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Kryptopterus geminus, a new species of silurid catfish (Teleostei: Siluridae) from mainland Southeast Asia

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Abstract

Kryptopterus geminus, a new species of silurid catfish is described from the Bang Pakong, Mekong, Mae Khlong and Chao Phraya River drainages in mainland Southeast Asia. *Kryptopterus geminus*, together with *K. cryptopterus*, can be distinguished from congeners by the dorsal profile lacking a nuchal concavity and short maxillary barbels extending to the base of the pectoral fin. *Kryptopterus geminus* can be further distinguished from *K. cryptopterus* in having a narrower head (9.5–12.0% SL vs. 12.2–14.2), longer anal fin (62.2–72.7% SL vs. 57.2–62.9) and snout (39.5–45.3% HL vs. 35.1–39.8), and more laterally-placed eyes (only ventral half, vs. ventral two-thirds, of the orbital margin visible when the head is viewed ventrally).

Key words: *Kryptopterus*, Siluridae, Indochina, Southeast Asia

Introduction

Members of the silurid catfish genus *Kryptopterus* Bleeker, 1858 are small-to medium-sized fishes found in inland waters throughout Southeast Asia. *Kryptopterus*, as currently understood, is known to be paraphyletic and shown to consist of at least two distinct clades (Bornbusch, 1995). This is reflected in the recent taxonomy of the group, in which the large species with elevated (14–17 vs. 8–13) branchiostegal-ray counts are reassigned to the genus *Micronema* (e.g. Rainboth, 1996; Kottelat, 2001). The distinctive type species of *Kryptopterus*, *K. cryptopterus* (Bleeker 1851), is widely distributed throughout Southeast Asia and easily identified by its dorsal profile (horizontal or very gently convex and lacking a nuchal concavity) and short maxillary barbels.

While examining material as part of a larger collaborative phylogenetic study of the Siluridae, distinct and consistent differences were observed between populations of *K. cryptopterus* from mainland (Indochinese peninsula excluding the Malay Peninsula) and

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Sundaic (Borneo, Java, Sumatra and Malay Peninsula) Southeast Asia. This led to the recognition of the mainland Southeast Asian population as belonging to a distinct species, herein described as *K. geminus*, new species.

Material and methods

Measurements were made point to point with dial calipers and data recorded to tenths of a millimeter. Counts and measurements were made on the left side of specimens whenever possible. Subunits of the head are presented as proportions of head length (HL). Head length and measurements of body parts are given as proportions of standard length (SL). Measurements follow those of Ng & Ng (1998).

Institutional codes for depositories of specimens follow Leviton et al. (1985) except for the Zoological Reference Collection of the Raffles Museum of Biodiversity Research, National University of Singapore (ZRC).

Kryptopterus geminus sp. nov. (Figs. 1 & 2a)

Cryptopterus cryptopterus (non Bleeker, 1851) – Hora, 1923: 166.
Kryptopterus cryptopterus (non Bleeker, 1851) – Fowler, 1937: 136; Smith, 1945: 340; Taki, 1968: 18 (misspelled *K. chryptopterus*); 1974: 63, Fig. 63; Kottelat, 1985: 268; 1998: 104, Fig. 157; 2001: 127, Fig. 347; Mai et al., 1992: 159; Truong & Tran,1993: 162, Fig. 69; Roberts, 1993: 34; Roberts & Warren, 1994: 102; Bornbusch , 1995: 44 (in part); Rainboth, 1996: 146, Pl. XIX Fig. 151; Gaanantkul et al., 2000: 38.

Type material. Holotype: UMMZ 234664, 123.8 mm SL; Cambodia: Stung Treng, Mekong River 2 km downstream from mouth of Tonle San on sandbars, Mekong River drainage, 13°31'N 105°56'E; WJ Rainboth et al., 11 February 1996.

