THE RAFFLES BULLETIN OF ZOOLOGY 1996 **44**(1): 143-155

REDESCRIPTION OF *BETTA BELLICA* SAUVAGE, 1884 (TELEOSTEI: BELONTIIDAE), WITH DESCRIPTION OF A NEW ALLIED SPECIES FROM SUMATRA

H. H. Tan and **P. K. L. Ng**

ABSTRACT. - *Betta bellica* Sauvage, 1884, is redescribed on the basis of recent material from the type locality in Peninsular Malaysia. The status of two junior synonyms, *B. fasciata* Regan, 1910, and *B. bleekeri* Regan, 1910, are clarified. The type material of *B. fasciata* Regan, 1910, contains two species, and a lectotype is selected, confirming *B. fasciata* as a junior subjective synonym of *B. bellica*. *Betta bleekeri* Regan, 1910, is shown to be not conspecific with *B. bellica*. A new species, closely allied to *B. bellica*, is described from blackwaters of Sumatra, Indonesia. The new species, *Betta simorum*, differs from *B. bellica* most distinctly in having a different head shape and proportionately longer pelvic fins. To ensure stability of the taxonomy of *B. bellica* and the new species from Sumatra, a neotype is designated for *Betta bellica*.

INTRODUCTION

Betta bellica was described by Sauvage (1884) from a single specimen collected from Perak, Peninsular Malaysia. No specific locality data was provided. Regan (1910) subsequently described two new species, *B. bleekeri* (no specific locality) and *B. fasciata* (from Sumatra), which have been regarded as subjective synonyms of *B. bellica* by Witte & Schmidt (1992). Recently, a good series of specimens which closely resemble *B. bellica* were collected from Jambi province, Sumatra. These were compared with specimens of *B. bellica* from Peninsular Malaysia and *B. fasciata* from Sumatra. The specimens from Jambi are here recognised as a new species.

The present paper serves to describe the new species, here named *B. simorum*. It also provides a redescription of *B. bellica* Sauvage, 1884, with designation of a neotype for the species and the synonymy of *B. bleekeri* and *B. fasciata* with *B. bellica* is also discussed.

H. H. Tan, P. K. L. Ng - Department of Zoology, National University of Singapore, Kent Ridge, Singapore 119260, Republic of Singapore.

MATERIAL AND METHODS

Specimens examined are deposited in the Zoological Reference Collection (ZRC), Department of Zoology, National University of Singapore; British Museum (Natural History) (BMNH), London; Balitbang Zoologi, Museum Zoologicum Bogoriense (MZB), Bogor, Indonesia; and the collection of Maurice Kottelat (CMK).

Terminology and measurements used follow Witte & Schmidt (1992), with some modifications. Measurements are taken from point to point and predorsal scale counts are counted continuously (after Ng & Kottelat, 1994). Two new morphometric features used for this study are: i) height of anal fin (HAF) is measured corresponding to fin ray alignment beneath the dorsal depth (DD); ii) distance between the left pelvic fin origin and anal fin origin (Pl&A) (see Fig. 1).

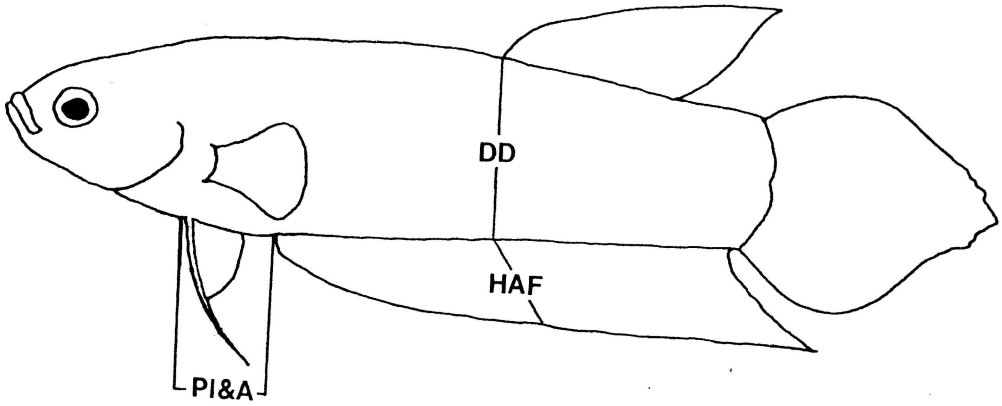

Fig. 1. Outline of fish showing three morphometric features: DD = dorsal depth; HAF = height of anal fin below dorsal depth; Pl&A = distance between origins of pelvic and anal fins.

TAXONOMY

Betta bellica Sauvage, 1884

(Figs. 2a-c; 3a, b; 4a, b)

Betta bellica Sauvage, 1884: 217; Regan, 1910: 779; Weber & de Beaufort, 1922: 363 (discussion only); Herre, 1940: 43 (key only); Kottelat, 1989: 19 (list only); Witte & Schmidt, 1992: 326 (part); Ng et al., 1992: 28; Kottelat et al., 1993: 161 (part), pl. 75; Ng et al., 1994: 210.

Betta fasciata Regan, 1910: 782, pl. 75, Fig. 4; Weber & de Beaufort, 1922: 362; Herre, 1940: 42 (key only); Witte & Schmidt, 1992: 326.

Material examined. - Neotype - ZRC 39196, 51.4 mm SL male, Malaysia: Selangor, north Selangor peat swamp forest, adjacent to Perak, 43 km towards Sungai Besar (3° 39' 12.9" N 101° 18' 00.4" E), coll. D. S. L. Chung et al., Sep.1993.

