

HEMIBAGRUS FURCATUS, A NEW SPECIES OF BAGRID CATFISH (TELEOSTEI: SILURIFORMES) FROM SABAH, EAST MALAYSIA

Ng Heok Hee

Department of Biological Sciences, National University of Singapore, 10 Kent Ridge Crescent, Singapore 119260.

Keith M. Martin-Smith

Department of Environmental and Evolutionary Biology, Graham Kerr Building, University of Glasgow, Glasgow G12 8QQ, Scotland.

Peter K. L. Ng

Department of Biological Sciences, National University of Singapore, 10 Kent Ridge Crescent, Singapore 119260.

ABSTRACT. - *Hemibagrus furcatus*, new species, is described from the Segama River drainage in Sabah, northeastern Borneo. It is similar to *H. baramensis* and *H. sabanus* in having the combination of a relatively short body with 43-45 vertebrae and a long adipose fin of more than 20 %SL spanning most of the postdorsal distance. It can be differentiated from congeners in having a unique combination of the following characters: head width 18.3-19.5 %SL, length of caudal peduncle 18.8-20.7 %SL, depth of caudal peduncle 9.4-10.3 %SL, length of adipose-fin base 21.2-26.3 %SL, dorsal to adipose distance 6.3-8.6 %SL, absence of a dark midaxial streak, 4-7 serrations on the dorsal spine, bifurcated serrae on the pectoral spine, upper lobe of the caudal fin rounded posteriorly, dorsal fin without an extended second ray, with broader membranes and allowing the fin to be spread wider, giving a more rounded appearance.

KEY WORDS. - *Hemibagrus*, Borneo, Sabah, new species.

INTRODUCTION

The genus *Hemibagrus* comprises large-sized bagrid catfishes that attain standard lengths of up to 800 mm. This taxon was established by Bleeker (1862) to include species with depressed heads, rugose head shields not covered by skin, slender occipital process, and moderately long adipose fins. Subsequent authors since Günther (1864) have synonymised *Hemibagrus* with *Mystus* and only recently has the genus *Hemibagrus* been rediagnosed (Mo, 1991) by having a depressed head with a thin, plate-like metapterygoid.

Four species of *Hemibagrus* have been reported from Sabah in northeastern Borneo to date (Inger & Chin, 1962, Lim & Wong, 1994), viz. *H. nemurus* (Valenciennes in Cuvier & Valenciennes, 1840), *H. planiceps* (Valenciennes in Cuvier & Valenciennes, 1840), *H. baramensis* (Regan, 1906), and *H. sabanus* (Inger & Chin, 1959). While carrying out an ecological study in the Segama River drainage in the Danum Valley (central Sabah), the second author obtained specimens

of a *Hemibagrus* with 43-45 vertebrae and a relatively long adipose fin (more than 20 %SL) which was initially identified as *H. baramensis* (see Chin & Samat, 1995; Martin-Smith, 1996). Comparison with other nominal species with similar features, i.e. *H. baramensis* and *H. sabanus* showed that the specimens from Danum Valley represent an undescribed species, which is named *H. furcatus* in this study.

The Singapore authors are currently revising the genus *Hemibagrus*, but this study cannot be completed in the near future. As the name for the new species from Sabah is needed for other biological studies, the present paper serves to validate the name now.

MATERIALS AND METHODS

Measurements were made point to point with dial callipers and data recorded to tenths of a millimetre. 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 itself and measurements of body parts are given as proportions of standard length (SL). Measurements and counts were made following Ng & Dodson (1999). Fin rays were counted under a binocular dissecting microscope using transmitted light. Vertebral counts were taken from radiographs following the method of Roberts (1994). Numbers in parentheses following a particular fin-ray, branchiostegal-ray, gill-raker or vertebral count indicate the number of specimens with that count. Drawings of the specimens were made with a Nikon SMZ-10 microscope and camera lucida. Institutional codes follow Eschmeyer (1998) with the following addition: Sabah Museum, Kota Kinabalu (SBM).

