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The identity of catfishes identified as *Mystus cavasius* (Hamilton, 1822) (Teleostei: Bagridae), with a description of a new species from Myanmar

PROSANTA CHAKRABARTY & HEOK HEE NG

Fish Division, Museum of Zoology, University of Michigan, 1109 Geddes Avenue, Ann Arbor, Michigan 48109-1079, USA. Email: pchakrab@umich.edu; heokheen@umich.edu

Abstract

The identity of South Asian riverine bagrid catfishes usually referred to as *Mystus cavasius* (Hamilton, 1822) is reviewed. Three species comprise what is currently understood as *M. cavasius*: *M. cavasius* s. str. from northern India, *M. seengtee* from southern India and a new species, *M. falcarius*, from the Salween and Irrawaddy river drainages in Myanmar and the shorter river drainages in southern Myanmar. *Mystus seengtee* is resurrected from synonymy with *M. cavasius* and both species are redescribed. The three species differ from other congeners with a long-based adipose fin in having a combination of a black spot in front of the dorsal-spine base, a dark humeral mark, a body without distinct midlateral stripes, very long maxillary barbels reaching to caudal-fin base, dorsal spine short and feebly serrate, tall dorsal fin, and 13–29 gill rakers. These species differ from each other in dorsal fin shape, shape of the predorsal profile, coloration, and number of rakers on the first gill arch.

Key words: *Mystus cavasius Mystus seengtee*, *Mystus falcarius*, South Asia

Introduction

Mystus Scopoli, 1777, is a diverse group of small- to medium-sized bagrid catfishes, from South Asia, with 23 of the 46 nominal species known from there (Talwar & Jhingran, 1991). Despite two previous studies (Jayaram, 1954; Jayaram & Anuradha Sanyal, 2003), the diversity and distribution of the group in South Asia is not well known. Phylogenetic relationships within the genus are also poorly understood, although Mo (1991) suggested there are two major lineages. Hardman (2005) recently confirmed the paraphyly of *Mystus*.

One group of species (considered *Mystus* s. str. by Roberts, 1994) can be easily distinguished from other congeners in having a very long adipose-fin base that spans

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almost the entire postdorsal distance. This group (hereafter referred to in the diagnoses as "congeners with a long-based adipose fin"), known from West, South and Southeast Asia, was revised by Roberts (1994), who considered the following eight species to be valid: *M. pelusius* (Solander, 1794), *M. cavasius* (Hamilton, 1822), *M. singaringan* (Bleeker, 1846), *M. bocourti* (Bleeker, 1864), *M. bleekeri* (Day, 1877), *M. rufescens* (Vinciguerra, 1890), *M. rhegma*, Fowler, 1935, and *M. albolineatus* Roberts, 1994.

A considerable amount of variation in the number of rakers on the first gill arch has been observed in *M. cavasius* (see Roberts, 1994). We investigated patterns in this variation and recognize three distinct species, one of which is undescribed. Redescriptions of two of these species, *Mystus cavasius* and *M. seengtee*, from northern and southern India respectively, and the description of a new species, *Mystus falcarius*, from Myanmar form the basis of this study.

Materials 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 & Dodson (1999).

Material examined in this study is deposited in the following institutions: Natural History Museum, London (BMNH), California Academy of Sciences, San Francisco (CAS), Department of Zoology, Oklahoma State University, Stillwater (OSUS), University of Michigan Museum of Zoology, Ann Arbor (UMMZ), and the National Museum of Natural History, Smithsonian Institution, Washington DC (USNM).

Mystus cavasius (Hamilton, 1822)

(Fig. 1)

Pimelodus cavasius Hamilton, 1822: 203, Pl. XI Fig. 67 [type locality: "Fluvio Atterei" (=Atrai River)]

Bagrus cavasius Valenciennes, in Cuvier & Valenciennes, 1840: 409; Jacquemont, 1835–1844: Pl. XIV Fig. 2; Bleeker, 1854: 113.

Macrones cavasius Günther, 1864: 76 (in part); Day, 1877: 447, Pl. C Fig. 1 (in part); Day, 1889: 155 (in part); Jenkins, 1910: 140.

Mystus cavasius Shaw & Shebbeare, 1937: 91, Fig. 90, Pl. 3 Fig. 3; Chauhan, 1947: 276; Chauhan & Ramakrishna, 1953: 411; Motwani et al., 1962: 21; Bhuiyan, 1964: 63; Singh, 1964: 89; Qureshi, 1965: 42, Fig. 106; Babu Rao & Chattopadhyay, 1969: 887, Pl. 2 Fig. 1; Rahman, 1974: 2, Fig. 1G; Pillai & Yazdani, 1977: 5; Jayaram, 1977: 29, Fig. 21A (in part); Jayaram & Singh, 1977: 262; Jayaram, 1981: 196, Fig. 92A (in part); Shrestha, 1981: 155, Fig. 73; Dutt et al., 1982: 27 (in part); Sharma & Dutt, 1983: 334 (in part); Husain & Tilak, 1984: 275; Sen,

1985: 136, Fig. 74; Edds, 1986a: 5; Edds, 1986b: 17; Sharma & Rajput, 1986: 566; Barman, 1988: 49; Datta Munshi & Srivastava, 1988: 235, Pl. XXIX Fig. 2; Rahman, 1989: 200; Roberts, 1989: 124 (in part); Talwar & Jhingran, 1991: 559, Fig. 184 (in part); Sen, 1992: 180, Fig. 58; Dutta et al., 1993: 25; Roberts, 1994: 248 (in part); Shrestha, 1994: 52, Fig. 79; Sen, 1995: 561, Pl. XXVI Fig. 2; Husain, 1997: 595; Jayaram, 1999: 235, Fig. 118C (in part); Menon, 1999: 200 (in part); Nath & Dey, 2000: 89, Fig. 78, Pl. 2-12; Barman, 2002: 263, Fig. 66; Jayaram & Anuradha Sanyal, 2003: 46, Fig. 5 (in part); Mishra et al., 2003: 26.

Mystus (*Mystus*) *cavasius* Jayaram, 1954: 532, Fig. 2 (in part); Motwani & David, 1957: 11; Majumdar, 1958: 368; Srivastava, 1968: 71, Fig. 45; Misra, 1976: 87, Fig. 18 (in part); Gupta, 1985: 17, Pl. IB.

Mystus mukherjii Ganguly & Datta, 1975: 293, Figs. 1–2 (type locality: Subarnarekha River, below waterfalls at Hundru, Ranchi District, Bihar, India).

