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A NEW SPECIES OF *ENHYDRIS* (SERPENTES: COLUBRIDAE: HOMALOPSINAE) FROM THE KAPUAS RIVER SYSTEM, WEST KALIMANTAN, INDONESIA

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***ABSTRACT.* –** A new species of homalopsine water snake of the genus *Enhydris* is described from Kalimantan, Indonesia on the basis of three specimens. It differs from its close relative *Enhydris doriae* (Peters, 1871) in the number of scale rows at midbody, a higher number of lower labials and ventral scales, plate like temporal scales, and a distinctive color pattern.

***KEY WORDS.* –** Snake, Homalopsinae, new species, Kapuas River, Indonesia.

INTRODUCTION

The revision of the colubrid snake subfamily Homalopsinae by Gyi (1970) recognized 10 genera and 34 species, with the genus *Enhydris* Latreille *in* Sonnini & Latreille, 1801, holding 22 of those species. *Enhydris* is composed of species with large head shields, smooth scales, nasal scales in contact behind the rostral, a single or double internasal posterior to the nasals, 19-33 rows of dorsal scales at midbody, 105-172 ventrals, and 23-92 subcaudals. Since Gyi's revision some taxonomic changes have been proposed. St. Girons (1971) considered *Enhydris longicauda* (Bourret) and *Enhydris smithi* (Boulenger) synonyms of *Enhydris innominata* (Morice) and considered both of these isolated, allopatric populations subspecies of *E. innominata*. Cogger et al. (1983) placed *Enhydris macleayi* (Ogliby) in the synonymy of *Enhydris polylepis* (Fischer). Although this had been done previously by Loveridge (1934), Gyi either overlooked it, or chose to ignore it, but did not comment on Loveridge's arrangement. *Enhydris pakistanica* Mertens (1959) was the most recently described member of the genus. Additionally, Voris et al. (2002) used mtDNA sequencing of three genes, CytB, 12S, and 16S to demonstrate that the genus *Enhydris* is paraphyletic. *Enhydris bocourti* (Jan) was shown to be part of a clade containing *Cerberus rynchops*, *Erpeton tentaculatum*, and *Homalopsis buccata*; while *Enhydris punctata* was the sister species to the Australian mangrove-dwelling snake *Myron richardsonii*.

The genus *Enhydris* is distributed along an east-west axis from the Indus River Valley of Pakistan to the east coast of Queensland, Australia. Of the 22 species, only two are widespread, *Enhydris enhydris* and *Enhydris plumbea*. The remaining twenty species Gyi recognized are restricted to specific drainage systems and coastlines of bioregions and ecoregions. He recognized five species as being present on the island of Borneo: *E. alternans*, *E. doriae*, *E. enhydris*, *E. plumbea*, and *E. punctata*.

Peters (1871) described *Homalophis doriae* on the basis of one of two syntypes from Sarawak, Borneo. He described this snake as having 31 dorsal scale rows, 141 ventrals, 45 subcaudals, 2-3 supraoculars, one preocular, three postoculars, 15 supralabials, and 16 infralabials. Boulenger (1896) placed this species in the genus *Hypsirhina*, and Haas (1950) moved it into the genus *Enhydris*. While examining museum specimens of *Enhydris doriae* we discovered a second species within the material.

MATERIALS AND METHODS

Measurements reported here include those taken with a meter stick to the nearest mm [snout-vent length (SVL) and tail length] or with dial calipers to the nearest 0.1mm. Sex was determined by visual inspection of the everted hemipenes, caudal incision, or probing. Scale counts from opposite sides of the same specimen are separated with a slash as opposed to a dash which is used to report ranges of scales on one specimen or more than one specimen. Specimens examined are listed in Appendix 1. Institutional abbreviations follow McDiarmid et al. (1999). Both specimens collected by Auliya

were taken as bycatches in fishing nets. All specimens observed are preserved in 70% ethanol.

TAXONOMY

Enhydris gyii, new species
(Figs. 1-3)

Hypsirhina doriae – Brown, 1902: 180.
Enhydris doriae – Barbour, 1912: 123; Gyi, 1970: 130; Auliya, 2003: 221.

***Material examined.* –** Holotype – Female, Indonesia, Kalimantan Barat, Sungai Kapuas at Putussibau (0º52'N 112º55'E), where the Sibau River empties into the Kapuas River, Kapuas Hulu Regency, West Kalimantan, coll. Mark Auliya, 27 Oct.1996 (ZFMK 65824).