TAXONOMY

Hemibagrus furcatus, new species (Fig. 1)

Mystus baramensis (non Regan) - Chin, 1990: SC39 (in part); Chin & Samat, 1995: 24; Martin-Smith, 1996: 51.

Hemibagrus aff. *baramensis* - Martin-Smith & Tan, 1998: 589; Martin-Smith & Laird, 1998: 334.

Material examined. - *Holotype*. - SBM, U, 138.4 mm SL; Borneo: Sabah, Lahad Datu district, Danum Valley Conservation Area, Sungai Segama; K. M. Martin-Smith, Nov.1996.

Paratypes. - ZRC 40523, 2 UU, 93.1-96.6 mm SL; Borneo: Sabah, Lahad Datu district, Danum Valley Conservation Area, Sungai Segama, in front of Danum Valley Field Centre (4°57'42.5"N 117°48'21.6"E); H. H. Tan & Y. Y. Goh, 1 Oct.1996. - ZRC 40524, 1 U, 128.0 mm SL; Borneo: Sabah, Lahad Datu district, Danum Valley Conservation Area, a small tributary of Sungai Bole ca. 500 m into coupe 93 (logging trail) (4°58'17.8"N 117°51'48.0"E); H. H. Tan & Y. Y. Goh, 2 Oct.1996. - ZRC 40525, 2 TT, 128.6-150.0 mm SL; Borneo: Sabah, Lahad Datu district, Danum Valley Conservation Area, stream at km 113 on main line W after turnoff to Borneo Rainforest Lodge (5°0'37.6"N 117°31'43.9"E); H. H. Tan & Y. Y. Goh, 3 Oct.1996. - ZRC 40526, 1 U, 116.7 mm SL, 3 TT, 115.3-138.7 mm SL; Borneo: Sabah, Lahad Datu district, Danum Valley Conservation Area, Cabin Stream Right km 50 on road to Danum Valley Field Centre, drains from Bukit Rafflesia (4°59'8.5"N 117°54'5.1"E); H. H. Tan & Y. Y. Goh, 2 Oct.1996. - ZRC 40527, 2 UU, 123.6-129.9 mm SL, 4 TT, 80.0-111.2 mm SL; Borneo: Sabah, Lahad Datu district, Danum Valley Conservation Area, Sungai Bole Kechil tributary (4°57'33.5"N 117°51'34.1"E); H. H. Tan & Y. Y. Goh, 2 Oct.1996. - CMK 15119, 1 T, 108.4 mm SL; ZRC 40528, 2 UU, 108.4-120.0 mm SL; Borneo: Sabah, Lahad Datu district, Danum Valley Conservation Area, Sungai Bilong at ca. 83 km on main line W after turnoff to Borneo Rainforest Lodge (5°4'26.8"N 117°42'52.3"E); H. H. Tan & Y. Y. Goh, 3 Oct.1996. - CAS 210089, 1 T, 125.0 mm SL; SBM, 1 T, 132.3 mm SL; ZRC 40588, 1 U, 145.0 mm SL; data as for holotype.

Diagnosis. - *Hemibagrus furcatus* can be differentiated

from its congeners by the unique combination of the following characters: head width 18.3-19.5 %SL, length of caudal peduncle 18.8-20.7 %SL, depth of caudal peduncle 9.4-10.3 %SL, length of adipose-fin base 21.2-26.3 %SL, dorsal to adipose distance 6.3-8.6 %SL, absence of a dark midaxial streak, 4-7 serrations on dorsal spine, bifurcated serrae on the pectoral spine, upper lobe of the caudal fin rounded posteriorly, dorsal fin without an extended second ray, with broader membranes and allowing the fin to be spread wider to give a more rounded appearance.