Material examined. BMNH 1860.3.19.955, 113 mm SL; India (photograph examined). BMNH 1938.2.22.122 (1), 121.8 mm SL; BMNH 1938.2.22.124–128 (5), 57.8–71.5 mm SL; India: Bombay Presidency, Deolali district [=Maharashtra, Nasik district], Darna River. BMNH 1938.2.22.123 (1), 108.9 mm SL; India: Bombay Presidency, Deolali district [=Maharashtra, Nasik district], Unanda River. CAS 94220 (1), 80.7 mm SL; India: Orissa, Rushukulya River near Purushotampur, 15–20 km inland. CAS 50327 (32), 160.5-67.4 mm SL; Nepal: Chitawan Valley, Dudara River, tributary to Rapti River. OSUS 15972 (2), 57.4–68.0 mm SL; Nepal: Sunsari, Sapt Kosi River, bought in market in Itahari. OSUS 17352 (1), 75.2 mm SL; Nepal: Nawalparasi, Narayani River at Taadi Ghat. OSUS 17434 (2), 75.5–77.9 mm SL; Nepal: Nawalparasi/Chitawan, Narayani River below Rapti River confluence. UMMZ 189647 (2), 84.6–88.0 mm SL; India: West Bengal, Santal Parganas, Kanloi River near Kotalpukur Railway Station. UMMZ 208686 (1), 63.7 mm SL; Bangladesh, Sylhet, Surma (Meghna) drainage, Shari River, 6.8 km S of Jaintapur on Sylhet-Shillong highway. UMMZ 208750 (10), 59.3–96.5 mm SL; Bangladesh: Sylhet, Surma (Meghna) drainage, Gowain River and Khal at Gowainghat. UMMZ 238800 (5), 130.1–152.4 mm SL; India: West Bengal, market in Calcutta. UMMZ 244745 (2), 97.9–103.9 mm SL; India: West Bengal, Mansai River, 1 km after Amtala on Jalpaiguri-Coochbehar road, 26°19'30"N 84°14'4"E. UMMZ 244869 (2), 90.1–90.2 mm SL; India: West Bengal, Tista River at Tista Barrage, 26°45'1"N 88°35'11"E. UMMZ 244939 (1), 100.3 mm SL; India: West Bengal Hooghly River at Kalna, 23°13'30"N 88°22'39"E. USNM 205615 (2 paratypes of *M. mukherjii*), 76.3–77.3 mm SL; India: Bihar, Ranchi district, Subarnarekha River, below waterfalls at Hundru.

Diagnosis. *Mystus cavasius* differs from other congeners with a long-based adipose fin (except *M. seengtee* and *M. falcarius*) in having a combination of a black spot in front of the dorsal-spine base, a dark humeral mark, a body without distinct midlateral stripes, very long maxillary barbels reaching to caudal-fin base, dorsal spine short and feebly serrate, tall dorsal fin, and 13–22 gill rakers. *Mystus cavasius* differs from *M. seengtee* in having fewer gill rakers on the first gill arch (13–22 vs. 23–28; Table 1) and a more gently sloping predorsal profile (making an angle of 20–25° with the horizontal vs. 30–35°; Fig. 2), and from *M. falcarius* in having fewer rakers on the first gill arch (13–22 vs. 22–29;

Table 1), a straight or gently concave (vs. markedly concave) dorsoposterior margin of the dorsal fin (Fig. 3), a faint (vs. very prominent) dark spot at the base of the dorsal spine and a ovoid (vs. crescentic) dark humeral mark.

FIGURE 1. *Mystus cavasius*, UMMZ 244869, 90.2 mm SL; India: Tista River.

TABLE 1. Distribution of gill raker counts in *Mystus cavasius* (n=70), *M. seengtee* (n=25) and *M. falcarius* (n=29).

		NO. OF GILL RAKERS																
		13	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**
SPECIES	***M. cavasius***	1	1	4	8	17	22	8	4	4	1							
	M. seengtee											5	7	8	1	3	1	
	M. falcarius										9	7	5	5	1	1		1

Description. Biometric data are given in Table 2. Head depressed; dorsal profile evenly sloping (at angle of 20–25° to horizontal) and ventral profile almost straight. Bony elements of dorsal surface of head covered with thin skin; bones readily visible, especially on posterior half of neurocranium, and ornamented with numerous fine, radial grooves. Anterior cranial fontanelle extending from behind snout to line through posterior orbital margins, separated from posterior fontanelle by narrow epiphyseal bar. Posterior fontanelle extending to base of supraoccipital spine. Supraoccipital spine elongate, slender and with blunt tip; extending to anterior nuchal plate. Eye ovoid, horizontal axis longest; located entirely in dorsal half of head. Gill openings wide, extending from exposed surface of posttemporal to beyond isthmus at line through mouth corners. Gill membranes free from isthmus. First branchial arch with 13–22 long, slender gill rakers.

Mouth subterminal, fleshy upper lip extending anteriorly beyond upper jaw. Oral teeth small and villiform, in irregular rows on all tooth-bearing surfaces. Premaxillary tooth band rounded, of equal width throughout. Dentary tooth band much narrower than premaxillary tooth band at symphysis, tapering laterally. Vomerine tooth band unpaired, continuous across midline; smoothly arched along anterior margin, tapering laterally to point extending posteriorly well past level of premaxillary band; band width narrower than

premaxillary band at midline, widening laterally and then tapering to a sharp point posterolaterally.

TABLE 2. Biometric data for *Mystus cavasius* (n=39).

	Range	Mean ± SD
%SL		
Predorsal length	34.3–37.1	35.6±0.79
Preanal length	67.4–74.1	69.4±1.90
Prepelvic length	44.5–49.8	47.2±1.62
Prepectoral length	20.1–21.6	20.7±0.48
Length of dorsal-fin base	13.0–15.1	14.3±0.80
Dorsal spine length	11.4–16.5	14.1±1.36
Anal-fin length	9.3–12.4	10.8±0.86
Pelvic-fin length	15.9–20.2	17.4±1.45
Pectoral-fin length	15.6–20.7	17.9±1.27
Pectoral-spine length	11.4–16.8	14.2±1.42
Caudal-fin length	25.9–36.8	31.4±3.30
Length of adipose-fin base	32.9–44.7	40.2±2.90
Adipose maximum height	3.3–6.2	5.2±0.79
Post-adipose distance	7.8–10.9	9.9±0.92
Caudal peduncle length	19.1–27.7	21.0±2.10
Caudal peduncle depth	7.1–10.3	8.4±1.07
Body depth at anus	15.3–21.2	18.9±1.89
Head length	21.0–23.4	22.3±0.62
Head width	14.0–17.8	15.8±0.95
Head depth	13.8–17.4	15.6±1.02
%HL		
Snout length	37.7–45.0	40.3±2.38
Interorbital distance	26.4–35.0	30.4±2.93
Eye diameter	21.2–32.7	27.0±4.12
Nasal barbel length	56.0–71.3	64.0±7.00
Maxillary barbel length	355.8–504.9	436.2±40.80
Inner mandibular barbel length	77.0–103.5	90.7±9.05
Outer mandibular barbel length	129.6–185.8	162.3±17.80

Barbels in four pairs. Maxillary barbel long and slender, extending to caudal-fin base. Nasal barbel slender, extending to vertical through base of pectoral spine. Inner mandibular-barbel origin close to midline; thicker and longer than nasal barbel and extending to base of posteriormost pectoral-fin ray. Outer mandibular barbel originating

posterolateral of inner mandibular barbel, extending to vertical through middle of dorsal-fin base.