Other material - ZRC 39253, (2 ex., 43.2-44.1 mm SL, Aug.1992.), - ZRC 39254 (1 ex., 54.4 mm SL, Sep.1992.), - ZRC 39255 (3 ex., 43.9-48.3 mm SL, Jul.1993.), - ZRC 39256 (1 ex., 49.8 mm SL, Sep.1993.), - ZRC 39262 (3 ex., 39.0-40.7 mm SL, Jul.1993.), same locality data as neotype. — ZRC 39257 (1 ex., 49.4 mm SL, Jul.1993.), - ZRC 39258 (7 ex., 39.1-57.6 mm SL, Sep.1993.), - ZRC 39263 (1 ex., 48.6 mm SL, Mar.1993.), Malaysia: Selangor, north Selangor peat swamp forest, streams running parallel to road at 46.5 km towards Sungai Besar (3°39'51.4"N 101°19'43.0"E), coll. D. S. L. Chung et al. — ZRC 39259 (1 ex., 49.4 mm SL, Sep.1992.), - ZRC 39260 (1 ex., 54.3 mm SL, Jul.1993.), - ZRC 39261 (2 ex., 46.0-49.7 mm SL, Sep.1993.), Malaysia: Selangor, north Selangor

peat swamp forest, stream parallel to road at 47.6 km towards Sungai Besar (3°40'12.7"N 101°20'10.2"E), coll. D. S. L. Chung et al. — ZRC 15059 (1 ex., 56.1 mm SL), Malaysia: Selangor, north Selangor peat swamp forest, stream at 43 km mark on road to Sg. Besar, coll. 1991-92 Honours class, 19 Jun.1991. — ZRC 39577 (2 ex., 39.8-47.7 mm SL), Malaysia: Selangor, north Selangor peat swamp forest, stream at 43 km mark on road to Sg. Besar, coll. P. K. L. Ng et al., Sep.1994. — ZRC 39578 (2 juv.), Malaysia: Selangor, north Selangor peat swamp forest, road from Sg. Besar to Tanjung Malim, 0.65 km from 35 km stone, coll. P. K. L. Ng et al., Sep.1994. — ZRC 38274 (1 juv.), Malaysia: Selangor, north Selangor peat swamp forest, coll. P. K. L. Ng et al., Sep.1994. — ZRC 15053-54 (2 juv.), Peninsular Malaysia, north Selangor peat swamp forest, stream at 34 km mark on road to Tanjung Malim, coll. NUS 1991-92 Honours class, 17 Jun.1991. — ZRC 16700 (1 juv.), - ZRC 15055-58 (4 juv.), Malaysia: Selangor, north Selangor peat swamp forest, stream at 50 km mark to Tanjung Malim (United Plantations Berhad), coll. NUS 1991-92 Honours class, 18 Jun.1991. — ZRC 17374-76 (3 juv.), Malaysia: Selangor, north Selangor peat swamp forest, coll. P. K. L. Ng, Aug.1991. — ZRC 39195 (1 ex., 47.7 mm SL), Malaysia: Selangor, north Selangor peat swamp forest, stream running through edge of United Plantations, coll. D. S. L. Chung et al., Sep.1993. — ZRC 28636-37 (2 ex., 48.2-58.0 mm SL), Malaysia: Johor, Segamat, aquarium collectors, Oct.1992. — ZRC 29126 (1 ex., 39.5 mm SL), - ZRC 29052 (1 juv.), Malaysia: Johor, Pontian, Sri Bunian, Kg. Pt. Tekong, blackwater stream, coll. P. K. L. Ng et al., 8 May.1992. — ZRC 28799-800 (2 juv.), Malaysia: Johor, near Pontian, Tenggoyon (between Pekan Nanas and Kukup), coll. P. K. L. Ng et al., 4 Mar.1992. — ZRC 21949-50 (2 juv.), Malaysia: Johor, 56 km Pontian-Johor Bahru road, blackwater stream, coll. K. K. P. Lim & D. S. L. Chung, 14 May.1992. — ZRC 17377-79 (3 juv.), Malaysia: Johor, about 2 km north of Ayer Hitam, blackwater stream, coll. P. K. L. Ng & K. K. P. Lim, 23 May.1991. — ZRC 17373 (1 juv.), Malaysia: Johor, about 2 km north of Ayer Hitam, in swamp forest, coll. P. K. L. Ng & K. K. P. Lim, 23 May.1991. — ZRC 28676-77 (2 juv.), Malaysia: Pahang, pool along Mersing-Pekan road (73 km to Kuantan, 400 m to Sg. Beto), coll. M. Kottelat & P. K. L. Ng, 9 Mar.1992. — ZRC 25674-76 (3 juv.), Malaysia: Pahang, 69 km, Mersing-Kuantan road, blackwater stream, coll. P. K. L. Ng et al., 10 Mar.1992. — ZRC 29408 (1 ex., 42.8 mm SL), Malaysia: Pahang, Pekan road, 66 km from Mersing to Kuantan road, blackwater stream, coll. P. K. L. Ng et al., 24 Jul.1992.

Betta fasciata - Lectotype - BMNH 1889.12.26:30, 69.1 mm SL, Indonesia: Sumatra, Deli (Medan), coll. Iversen.