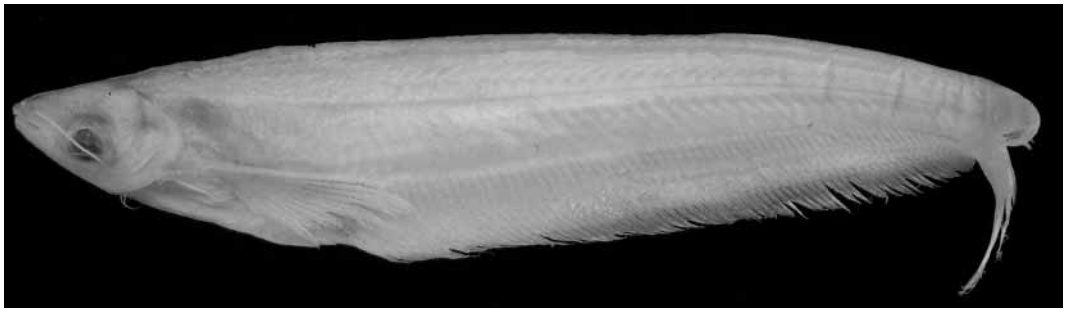

FIGURE 1. *Kryptopterus geminus*, UMMZ 234664, holotype, 123.8 mm SL; Cambodia: Mekong River.

Paratypes: **CAMBODIA**: CAS 94290, 8 ex., 82.8–122.7 mm SL; Stung Treng market, Mekong River drainage, 13°30'N 105°58'E; TR Roberts, 2–18 February 1994. UMMZ 181135, 3 ex., 76.3–110.1 mm SL; Prey Veng province: Prek Toch at Banam, Mekong River drainage, 11°17'N 105°17'E; KH Toy, 23 June 1959. UMMZ 181258, 1 ex., 126.2 mm SL; Pursat, Great Lake at Kompong Luong, Mekong River drainage, 12°35'N 104°11'E; J. Bardach, 18 March 1959. UMMZ 232390, 2 ex., 62.2–76.0 mm SL; Kandal: Tonle Sap, 22 km upstream from Phnom Penh, Mekong River drainage, 11°44'N 104°50'E; WJ Rainboth, 3 February 1995. UMMZ 232678, 3 ex., 92.1–107.8 mm SL; Kompong Chhnang: Tonle Sap at Kompong Chhnang, fishing lot 9 in second channel E of town, Mekong River drainage, 12°16'N 104°47'E; WJ Rainboth, C Rotha & N van Zalinge, 27 February 1995. UMMZ 232734, 3 ex., 76.3–87.9 mm SL; Kompong Thom: Tonle Sap at exit to Great Lake, 4 km NW of Chhnok Trou at Kompong Thom fishing lot 2, Mekong River drainage, 12°31'N 104°27'E; WJ Rainboth, C Rotha & N van Zalinge, 28 February 1995. UMMZ 232754, 6 ex., 72.2–89.2 mm SL; Kompong Chhnang: Tonle Sap River, 17 km upstream from Kompong Chhnang, Mekong River drainage, 12°24'N 104°37'E; WJ Rainboth, C Rotha & N van Zalinge, 1 March 1995.

LAOS: CAS 94760, 1 ex., 82.4 mm SL; Mekong River at Ban Hang Khone, just below Khone falls, Mekong River drainage, 13°56'N 105°56'E; TR Roberts, June–July 1993. UMMZ 235385, 3 ex., 100.7–126.5 mm SL; Mekong River at Ban Hang Khone, just downstream from Khone Falls, Mekong River drainage, 13°56'N 105°56'E; I. Baird, date unknown. UMMZ 241113, 5 ex., 122.0–170.6 mm SL; Vientiane province, morning market at Vientiane, Mekong River drainage, 17°59'N 102°36'E; WJ Rainboth, March 1997.