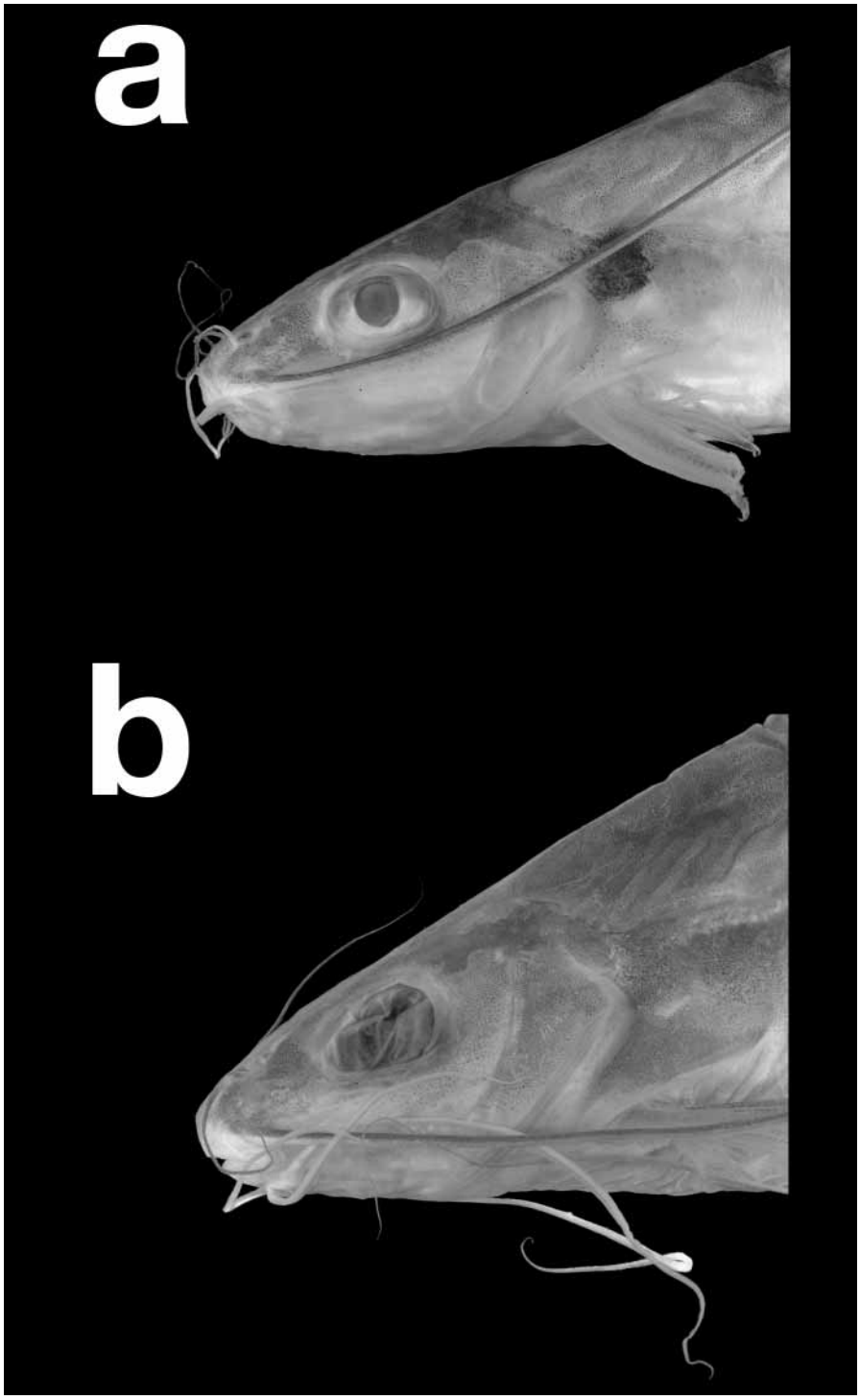

FIGURE 2. Predorsal profiles of: a. *Mystus cavasius*, UMMZ 244745, 103.9 mm SL and b. *M. seengtee*, CAS 62027, 100.8 mm SL.

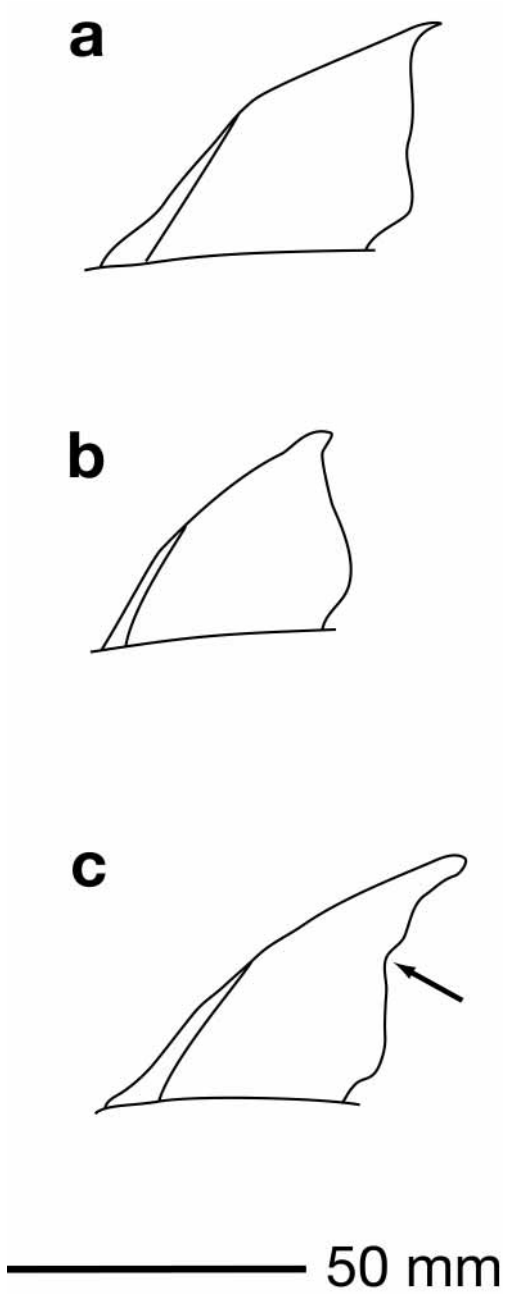

FIGURE 3. Schematic illustration of dorsal fins of: a. *Mystus cavasius*, CAS 50327, 160.5 mm SL; b. *M. seengtee*, CAS 62078, 152.6 mm SL; c. *M. falcarius*, CAS 89001, holotype, 170.2 mm SL. Arrow highlights concave margin of fin in *M. falcarius*.

Body moderately compressed. Dorsal profile rising evenly but not steeply from tip of snout to origin of dorsal fin and sloping gently ventrally from origin of dorsal fin to end of caudal peduncle. Ventral profile slightly convex to anal-fin base, then sloping slightly

dorsally to end of caudal peduncle. Skin smooth. Lateral line complete and midlateral in position. Vertebrae 21+17=38 (2), 20+19=39 (1), 21+18=39 (5), 22+17=39 (2), 21+19=40 (9), 22+18=40 (10), 21+20=41 (3), 22+19=41 (4), 23+18=41 (1), 21+21=42 (1) or 22+21=43 (1).

Dorsal fin with spinelet, spine, and 6 (1) or 7 (38) rays. Origin of dorsal fin anterior to mid-body, about two-fifths of body. Dorsal fin margin straight or slightly concave, with first two fin rays longer than others. Dorsal fin spine moderately long, straight and slender, posterior edge with 3–4 indistinct serrations. Serrations fewer, lower and less distinct in smaller specimens. Anterior nuchal plate acutely triangular.

Pectoral fin with stout spine, sharply pointed at tip, and 6 (1), 7 (5), 8 (21), 9 (9) or 10 (3) rays. Anterior spine margin smooth; posterior spine margin with 12–22 serrations along entire length (serrations fewer in smaller specimens). Pectoral fin margin straight anteriorly, convex posteriorly. Postcleithral (humeral) process short and slender, with concave dorsal edge and extending to anterior tip of anterior nuchal plate.