Description. - General body shape and appearance as shown in Fig. 3a, b. Body long, slender, dorsal depth 23.7-26.2% SL; head length 26.0-28.0% SL; head blunt, small; operculum without iridescent scales; body brown with green iridescence on scales; caudal round with median rays extended, dorsal and anal pointed, pelvic filamentous, flange (narrow membrane) on first simple pelvic ray ends abruptly before one-third of ray (Fig. 2b). Scale counts: lateral 33-34, dorsal depth $8^{1}/_{2}$-9, predorsal 24-26, subdorsal 9-10, postdorsal 7-9. Fin ray counts: dorsal I, 11-12, caudal ii, 5+6, ii, anal I-II, 29-31, pelvic I, 1, 4, pectoral 12-13. Vertebral formula 2+8-9+22-23 (total 32-33, mode 33) (n=10). Morphometrics and counts of neotype of *B. bellica* as in Table 1; lateral head profile as in Fig. 2a.

Sexual dimorphism. - Males have more iridescent (and more intense) green scales on the body and have proportionately longer anal, dorsal and caudal fins, with longest rays appearing filamentous (Fig. 3a, b). In preserved specimens, the body is a uniform greyish-brown (Fig. 4a).

Distribution. - This species is widely distributed in Peninsular Malaysia: Terengganu (present study), Perak (Sauvage, 1884), Selangor (Ng et al., 1992), Pahang (Ng & Kottelat, 1994) and Johor (Vierke, 1987). It is also found near Medan, Sumatra (Regan, 1910, as *B. fasciata*) (see Fig. 5).

Ecology. - *Betta bellica* is usually found in blackwater habitats, although it can also occasionally be found in acid water habitats (Ng et al., 1992). *Betta* species sympatric with

it are: *B. tussyae*, *B. waseri* (Pahang), *B. hipposideros*, *B. livida* (Selangor), *B. imbellis*, *B. persephone*, *B.*cf. *pugnax* (Johor). Gut contents of wild caught specimens show a high incidence of odonate nymphs (Chung et al., 1994). Quek et al.'s (1994) study of *B. bellica* was actually based on *B. simorum* (unpublished data). Quek et al.'s study however, partially confirms both species' preference for odonate nymphs.

Betta bellica is the largest known bubblenest building *Betta*, reaching a size of 77 mm SL. Details of its spawning can be obtained from Vierke (1987, 1991) and van den Nieuwenhuizen (1993); although this is apparently not an easy fish to breed in captivity. Mohsin & Ambak (1983: 249) listed *B. bellica* as rare or extinct in Malaysia, but as recent collections show, this is incorrect. The statement probably reflects the lack of sampling in peat swamp habitats (see Ng, 1994).

Remarks. - Sauvage (1884) apparently described *Betta bellica* from only one 90 mm (TL) specimen, which is lost (Witte & Schmidt, 1992: 308; M. Kottelat, pers. comm.). Weber & de Beaufort (1922: 363) commented in a footnote that the anal fin ray count provided in the description of Sauvage (1884: 217) (37) conflicted with that derived from his figure (Sauvage, 1884: 217) (34). The highest anal fin ray count we have recorded from our Peninsular Malaysian specimens is 32 (soft rays and spines).

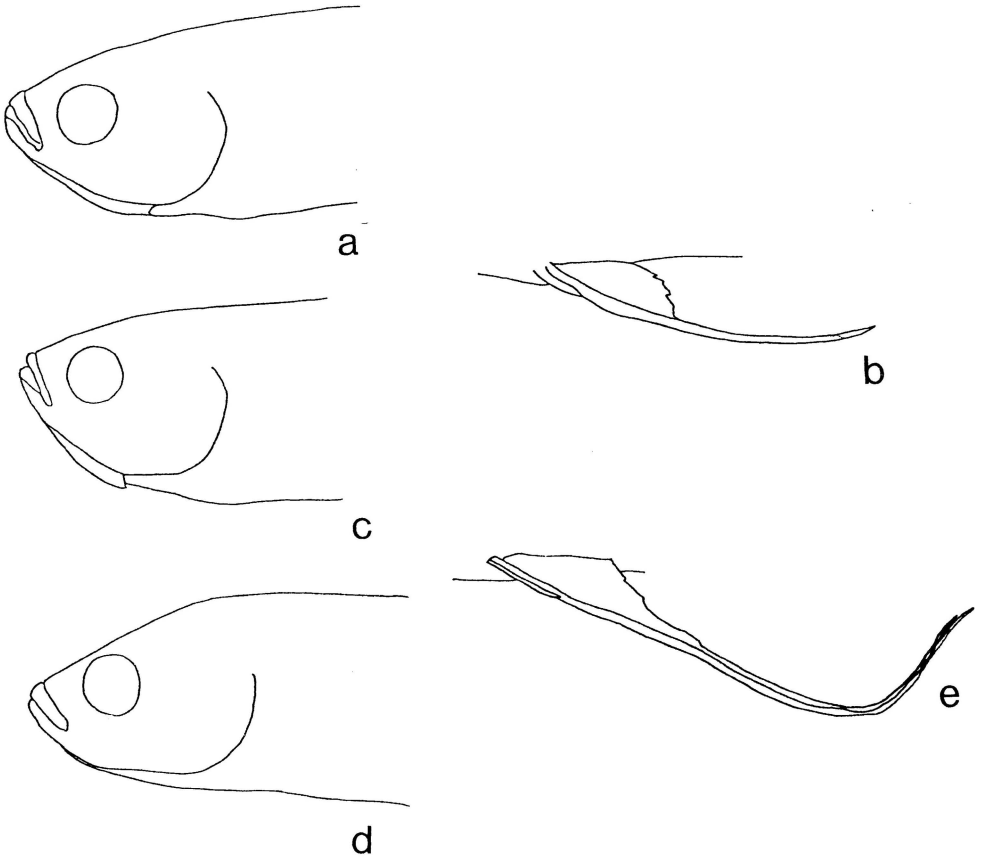

Fig. 2. Outlines of lateral head profiles and left pelvic fins. a: *Betta bellica*, neotype, ZRC 39196 (51.4 mm SL); b: pelvic fin outline of *B. bellica*, neotype; c: *B. fasciata*, lectotype, BMNH 1889.12.26:30 (69.1 mm SL); d: *B. simorum*, new species, holotype, ZRC 39628 (63.8 mm SL); e: pelvic fin outline of B. simorum, new species, holotype.