Paratypes – a female from Indonesia, near Nanga Bunut, where Sungai Bunut empties into the Kapuas River, approximately 106 km downstream the Kapuas River from Putussibau; Kapuas Hulu Regency, West Kalimantan, coll. Mark Auliya, 9 Dec.1996 (ZFMK 65825,); a female from an unknown location along the Kapuas River, West Kalimantan (ANSP 26411).

***Diagnosis.* –** *Enhydris gyii* is readily distinguished from all other Borneo *Enhydris* by the presence of subocular scales, 25-27 scale rows at midbody, and red-brown dorsal coloration. Each dorsal scale in the rows above row four contain a central red area surrounded by a perimeter of gray-brown pigment. Red pigment also occurs on dorsal scale rows 1-4, and the chin and anterior upper labials are also red-brown. Females have 155-159 ventral scales, two preocular scales, temporal scales that are plate-like (Fig. 1a) and distinct in the primary and secondary rows. Additionally, the head of females tends to be broad and rounded when viewed from above. In contrast, *Enhydris doriae*, a sympatric congener, has 29-31 scale rows at midbody, is gray to black above, with red ventral pigment extending on to scale rows 1-5, 1-6, or 1-7 at midbody; its scales lack a central red spot, it has 137-152 ventral scales (137-152 in females and 139-145 in males); one preocular scale; and the temporal scales tend to be small (Figure 1b), and similar to the occipital scales in size, particularly in the secondary and tertiary rows. The head of female *E. doriae*, of about equal size to *E. gyii*, tends to be narrower, with a squared-off snout when viewed from above. The other Bornean *Enhydris* with 25-27 scale rows at mid body is *Enhydris punctata* but it lacks the red pigmentation and the subocular scales, and has two pairs of chin shields with the anterior pair flared (*E. gyii* and *E. doriae* have 3 or 4 elongated or boomerang-shaped chin shields). Table 1 compares the three species of Bornean *Enhydris* with 25 or more scale rows at mid body in more detail.

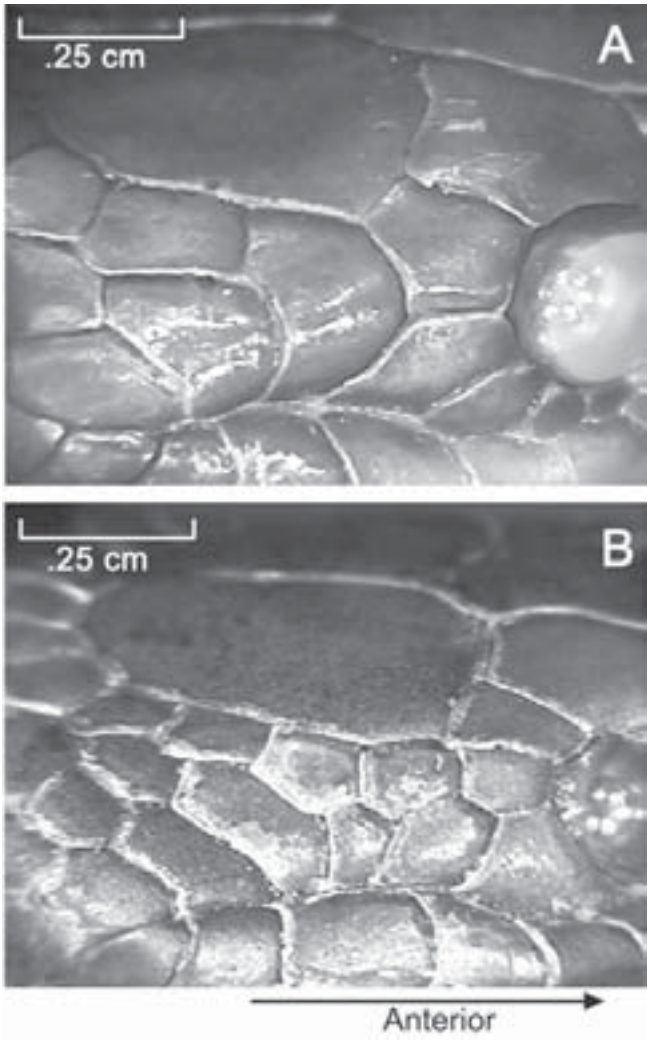

Fig. 1. A comparison of the temporal regions of (A) *Enhydris gyii* (Holotype, ZFMK 65824) and (B) *E. doriae*, REP 0322. *Enhydris gyii* has fewer, large, plate like temporal scales.