THAILAND: CAS 61912, 11 ex., 92.7–132.2 mm SL; Ubon Ratchathani province: fish market at Ubon Ratchathani, Mekong River drainage, 15°13'59"N 104°51'47"E; TR Roberts, 28 June–2 July 1985. CAS 93915, 1 ex., 136.2 mm SL; Ayutthaya province: Ayutthaya market, Chao Phraya River drainage, 14°20'N 100°32'E; TR Roberts, 5–7 March 1989. CAS 96689, 1 ex., 101.2 mm SL; Prachinburi market, Bang Pakong River drainage, 14°3'N 101°22'E; TR Roberts, 8–10 September 1990. CAS 96690, 1 ex., 92.3 mm SL; Nakhon Sawan market, Chao Phraya River drainage, 15°37'N 100°7'E; TR Roberts, 10–12 April 1989. CAS 96745, 1 ex., 110.9 mm SL; Nakhon Sawan market, Chao Phraya River drainage, 15°37'N 100°7'E; TR Roberts, 4–5 February 1989. CAS 97094, 18 ex., 55.7–100.3 mm SL; Ubon Ratchathani province: fish market at Ubon Ratchathani, Mekong River drainage, 15°13'59"N 104°51'47"E; TR Roberts, 11–13 September 1990. CAS 128829, 1 ex., 114.2 mm SL; Mae Nam Chao Phraya at Bangkok, Chao Phraya River drainage, 13°45'N 100°31'E; HM Smith, 12 September 1923. UMMZ 186694, 1 ex., 143.3 mm SL; Chao Phraya River, ca. 20 km N of Nakhon Sawan, Chao Phraya River drainage, 15°37'N 100°7'E; KF Lagler, 15 October 1964 UMMZ 186767, 1 ex., 139.4 mm SL; market at Nakhon Phanom, Mekong River drainage, 17°25'N 104°46'E; KF Lagler, 9 February 1965. UMMZ 186777, 2 ex., 79.8–80.6 mm SL; Nam Kham River, at base of

dam building Nong Han, Mekong River drainage, 17°21'N 103°6'E; KF Lagler et al., 8 February 1965. UMMZ 186826, 1 ex., 107.4 mm SL; fish market at Korat, Mekong River drainage, 14°56'N 102°5'E; KF Lagler et al., 13 February 1965. UMMZ 186838, 5 ex., 113.1–145.2 mm SL; market at Kanchanaburi, Mae Khlong River drainage, 14°1'N 99°32'E; KF Lagler, NC Suvatti & M Boonbrahm, 24–25 March 1965. UMMZ186843, 1 ex., 128.0 mm SL; Mae Nam Mae Khlong at Ban Pong, 2 km downstream, Mae Khlong River drainage, 14°18'N 99°49'E; KF Lagler et al., 25–26 March 1965. UMMZ 214560, 6 ex., 59.2–113.0 mm SL; Ubon Ratchathani province: Huay Mark 8 km N of Khong Chiam at confluence with Mekong River, Mekong River drainage, 15°22'N 105°29'E; RE Arden, T Maknuam & V Kathong, 7 October 1975. UMMZ 217165, 5 ex., 49.7–108.7 mm SL; Ubon Ratchathani province: Huay Phai, 7 km N of Khong Chiam, at confluence with Mekong River, Mekong River drainage, 15°22'N 105°29'E; RE Arden, T Maknuan & V Kathong, 7 October 1975. UMMZ 217169, 1 ex., 122.6 mm SL; Nakhon Phanom province: Mekong River at Ban Tha Kai, 21 km downstream from Mukdahan, Mekong River drainage, 16°22'5"N 105°53'22"E; Y Dhammigbavon & S Sairaj, 6 October 1975. UMMZ 217171, 2 ex., 39.4–54.4 mm SL; Ubon Ratchathani province: Mun River, 3 km downstream from Ubon Ratchathani, Mekong River drainage, 15°13'N 104°51'E; Y Dhammigbavorn & V Kathong, 28 November 1975. UMMZ 224384, Ubon Ratchathani province, Mun River at Ban Dan, 3 km upstream of confluence with Mekong River, Mekong River drainage, 15°22'N 105°29'E; S Sontirat& ED Buskirk, 20 June 1975. ZRC 40768, 5 ex., 107.9–115.9 mm SL; Nakhon Phanom, Mekong River drainage, 17°25'N 104°46'E; K. Kubota, 1998.