Pelvic fin origin at vertical through posterior end of dorsal-fin base, with i,5 (39) rays and slightly convex margin; tip of adpressed fin not reaching anal fin origin. Anus and urogenital openings located at vertical through middle of adpressed pelvic fin. Males with a short genital papilla reaching to base of first anal-fin ray.

Adipose fin with very long base and deeply incised posterior portion, spanning almost all of postdorsal distance. Anal fin origin located at approximately middle third of adipose fin, fin with iv,6 (7), iv,7 (20), iv,8 (10) or iv,9 (2) rays and curved posterior margin.

Caudal peduncle moderately deep. Caudal fin deeply forked, with i,6,6,i (1), i,6,7,i (6), i,6,8,i (2), i,7,7,i (18) or i,7,8,i (12) principal rays; upper lobe slender and lanceolate, lower lobe pointed. Procurrent rays extending only slightly anterior to fin base.

Coloration. In 70% ethanol: dorsal surface of head and body uniform brownish gray in some individuals, silvery white in others. Dark spots in front of base of dorsal spine and on humeral region, faint in some specimens. Some individuals with distinct dark stripe along lateral line, consisting of densely aggregated melanophores and with pale stripe without melanophores immediately above. Ventral surfaces of head and body dirty white; adipose fin brownish gray. All fins hyaline, with melanophores on fin membranes on some individuals, usually more densely aggregated along margins with fin rays. Dorsal half of barbels gray dorsally, gradually turning to dirty white on ventral half and tips.

Distribution. Known from the Ganges, Brahmaputra, Mahanadi, Subarnarekhar and Godavari river drainages in northern India, Nepal and Bangladesh (Fig. 4). Records of *M. cavasius* from the Indus River drainage further to the west presumably refer to this species, but no material for verification was available to us.

Habitat and biology. *Mystus cavasius* is known from a wide variety of habitats, including both fast- and slow-flowing rivers and streams (Nath & Dey, 2000), where it reportedly feeds on invertebrates and, to a smaller extent, smaller fishes (Bhatt, 1971). In the Ganges, this species spawns in August and September (Bhatt, 1971).

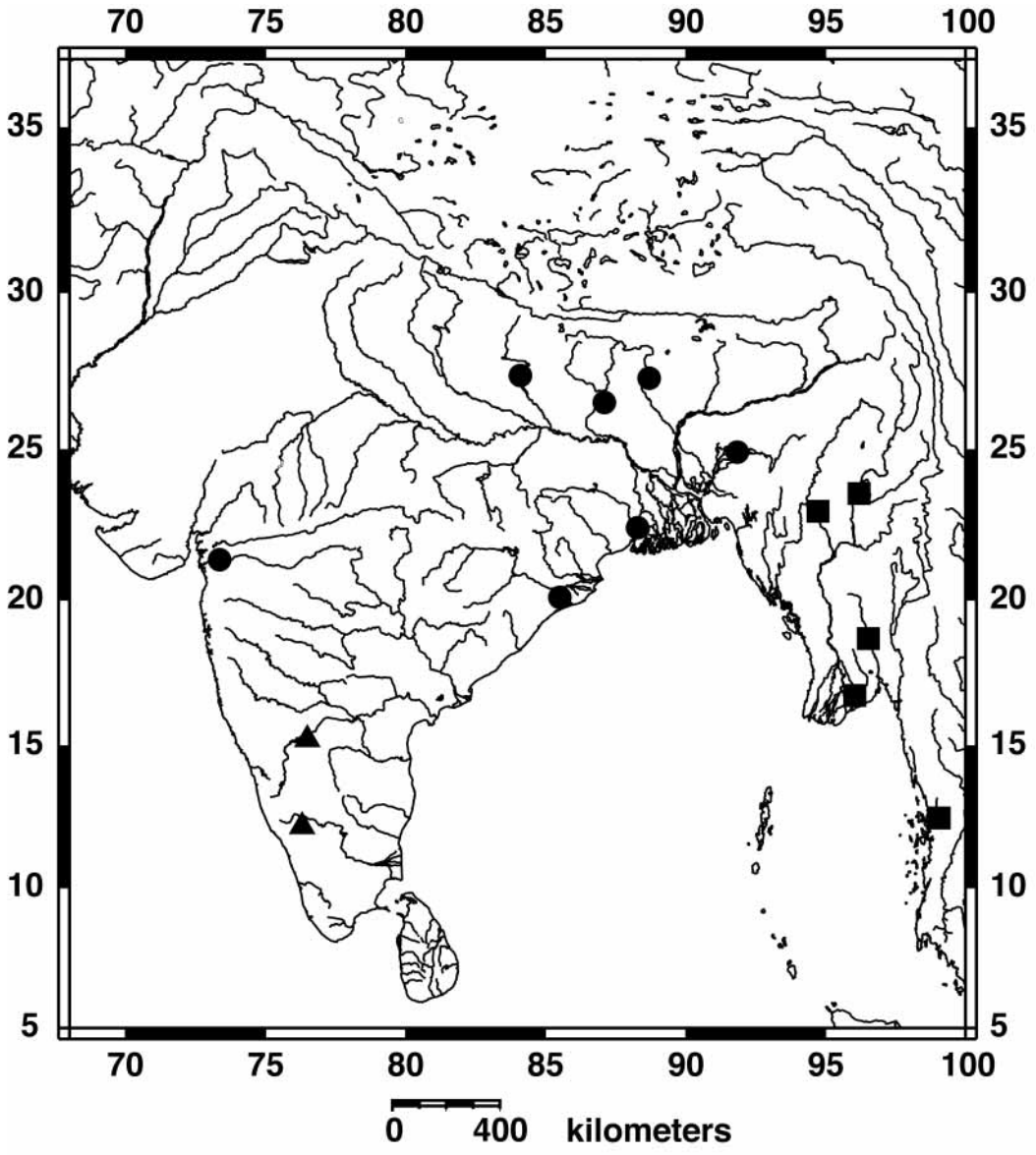

FIGURE 4. Map showing collection localities of *M. cavasius* (●), *M. seengtee* (▲) and *M. falcarius* (■) examined.

***Mystus seengtee* (Sykes, 1839)**
(Figs. 5–6)

Pimelodus seengtee Sykes, 1839: 164 (type locality: Dukhun, India, probably Bhima River at Pargaon); Sykes, 1841: 374, Pl. 66 Fig. 2.
Bagrus cavasius (non Hamilton) Jerdon, 1849: 337.

Macrones cavasius (non Hamilton) Günther, 1864: 76 (in part); Day, 1865a: 290; Day, 1877: 447, Pl. C Fig. 1 (in part); Day, 1889: 155 (in part).
Hypselobagrus cavasius (non Hamilton) Day, 1865b: 188.
Mystus cavasius (non Hamilton) Hora, 1936: 1; Hora, 1937: 17; Silas, 1949: 793; Rajan, 1955: 45; Jayaram, 1981: 196, Fig. 92A (in part); Jayaram et al., 1982: 84, Fig. 23; Talwar & Jhingran, 1991: 559, Fig. 184 (in part); Raghunathan, 1993: 336; Roberts, 1994: 248 (in part); Jayaram, 1995: 97; Shaji et al., 1995: 361; Jayaram, 1999: 235, Fig. 118C (in part); Menon, 1999: 200 (in part); Jayaram & Anuradha Sanyal, 2003: 46, Fig. 5 (in part); Yadav, 2003: 18.
Mystus (*Mystus*) *cavasius* (non Hamilton) Jayaram, 1954: 532, Fig. 2 (in part); Misra, 1976: 87, Fig. 18 (in part).
Mystus cavasus [sic.] (non Hamilton) Jadhav & Bhosale, 1996: 76.