***Description of holotype.* –** The head distinct from neck, the body cylindrical, the posterior body and tail slightly compressed. Body 665 mm long, tail 101 mm, total length 766 mm (Fig. 2). The rostral tall as broad, pentagonal, and with shallow notch; it is also horizontally divided; and, has about the same area as a nasal scale. Nasals in contact and semi-divided, nasal cleft contacts the second labial. Two internasal scales are posterior to the nasals and slightly penetrating; they also contact the loreal scale. Prefrontal scales paired, larger than internasals, and contact the loreals. Frontal length less than the interorbital distance. Parietals slightly

Fig. 2. *Enhydris gyii*, new species, Holotype, ZFMK 65824 from Sungai Kapuas at Putussibau (0º52'N 112º55'E), where the Sibau River empties into the Kapuas River, Kapuas Hulu Regency, West Kalimantan, Indonesia. Photo: Mark Auliya.

longer than the frontal (Fig. 3a). Loreal scales are 1/1 and larger than the prefrontal scales. On left the loreal contacted by upper labials 3-5, on right side it contacts labials 2-6. Two supraocular scales on each side; anterior scale smaller than posterior scale. Postocular scales number 3/3, preocular scales 1/1, subocular scales 2/2. Lower preocular scale extends under the eye and not included in subocular count. Eyes are dorsolateral, pupil round, with a diameter slightly less than greatest diameter of nasal scale. Diameter of the orbit less than eye-mouth distance. Right temporal formula 1:2:3, left temporal formula 1:1:2, secondary temporal scale(s) largest. Upper labials tuberculate, number 15 on both sides; on right side upper labials 1-4 tall, narrow, and undivided; labials 5-9 divided into two tiers; labials 10-12 divided into three tiers; at labial 13 the jaw turns upward and forms a right angle; on left side labials 1-4 undivided; 5-10 divided into two tiers, 11-12 divided into three tiers (Fig. 3b). Lower labials number 17/16; labials 1-2 form mental groove, and lower labials 2-5 contact anterior chin shields; labials 1-6 /1-7 undivided; and labials 8-9 divided. Four pairs of chin shields, first pair largest boomerang-shaped. Other pairs separated by small scales and do not border the mental groove (Fig. 3c). Six gular scales occur between last pair of chin shields and first ventral scale. Dorsal scales in 27 rows on the neck, 25 rows at midbody, and reduced to 21 rows near the vent. Scales in row one slightly taller than those in subsequent rows. Scales are smooth, and a few scales at midbody toward the vertebral midline are tuberculate. Ventrals rounded and broad, about 4-5 times wider than the length of a nearby dorsal scale; they number 158. Subcaudal scales are divided and number 44/45. Color in life: dorsum gray-black with iridescent scales, ventral surface and first four scale rows red-brown. Upper labials anterior to orbit gray-black, posterior upper labials red-brown. Black stripe from nape to angle of jaw. The color pattern on scale rows 1-4 at mid body is red with scattered brown pigment, on the remainder of scale rows each scale has light colored margin bordered on the inside by brown pigment, with a central irregular red spot; overall the dorsum is a uniform red-brown. Red-brown coloration extends onto crown of head and on chin (the mental and first 4-5 labials); coloration forms a line on margin of the lower labials, which outlines upper jaw. Ventral surface of body red; the ventral surface of tail braided in appearance with dark anterior spot on each scale and posterior portion of the scale has a red spot. Posterior upper labials also red.