VIETNAM: UMMZ 217354, 2 ex., 41.0–65.5 mm SL; Phong Dinh province: Bassac River at Can Tho, Mekong River drainage, 10°1'N 105°46'E; RE Arden & OK Minh, 3 November 1974. UMMZ 217365, 1 ex., 41.8 mm SL; Phong Dinh province: Bassac River 0.5 km downstream of Can Tho, Mekong River drainage, 10°1'N 105°46'E; RE Arden & OK Minh, 3 November 1974. UMMZ 227492, 2 ex., 88.4–100.7 mm SL; Phong Dinh province, Can Tho island, shallows around E end, 3.5 km SE of Can Tho, Mekong River drainage, 10°1'N 105°46'E; ML Smith & RP Weidenbach, 19 July 1974.

Diagnosis. Both *K. cryptopterus* and *K. geminus* can be distinguished from congeners in the dorsal profile lacking a nuchal concavity (vs. nuchal concavity present) and having short maxillary barbels (extending to the base of the pectoral fin vs. extending beyond tip of pectoral fin). *Kryptopterus geminus* differs from *K. cryptopterus* in having a narrower head (9.5–12.0% SL vs. 12.2–14.2), longer anal fin (62.2–72.7% SL vs. 57.2–62.9) and snout (39.5–45.3% HL vs. 35.1–39.8), and more laterally-placed eyes (only ventral half of the orbital margin visible when the head is viewed ventrally vs. ventral two-thirds; Fig. 2).

Description. Body laterally compressed; maximum body depth located immediately anterior to pelvic-fin origin; head as broad as body and moderately depressed. Dorsal profile of body horizontal to very slightly convex, without nuchal concavity.

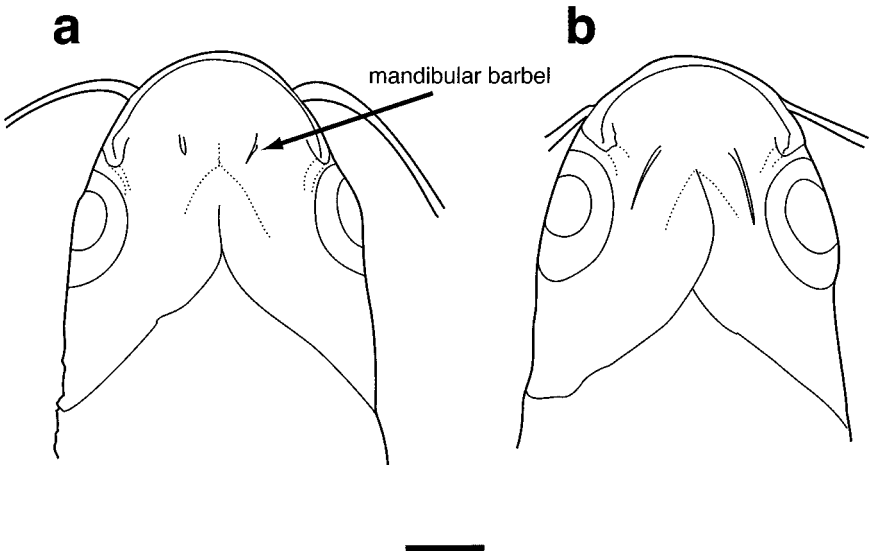

FIGURE 2. Ventral views of heads of: a. *Kryptopterus geminus*, UMMZ 181258, paratype, 126.2 mm SL; b. *K. cryptopterus*, ZRC 45780, 123.0 mm SL. Scale bar represents 5 mm.

Anterior profile of snout rounded. Anterior pair of nostrils tubular and anteromedial to maxillary barbel base. Posterior pair of nostrils bordered by fleshy dorsal and ventral membranes and posteromedial to maxillary barbel base.

