide as supraocular; 221 ventrals.

*Description.*—Rostral higher than broad, visible from above; prefrontals large, maximum length subequal to length of frontal, posterior border angular, in contact with first and second supralabials and entering orbit at a point; preocular present, small, triangular; postocular small, its height about half its distance from mouth; supraocular broad; frontal slightly longer than broad, less than twice width of supraocular, about two-thirds length of parietals; 4 supralabials, second and third entering eye, second larger than first or third, fourth largest; first infralabials not in contact with each other; mental and first three infralabials in contact with anterior chin shields, the latter in contact for entire length; posterior chin shields about two-thirds length of anterior ones, in contact anteriorly only; vertebral row of nuchals smaller than adjacent rows; maxilla with 9 modified teeth.

Scales in 13 rows; ventrals 221; anal entire; subcaudals 13; tail ending in a blunt point; position of reduction to 4 dorsal scale rows, counting subcaudals forward from terminal scute 3.

Color (in alcohol) purplish gray above, an obscure dark vertebral line anteriorly; an interrupted light nuchal band; outer row of

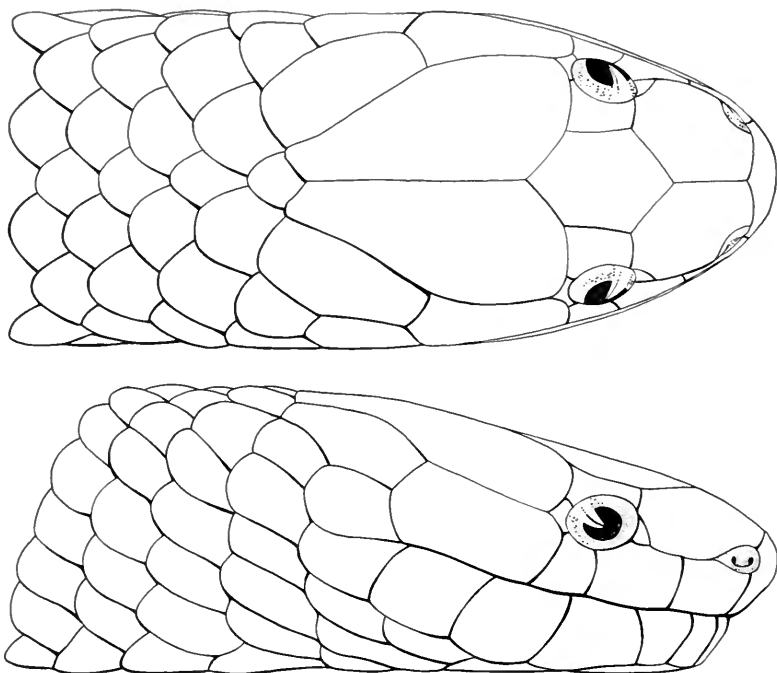


FIG. 26. *Calamaria buchi* sp. nov. (type, CNHM 71697); actual length of head 7.5 mm.

scales white, edged above with black; second row of scales white in lower half, in posterior third of body becoming dark; ventral surface white, uniform except for dark spots on infralabials and irregular dark speckling under tail.

Total length 389 mm.; tail length 15 mm., length of head to end of parietals 7.5 mm.

*Comparisons.*—The number of labials, which we find to be a relatively unvarying character, and the high ventral count eliminate all but *javanica lineata*, *gimletti*, *ventralis*, *lowi*, and *gracillima* from consideration. *Calamaria gracillima* has more than 300 ventrals, no preocular, and a tiny supraocular; the first lower labials are in contact. *C. lowi* has 198–236 ventrals but differs from *buchi* in the lack of preoculars, in the smaller eye, in the relatively broader frontal, and in coloration; the entire ventral surface of *lowi* is dark; furthermore, only the third labial enters the eye in *lowi*. *C. ventralis* has 249 ventrals, but has no preocular, a smaller eye, and dark ventrals. *C. gimletti* has 200–249 ventrals, but no preocular, a

broader frontal, the first lower labials in contact, and the outer rows of scales dark. *C. javanica lineata* has only 199 ventrals, no preocular, a smaller eye, and light dorsal stripes.

*Remarks.*—The gut of the type specimen contained the remains of an earthworm.