Description. - Head depressed and broad, body moderately compressed. Dorsal profile rising evenly but not steeply from tip of snout to origin of dorsal fin, then sloping gently ventrally from there to end of caudal peduncle. Ventral profile horizontal to origin of anal, then sloping dorsally to end of caudal peduncle. In %SL: head length 27.1-29.5, head width 18.3-19.5, head depth 13.5-15.2, predorsal distance 37.7-40.0, preanal length 68.7-72.4, prepelvic length 50.2-54.0, prepectoral length 23.8-28.2, body depth at anus 15.4-18.2, length of caudal peduncle 18.8-20.7, depth of caudal peduncle 9.4-10.3, pectoral-spine length 14.7-18.5, pectoral-fin length 18.4-21.1, dorsal-spine length 12.6-17.4, length of dorsal-fin 25.5-28.4, length of dorsal-fin base 15.3-17.4, pelvic-fin length 15.9-17.3, length of anal-fin base 12.0-13.0, caudal-fin length 20.4-25.5, length of adipose-fin base 21.2-26.3, adipose maximum height 5.3-6.3, post-adipose distance 13.8-15.9, dorsal to adipose distance 6.3-8.6; in %HL: snout length 36.1-39.0, interorbital distance 28.5-33.3, eye diameter 15.9-19.7, nasal barbel length 35.8-52.3, maxillary barbel length 222.2-259.7, inner mandibular barbel length 49.3-85.2, outer mandibular barbel length 86.0-109.2. Branchiostegal rays 10 (4) or 11 (8). Gill rakers 5+15=20 (4), 5+16=21 (4), 5+17=22 (2), 6+15=21 (3) or 6+16=22(1). Vertebrae 22+21=43 (2), 22+22=44 (2), 23+21=44 (6), 23+22=45 (1) or 24+21=45 (1).

Fin ray counts: dorsal I,7 (12); pectoral I,9 (11) or I,10 (1); pelvic i,5 (12); anal iv,8 (1) or iv,9 (11); caudal 8/9 (12). Dorsal origin nearer tip of snout than caudal flexure. Dorsal spine stout, with 4-7 small serrae posteriorly. Pectoral spine stout, with 8-14 bifurcated serrae posteriorly (Fig. 2). Anal origin slightly posterior to adipose origin. Depressed dorsal not reaching adipose fin. Caudal fin forked; upper lobe rounded with upper simple principal ray produced into a filament, lower lobe rounded posteriorly.

Colour. - Dorsal surface of head and body uniform light brown to dark brown, with a very faint dark grey humeral spot, lateral line cream to yellow; ventral surfaces of head and body dirty white; adipose fin and fin rays of all fins brown; inter-radial membranes of all fins with scattered melanophores. *Hemibagrus furcatus* shows considerable variation in colour, which seems to correspond with the colour of the substrate (Fig. 3). Specimens caught from areas that are more well-shaded