Mouth terminal; gape oblique, moderate and extending to midway between maxillary barbel base and anterior orbital margin. Well-developed rictal lobes present, subtended by deep submandibular groove. Thin, broad supralabial fold extending from below orbit to point two thirds of way between maxillary barbel base and anterior orbital margin.
Jaw teeth depressible and villiform. Premaxillary teeth in 4–5 irregular rows in narrow, gently curved rectangular bands. Dentary teeth in similar, slightly narrower bands narrowing posterolaterally, reaching from symphysis almost to mouth corners. First row of dentary teeth slightly visible when mouth is closed. Vomerine teeth in 2–3 rows in single crecentic band straddling midline.

Two pairs of barbels. Maxillary barbels slightly flattened for entire length, reaching to base of pectoral fin. Mandibular barbels (only outer pair present) very short and thin; length about half of eye diameter. Eyes fairly large, subcutaneous (without free orbital margin); located at approximately midpoint of head and immediately behind supralabial fold. Anterior orbital margin just visible dorsally; ventral half of orbital margin visible ventrally.

Gill membranes separate and overlapping, free from isthmus; gular fold well-developed and v-shaped. Branchiostegal rays 9 (2) or 10 (40). Gill rakers short, without odontodes; anteriormost rakers on lower first arch widely spaced; 4+16 (17), 5+15 (12), 4+17 (10), 5+16 (5), 4+18 (5) or 5+17 (3).

Dorsal fin rudimentary, with 2 (42) rays. Depressed pectoral fin reaching beyond origin of anal fin; distal margin broadly convex, with rounded tip. Fourth branched pectoral ray longest and fin with 12 (34) or 13 (8) rays. Proximal two-thirds of first pectoral-fin element co-ossified into a slender spine. Spine with shallow oblique striae on dorsal and ventral surfaces and with 10-18 very small serrations on posterior edge in both sexes. Axillary pore small, located just above pectoral spine base. Depressed pelvic fin reaching to second or third anal-fin ray; distal margin convex with i,5 (42) rays. Distal margin of anal fin straight, with 64 (1), 65 (5), 66 (4), 67 (7), 68 (5), 69 (8), 70 (5), 71 (3), 72 (2), 73 (1) or 74 (1) rays; separate from caudal fin. Integument over anal fin thickened proximally for two thirds of ray lengths; fin-ray erector muscles attaching to base of fin rays, ventralmost extent of muscles defined by area of thickened integument. Caudal peduncle slender. Caudal fin deeply forked, lobes elongate and with rounded tips; upper lobe slightly longer; principal rays i,7,8,i (42). Urogenital papillae of both sexes located immediately posterior to insertion of pelvic fin.

Sensory canals on head with simple elongate tubes under skin leading to minute pores, which often appear as small unpigmented spots. Lateral line complete, extending to middle of caudal-fin base, with short branches along flanks directed posteroventrally.

Vertebrae 13+37=50 (1), 13+38=51 (6), 14+37=51 (1), 13+39=52 (14), 14+38 (1), 13+40=53 (7), 14+39=53 (8) or 14+40=54 (4). Morphometric data are in Table 1.

Coloration. In 70% ethanol: Light brown on dorsal region and upper one third of flank, gradually fading to paler color on lower two-thirds of flank and ventral region. Melanophores distributed in thin bands along dorsal midline and along lateral line. Scattered melanophores on flanks and thickened integument over anal fin. Interradial membranes of pectoral and anal fins with melanophores, scattered in some and densely distributed in others. Caudal fin hyaline, with black distal margin. Dorsal half of barbels pale brown, fading to a paler color towards ventral surface. Color in life translucent.

Distribution. Known from the Mekong (from the mouth upriver to Vientiane), Mae Khlong (the mouth to at least Kanchanaburi), Bang Pakong (from the mouth to at least Prachinburi) and Chao Phraya River (the mouth upriver to at least Ayutthaya) drainages in mainland Southeast Asia (Fig. 3).