***Calamaria schmidti* sp. nov.** Figure 27.

*Type.*—United States National Museum no. 130240. A female from Bundu Tuhan, Mount Kina Balu, North Borneo. Collected at 4,500 feet, on August 1, 1951, by D. H. Johnson. This species is named in honor of Karl P. Schmidt.

*Diagnosis.*—A *Calamaria* with the eye much smaller than its distance from the mouth; 4 supralabials, the first three subequal; no preocular; frontal about five to six times as wide as supraocular; maxillary teeth conical; first pair of infralabials in contact behind mental.

*Description of type.*—Rostral broader than high, visible from above; prefrontals squarish, maximum length subequal to length of frontal, posterior border transverse, in contact with first and second labial and eye; nasal large, slightly larger than eye; eye small, diameter one-half its distance from the mouth; no preocular; one small postocular, not as high as eye; supraocular small, about equal to nasal; frontal about as wide as long, pentagonal, 5 to 6 times width of supraocular, about two-thirds length of parietals; 4 supralabials, first three subequal, fourth twice length of second, second and third entering eye; 5 infralabials, first pair in contact behind mental, fourth largest; two pairs of chin shields, both pairs in contact, anterior in contact with three infralabials, anterior pair larger than posterior pair; parietals bordered posteriorly by three nuchals; vertebral row of nuchals distinctly smaller than para-vertebral rows. Maxilla with 7 conical, slightly curved teeth widely spaced at the base.

Scales in 13 rows; ventrals 144; subcaudals 14; anal entire; tail ending in a blunt point; position of reduction to 4 dorsal scale rows, counting subcaudals forward from terminal scute 6.

Color (in alcohol) purplish gray above, uniform; head without markings; supralabials same color as back; anterior infralabials and first pair of chin shields purplish gray, remainder of under side of head yellowish; ventral surface without markings; anterior ventrals yellowish, belly becoming increasingly more purple posteriorly, but

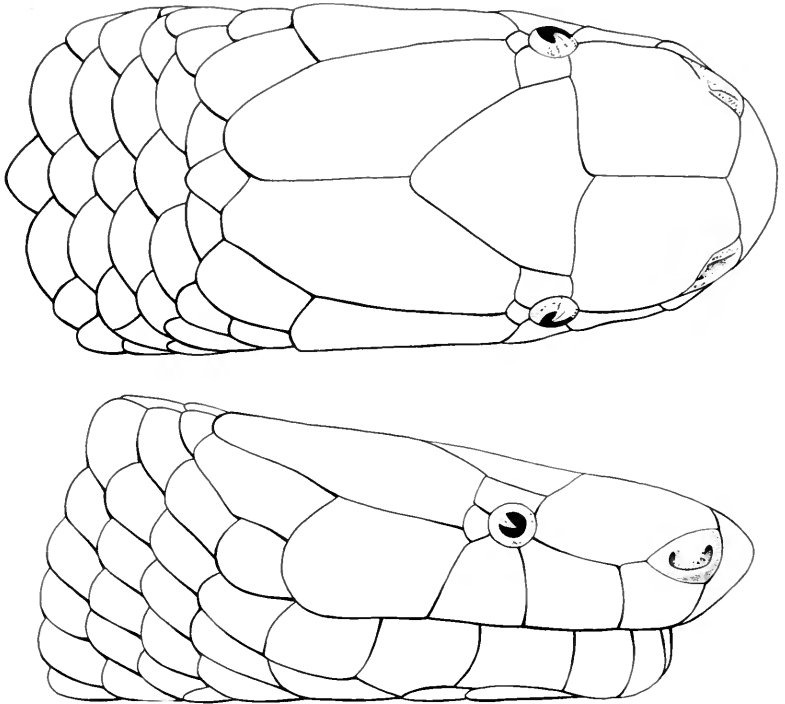


FIG. 27. *Calamaria schmidti* sp. nov. (type, USNM 130240); actual length of head 9 mm.

lighter than dorsal color; under side of tail darker than belly but slightly lighter than dorsal surface.

Total length 253 mm., tail length 19 mm., length from tip of snout to posterior border of parietals 9 mm.

*Paratype*.—Stanford University no. 8568 from Mount Kina Balu, North Borneo. This animal is in several pieces and somewhat dried. However, the head scutellation is distinct and unmistakably identical to that of the type.