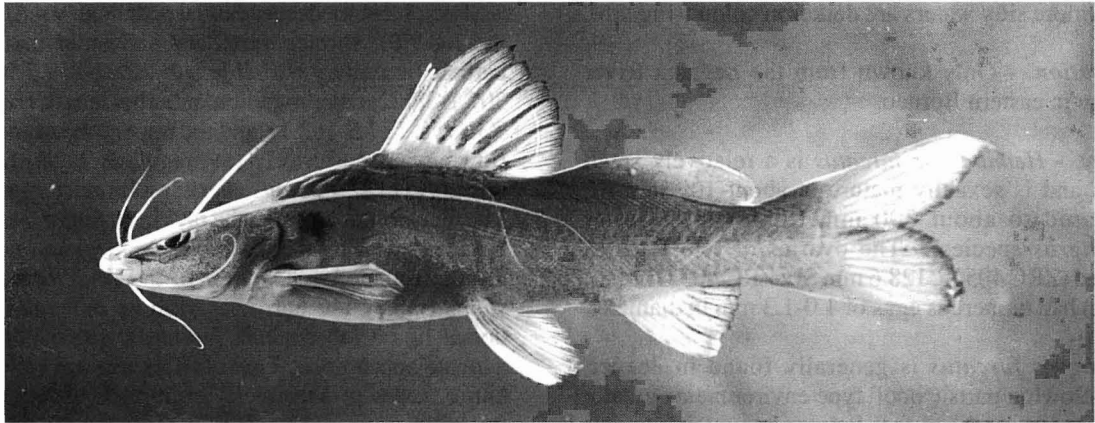


Fig. 1. *Hemibagrus furcatus*, paratype T, SBM, 132.3 mm SL.

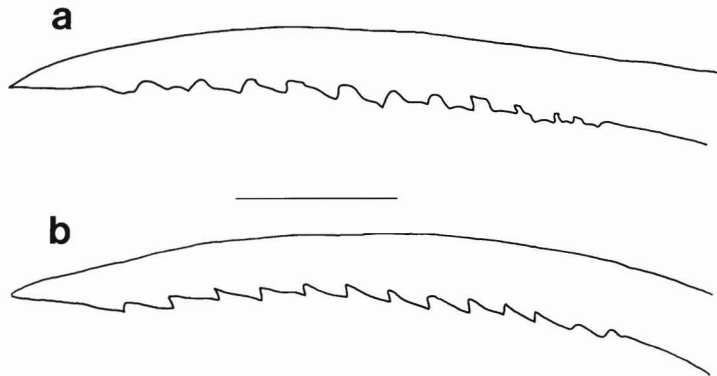


Fig. 2. Right pectoral spines of: a. *H. furcatus* (CAS 210089, paratype, 126.3 mm SL); b. *H. baramensis* (BMNH 1895.7.2:50, holotype, 133.9 mm SL). Scale bar indicates 5 mm.

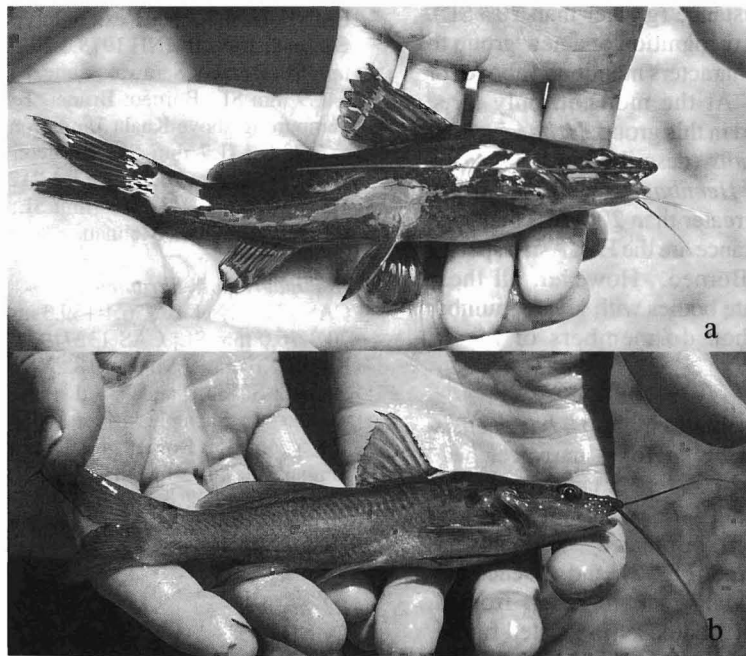


Fig. 3. Live coloration of *H. furcatus* showing: a. the dark colour morph (ZRC 40526, paratype T, 138.7 mm SL) and b. the light colour morph (ZRC 40527, paratype U, 129.9 mm SL).

or with more silty waters are darker in colour (Fig. 3b).

Distribution. - Only known from the Segama River drainage in eastern Borneo.