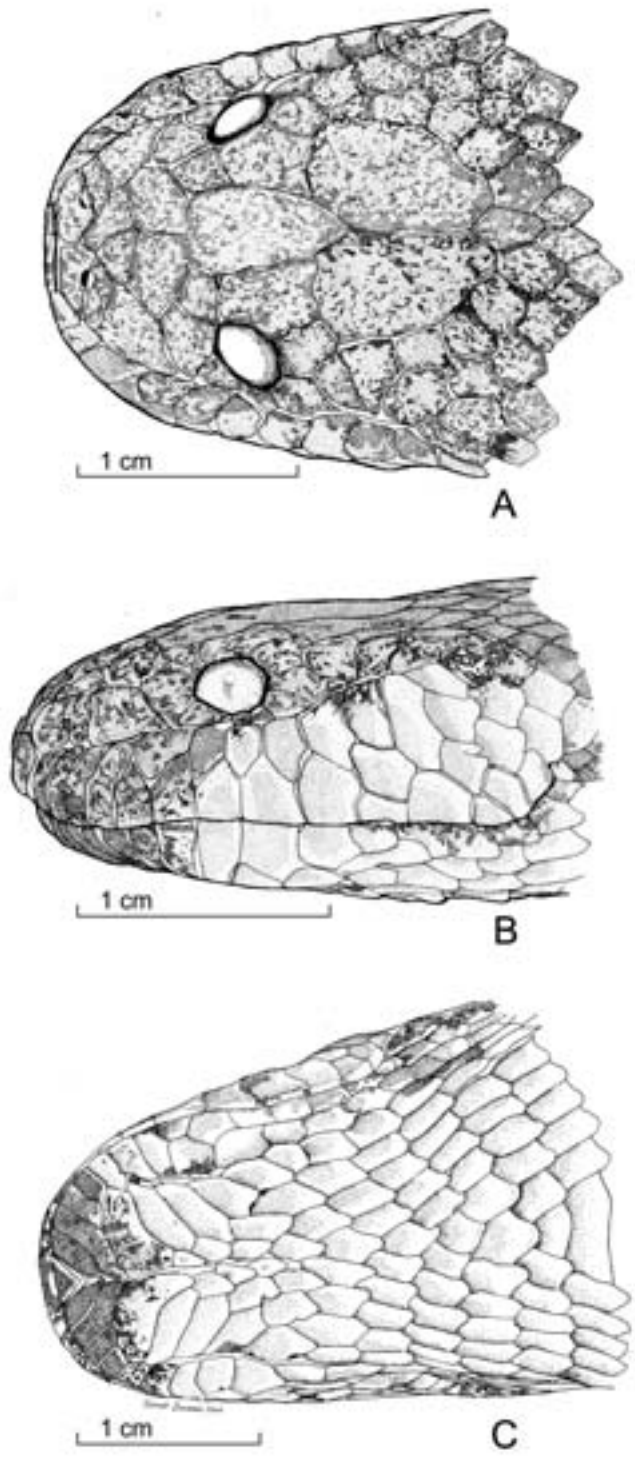

Fig. 3. *Enhydris gyii*, new species, Holotype, ZFMK 65824. A. dorsal view of head; B. lateral view of head; C. ventral view of head.

Variation. **–** The two other specimens differ from the holotype in the following ways: (1) ZFMK 65825 has dorsal scales in 29 rows on the neck, 27 at midbody, and 22 rows near the vent; (2) ANSP 26411 has 155 ventrals and 44 subcaudal scales, while ZFMK 65825 has 155 ventrals and 45 subcaudal scales; (3) ZFMK 65825 has 16 supralabial scales on the right side and 17 supralabials on the left; (4) ANSP 26411 has the internasal divided into three small scales; (5) both of these have three supraoculars compared to two in the holotype; (6) ZFMK 65825 has a single subocular on the right side, and the pre- and postoculars on the left extend under the eye; (7) both of these have divided loreals, and upper labials 3-5 touching the loreal, while the holotype has a single loreal and supralabials 2-5 touching the loreal; (8) ANSP 26411 has a 2:2:3 temporal arrangement on the left side, and a 1:2:3 arrangement on the right, the latter arrangement is found in the other specimen as well; (9) neither of the other specimens has a horizontally divided rostral; (10) the other two females have total lengths of 643 mm and 762 mm, with tails that are 85 and 96 mm respectively.

Etymology. **–** We are pleased to name this new homalopsine snake in honor of the late Burmese herpetologist Ko Ko Gyi, Professor at Rangoon University, and the first zoologist to

Table 1. A comparison of some selected morphological characteristics for three species of Bornean *Enhydris* with 25 scale rows or more. NA = None Available.

Characteristic	*gyii* (n=3)	*doriae* (n=21)	*punctata* (n=11)
Scale rows on neck	27-29	31-33	25-27
scale rows midbody	25-27	29-31	25-27
Scale rows near vent	21-23	25	21-23
Ventrals in males	NA	139-145	141-151
Ventrals in females	155-159	137-152	137-160
Subcaudals in males	NA	47-60	46-48
Subcaudals in females	44-46	39-45	27-39
Loreal, single or divided	Both	Both	Both
Upper labials	15 to 17	11 to 16	10-14
Upper Labials divided into 3 tiers posteriorly	Yes	Yes	Yes
Lower labials	16-20	12-16	14-16
Supraoculars	2 or 3	2 to 4	1
Preoculars	2	1	1
Suboculars	Present	Present	None
Pairs of chin shields	4	3 or 4	2
Temporal scales enlarged and plate-like	Yes	No	Yes
2nd pair of chin shields form mental groove	Yes	Yes	Yes/No
Red spot in center of each dorsal scale	Yes	No	No

revise the entire subfamily Homalopsinae in the 20th century. Without his efforts our current work would be much more difficult. We suggest that the common English name for this new snake should be Kapuas Mud Snake.