The following data are all that can be gleaned from this snake; subcaudals 14; supralabials 4, second and third entering eye, first three subequal; first pair of infralabials in contact behind mental, first three pairs in contact with anterior chin shields; frontal 5 to 6 times width of supraocular; no preocular; postocular present; position of reduction to 4 dorsal scale rows, counting subcaudals from terminal scute 7; maxilla with 6, widely spaced, conical teeth.

*Comparisons.*—Only three species of *Calamaria* agree with *schmidti* in having four supralabials, the first infralabials in contact behind the mental, and no preocular. The three are *gimletti*, *gracillima*, and *doerianense*. The first two differ radically from *schmidti* in ventral counts, *gimletti* having 202–249 and *gracillima* having 300–320 as compared to 144 in the type of *schmidti*. The frontal-supraocular ratio of *schmidti* (5–6) is about twice that of *gimletti* ( $3-3\frac{1}{2}$ ).

*Calamaria doerianense* has the second and fourth supralabials subequal in length whereas in *schmidti* the first three supralabials are subequal and much smaller than the fourth. The frontal-supraocular ratio of *schmidti* (5–6) is twice that of *doerianense* (2–3).

*Remarks.*—The type specimen contained an earthworm.

### *Calamaria lowi* Boulenger

*Calamaria lowi* Boulenger, 1887, Ann. Mag. Nat. Hist., (5), 19: 169, fig.—  
Rejang River, Sarawak.

*Descriptive notes.*—Two males; total length 122–239 mm.; tail 0.07 (two) of total; ventrals 198–202; subcaudals 19–20. Two females; total length 279–316 mm.; tail 0.04–0.05 of total; ventrals 223 (two); subcaudals 14 (two).

Supralabials 4, third only entering the eye; infralabials 4, first pair not in contact behind mental, first two pairs in contact with anterior chin shields; no preocular; postocular 1; position of reduction to 4 dorsal scale rows, counting subcaudals forward from terminal scute 3–6; maxilla with 8–9 modified teeth.

In all respects these snakes agree with the original description.

*Locality and specimens examined.*—SARAWAK: Fourth Division, Long Mujan (RM 51, 55, no number; SU 8525).

### CHECK LIST

#### *Calamaria acutirostris* Boulenger

*Calamaria acutirostris* Boulenger, 1896, Ann. Mag. Nat. Hist., (6), 17: 394—  
Loka, Mount Bonthain, Celebes.

#### *Calamaria albiventer* Gray

*Changulia albiventer* Gray, 1834, Ill. Ind. Zool., 2, pl. 86, figs. 6–9—Penang.

#### *Calamaria albopunctata* Barbour

*Calamaria albopunctata* Barbour, 1908, Bull. Mus. Comp. Zool., 51: 319—  
East Indies.

**Calamaria alidae** Boulenger

*Calamaria alidae* Boulenger, 1920, Ann. Mag. Nat. Hist., (9), 5: 282—Lebong Tandai in Benkulen, Sumatra.

**Calamaria apraeocularis** Smith

*Calamaria apraeocularis* Smith, 1927, Proc. Zool. Soc. London, 1927: 224—Djikoro, Mount Bonthain, Celebes.

**Calamaria beccarii** Peters

*Calamaria beccarii* Peters, 1872, Ann. Mus. Civ. Genova, 3: 34—Sarawak.

**Calamaria benjaminsi** Edeling

*Calamaria benjaminsi* Edeling, 1864, Ned. Tijds. Dierk., 2: 202—Martapura, Borneo.

**Calamaria bicolor** Duméril and Bibron

*Calamaria bicolor* Duméril and Bibron, 1854, Erp. Gén., 7: 78—Borneo.

**Calamaria bitorques** Peters

*Calamaria bitorques* Peters, 1872, Monatsber. Akad. Wiss. Berlin, 1872: 585—Philippine Islands.

**Calamaria borneensis** Bleeker

*Calamaria borneensis* Bleeker, 1860, Nat. Tijds. Ned. Indië, 21: 296—Sintang, Borneo.

**Calamaria brachyura** Boulenger

*Calamaria brachyura* Boulenger, 1895, Ann. Mag. Nat. Hist., (6), 16: 481—Mount Kina Balu, North Borneo.