Ecology. - *Hemibagrus furcatus* is a relatively small species and is sexually mature at about 100 mm SL (compared to about 300 mm SL for most other *Hemibagrus* species). The ovaries of two females dissected (ZRC 40525, 128.6 mm SL; ZRC 40527, 111.2 mm SL) had numerous eggs of 1.0-1.3 mm in diameter.

Hemibagrus furcatus is generally found in deeper, slower-flowing parts ('pool' type environments greater than 50cm in depth) of fast-flowing mountain streams with sandy or rocky substrates (Martin-Smith & Laird, 1998). The fish are usually associated with hiding places such as under large boulders, tree or wood debris, or undercut banks. Very small specimens (less than 60mm SL) are occasionally found in shallow, faster-flowing water (KMMS pers. obs.). *Hemibagrus furcatus* is carnivorous and feeds on small fish, frogs, crustaceans and insects (KMMS pers. obs.)

Etymology. - From the Latin "furcatus", meaning forked; in reference to the bifurcated serrations on the pectoral spine.

Remarks. - Ng & Ng (1995) placed *H. baramensis* within an artificial grouping which consisted largely of nominal species currently treated as synonyms of *H. nemurus*. This placement is unjustified, since both *H. baramensis* and *H. sabanus* (which was not mentioned by Ng & Ng, 1995) differ from all other *Hemibagrus* species in having a combination of relatively few vertebrae (43-46) and a long-based adipose fin that span most of the postdorsal distance (greater than 20%SL). We therefore propose the recognition of a new group to include species with the characters mentioned above for the ease of discussion. At the moment, only three nominal species are placed in this group: *H. baramensis*, *H. sabanus* and *H. furcatus* (described in this study). The only other species of *Hemibagrus* with a relatively long-based adipose fin (greater than 20 %SL) that span most of the postdorsal distance are the East Asian species and *H. olyroides* from Borneo. However, all these species have more elongate bodies with greater number of vertebrae (48-60) than do members of the *H. baramensis* species group.

Hemibagrus furcatus closely resembles *H. baramensis*, but can be distinguished by having a narrower head (18.3-19.5 %SL vs. 19.8-20.6), longer caudal peduncle (18.8-20.7 %SL vs. 17.5-19.0), fewer serrations on dorsal spine (4-7 vs. 9-13), bifurcated (vs. unicuspid) serrae on the pectoral spine (Fig. 2), and absence (vs. presence) of a dark midaxial streak. It differs from *H. sabanus* in having a smaller adipose fin located further from the dorsal fin (length of adipose-fin base 21.2-26.3 %SL vs. 29.3-34.9; dorsal to adipose distance 6.3-8.6

%SL vs. 1.2-4.4), deeper caudal peduncle (9.4-10.3 %SL vs. 7.4-9.0), shorter maxillary and outer mandibular barbels (maxillary barbel length 222.2-259.7 %HL vs. 307.1-388.2; outer mandibular barbel length 86.0-109.2 %HL vs. 127.5-162.1), and the upper lobe of the caudal fin rounded posteriorly (vs. regularly tapering). The dorsal fin of *H. furcatus* also has a broader appearance. The membranes between the rays in *H. furcatus* are much broader, allowing the fin to be spread wider and giving a more rounded appearance to the fin, whereas in *H. sabanus* they are narrower with an extended second dorsal-fin ray (absent in *H. furcatus*), with the fin having a lunate appearance. These differences are valid for the entire series of specimens examined, which includes juveniles.

Hemibagrus baramensis is a poorly-known species and most previous records of this taxon are in doubt. We examined specimens reported as this species by Inger & Chin (1962) and Lim & Wong (1994) from the Kalabakan and Kinabatangan River drainages in Sabah, and they are not conspecific with the holotype of *H. baramensis*. They belong to another undescribed species currently being described in the revision of the genus. The material reported from the Baram River drainage by Watson & Balon (1984) consists of three species: *H. baramensis*, *H. bongan* and *H. nemurus*. It is part of this material, together with fresh specimens of *H. baramensis* collected from the Baram River drainage, which enabled us to permit proper comparison of *H. furcatus* with *H. baramensis*.