Etymology. From the Latin geminus, meaning twin-born; in allusion to the close morphological similarity of this species to *K. cryptopterus*. Used as a noun.

Discussion

Both *K. cryptopterus* and *K. geminus* can be distinguished from all other silurids in possessing the following two synapomorphies: a supralabial fold that is anteriorly truncated such that the lower edge extends far posterior to the base of the maxillary barbel and an elongate antorbital process of the lateral ethmoid that is not anteroposteriorly compressed (Bornbusch, 1995). *Kryptopterus geminus* and *K. cryptopterus* also do not show any

marked sexual dimorphism in the pectoral-fin spine as reported for most other silurid genera (e.g. Inger & Chin, 1962; Bornbusch & Lundberg, 1989; Ng & Ng, 1998). The two species are further distinguished from congeners in lacking a nuchal concavity (present in all other *Kryptopterus*) and short maxillary barbels (reaching to base of pectoral fin vs. reaching at least to the origin of the anal fin in congeners).

TABLE 1. Morphometric data for *Kryptopterus geminus* (n=50).

	Holotype	Range	Mean±SD
%SL			
Predorsal length	26.7	24.8–28.9	27.0±0.96
Preanal length	34.4	33.6–40.9	36.3±1.62
Prepelvic length	31.7	30.1–35.5	32.5±1.05
Prepectoral length	19.9	18.4–22.5	20.2±1.04
Dorsal-fin length	4.0	2.1–5.3	3.7±0.63
Anal-fin length	66.2	62.2–72.7	65.4±1.83
Pelvic-fin length	3.3	2.4–4.2	3.3±0.47
Pectoral-fin length	23.6	20.2–25.7	23.4±1.55
Pectoral-spine length	21.1	17.3–23.1	20.3±1.51
Caudal-fin length	17.2	12.7–19.5	15.9±1.90
Body depth at anus	18.5	15.5–21.7	19.3±1.16
Caudal peduncle depth	6.3	5.8–7.9	7.0±0.54
Head length	18.0	17.3–20.2	18.8±5.00
Head width	10.3	9.5–12.0	10.9±6.74
Head depth	12.5	10.7–13.2	12.0±0.67
%HL			
Snout length	41.7	39.5–45.3	42.1±3.74
Interorbital distance	50.2	47.7–58.3	50.7±3.31
Eye diameter	27.8	21.3–32.4	26.7±1.83
Maxillary barbel length	134.5	88.3–154.1	127.6±17.04
Mandibular barbel length	13.9	4.7–14.5	8.8±3.16

The differences noted between *K. cryptopterus* and *K. geminus* are not due to ontogeny. Bivariate analyses (ANCOVA) of the regression lines of the anal-fin length, head width and snout length on SL for both species are significantly different at $P<0.000005$ (Fig. 4).

The identity of the material identified as *K. cryptopterus* by Smith (1945) from the Tapi River drainage could not be ascertained. It is very likely that it may represent *K. geminus*, given the similarity of the fauna from the Tapi River drainage with that of the Mekong.