**Calamaria buchi** sp. nov.

Dalat, Viet Nam, Indo-China.

**Calamaria bungaroides** Werner

*Calamaria bungaroides* Werner, 1901, Zool. Anz., 24: 300—type locality unknown, probably Java.

**Calamaria ceramensis** de Rooij

*Calamaria ceramensis* de Rooij, 1913, Bijdr. Dierk., 19: 26—Honitétu, Ceram.



**Calamaria collaris** Boulenger

*Calamaria collaris* Boulenger, 1897, Proc. Zool. Soc. London, 1897: 225, pl. 14, fig. 4—Bone Mountains, Tomohon, Rurukan, Celebes.

**Calamaria crassa** Lidth de Jeude

*Calamaria crassa* Lidth de Jeude, 1922, Zool. Meded., 6: 248—Gunung Talamau, Ophir District, Padang Highlands, Sumatra.

**Calamaria curta** Boulenger

*Calamaria curta* Boulenger, 1896, Ann. Mag. Nat. Hist., (6), 18: 62—South Celebes.

**Calamaria doderleini** Gough

*Calamaria doderleini* Gough, 1902, Zool. Anz., 25: 645—Langkat, Sumatra.

**Calamaria doerianense** Brongersma

*Calamaria doerianense* Brongersma, 1928, Zool. Anz., 75: 255, 2 figs.—Pulau Durian, Riouw Archipelago.

**Calamaria egregia** Barbour

*Calamaria egregia* Barbour, 1927, Proc. Biol. Soc. Washington, 40: 127—Mount Tibang, Borneo.

**Calamaria electa** Barbour

*Calamaria electa* Barbour, 1927, Proc. Biol. Soc. Washington, 40: 128—Pasir, Borneo.

**Calamaria elegans** de Rooij

*Calamaria elegans* de Rooij, 1917, Rept. Indo-Austr. Arch., 2: 158, fig. 64—Simalur Island.

**Calamaria everetti** Boulenger

*Calamaria everetti* Boulenger, 1893, Proc. Zool. Soc. London, 1893: 525—Sarawak.

**Calamaria gervaisi** Duméril and Bibron

*Calamaria gervaisi* Duméril and Bibron, 1854, Erp. Gén., 7: 76—Java [in error, see text p. 182].

**Calamaria gimletti** Boulenger

*Calamaria gimletti* Boulenger, 1905, Ann. Mag. Nat. Hist., (6), 15: 456—Kelantan, Malay Peninsula.

**Calamaria goringi** Vogt

*Calamaria goringi* Vogt, 1925, Zool. Anz., 62: 64—Java.

**Calamaria grabowskyi** Fischer

*Calamaria grabowskyi* Fischer, 1885, Arch. Naturg. Berlin, 51: 50, pl. 4, fig. 1—Telang and Tameanglajang, Dusson Timor District, Borneo.

**Calamaria gracilis** Boulenger

*Calamaria gracilis* Boulenger, 1896, Ann. Mag. Nat. Hist., (6), 18: 63—Mount Bonthain, Celebes.

**Calamaria gracillima** Günther

*Calamaria gracillima* Günther, 1872, Proc. Zool. Soc. London, 1872: 594, pl. 39, fig. A—Sarawak.

**Calamaria griswoldi** Loveridge

*Calamaria lumbricoidea griswoldi* Loveridge, 1938, Proc. Biol. Soc. Washington, 51: 43—Luidan River, near Bundu Tuhan, Mount Kina Balu, North Borneo.

**Calamaria hollandi** Taylor

*Calamaria hollandi* Taylor, 1923, Phil. Jour. Sci., 22: 550—Port Holland, Basilan, Philippine Islands.

**Calamaria hosei** Günther

*Calamaria hosei* Günther, 1896, Ann. Mag. Nat. Hist., (6), 17: 229—Entoyut River, Sarawak.

**Calamaria indragirica** Schenkel

*Calamaria indragirica* Schenkel, 1901, Verh. Ges. Basel, 13: 164, fig. 3—Indragiri, Sumatra.

**Calamaria javanica javanica** Boulenger

*Calamaria javanica* Boulenger, 1891, Ann. Mag. Nat. Hist., (6), 7: 279—Java.

**Calamaria javanica lineata** Brongersma

*Calamaria javanica* var. *lineata* Brongersma, 1928, Zool. Anz., 75: 256—Long Petah, Borneo.