Comparative material

H. baramensis

BMNH 1895.7.2:50, 1 ex., holotype, 133.9 mm SL; Borneo: Baram district. BMNH 1978.3.20.291-292, 2 ex., 155.6-155.8 mm SL; Borneo: Sarawak, Sungai Tutoh. - ZRC 31799, 1 ex., 141.9 mm SL; Borneo: Brunei, Temburong District, Sungai Temburong above Kuala Temburong. - ZRC 36148-36156, 9 ex., 73.0-141.7 mm SL; Borneo: Sarawak, Sungai Baram drainage, Sungai Pahang (3°22'12"N 114°56'18"E). ZRC 42742, 2 ex., 141.9-150.0 mm SL; Borneo: Sarawak, Mulu, tributary of Sungai Melinau.

Hemibagrus aff. baramensis

CAS 132711, 11 ex., 56.4-159.3 mm SL; CAS 132713, 2 ex., 70.3-76.0 mm SL; CAS 132719, 1 ex., 85.4 mm SL; Sabah: Kabili River. - FMNH 51825, 9 ex., 57.0-140.9 mm SL; Borneo: Sabah, Sandakan district, Sapagaya forest reserve, tributary of Sapagaya River. - FMNH 68059, 12 ex., 17.7-168.5 mm SL; Borneo: Sabah, Tawau district, Kalabakan, Sungai Marikut. - FMNH 68060, 19 ex., 29.8-129.5 mm SL; FMNH 68091, 2 ex., 109.1-128.7 mm SL; Borneo: Sabah, Tawau district, Kalabakan, Sungai Tibas camp, Sungai Tawan (4°25'N 117°28'E).

H. sabanus

FMNH 68088, 1 ex., holotype, 118.5 mm SL; FMNH 68061, 1 ex., paratype, 97.5 mm SL; FMNH 68062, 5 ex., paratypes, 47.7-93.3 mm SL; FMNH 68085, 1 ex., paratype, 151.6 mm SL; FMNH 68086, 1 ex., paratype, 130.7 mm SL; FMNH

68087, 1 ex., paratype, 94.8 mm SL; BMNH 1958.4.28.5, 1 ex., paratype, 122.2 mm SL; Borneo: Sabah, Kinabatangan District, Kinabatangan river at Deramakot camp. - ZRC 40493, 1 ex., 104.9 mm SL; Borneo: Sabah, lower Segama river at Bukit Belacong. - ZRC 41190, 1 ex., 93.2 mm SL; Borneo: Sabah, Sungai Kinabatangan at Sukau. - ZRC 42741, 6 ex., 93.2-110.5 mm SL; Borneo: Sabah, Sungai Segama, small village on road to Sungai Kinabatangan. - ZRC 42743, 6 ex., 105.0-142.6 mm SL; Borneo: Sabah, Sandakan, Sungai Kinabatangan at Pekan Bukit Garam.

ACKNOWLEDGEMENTS

We thank the following: Goh Yan Yih for obtaining most of the type series and initiating the study, Tan Heok Hui for assistance in field work and taking the photograph; Lindsay Laird, Adrian Marshall and John Salleh bin Otong for assistance in field work; Darrell Siebert (BMNH), David Catania (CAS), Mary Anne Rogers (FMNH), and Kelvin Lim (ZRC) for the loan of material under their care. Fieldwork for the second author was supported by grants 1228B from the British Ecological Society and 95/31/13 from Fauna and Flora International, as well as financial assistance from the Royal Society. A short-term visitor grant to the first author from the Smithsonian Institution and research grants RP 960314 and RP 3982327 to Peter K. L. Ng from the National University of Singapore have provided additional support for this project.

