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FRESHWATER CROCODILES OF KALIMANTAN (INDONESIAN BORNEO).—The taxonomic status of crocodilians inhabiting the Southeast Asian island of Borneo (now Kalimantan, Sarawak, Sabah, and Brunei) is unclear. The estuarine crocodile *Crocodylus porosus* and Malayan false gavial *Tomistoma schlegelii* are known residents (Cox and Gombeck, WWF, unpubl.; Frazier and Maturbongs, FAO, unpubl.), but on the basis of museum specimens, a range extension of an extant species [*C. palustris*: Gray, 1844, 1862; Strauch, 1866; Bartlett, 1895; *C. siamensis*: Gray, 1869, 1872 (in Ross, 1990); Neill, 1971; Wermuth and Fuchs, 1978] or a new species [*C. raninus*; Müller and Schlegel, 1844 (in Ross, 1990)] may occur.

Ross (1990) recently resurrected *C. raninus* based on ventral and postoccipital scalation of two preserved juveniles and the cranial osteology of a skull lacking mandibles; these specimens are from "Borneo." The reduced number of transverse ventral scale rows (25) is distinct from either *C. siamensis* (29–33, n = 14) or *C. palustris* (27–37, n = 34). The number of transverse throat scale rows (38–39) falls within the range of *C. palustris* (35–43, n = 34) but well outside that of the uniquely fine squamation among Indopacific crocodiles of *C. siamensis* (49–53, n = 15). However, no living specimens of *C. raninus* are known.

Fig. 1. Inset of East Kalimantan showing sites where *buaya badas hitam* was observed.

On 5 and 6 Sept. 1990, at Muara Ancalong (116°41'E; 0°27'N; Fig. 1), Kalinjau River, a major tributary of the Mahakam River in East Kalimantan province, a caged crocodile of 2.3 m total length (TL) was inspected. Unlike *C. porosus*, which village informants claim formerly occurred in the area, this crocodile featured much darker coloration and a broader, blunter snout. Large dorsal scutes were sharply keeled, giving the animal a rough appearance. In addition, there were two large raised pairs of postoccipital scutes, bordered by smaller anterior and posterior ones, and surrounded by uniformly small scalation.

The specimen was reportedly captured in 1983 at nearby Lake Sohuwi. Local residents refer to the species as *buaya badas hitam* (black *badas* crocodile), which was said to inhabit freshwater swamps, particularly lakes. ("Badas" is a local name of unknown derivation.) *C. porosus* is called *buaya badas kuning* (yellow *badas* crocodile) (Frazier and Maturbongs, FAO, unpubl.).

On 10 Sept. 1990, some 35 *buaya badas hitam*, ranging from yearling to large adult (3.5–4.0 m TL) size, were examined at P.T. Makmur Abadi Permai crocodile farm outside Samarinda, East Kalimantan. Adults exhibited dark green coloration with thick caudal banding. Some of the young specimens were more yellowish in coloration but also strongly banded. Both young and adults closely resembled the Muara Ancalong specimen in head shape and postoccipital scalation.

TABLE 1. SCALATION CHARACTERS OF SELECTED *Crocodylus*.

	C. raninus[a]	*C. palustris*[a]	*C. siamensis*	Borneo sp.
Transverse ventral scale rows	25 (n = 2)	27–37 (n = 34)	29–33 (n = 14)	32–34 (n = 11)
Transverse throat scale rows	38–39 (n = 2)	35–43 (n = 34)	49–53 (n = 15)	53–54 (n = 15)

[a] From Ross, 1990.

On 25 Feb. 1991, four additional juveniles (1.2–1.4 m TL) were inspected at C.V. Surya Raya crocodile farm, 28 km NE of Balikpapan. These animals were said to have been captured 2–3 years earlier in the upper reaches of the Mahakam River (T. Sugiarto, pers. comm.).

On the basis of limited scale count data collected from the specimens at Samarinda (Table 1), *buaya badas hitam* is neither *C. raninus* nor *C. palustris*, and most closely resembles the Siamese crocodile *C. siamensis*. To date, no skulls have been available for examination.

Crocodylus siamensis was formerly widely distributed in mainland Southeast Asia, ranging from Vietnam, Kampuchea, Thailand, and possibly Laos southward into the Malay Peninsula (although apparently not to West Malaysia) (Groombridge, 1982). The southern limit of the historical range is reported as Java (Groombridge, 1982). According to Ross (1986), there are literature reports referring to museum specimens of *C. siamensis* in the Indonesian archipelago from Borneo, Sumatra, Bangka, and Sulawesi.

Recent crocodile surveys in Sabah (Whitaker, WWF, unpubl.) and Sarawak (Cox and Gombek, WWF, unpubl.) failed to find evidence of the species in northern Borneo. However, a renowned hunter of the Batang Lupar river system in Sarawak described a third crocodilian (in addition to *C. porosus* and *Tomistoma*) similar to *C. siamensis*, which was alleged to persist in the Kelauh, Seterap, and Dor tributaries (Cox and Gombek, WWF, unpubl.).

In East Kalimantan, wild populations of *buaya badas hitam* reportedly still occur in plaustrine habitats associated with upriver tributaries of the Mahakam River system, where the Samarinda specimens are said to originate (W. Mawengkang, pers. comm.). In the province of Central Kalimantan, there is widespread consensus among local residents that a third species of crocodile (*buaya kodok* = frog crocodile), distinct from *C. porosus* and *Tomistoma* yet matching the description of *buaya badas hitam*, occurs there (Frazier and Maturbongs, WWF, unpubl.).