Material examined. CAS 62005 (5), 71.3–128.0 mm SL; India: Karnataka, Cauvery River drainage, 9 km north of Kushalnagar (about 80 km WNW of Mysore). CAS 62027 (12), 56.3–109.8 mm SL; India: Karnataka, Cauvery River drainage, NW/WNW of Mysore. CAS 62078 (8), 91.9–152.6 mm SL; India: Karnataka, Krishna River drainage, Tungabahdra River and Reservoir at Hospet, Hampi, and Kampli.

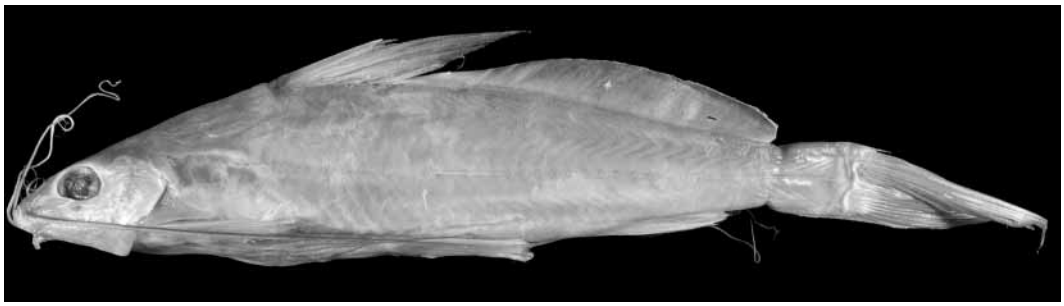

FIGURE 5. *Mystus seengtee*, CAS 62078, 106.0 mm SL; India: Tungabahdra River.

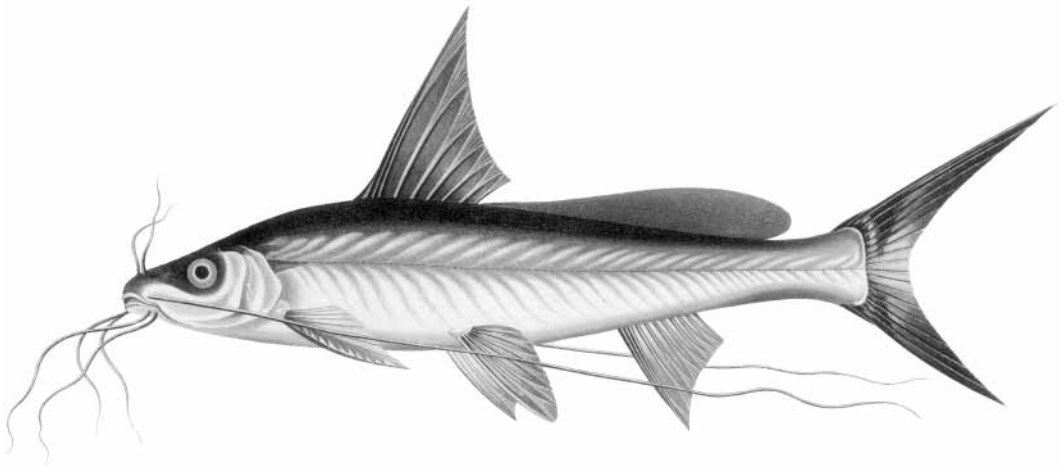

FIGURE 6. *Mystus seengtee*, illustration (laterally inverted) from Sykes (1841).

Diagnosis. *Mystus seengtee* differs from other congeners with a long-based adipose fin (except *M. cavasius* and *M. falcarius*) in having a combination of a black spot in front of the dorsal-spine base, a dark humeral mark, a body without distinct midlateral stripes, very long maxillary barbels reaching to caudal-fin base, dorsal spine short and feebly serrate, tall dorsal fin, and 23–28 rakers on the first gill arch. It can be distinguished from *M. cavasius* in having more rakers on the first gill arch (23–28 vs. 13–22; Table 1) and a more steeply sloping predorsal profile (making an angle of 30–35° to the horizontal vs. 20–25°; Fig. 2), and from *M. falcarius* in having a straight or gently concave (vs. markedly concave) dorsoposterior margin of the dorsal fin (Fig. 3), an ovoid (vs. crescentic) dark humeral mark and a faint (vs. very prominent) dark spot at the base of the dorsal spine.

Description. Biometric data are given in Table 3. Head depressed; dorsal profile evenly sloping (at angle of 30–35° to horizontal) and ventral profile almost straight. Bony elements of dorsal surface of head covered with thin skin; bones readily visible, especially on posterior half of neurocranium, and ornamented with numerous fine, radial grooves. Anterior cranial fontanelle extending from behind snout to line through posterior orbital margins, separated from posterior fontanelle by narrow epiphyseal bar. Posterior fontanelle extending to base of supraoccipital spine. Supraoccipital spine elongate, slender and with blunt tip; extending to anterior nuchal plate. Eye ovoid, horizontal axis longest; located entirely in dorsal half of head. Gill openings wide, extending from exposed surface of posttemporal to beyond isthmus at line through mouth corners. Gill membranes free from isthmus. First branchial arch with 23–28 long, slender gill rakers.

Mouth subterminal, fleshy upper lip extending anteriorly beyond upper jaw. Oral teeth small and villiform, in irregular rows on all tooth-bearing surfaces. Premaxillary tooth band rounded, of equal width throughout. Dentary tooth band much narrower than premaxillary tooth band at symphysis, tapering laterally. Vomerine tooth band unpaired, continuous across midline; smoothly arched along anterior margin, tapering laterally to point extending posteriorly well past level of premaxillary band; band width narrower than premaxillary band at midline, widening laterally and then tapering to a sharp point posterolaterally.

Barbels in four pairs. Maxillary barbel long and slender, extending beyond caudal-fin base. Nasal barbel slender, extending to vertical through base of pectoral spine. Inner mandibular-barbel origin close to midline; thicker and longer than nasal barbel and extending to base of posteriormost pectoral-fin ray. Outer mandibular barbel originating posterolateral of inner mandibular barbel, extending to vertical through middle of dorsal-fin base.

Body moderately compressed. Dorsal profile rising evenly but not steeply from tip of snout to origin of dorsal fin and sloping gently ventrally from origin of dorsal fin to end of caudal peduncle. Ventral profile slightly convex to anal-fin base, then sloping slightly dorsally to end of caudal peduncle. Skin smooth. Lateral line complete and midlateral in position. Vertebrae 21+19=40 (1), 22+19=41 (4), 23+18=41 (1) or 23+19=42 (7).

TABLE 3. Biometric data for *Mystus seengtee* (n=13).