**Calamaria jeudei** Kopstein

*Calamaria jeudei* Kopstein, 1926, Zool. Meded., 9: 108—Saparua Island, Molucca Islands.

**Calamaria joloensis** Taylor

*Calamaria joloensis* Taylor, 1922, Phil. Jour. Sci., **21**: 203—Jolo Island, Philippine Islands.

**Calamaria klossi** Smith

*Calamaria klossi* Smith, 1926, Ann. Mag. Nat. Hist., (9), **18**: 79—Siberut Island, Mentawai Islands.

**Calamaria lateralis** Mocquard

*Calamaria lateralis* Mocquard, 1890, Nouv. Arch. Mus. Hist. Nat. Paris, (3), **2**: 136, pl. 8, fig. 4—Mount Kina Balu, Borneo.

**Calamaria lautensis** de Rooij

*Calamaria lautensis* de Rooij, 1917, Rept. Indo-Austr. Arch., **2**: 163, fig. 66—Pulau si Laut, Cocos Islands, and Simalur.

**Calamaria leucocephala** Duméril and Bibron

*Calamaria leucocephala* Duméril and Bibron, 1854, Erp. Gén., **7**: 83—type locality unknown.

**Calamaria leucogaster** Bleeker

*Calamaria leucogaster* Bleeker, 1860, Nat. Tijds. Ned. Indië, **21**: 293—Ampat-Lawang, Sumatra.

**Calamaria linnaei** Boie

*Calamaria linnaei* Boie, 1827, Isis, **20**: 539—Java.

**Calamaria lowi** Boulenger

*Calamaria lowi* Boulenger, 1887, Ann. Mag. Nat. Hist., (5), **19**: 169, fig.—Rejang River, Sarawak.

**Calamaria lumbricoidea** Boie

*Calamaria lumbricoidea* Boie, 1827, Isis, **20**: 540—Java.

**Calamaria lumholtzi** Andersson

*Calamaria lumholtzii* Andersson, 1923, Nyt. Mag. Naturk. Kristiania, **61**: 123—Tumbang Maruwei, Borneo.

**Calamaria margaritophora margaritophora** Bleeker

*Calamaria margaritophora* Bleeker, 1860, Nat. Tijds. Ned. Indië, **21**: 294—Ampat-Lawang, Sumatra.

**Calamaria margaritophora gastropicta** Holtzinger

*Calamaria margaritophora gastropicta* Holtzinger, 1920, Arch. Naturg. Berlin, Abt. 85, p. 106—Indonesia.

**Calamaria mearnsi** Stejneger

*Calamaria mearnsi* Stejneger, 1907, Smiths. Misc. Coll., 50: 30—Tangob, Mindanao, Philippine Islands.

**Calamaria mecheli** Schenkel

*Calamaria mecheli* Schenkel, 1901, Verh. Ges. Basel, 13: 165, fig. 4—Indragiri, Sumatra.

**Calamaria melanota** Jan

*Calamaria linnaei* var. *melanota* Jan, 1862, Arch. Zool. Anat. Phys., 2: 5—type locality unknown.

**Calamaria mindorensis** Boulenger

*Calamaria mindorensis* Boulenger, 1895, Ann. Mag. Nat. Hist., (6), 16: 481—Mindoro, Philippine Islands.

**Calamaria mjobergi** Lönnberg and Rendahl

*Calamaria mjobergi* Lönnberg and Rendahl, 1925, Ark. Zool. Stockholm, 17A, no. 23, p. 1—Brastagi, Sumatra.

**Calamaria muelleri** Boulenger

*Calamaria muelleri* Boulenger, 1896, Ann. Mag. Nat. Hist., (6), 17: 394—Loka, Mount Bonthain, Celebes.

**Calamaria nuchalis** Boulenger

*Calamaria nuchalis* Boulenger, 1896, Ann. Mag. Nat. Hist., (6), 18: 62—South Celebes.

**Calamaria occipitalis** Jan

*Calamaria occipitalis* Jan, 1862, Arch. Zool. Anat. Phys., 2: 9—Java.

**Calamaria ornata** Werner

*Calamaria ornata* Werner, 1909, Mitt. Naturh. Mus. Hamburg, 26: 229, fig. 6—Indragiri, Sumatra.