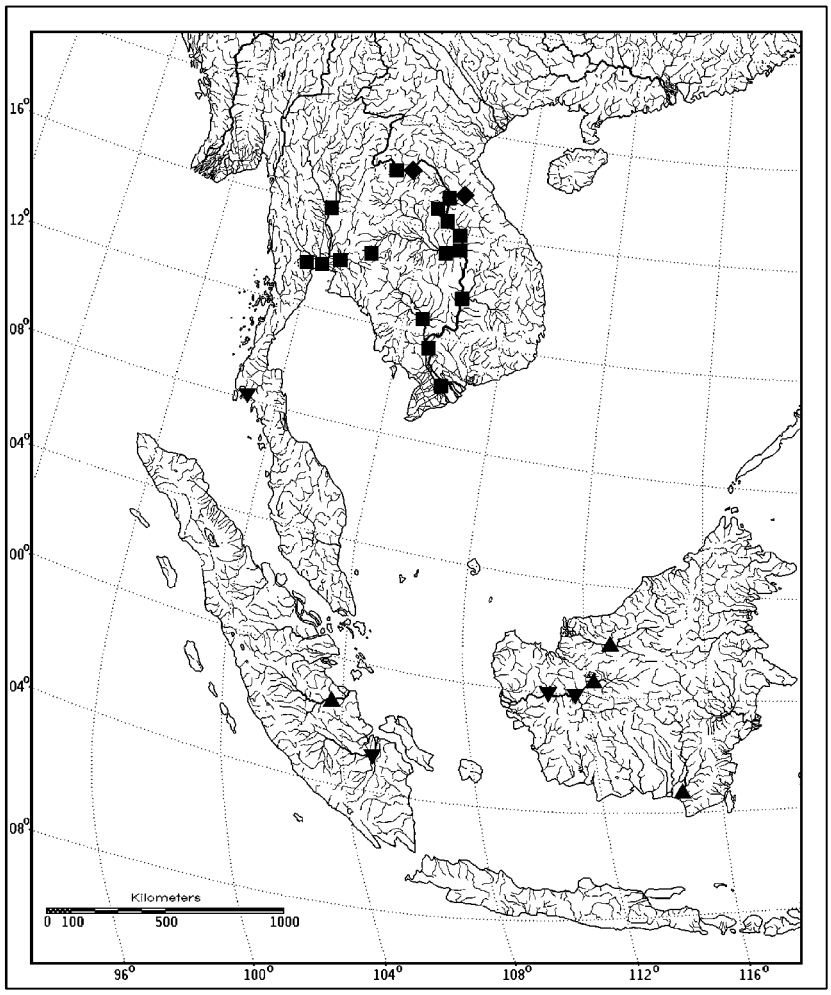

FIGURE 3. Map showing distribution of *K. geminus* (■◆) and *K. cryptopterus* (▲▼). The square and upright triangle indicate records based on material examined while the diamond and inverted triangle indicate records based on literature.

The post-Pleistocene isolation of the North Sunda River was probably the significant vicariant event leading to speciation of sister taxa in mainland and Sundaic Southeast Asia in freshwater fishes (Bornbusch & Lundberg, 1989). These sister species (consisting of distinct Sundaic and mainland Southeast Asian species) had long been assumed to be a single species widely distributed in large rivers throughout Southeast Asia, a phenomenon only recently acknowledged to exist in many freshwater fish groups. This is the most likely scenario for the speciation of *K. cryptopterus* and *K. geminus*, as in other silurid [*Belodontichthys* (see Kottelat & Ng, 1999), *Ceratoglanis* (see Ng, 1999), *Hemisilurus* (see Bornbusch & Lundberg, 1989), *Kryptopterus* (see Ng, 2001), and *Ompok* (see Ng, 2003a; 2003b)] and freshwater fish [e.g. *Epalzeorhynchos* (see Yang & Winterbottom, 1998)] groups.