	Range	Mean±SD
%SL		
Predorsal length	33.4–39.5	35.8±1.23
Preanal length	62.7–70.7	68.6±1.61
Prepelvic length	44.4–49.7	47.3±1.26
Prepectoral length	19.2–22.4	21.0±0.82
Length of dorsal-fin base	12.9–16.8	14.7±0.82
Dorsal spine length	12.4–17. 9	14.7±1.26
Anal-fin length	8.3–12.5	10.2±0.87
Pelvic-fin length	13.0–18.6	16.5 ±1.25
Pectoral-fin length	14.5–19.2	16.9±1.38
Pectoral-spine length	11.9–16.6	14.5±1.29
Caudal-fin length	25.4–38.7	31.7±3.06
Length of adipose-fin base	35.0–46.7	41.8±3.09
Adipose maximum height	2.9–6.6	4.9±0.97
Post-adipose distance	7.2–11.0	8.6±1.17
Caudal peduncle length	17.5–30.3	22.0±3.35
Caudal peduncle depth	6.3–8.6	7.6±0.70
Body depth at anus	15.3–21.7	18.9±1.62
Head length	21.0–25.8	23.1±1.16
Head width	14.3–18.1	15.9±0.82
Head depth	13.6–19.0	16.0±1.12
%HL		
Snout length	37.2–43.5	39.4±1.90
Interorbital distance	23.4–38.2	27.0±3.11
Eye diameter	22.4–31.0	27.0±2.04
Nasal barbel length	52.9–89.7	70.1±8.89
Maxillary barbel length	344.8–513.6	416.5±54.20
Inner mandibular barbel length	70–109.0	87.9±10.81
Outer mandibular barbel length	137.5–190.5	162.4±17.00

Dorsal fin with spinelet, spine, and 6 (2) or 7 (11) rays. Origin of dorsal fin anterior to mid-body, about one-third of body. Dorsal fin margin straight or slightly concave, with first two fin rays longer than others. Dorsal fin spine moderately long, straight and slender, posterior edge with 3–4 indistinct serrations. Serrations fewer, lower and less distinct in smaller specimens. Anterior nuchal plate acutely triangular.

Pectoral fin with stout spine, sharply pointed at tip, and 7 (4), 8 (6) or 9 (3) rays. Anterior spine margin smooth; posterior spine margin with 11–16 serrations along entire length (serrations fewer in smaller specimens). Pectoral fin margin straight anteriorly, convex posteriorly. Postcleithral (humeral) process short and slender, with straight dorsal edge and extending to anterior tip of anterior nuchal plate.

Pelvic fin origin at vertical through posterior end of dorsal-fin base, with i,5 (13) rays and slightly convex margin; tip of adpressed fin not reaching anal fin origin. Anus and urogenital openings located at vertical through middle of adpressed pelvic fin. Males with a short genital papilla reaching to base of first anal-fin ray.

Adipose fin with very long base and deeply-incised posterior portion, spanning almost all of postdorsal distance. Anal fin origin located at approximately middle third of adipose fin, fin with iv,6 (4), iv,7 (7), iv,8 (1) or iv,9 (1) rays and curved posterior margin.

Caudal peduncle moderately deep. Caudal fin deeply forked, with i,6,7,i (1), i,7,7,i (6) or i,7,8,i (6) principal rays; upper lobe slender and lanceolate, lower lobe pointed. Procurrent rays extending only slightly anterior to fin base.

Coloration. In 70% ethanol: dorsal surface of head and body uniform brownish gray. Dark spots in front of base of dorsal spine and on humeral region, indistinct in most specimens. Ventral surfaces of head and body dirty white; adipose fin brownish gray. All fins hyaline, with melanophores on fin membranes on some individuals, usually more densely aggregated along margins with fin rays. Dorsal half of barbels gray dorsally, gradually turning to dirty white on ventral half and tips.

Distribution. Known from the Krishna and Cauvery river drainages in southern India (Fig. 4). *Mystus seengtee* is very likely to be found in most (if not all) other river drainages south of the Krishna River drainage.

Mystus falcarius sp. nov.

(Fig. 7)

Bagrus cavasius (non Hamilton, 1822) Blyth, 1858: 284; Blyth, 1860: 149.

Macrones cavasius (non Hamilton) Day, 1877: 447, Pl. C Fig. 1 (in part); Day, 1889: 155 (in part); Vinciguerra, 1890: 28 (in part); Jenkins, 1910: 137; Chaudhuri, 1911: 20; Kyaw Win, 1971: 52, Fig. 20 (5).

Aoria cavasius (non Hamilton) Prashad & Mukerji, 1929: 179; Mukerji, 1933: 815.

Mystus (*Mystus*) *cavasius* (non Hamilton) Jayaram, 1954: 532, Fig. 2 (in part); Misra, 1976: 87, Fig. 18 (in part).

Mystus cavasius (non Hamilton) Tint Hlaing, 1971: 513; Jayaram, 1981: 196, Fig. 92A (in part); Dutt et al., 1982: 27 (in part); Sharma & Dutt, 1983: 334 (in part); Talwar & Jhingran, 1991: 559, Fig. 184 (in part); Roberts, 1994: 248, Fig. 3 (in part); Jayaram, 1999: 235, Fig. 118C (in part); Menon, 1999: 200 (in part); Jayaram & Anuradha Sanyal, 2003: 46, Fig. 5 (in part).

Mystus near *cavasius* #1 Roberts, 1989: 124.

Type material. Holotype: CAS 89001, 170.2 mm SL; Myanmar: Kachin State, Myitkyina market; C.J. Ferraris, 21–22 April 1996.

FIGURE 7. *Mystus falcarius*, holotype, CAS 89001, 170.2 mm SL; Myanmar: Myitkyina.

Paratypes: BMNH 1891.11.30.210–219 (13), 96.0–139.6 mm SL; Myanmar: Sittaung River and adjacent streams from Taungoo to about 240 km S; E.W. Oates, date unknown. CAS 79033 (2), 118.8–124.8 mm SL; Myanmar: Yangon market; T.R. Roberts, 5–12 March 1985. CAS 89000 (4), 92.2–125.8 mm SL; USNM 344668 (6), 74.8–99.0 mm SL; Myanmar: Sagaing Division, Pinda River in vicinity of Pinda Village, 23°10'59"N 94°5'37"E; C.J. Ferraris et al., 24 April 1996. CAS 92932 (1), 101.6 mm SL; Myanmar: Taninthayi Division, Tenasserim River backwater, midway between Htee-tah & Baowashung; T.R. Roberts, 12 March 1992. CAS 96569 (1), 190.4 mm SL; Myanmar: Taninthayi Division, Tenasserim River and tributaries midway between Htee-tah & Baowashung; T.R. Roberts, March 1992. USNM 343550 (1), 80.1 mm SL; Myanmar: Bago Division, Sittaung River at Taungoo; C.J. Ferraris & D. Catania, 7 April 1996.

Diagnosis. *Mystus falcarius* differs from other congeners with a long-based adipose fin (except *M. cavasius* and *M. seengtee*) in having a combination of a black spot in front of the dorsal-spine base, a dark humeral mark, a body without distinct midlateral stripes, very long maxillary barbels reaching to caudal-fin base, dorsal spine short and feebly serrate, tall dorsal fin, and 22–29 rakers on the first gill arch. It can be distinguished from *M. cavasius* and *M. seengtee* in having a very prominent (vs. faint) dark spot at the base of the dorsal spine, a crescentic (vs. ovoid) dark humeral mark, and a dorsal fin with very elongate first and second rays and a markedly concave dorsoposterior margin (vs. with moderately elongate first and second rays and a straight or weakly concave dorsoposterior margin; Fig. 3). The black spot in front of the dorsal-spine base is also more prominent in preserved material of *M. falcarius* than in either *M. cavasius* or *M. seengtee*. *Mystus falcarius* further differs from *M. cavasius* in having more gill rakers (22–29 vs. 13–22; Table 1).