**Calamaria pavementata pavementata** Duméril and Bibron

*Calamaria pavementata* Duméril and Bibron, 1854, Erp. Gén., 7: 71—Java.

**Calamaria pavimentata formosana** Maki

*Calamaria pavimentata formosana* Maki, 1931, Monog. Snakes Japan, p. 136, pl. 51A, figs. 90-91—Arisan, Formosa.

**Calamaria pendleburyi** Smith

*Calamaria pendleburyi* Smith, 1931, Bull. Raffles Mus., no. 5, p. 27—Kiau, Mount Kina Balu, North Borneo.

**Calamaria pfefferi** Stejneger

*Calamaria pfefferi* Stejneger, 1901, Proc. Biol. Soc. Washington, 14: 191—Miyako Shima, Yayeyama group, Riu Kiu Archipelago.

**Calamaria polillensis** Taylor

*Calamaria polillensis* Taylor, 1923, Phil. Jour. Sci., 22: 549—Polillo, Polillo Island, Philippine Islands.

**Calamaria prakkei** Lidth de Jeude

*Calamaria prakkei* Lidth de Jeude, 1893, Notes Leyden Mus., 15: 252—Sandakan Bay, North Borneo.

**Calamaria quinquetaeniata** Despax

*Calamaria quinquetaeniata* Despax, 1912, Bull. Mus. Paris, 18: 203—East Indies.

**Calamaria raveni** Cochran

*Calamaria raveni* Cochran, 1923, Proc. Biol. Soc. Washington, 36: 92—Sungai Merah, Borneo.

**Calamaria rebentischi** Bleeker

*Calamaria rebentischi* Bleeker, 1860, Nat. Tijds. Ned. Indië, 21: 293—Singawang, Borneo.

**Calamaria schlegeli** Duméril and Bibron

*Calamaria schlegeli* Duméril and Bibron, 1854, Erp. Gén., 7: 81—Borneo.

**Calamaria schmidti** sp. nov.

Bundu Tuhan, Mount Kina Balu, North Borneo.

**Calamaria semiannulata** Boettger

*Calamaria semiannulata* Boettger, 1898, Kat. Rept. Senck. Mus., 2: 84—Borneo.

**Calamaria septentrionalis** Boulenger

*Calamaria septentrionalis* Boulenger, 1890, Proc. Zool. Soc. London, 1890: 34—Kiu Kiang and Hong Kong.

**Calamaria simalurensis** de Rooij

*Calamaria simalurensis* de Rooij, 1917, Rept. Indo-Austr. Arch., 2: 159, fig. 65—Simalur Island.

**Calamaria smithi** Dunn

*Calamaria smithi* Dunn, 1923, Jour. Malayan Asiat. Soc., 1: 3—Long Mujan, Sarawak.

**Calamaria sondaica** Barbour

*Calamaria sondaica* Barbour, 1908, Bull. Mus. Comp. Zool., 51: 319—Buitenzorg, Java.

**Calamaria stahlknechti** Stoliczka

*Calamaria stahlknechti* Stoliczka, 1873, Jour. Asiat. Soc. Bengal, 42: 119, pl. 11, fig. 2—Dilli, Sumatra.

**Calamaria suluensis** Taylor

*Calamaria suluensis* Taylor, 1922, Snakes Phil. Isls., p. 189—Cagayan Sulu, Philippine Islands.

**Calamaria sumatrana** Edeling

*Calamaria sumatrana* Edeling, 1870, Nat. Tijds. Ned. Indië, 31: 379—Redjang, Sumatra.

**Calamaria tropica** Taylor

*Calamaria tropica* Taylor, 1922, Snakes Phil. Isls., p. 194—near Naujan, Mindoro, Philippine Islands.

**Calamaria ulmeri** Sackett

*Calamaria ulmeri* Sackett, 1940, Not. Nat., no. 41, p. 2—northwest of Blangkedjeren, Atjeh Province, Sumatra.

**Calamaria uniformis** Smith

*Calamaria pavementata* var. *uniformis* Smith, 1921, Proc. Zool. Soc. London, 1921: 426—Langbian peaks, Annam, Indo-China.

**Calamaria ventralis** Cochran

*Calamaria ventralis* Cochran, 1923, Proc. Biol. Soc. Washington, 36: 91—Sungai Merah, Borneo.