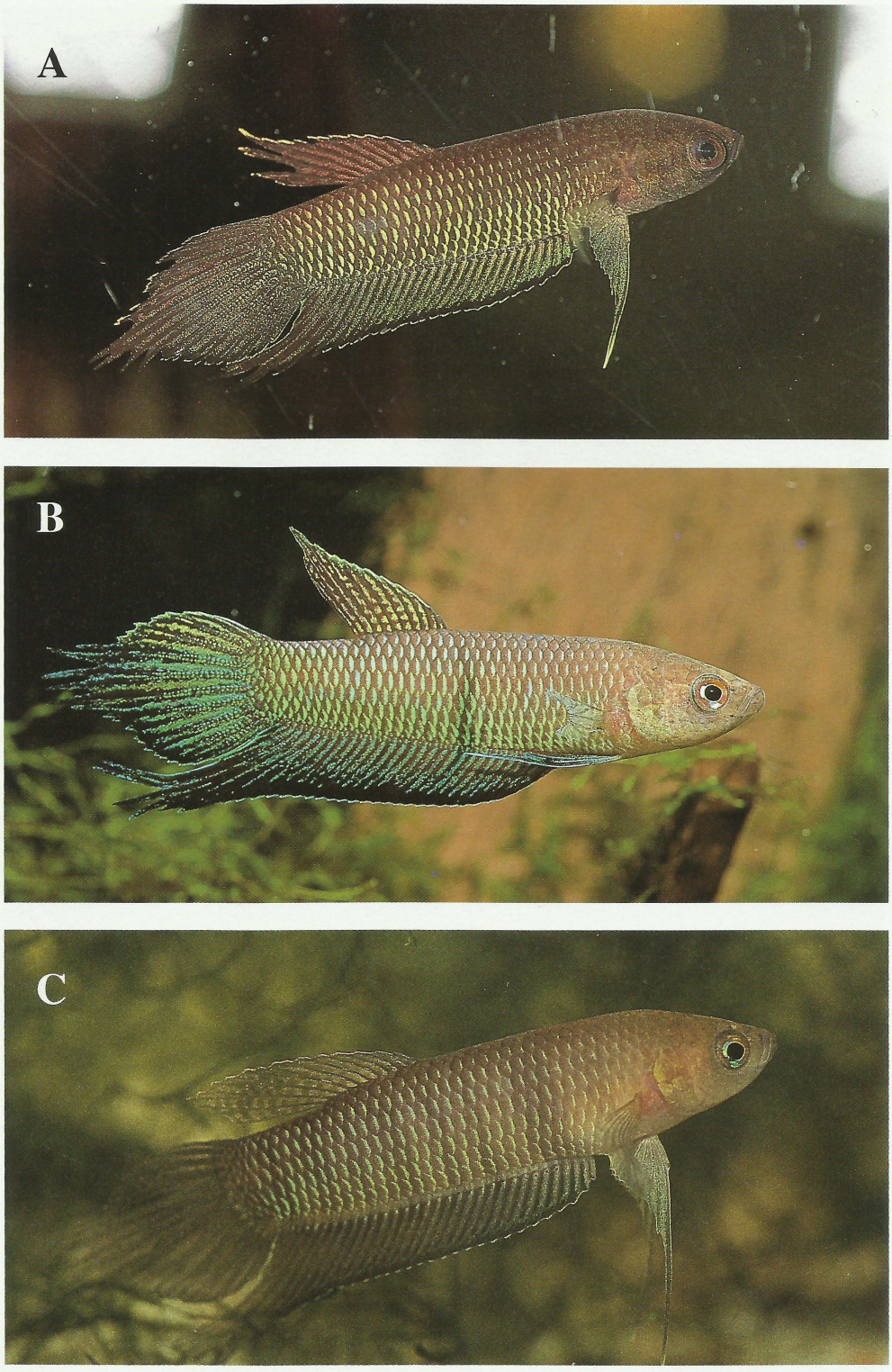

Fig. 3. Live colours: A: *Betta bellica* (male from Pontian, Johor), ZRC 29126; B: *B. bellica* (male from aquarium trade, probably from Malaysia), not preserved. (Photgraphed by Koji Yamazaki); C: *B. simorum*, new species (52.5 mm SL-male from Jambi), ZRC 39118 .