Description. Biometric data are given in Table 4. Head depressed; dorsal profile evenly sloping, and ventral profile almost straight. Bony elements of dorsal surface of head covered with thin skin; bones readily visible, especially on posterior half of neurocranium, and ornamented with numerous fine, radial grooves. Anterior cranial

fontanelle extending from behind snout to line through posterior orbital margins, separated from posterior fontanelle by narrow epiphyseal bar. Posterior fontanelle extending to base of supraoccipital spine. Supraoccipital spine elongate, slender and with blunt tip; extending to anterior nuchal plate. Eye ovoid, horizontal axis longest; located entirely in dorsal half of head. Gill openings wide, extending from exposed surface of posttemporal to beyond isthmus at line through mouth corners. Gill membranes free from isthmus. First branchial arch with 22–29 long, slender gill rakers.

TABLE 4. Biometric data for *Mystus falcarius* (n=29).

	Range	**Mean±SD**
%SL		
Predorsal length	33.1–36.0	34.2±0.84
Preanal length	61.0–70.7	67.5±2.71
Prepelvic length	42.6–49.9	46.7±2.40
Prepectoral length	17.8–22.3	20.2±1.62
Length of dorsal-fin base	13.2–14.6	13.7±0.57
Dorsal spine length	14.0–19.0	16.3±1.41
Anal-fin length	9.8–11.5	10.8±0.51
Pelvic-fin length	16.2–18.8	17.7±0.72
Pectoral-fin length	14.9–19.2	17.3±1.07
Pectoral-spine length	13.9–16.6	15.3±0.92
Caudal-fin length	26.5–34.7	31.8±2.52
Length of adipose-fin base	39.9–48.8	44.8±2.62
Adipose maximum height	4.6–7.4	6.0±0.82
Post-adipose distance	7.8–11.7	10.1±1.34
Caudal peduncle length	19.3–24.3	21.9±1.43
Caudal peduncle depth	6.7–8.6	7.7±0.77
Body depth at anus	17.3–22.0	19.9±1.75
Head length	19.8–23.7	22.0±1.01
Head width	13.7–17.1	14.7±1.17
Head depth	14.0–17.2	15.4±1.29
%HL		
Snout length	36.8–45.2	42.2±2.65
Interorbital distance	26.1–35.6	29.1±2.95
Eye diameter	22.4–30.2	26.3±2.14
Nasal barbel length	52.6–81.5	70.0±11.13
Maxillary barbel length	435.6–538.0	492.0±32.78
Inner mandibular barbel length	75.2–101.4	89.7±10.84
Outer mandibular barbel length	148.3–190.2	173.8±14.28

Mouth subterminal, fleshy upper lip extending anteriorly beyond upper jaw. Oral teeth small and villiform, in irregular rows on all tooth-bearing surfaces. Premaxillary tooth band rounded, of equal width throughout. Dentary tooth band much narrower than premaxillary tooth band at symphysis, tapering laterally. Vomerine tooth band unpaired, continuous across midline; smoothly arched along anterior margin, tapering laterally to point extending posteriorly well past level of premaxillary band; band width narrower than premaxillary band at midline, widening laterally and then tapering to a sharp point posterolaterally.

Barbels in four pairs. Maxillary barbel long and slender, extending beyond caudal-fin base. Nasal barbel slender, extending to vertical through base of pectoral spine. Inner mandibular-barbel origin close to midline; thicker and longer than nasal barbel and extending to base of posteriormost pectoral-fin ray. Outer mandibular barbel originating posterolateral of inner mandibular barbel, extending to vertical through middle of dorsal-fin base.

Body moderately compressed. Dorsal profile rising evenly but not steeply from tip of snout to origin of dorsal fin and sloping gently ventrally from origin of dorsal fin to end of caudal peduncle. Ventral profile slightly convex to anal-fin base, then sloping slightly dorsally to end of caudal peduncle. Skin smooth. Lateral line complete and midlateral in position. Vertebrae 22+18=40 (1), 22+19=41 (2), 22+20=42 (11), 23+19=42 (8), 23+20=43 (5) or 23+21=44 (2).

Dorsal fin with spinelet, spine, and 7 (29) rays. Origin of dorsal fin anterior to mid-body, about one-third of body. Dorsal fin margin markedly concave, with first two fin rays longer than others. Dorsal fin spine moderately long, straight and slender, posterior edge with 3–8 indistinct serrations. Serrations fewer, lower and less distinct in smaller specimens. Anterior nuchal plate acutely triangular.

Pectoral fin with stout spine, sharply pointed at tip, and 7 (6), 8 (10), 9 (10) or 10 (3) rays. Anterior spine margin smooth; posterior spine margin with 12–22 serrations along entire length (serrations fewer in smaller specimens). Pectoral fin margin straight anteriorly, convex posteriorly. Postcleithral (humeral) process short and slender, with concave dorsal edge and extending to anterior tip of anterior nuchal plate.

Pelvic fin origin at vertical through posterior end of dorsal-fin base, with i,5 (29) rays and slightly convex margin; tip of adpressed fin not reaching anal fin origin. Anus and urogenital openings located at vertical through middle of adpressed pelvic fin. Males with a short genital papilla reaching to base of first anal-fin ray.

Adipose fin with very long base and deeply-incised posterior portion, spanning almost all of postdorsal distance. Anal fin origin located at approximately middle third of adipose fin, fin with iv,6 (5), iv,7 (11), iv,8 (12) or iv,9 (1) rays and curved posterior margin.

Caudal peduncle moderately deep. Caudal fin deeply forked, with i,7,7,i (5), i,7,8,i (13), i,7,9,i (10) or i,8,9,i (1) principal rays; upper lobe slender and lanceolate, lower lobe pointed. Procurrent rays extending only slightly anterior to fin base.

Coloration. In 70% ethanol: dorsal surface of head and body uniform brownish gray. Very distinct dark spot in front of base of dorsal spine. Crescentic dark mark on humeral region, indistinct in some specimens. Ventral surfaces of head and body dirty white; adipose fin brownish gray. All fins hyaline, with melanophores on fin membranes on some individuals, usually more densely aggregated along margins with fin rays. Dorsal half of barbels gray dorsally, gradually turning to dirty white on ventral half and tips.

Distribution. Known from the Irrawaddy and Salween river drainages in Myanmar, as well as the shorter drainages in southern Myanmar (in the Tenasserim region; Fig. 4).

Etymology. From the Latin falx, meaning sickle, in reference to both the markedly concave dorsoposterior margin of the dorsal fin in this species and the crescent shaped humeral mark. Used as an adjective.

Discussion

Pimelodus seengtee was originally described from the Deccan region in southwestern India from a holotype 6 inches (=152.4 mm) long (this length almost certainly refers to TL). There are two specimens in the Natural History Museum (London) attributed to Sykes (see Roberts, 1994): a dried, stuffed specimen 130 mm SL (BMNH 1857.6.13.154), and a wet specimen 113 mm SL (BMNH 1860.3.19.955). Before we discuss the identities of the two specimens, it is instructive to briefly review the history of the ichthyological material collected by Colonel William Henry Sykes during his Deccan survey. This material was initially deposited in two institutions: the Zoological Society of London (Greenwood, 1976; however, it is interesting to note that there are no written records that Sykes ever deposited fish specimens there, see Wheeler, 1997) and the Honourable East India Company's India Museum (sometimes also referred to as the "East India Museum" or the "East Indian Museum"; Whitehead & Talwar, 1976). The collections of the Zoological Society of London were sold to the Natural History Museum [then British Museum (Natural History)] in 1855–56 (Boulenger, 1906; Mitchell, 1929; Greenwood, 1976; Wheeler, 1997) and the collections of the India Museum were transferred to the Natural History Museum in 1859–60 (Boulenger, 1906). These may have been the reasons why BMNH 1857.6.13.154 (purchased from the Zoological Society of London) and BMNH 1860.3.19.955 (donated by the Honourable East India Company; such material is indicated in the registers as "...presented by the Secretary of State for India") were both regarded as potential types of *Pimelodus seengtee* (see Roberts, 1994).