LITERATURE CITED

- Bleeker, P., 1862. *Atlas Ichthyologique des Indes Orientales Néerlandaises. Tome 2. Siluroïdes, Chacoides et Hétérobranchoïdes*. Frederic Muller, Amsterdam, 112 pp., pls. 49-101.
- Chin, P. K., 1990. The Freshwater Fishes of North Borneo. Supplementary Chapter. In: Inger & Chin, *The freshwater fishes of North Borneo* (reprinted). Pp. SC1-SC47. Sabah Zoological Society, Kota Kinabalu.
- Chin, P. K. & A. Samat, 1995. Freshwater fishes of Danum Valley, Sabah. *Sabah Soc. J.*, **12**: 17-46.
- Cuvier, G. & A. Valenciennes, 1840. *Histoire Naturelle des Poissons. Tome 14*. Pitois-Levrault, Paris, 464 pp., pls. 389-420.
- Eschmeyer, W., 1998. *Catalog of Fishes*. California Academy of Sciences, San Francisco, 2905 pp.
- Günther, A., 1864. *Catalogue of Fishes in the British Museum. Vol. 5*. Trustees of the British Museum, London, xxii + 455 pp.
- Inger, R. F. & P. K. Chin, 1959. New species of fresh-water catfishes from North Borneo. *Fieldiana: Zool.*, **39**: 279-296.
- Inger, R. F. & P. K. Chin, 1962. The freshwater fishes of North Borneo. *Fieldiana: Zool.*, **45**: 1-268.
- Lim, K. K. P. & A. Wong, 1994. Fishes of the Kinabatangan basin, Sandakan district, Sabah, East Malaysia. *Sabah Mus. J.*, **1**: 39-71.
- Martin-Smith, K. M., 1996. Identification of morphological guilds in stream fish communities and their application in the estimation of biomass. *Malaysian J. Sci.*, **17**(A): 49-57.
- Martin-Smith, K. M., 1998. Relationships between fishes and habitat in rainforest streams in Sabah, Malaysia. *J. Fish Biol.*, **52**: 458-482.
- Martin-Smith, K. M. & L. M. Laird, 1998. Depauperate freshwater fish communities in Sabah: the role of barriers to movement and habitat quality. *J. Fish Biol.*, **53** (Suppl. A): 331-344.
- Martin-Smith, K. M. & H. H. Tan, 1998. Diversity of freshwater fishes from Eastern Sabah: annotated checklist for Danum Valley and a consideration of inter- and intra-catchment variability. *Raffles Bull. Zool.*, **46**: 573-604.
- Mo, T., 1991. Anatomy, relationships and systematics of the Bagridae (Teleostei: Siluroidei) with a hypothesis of siluroid phylogeny. *Thesis Zool.* **17**: 1-216 and 63 figs.
- Ng, H. H. & J. J. Dodson, 1999. Morphological and genetic descriptions of a new species of catfish, *Hemibagrus chrysops*, from Sarawak, East Malaysia, with an assessment of phylogenetic relationships (Teleostei: Bagridae). *Raffles Bull. Zool.*, **47**: 45-57.
- Ng, P. K. L. & H. H. Ng, 1995. *Hemibagrus gracilis*, a new species of large riverine catfish (Teleostei: Bagridae) from Peninsular Malaysia. *Raffles Bull. Zool.*, **43**: 133-142.
- Regan, C. T., 1906. Descriptions of five new freshwater fishes from Sarawak, Borneo, collected by Dr. C. Hose. *Ann. Mag. Nat. Hist.*, Ser. 7, **18**: 66-68.
- Roberts, T. R., 1994. Systematic revision of Asian bagrid catfishes of the genus *Mystus* sensu stricto, with a new species from Thailand and Cambodia. *Ichthyol. Explor. Freshwaters*, **5**: 241-256.
- Watson, D. J. & E. K. Balon, 1984. Structure and production of fish communities in tropical rain forest streams of northern Borneo. *Can. J. Zool.*, **62**: 927-940.