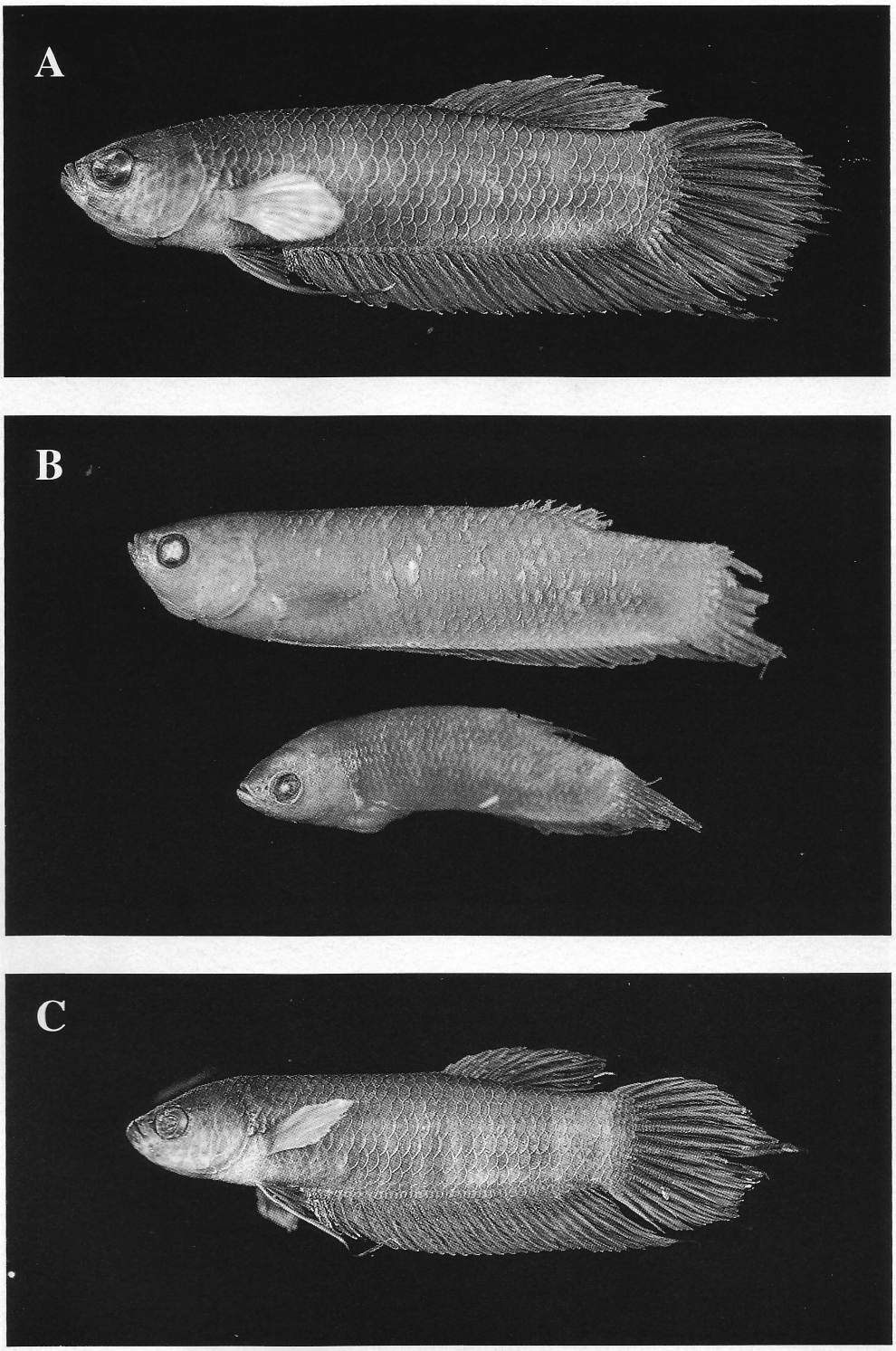

Fig. 4. Preserved specimens: A: *Betta bellica*, neotype, ZRC 39196 (51.4 mm SL-male); b: *B. fasciata* (arrow denotes lectotype - BMNH 1889.12.26:30, 69.1 mm SL), BMNH 1889.12.26:31 (46.1 mm SL); C: *B. simorum*, new species, holotype, MZB uncat (present ZRC 39628, 63.8 mm SL-male from Jambi).

Betta fasciata Regan, 1910, was described from two specimens collected from Deli (=Medan) in Sumatra. Deli is an old name for a town on the outskirts of Medan, Sumatra (Whitten et al., 1987: 41). Regan (1910) did not designate a holotype, therefore both specimens are syntypes. Weber & de Beaufort (1922) subsequently reported that *B. fasciata* was also found in Djambi (= Jambi), Sumatra. Witte & Schmidt (1992) synonymised *B. fasciata* under *B. bellica* in a very brief note but did not provide any details for this action. We examined both syntypes of *B. fasciata*, and the matter is not as straightforward. The two syntypes of *B. fasciata* actually belong to two different species. The larger syntype (69.1 mm SL, BMNH 1889.12.26:30) is clearly conspecific with *B. bellica* as defined here (see Fig. 4b, Table 1). The smaller syntype (46.1 mm SL, BMNH 1889.12.26:31) however, is clearly not *B. bellica* or any allied species. It belongs to the *B. waseri* Krummenacher, 1986,