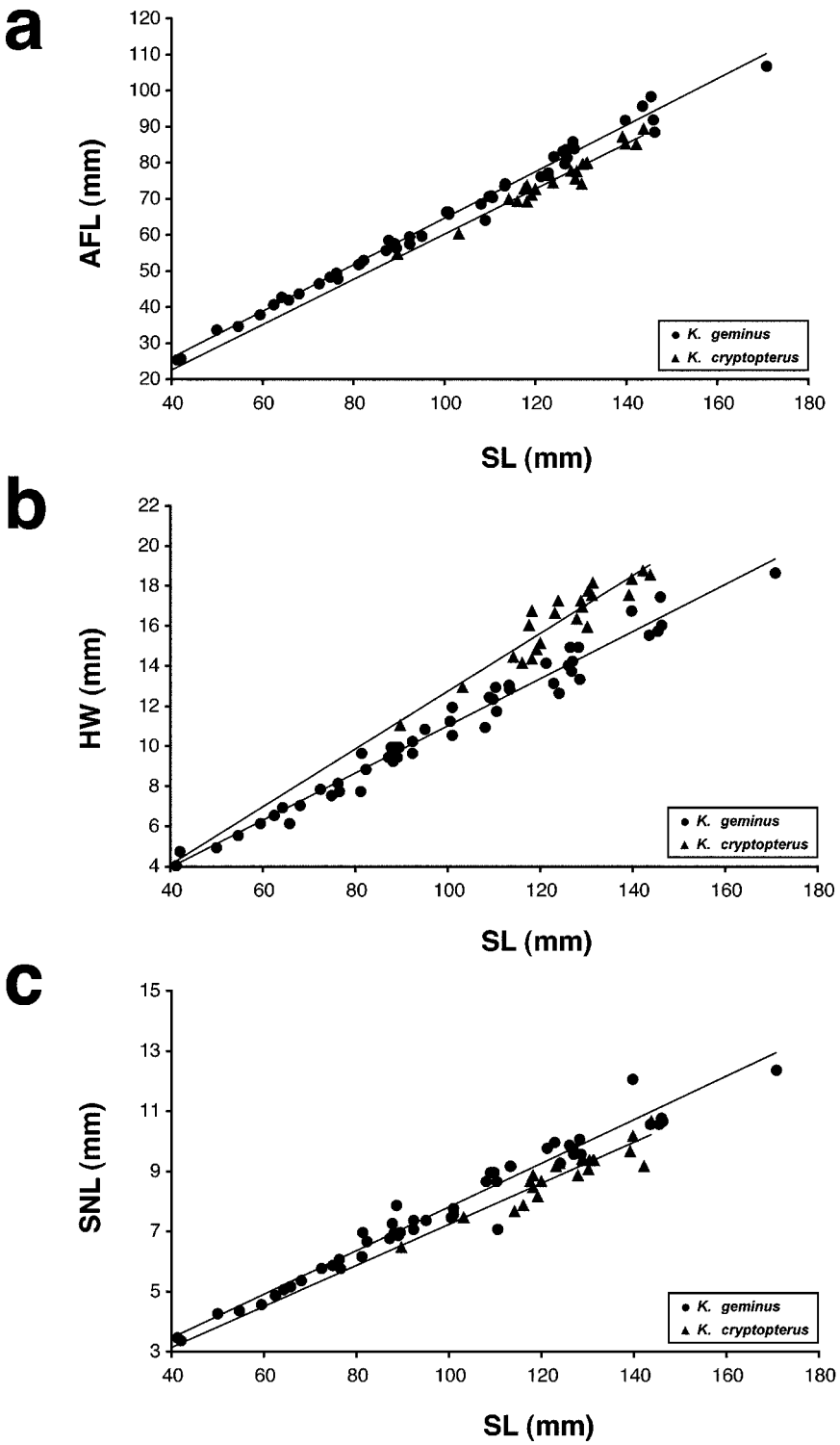

FIGURE 4. *Kryptopterus geminus* and *K. cryptopterus*; biplots of (a) anal-fin length (AFL), (b) head width (HW) and (c) snout length (SNL) against standard length (SL).

Comparative material

Kryptopterus cryptopterus: RMNH 6840, holotype, 92.6 mm SL; Borneo: Banjarmasin. UMMZ 70689, 1 ex., 118.0 mm SL; Sumatra: Jambi, Batang Hari. UMMZ 209890, 2 ex., 139.0–143.6 mm SL; Borneo: Kalimantan Barat, Kapuas mainstream, Danau Mawan and "Danau Bahru" near Kampung Nibung, about 100 km NE of Sintang and 7 km NE of Selimbau. USNM 323362. 8 ex., 89.5–139.6 mm SL; Borneo: Sarawak, Kapit market. ZRC 44135, 20 ex., 98.7–142.0 mm SL; Sumatra: Jambi market. ZRC 45780, 8 ex., 109.6–135.0 mm SL; Borneo: Sarawak, Kapit market.

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