Elsewhere within its reported range, *C. siamensis* appears to have been critically depleted by overhunting and habitat destruction (Groombridge, 1982). The only known noncaptive locality for the species is at Bung Boraphet in Thailand (Groombridge, 1982), but wild populations may well persist in other areas of Thailand (Frazier, CSG, unpubl.) and Kampuchea (Brisbin, CSG, unpubl.). An extensive crocodile survey in Sumatra during 1990 found no indication, even anecdotal, of a palustrine *Crocodylus* (Cox and Nababan, unpubl. data).

Significant findings on the ecology of *C. siamensis* and possible taxonomic distinctions of mainland versus island races may yet be obtained from initial surveys in Southeast Asia and follow-up investigations in Kalimantan. Indeed, our knowledge of all Indopacific crocodilians is limited and in urgent need of taxonomic review (Ross, 1986).

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TADPOLE OF *PHYSALAEMUS CENTRALIS* (ANURA, LEPTODACTYLIDAE).—The genus *Physalaemus* has 33 recognized species ranging from Mexico to and including Argentina (Frost, 1985). Lynch (1970) defined four groups within the genus, among which the *cuvieri* group is the largest, with 18 (Lynch, 1970) or 19 (Frost, 1985) species. Tadpoles of only 11 species of *Physalaemus* are currently known (Altig and Johnston, 1986; Langone, 1989), and five of them belong to the *cuvieri* group: *Physalaemus cuvieri, fernandezae, gracilis, henseli,* and *riograndensis.* Here we describe an additional species, and compare it to the other known tadpoles of the *cuvieri* group.

Physalaemus centralis Bokermann, 1962, and *P. cuvieri* Fitzinger, 1826, males were observed calling simultaneously in temporary, rain-filled ponds on a pasture area in northwestern São Paulo State, Brazil. Tadpoles were collected with a dipnet along unshaded pond edges. Subadults of *P. centralis* and *P. cuvieri,* metamorphosed in the laboratory, confirmed the simultaneous reproduction and tadpole development of these species. The use of morphological characters follows mostly Altig and Johnston (1986), Inger (1985), and Johnston and Altig (1986). Measurements were made with an ocular grid at 14.0× magnification, except for the width of the oral disc, which was measured at 64.0× magnification. Mouth parts were cleared in 4% potassium hydroxide and prepared on temporary slides with lactic acid. Tadpoles were drawn using a phase-contrast light microscope and are deposited in the JJ (Jorge Jim) Collection, Departamento de Zoologia, Universidade Estadual Paulista, Botucatu, São Paulo State.

Physalaemus centralis Bokermann, 1962
(tadpole)

Specimens examined.—JJ 6942: 90 tadpoles obtained by Denise de C. Rossa-Feres from a pond near the road leading from Nova Itapirema to the cemetery, district of Nova Aliança, São Paulo, Brazil (approx. 21°1'S, 49°4'W), on 11 April 1990.

Measurements in mm.—Mean (range) and standard error of 13 specimens at developmental stage 37 according to Gosner (1960): total length 20.2 (18.6–21.7), 0.93; body length 8.5 (7.8–9.0), 0.38; tail length 11.7 (10.8–13.1), 0.63; maximum body width 5.2 (5.0–5.5), 0.16; maximum body height 4.1 (3.7–4.4), 0.20; eye diameter 1.1 (1.0–1.2), 0.05; nostril aperture diameter 0.16 (0.1–0.2), 0.04; interorbital distance 0.9 (0.8–1.0), 0.05; internarial distance 0.7 (0.66–0.72), 0.02; eye–nostril distance 0.3 (0.3–0.4), 0.03; eye–snout distance 1.6 (1.6–1.8), 0.09; nostril–snout distance 1.0 (0.8–1.1), 0.09; width of oral disc 1.4 (1.2–1.5), 0.07.

Description.—Body ovoid in dorsal view (Fig. 1A), depressed/globular in lateral view (Fig. 1B). Snout rounded. Eyes large, dorsal, laterally directed. Nostrils dorsal, small and rounded. Nostril aperture on level with overall body surface; internal and posterior borders in a slight depression. Spiracle on the middle third of the body, low on left side (paragyrinid), short, broad, without free edge. Spiracle tube fused to body wall, with elliptical opening directed posteroventrally. Vent tube long, medial, feces emerging in line with ventral fin. Vent tube partially attached to divergent part of the ventral fin.

Oral disc ventral (Fig. 2A), emarginate laterally, with single row of lateral marginal papillae. Lower ridge with one to 10 papillae (Table 1); inframarginal papillae absent. Papillae large, conical, simple, with convex extremity. Labial teeth dark, curved slightly toward the mouth, often with three to six cusps, with slightly divergent tips (Fig. 2B, C). Teeth widely spaced in rows, the distance between adjacent teeth about half the width of a single tooth. Some teeth with bifurcate implantation. Tooth row formula 2(2)/2; innermost upper row interrupted medially by a gap approximately one-third the length of outermost upper row. Lower rows subequal in length. Jaw sheaths heavy, fully dark pigmented. Upper sheath slightly convex medially and laterally. Lower sheath widely V-shaped. Serrae triangular and pointed with equal sides; serration density approximately 48 serrae/mm, a single serra 2.2 μm wide.

Tail weakly convex, maximum depth equalling or slightly deeper than body, tip rounded. Caudal muscle heavy, deeper than dorsal fin until approximately one-third the length of tail. Dorsal fin originating on body just posterior to origin of tail. Dorsal fin deeper than ventral