Table 1: Meristic and Morphometric data of the *Betta bellica* species group

	Betta bellica NeotypeE ZRC 39196	*B. fasciata* Lectotype BMNH 1889 .12.26:30	Holotype ZRC 39628	*B. simorum*, new species Paratype ZRC 38549	Paratype ZRC 38549	Paratype ZRC 38549
			Vertebrae			
	2+8+22 (32)	2+8+23 (33)	2+8+23 (33)	2+9+23 (34)	2+8+23 (33)	2+8+23 (33)
Standard length (mm)	51.4	69.1	63.8	51.8	50.7	51.5
Total length (mm)	68.8	-	90.8	81.0	76.7	78.0
Head length (mm)	13.6	16.1	16.8	14.3	14.3	13.8
			Meristics - Fin Ray Counts			
Anal	I, 29	II, 30	II, 30	II, 29	II, 28	II, 31
Dorsal	I, 12	11	I, 10	I, 10	I, 10	12
Caudal	ii, 5+6, ii	ii, 5+6, ii	ii, 5+6, ii	ii, 5+6, ii	ii, 5+6, ii	ii, 5+6, ii
Pelvic	I, 1, 4	I, 1, 4	I, 1, 4	I, 1, 4	I, 1, 4	I, 1, 4
Pectoral	13	13	12	12	12	12
			Scale Counts			
Sub-dorsal	9	7	8	9	8	9
Dorsal depth	9	9	$8^1/_2$	9	9	$9^1/_2$
Lateral	33	35	34	34	$33^1/_2$	35
Pre-dorsal	26	27	27	26	27	27
Post-dorsal	8	9	9	9	10	10
			Morphometrics - % standard length			
TL	133.9	-	142.3	156.4	151.3	151.5
PDL	63.0	65.3	63.3	64.9	63.1	63.3
PAL	38.9	37.0	37.6	38.8	38.5	38.6
HL	26.5	23.3	26.3	27.6	28.2	26.8
DD	23.9	23.9	25.1	26.8	26.4	24.5
VL	32.7	19.8	41.8	48.3	42.4	42.7
AB	58.9	60.5	62.9	60.0	61.5	61.4
DB	18.7	16.2	19.6	19.1	18.9	18.8
HAF	14.4	~7.8	16.9	17.6	17.9	15.1
Pl&A	10.5	13.2	9.4	8.7	8.5	9.7
			- % head length			
O	30.1	26.1	28.0	29.4	30.1	29.7
POL	48.5	50.9	48.8	49.7	48.3	48.6
IO	33.1	32.9	31.5	32.2	30.1	31.2

Note: numbers in parenthesis denote total count.

species group based on the following meristic data: anal ray count II, 29, lateral scale count 32 and pre-dorsal scale count 24 (fide Ng & Kottelat, 1994) (Fig. 4b). The larger syntype (BMNH 1889.12.26:30) agrees best with the description and figure provided by Regan (1910: pl. 77, Fig. 4) for *B. fasciata* and is hereby designated the lectotype. Although this specimen is not in good condition, with the caudal and anal fins damaged (Fig. 4b), it is nevertheless still usable. The present lectotype designation maintains the status of *B. fasciata* Regan, 1910, as a junior subjective synonym of *B. bellica* Sauvage, 1884. The smaller syntype of *B. fasciata* (BMNH 1889.12.26:31) is a juvenile and its precise identity cannot be determined, although as noted above, it clearly belongs to the *B. waseri* species group.

The record of *B. fasciata* from Jambi reported by Weber & de Beaufort (1922) is more likely to be based on *B. simorum*, new species. From their paper, it is not certain if Weber & de Beaufort (1922) actually examined specimens from Jambi or obtained secondary information from elsewhere.

With the confirmation of *B. fasciata* Regan, 1910, as a synonym of *B. bellica* and the description of a new species (*B. simorum*) from Sumatra closely allied to *B. bellica* , where both *B. bellica* and *B. simorum* occur, a neotype designation for *B. bellica* is necessary to stabilise the taxonomy. A male specimen 51.4 mm SL (ZRC 39196) collected from the north Selangor peat swamp forest in the state of Selangor, Peninsular Malaysia (the locality is just adjacent to the state of Perak, the type locality of *B. bellica*), is hereby designated as the neotype of *B. bellica*. Attempts have been made to collect *B. bellica* from Perak, but as yet no specimens have been obtained. Much of the peat swamp forest in Perak has been destroyed and converted for agricultural, residential and industrial usage (pers. obs.).

The synonymy of *B. bleekeri* Regan, 1910, with *B. bellica* as proposed by Witte & Schmidt (1992: 326) is far more problematic. *Betta bleekeri* was described by Regan (1910: 780) on the basis of specimens which Bleeker (1877: pl. 395, fig. 3; 1879, 19: 26) identified as *Betta picta* (not *Panchax pictum* Valenciennes, in Cuvier & Valenciennes, 1846). Regan apparently did not examine any of Bleeker's specimens nor possess any of his own. He (1910: 780) remarked that "... Bleeker's description [of *B. picta*] is evidently chiefly based on specimens of the species figured in the Atlas [1877]". It was presumably on the basis of Bleeker's (1877: pl. 395, fig. 3) figure that Regan felt that Bleeker's specimens did not belong to *B. picta* but to a new taxon, for which he applied the name *Betta bleekeri*.

As Regan (1910) did not designate a type and made reference to two of Bleeker's (1877, 1879) papers in naming *B. bleekeri*, all of the specimens listed by Bleeker in his two papers should be regarded as syntypes. This unfortunately poses serious problems. In Bleeker's (1877) publication, the illustration identified as *B. picta* (presumably a life-sized figure) was not accompanied by any text which would indicate the number of specimens he had, their sizes, or where they were collected. In his next paper, Bleeker (1879: 27) listed *Macropodus pugnax* Cantor, 1850 (type locality Pinang, Malaysia) (now *Betta pugnax*), *Betta trifasciata* Bleeker, 1850 (type locality Java, Indonesia) and *B. anabatoides* Bleeker, 1851 (type locality Borneo), as synonyms of *B. picta*, and listed the following localities for the species - "Sumatra (Palembang, Moara Kompeh, Lahat); Pinang; Singapura; Bangka; (Muntok, Marawang, Tobali); Biliton (Tjinitjap, Buitenzorg, Sading meton, Tjipanas, Pandjallis, Garut, Ambarawa); Borneo (Bandjermasin, Kahajan, Sambas)" (Bleeker, 1879: 27). Bleeker (1879: 27) noted he had 130 specimens between 40 mm to 112 mm (probably total length) but did not indicate where these came from. Neither was it clear if Bleeker actually had specimens from all these localities or he had included data from the literature (e.g. for *B. pugnax* from Pinang).