Although the wet specimen (BMNH 1860.3.19.955) is closer in size to that of the holotype (*M. seengtee* has a caudal fin of about 30% SL in length; this would make BMNH 1857.6.13.154 about 169 mm TL and BMNH 1860.3.19.955 about 146.9 mm TL), our examination of a photograph of this specimen shows that it is not *M. seengtee*, but *M. cavasius* (as the specimen has a gently-sloping predorsal profile making an angle of about 25° to the horizontal typically seen in *M. cavasius*). This is confirmed by the gill raker

counts (21) of this specimen (J. Maclaine pers. comm. to HHN), which correspond to *M. cavasius* (but not *M. seengtee*). Therefore BMNH 1860.3.19.955 cannot be the holotype of *Pimelodus seengtee*.

The dried specimen (BMNH 1857.6.13.154) is also approximately the same size as that stated for the holotype. However, it is poorly prepared, having the head strongly arched backwards such that it is no longer possible to accurately determine the slope of the predorsal profile (Fig. 8). Furthermore, it is not possible to confirm the identity of the dried specimen by counting the gill rakers, because the gill openings have been sealed shut (J. Maclaine, pers. comm. to NHH); it also highly likely that the gill arches have been removed in the course of preparation. Given the uncertainty concerning the specific identity of BMNH 1857.6.13.154, we have refrained from identifying it as the holotype of *Pimelodus seengtee*. Since we are not even sure if it is conspecific with southern Indian material we have examined, we tentatively identify it as *Mystus* sp. *incerta sedis*.

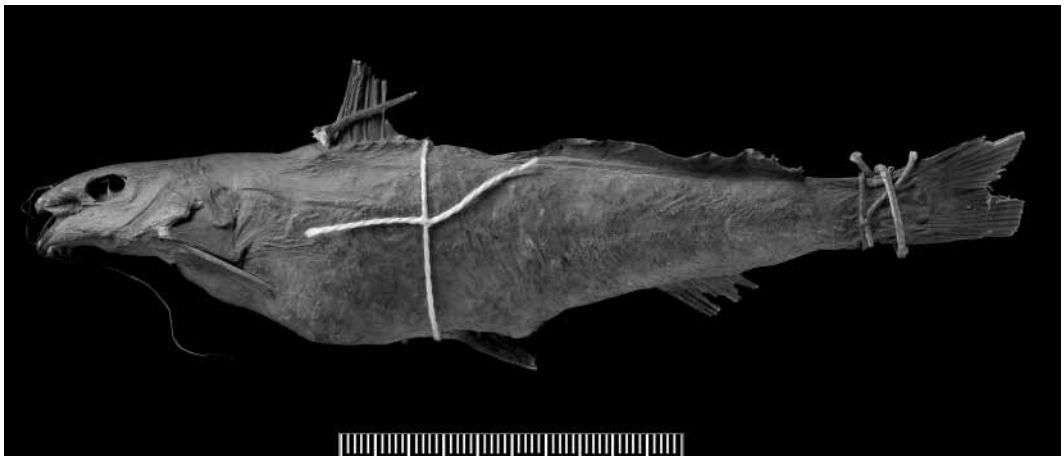

FIGURE 8. *Mystus* sp. *incerta sedis*, BMNH 1857.6.13.154, 130 mm SL; India. Photograph courtesy of J. Maclaine (BMNH).

Although it is frequently acknowledged that the fishes collected by Sykes (particularly the types of the species he described) are lost (e.g. Ferraris & Runge, 1999), our investigations uncover evidence that some of this material may still be extant. One other specimen (BMNH 1857.6.13.158) also acquired from the Zoological Society (and accessioned) at the same time bears the name *Hypophthalmus goongorensis* (most likely a misspelling of *Hypophthalmus goongwaree*) in the register, and its status as the holotype of this species should be investigated. This is beyond the scope of this study, but we mention it here to draw attention to the problem.

Both *M. seengtee* and *M. falcarius* can be distinguished from *M. cavasius* by the differences in the number of rakers on the first gill arch. Although the gill raker counts can be variable among *Mystus* species (Roberts, 1989), the differences in counts as being

indicative of interspecific differences are further supported by the presence of other characters in predorsal profile shape, dorsal fin shape, and coloration unique to the southern Indian, northern Indian and Myanmar populations of "*M. cavasius*". Although some overlap exists between gill raker counts for *M. cavasius* (n=70) and both *M. seengtee* (n=25) and *M. falcarius* (n=29) combined, the overlap only occurs at the uppermost limit of the gill raker counts for *M. cavasius* (22) and only in one out of 70 specimens of *M. cavasius* examined. We note that because of this and the fact that gill raker counts can be useful in distinguishing species of *Mystus* (e.g. Roberts, 1992), the differences observed are treated as interspecific in nature. Furthermore, it is unlikely that the variation in gill raker counts is the result of clinal variation, as no clear geographic pattern exists (Roberts, 1994). The slope of the predorsal profile is consistent for all of the material we have examined and it can be reliably used to distinguish *M. seengtee* from *M. cavasius*. The shape of the humeral mark can be reliably used to distinguish *M. falcarius* from *M. cavasius* and *M. seengtee*. In *M. falcarius*, this mark is always crescent shaped (vs. ovoid). The ovoid humeral mark is also more prominent in nearly all of the *M. cavasius* material we have examined (except in UMMZ 238800, BMNH 1938.2.22.122, BMNH 1938.2.22.123 and BMNH 1938.2.22.124–128) when compared to that of *M. seengtee*. However, since we do not know the live coloration of *M. seengtee* (the humeral mark is prominent in the live coloration of *M. cavasius*) and cannot rule out the faded condition in *M. seengtee* as a preservation artifact, we have refrained from using it as a diagnostic character. The dark spot at the base of the dorsal spine is very prominent in *M. falcarius*, more so than in either *M. cavasius* or *M. seengtee*. This is evident even in old material which has not been properly fixed and in which the color is considerably faded (BMNH 1891.11.210–219).

The species diversity and distributional patterns as observed in *M. cavasius*, *M. seengtee* and *M. falcarius* (with three distinct species distributed in northern India, southern India and Myanmar respectively) is fairly common among riverine catfishes in this region. For example, similar distributional patterns have been observed in other catfish genera, most notably *Rita* (see Ferraris, 1999) and *Gagata* (see Roberts & Ferraris, 1998).

A species of *Mystus* with a long-based adipose fin similar to *M. seengtee* (currently identified as *M. cavasius*) is also found in Sri Lanka. A comparison based on a photograph of a Sri Lankan specimen in Pethiyagoda (1991) shows that it differs from *M. seengtee* in having a more falcate dorsal fin and the apparent absence of a dark spot in front of the dorsal-spine base. The identity of the Sri Lankan species is being further investigated in a separate study by the second author and colleagues.

Additional material examined

Mystus sp. *incerta sedis*: BMNH 1857.6.13.154, 130 mm SL; India: purchased from the Zoological Society of London (photograph examined).

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