**Calamaria vermiformis vermiformis** Duméril and Bibron

*Calamaria vermiformis* Duméril and Bibron, 1854, *Erp. Gén.*, 7: 85—Java.

**Calamaria vermiformis grayi** Günther

*Calamaria grayi* Günther, 1858, *Cat. Snakes Brit. Mus.*, p. 6—Philippine Islands.

**Calamaria virgulata** Boie

*Calamaria virgulata* Boie, 1827, *Isis*, 20: 540—Java.

**Calamaria zamboangensis** Leviton

*Calamaria zamboangensis* Leviton, 1952, *Jour. Washington Acad. Sci.*, 42: 239, fig. 1—Zamboanga, Mindanao, Philippine Islands.

## REFERENCES

- BOULENGER, G. A.**  
 1894. Catalogue of the snakes in the British Museum (Natural History). 2, xi+382 pp., 20 pls. London, Taylor & Francis.  
 1895. Description of a new snake from Borneo. *Ann. Mag. Nat. Hist.*, (6), 15: 329.
- DUMÉRIL, A. M. C. and BIBRON, G.**  
 1854. *Erpétologie général ou histoire naturelle des reptiles*. 7, pt. 1, xvi+780 pp. Paris, Librairie Encyclopédique Roret.
- EYDOUX, FORTUNÉ and GERVAIS, PAUL**  
 1837. Voyage de la Favorite. Reptiles. *Guérin's Mag. Zool.*, 1837, Cl. 3, pp. 1-10, pls. 12-16.
- FISCHER, J. G.**  
 1885. Über eine Kollektion von Amphibien und Reptilien aus Südost-Borneo. *Arch. Naturg. Berlin*, 51: 41-72, pls. 4, 5.
- GÜNTHER, ALBERT**  
 1858. Catalogue of colubrine snakes in the collection of the British Museum. xvi+281 pp. London, Taylor & Francis.  
 1865. Fourth account of new species of snakes in the collection of the British Museum. *Ann. Mag. Nat. Hist.*, (3), 15: 89-98, pls. 2, 3.
- HAAS, C. P. J. DE**  
 1950. Checklist of the snakes of the Indo-Australian Archipelago. *Treubia*, 20: 511-625.
- HAAS, GEORG**  
 1930. Über die Kaumuskulatur und die Schädelmechanik einiger Wühlschlangen. *Zool. Jahrb., (Anat.)*, 52: 95-218, figs. 1-74.
- JAN, GEORGIO and SORDELLI, FERNANDO**  
 1865. *Iconographie générale des Ophidiens*. Livr. 10, 6 pls.
- MERTENS, ROBERT**  
 1930. Die Amphibien und Reptilien der Inseln Bali, Lombok, Sumbawa und Flores. *Abh. Senck. Naturf. Ges.*, 42: 115-344, pls. 1-9.
- POPE, C. H.**  
 1935. Reptiles of China. *Nat. Hist. Central Asia*, 10: lii+604, 27 pls., 78 text figs.
- ROOIJ, NELLY DE**  
 1917. The reptiles of the Indo-Australian Archipelago. II: Ophidia. xiv+334 pp., 117 figs. Leiden, E. J. Brill.
- SMITH, M. A.**  
 1930. The Reptilia and Amphibia of the Malay Peninsula. *Bull. Raffles Mus.*, no. 3, xviii+149 pp., figs. 1-13.



1931. The herpetology of Mt. Kinabalu, North Borneo, 13,455 ft. Bull. Raffles Mus., no. 5, pp. 1-32, pls. 1, 2.

1943. The fauna of British India, Ceylon, and Burma. Reptilia and Amphibia, 3, xii+583 pp., 166 figs.

TAYLOR, E. H.

1917. Snakes and lizards known from Negros, with descriptions of new species and new subspecies. Phil. Jour. Sci., 12: 353-379, pls. 1, 2, text figs. 1, 2.

1922. The snakes of the Philippine Islands. Phil. Bur. Sci., Manila, Monogr. 16, 312 pp., 37 pls., 32 text figs.

TWEEDIE, M. W. F.

1950. Notes on Malayan reptiles, no. 2. Bull. Raffles Mus., no. 23, pp. 191-199, fig. 1.







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