He also did not specify from which specimens the meristic and morphometric data he provided came from.

This is most problematic for selecting a lectotype or clarifying the identity of *B. bleekeri*. From Bleeker's (1877) figure of "*B. picta*" however, it is most unlikely that it is conspecific with *B. bellica*. From the general morphology of the specimen figured, as well its meristics and morphometrics (see Table 1), it belongs to the *B. waseri* species group as defined by Ng & Kottelat (1994). Interestingly, Witte & Schmidt (1992: 326) regarded the figure of *B. bleekeri* in Bleeker's Atlas (1877, 9: pl. 395, fig. 3) as coming close to *B. patoti* Weber & de Beaufort, 1922, but they nevertheless provisionally synonymised *B. bleekeri* under *B. bellica*, arguing that one Bleeker specimen of "*B. picta*" (RMNH 10741) they had, presumably from Sumatra, matched *B. bellica*. Whether this specimen is *B. bellica* cannot be confirmed. The selection of a lectotype from the extant syntypes of *B. bleekeri* however, would not solve the nomenclatural and taxonomic problems associated with this species satisfactorily. This is the case since the large number of specimens from many localities listed by Bleeker (1879), as well as the very large "variation" in the meristic and morphometric data he provided, makes it clear that Bleeker's material (or concept of *B. picta*) contained specimens of several species. The selection of the figure in Bleeker (1877 pl. 395, fig. 3) as the lectotype is not advisable as the specimen figured was apparently not an adult male (important for belontiid taxonomy) and was from an unknown locality and lacks detailed colour and colour pattern information. The present paper is not the place to deal with this and the identity of *B. bleekeri* must remain an incerta sedis. Suffice to say, however, *B. bleekeri* is not a member of the *B. bellica* species group but belongs to the *B. waseri* species group instead, if Regan's (1910) original intentions are followed.

Betta simorum, new species

(Figs. 3c, 4c)

Betta bellica - Kottelat et al., 1993: 161 (part), pl. 75 (not Sauvage, 1884).
Betta fasciata - Weber & de Beaufort, 1922: 362 (part) (not Regan, 1910).

Material examined. - Holotype - MZB. (present ZRC 39628, 63.8 mm SL-male), Indonesia, Sumatra, Jambi, swamp in Rantau Panjang, coll. M. Kottelat, 2 Jun.1994.

Paratypes - ZRC 38549 (4 ex., 44.8-51.8 mm SL) and CMK 11182 (5 ex., 49.1-68.5 mm SL), same locality as holotype. — ZRC 39118 (19 ex., 32.7-52.7 mm SL), Indonesia, Sumatra, Jambi, swamp forest near Pematang Lumut, coll. P. K. L. Ng et al., 15 Jun.1995.

Others (non types) - ZRC 38684 (1 ex., 43.8 mm SL) and CMK 11264 (3 ex., 15.3-45.4 mm SL), Indonesia, Sumatra, Jambi, swamp near Pematang Lumut, coll. M. Kottelat, 7 Jun.1994. — ZRC 39015 (16 ex., 42.6-60.3 mm SL), Indonesia, Sumatra, Jambi, from aquarium collectors, 13 Jun.1995. — ZRC 39249 (2 ex., 50.3-52.1 mm SL), Indonesia, Sumatra, Riau, peat swamp draining into Sungai Bengkwan, tributary of Indragiri River, coll. H. H. Ng, S. H. Tan et al., Jun.1995. — ZRC 39672 (17 ex., 55.2-73.5 mm SL), Indonesia, Sumatra, Jambi, from aquarium trade, 6 Mar.1996. — ZRC 39673 (21 ex., 53.1-70.5 mm SL), Indonesia, Sumatra, Jambi, from aquarium trade, 12 Mar.1996.

Diagnosis. - *Betta simorum* differs from *B. bellica* in lateral scale count (mode 34 vs. 33), postdorsal scale count (mode 9 vs. 8), dorsal depth (mean 25.9 vs. 24.6 %SL), longer flange on first pelvic simple ray, pelvic fin length (mean 42.2 vs. 31.4 %SL), height of anal fin (mean 16.4 vs. 13.9 %SL), distance between pelvic and anal fin origin (mean 9.9 vs. 11.2 %SL), inter-orbital distance (mean 31.1 vs. 32.1 %HL) and a more sloping lateral head profile (Table 2, Fig. 2d).

Table 2. Differences between *Betta bellica* and *B. simorum*, new species

	Betta bellica	*Betta simorum*, new species
	Meristics	
Lateral scale count	33-34 (33)	$33^{1}/_{2}$-35 (34)
Post-dorsal scale count	7-9 (8)	9-10 (9)
	Morphometrics %	
SLTotal length	133.9-150.1 (138.2±5.1)	131.1-156.4 (145.0±6.9)
Dorsal depth	23.7-26.2 (24.6±0.9)	24.5-27.4 (25.9±1.0)
Ventral (pelvic) fin length	23.6-38.8 (31.4±4.7)	31.3-48.3 (42.2±4.3)
Height of anal fin at dorsal depth	11.4-15.9 (13.9±1.6)	12.7-19.4 (16.4±1.6)
Distance between pelvic and anal fin origins	10.5-12.6 (11.2±0.7)	8.5-13.1 (9.9±1.2)
	Morphometrics % HL	
Inter-orbital distance	29.5-33.6 (32.1±1.5)	30.0-33.3 (31.1±1.0)
	Descriptives	
Lateral head profile	Rounded; no hump (Fig. 2a).	Slight concavity; prominent hump in large specimens, just after the eye (Fig. 2c).
Snout (dorsal view)	Relatively blunt.	Relatively sharper.
Pelvic fin	Extends up to anal ray 8 (Fig. 4a).	Filamentous, extends up to anal ray 14 (Fig. 4c).
	Flange of first simple pelvic ray ends abruptly midway (Fig.2b)	Flange of first simple pelvic ray ends two-thirds down (Fig. 2e).
Height of anal fin	Relatively short (Fig. 4a).	Relatively deep (Fig. 4c).
Distance between pelvic and anal fin origins (adult specimens)	Distinct distance between the two fins (10.5-12.6 % SL) (Fig. 4a).	Distance between the two fins smaller (8.5-13.1 % SL) (Fig. 4a).
	No overlap of posterior part of pelvic with anterior part of anal (Fig. 4a).	Overlap of posterior part of pelvic with anterior part of anal (Fig. 4a).