Distribution and natural history. **–** *Enhydris gyii* may be restricted to the Kapuas drainage basin of Kalimantan, Indonesia. However, the maps and data presented by Voris (2000) suggest that this species may, in the future, be found to occur in the drainage basins of central Sumatra. This suggestion is based on the observation that the Kapuas system and the central Sumatran drainages were connected at three different times during the last 250,000 years for a total connection time of about 95,000 years. The connections occurred when sea level was at or below the 50 m contour line. The specimens collected by Auliya were obtained during periods of heavy rainfall in flooded riparian habitats. The wet season in Putussibau may be characterized by months that exceed 400 mm of precipitation (January, February, August, October and November in 1996), and total annual precipitation is 4480 mm.

Nothing is known about the feeding habits or reproduction of this new species. While lowland endemicity is frequently considered to be minimal, the Kapaus River drainage has at least one area high in endemicity, the Danau Sentarum National Park (00°51'N 112°06'E), a Ramsar site since 1994, and gazetted a National Park in 1999. This is in an area about 700 km upstream in western Kalimantan, is west of the type locality and is a large complex of swamp forest, peat swamps, and lakes. This area is subject to two annual monsoons, a northeast monsoon in October, and a second monsoon in March. Water levels in the area recede by August, at which time the floodplain lakes are completely dry for a 3-4 month period, the area then becomes a dry savanna with high daily temperatures. This climatic regime has produced an environment unique from the surrounding lowland forest and a number of endemic fish and bird species are known from this area (Sebastian, 1994). Rasmussen et al. (2001) have recently described the freshwater sea snake *Hydrophis sibauensis* (Hydrophiidae), from the Sibau River, on a level with Putussibau, very near to the type locality of *E. gyii*. The question of whether or not *E. doriae* and *E. gyii* are sympatric is unresolved. However, we have examined a single specimen of *E. doriae* from Kalimantan (UMMZ 65864) with no specific locality data.

DISCUSSION

Of historical interest is the paratype of *E. gyii*, ANSP 26411. This specimen was collected by A. E. Brown on the 1897 Harrison-Hiller Expedition, and considered by him to be *Enhydris doriae* (Brown, 1902). Barbour (1912) and Gyi (1970) apparently examined this same specimen, and both failed to recognize it as distinct from *E. doriae*. The specimen is now faded from preservatives and light, but when compared to a faded *Enhydris doriae* it stands out because each scale has a faded cream area in the center, that was most likely red in life, while *E. doriae* scales fade uniformly lacking a central spot. It is also interesting to note that Gyi (1970) listed this specimen in material examined, listed its 25 scale rows at

midbody in his Table 6, but failed to comment on the unusual specimen and scale counts in the species account for *E. doriae*.

Auliya (2003) made the interesting observation that when placed in a dark bucket for a period of time the snake "…turned almost white." Physiological color change in snakes has been described and reviewed (Hedges et al., 1989) but is rare and poorly understood.

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APPENDIX

Specimens examined. – *Enhydris doriae*: Indonesia: Kalimantan UMMZ – 65864. Malaysia: Sabah. – SSM – REP 0490, REP 0322. Sarawak – FMNH – 14919, 128272, 129420, 67267, 129419, 148904, 145704, 131728-9, 131723, 138665 6, 131724, 131727, 131730; Borneo – no specific locality: MCZ – 5240. *Enhydris gyii*: Indonesia, Kalimantan – ANSP - 26411, ZFMK- 65824-5. *Enhydris punctata*: Indonesia – MCZ 5165, RMNH 862. Malaysia – Kemanan BM 98.11.29.9, Gunong Pilai, Johore 1938.9.7.2, no specific locality 1940.2.2.8, Sinkawang, Borneo 1946.1.2.39, Selangor FMNH 250111-112, North Selengor ZRC 2.3272-3273. No data - NMB 12027.