**Betta bellica* (n=7); *Betta simorum* (n=15)
Numbers in parenthesis denotes either mode or mean with standard deviation.

Description. - General body shape and appearance as shown in Fig. 3c, 4c. Body long, slender, dorsal depth 24.5-27.4% SL; head length 25.2-28.2% SL; head blunt, relatively small, but sharper with hump after eye; operculum without iridescent scales; body brown with green iridescence on scales; caudal round with median rays extended, dorsal and anal pointed, pelvic filamentous, flange on first simple pelvic ray ends two-thirds down the ray (Fig. 2e). Scale counts: lateral $33^{1}/_{2}$-35, dorsal depth $8^{1}/_{2}$-$9^{1}/_{2}$, predorsal 24-27, subdorsal 8-9, postdorsal 9-10. Fin ray counts: dorsal I, 10-12, caudal ii, 5+6, ii, anal II, 28-31, pelvic I, 1, 4, pectoral 12-13. Vertebral formula 2+8-9+23 (total 33[5]-34[5]) (n=10) (see Table 1 for other data).

Sexual dimorphism. - Males possess longer anal, dorsal and caudal fins than females, and more numerous and intense iridescent green scales.

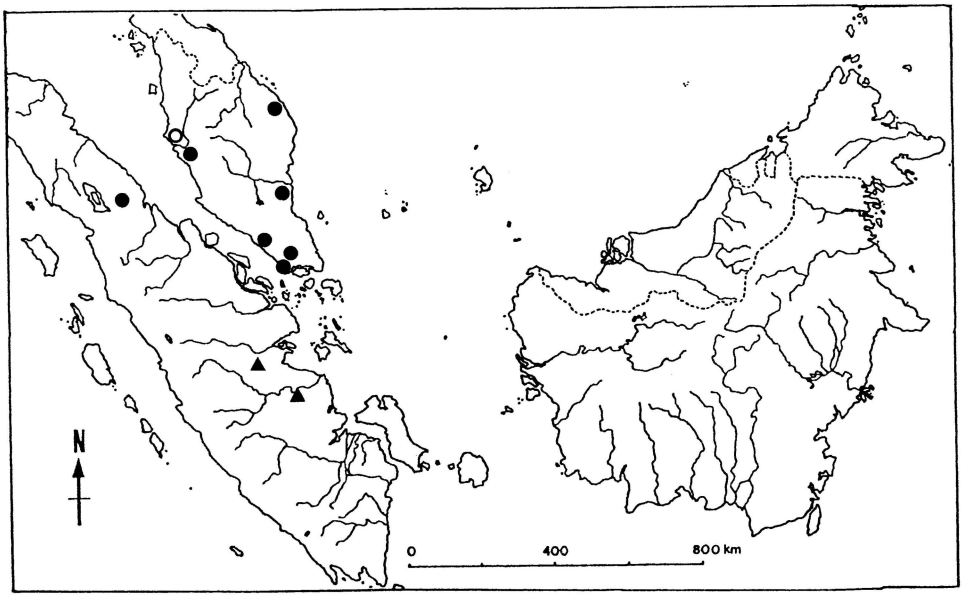

Fig. 5: Map showing distributions of *Betta bellica* and *B. simorum*, new species (solid symbols represent specimens examined, hollow symbols represent literature citations)

Distribution. - This species is found, thus far, in the provinces of Jambi and Riau (Indragiri basin) (Weber & de Beaufort, 1922; pers. obs.).

Ecology. - *Betta simorum* occurs, so far as is known, in blackwater habitats only. It is found in shallow parts of peat swamp forest amongst thick leaf litter and overhanging vegetation, which are slow-flowing to stagnant. Other sympatric belontiids are: *Belontia hasseltii*, *Betta coccina*, *B.* cf. *fusca*, *B.* cf. *waseri*, *Parosphromenus sumatranus*, *Sphaerichthys osphromenoides* and *Trichogaster leerii*. In captivity, *B. simorum* is not an active swimmer, preferring to rest on its belly on plants and substratum. The diet preference of this species, investigated by Quek et al. (1994) (as *B. bellica*) was for odonate nymphs.

Etymology. - The fish is named after Thomas G. K. Sim and his wife, Farah, proprietors of Sindo Aquarium Pte. Ltd., for being such excellent hosts during our stays in Jambi.

Remarks. - The geographical distributions of *B. bellica* and *B. simorum* are interesting. *Betta bellica* occurs in many parts of Peninsular Malaysia, as well as in the northeastern part of Sumatra (Deli area) (Fig. 5). *Betta simorum* is found further south on the east coast of Sumatra in Jambi and the Indragiri Basin, Riau Province (Fig. 5). Both species inhabit blackwaters of peat swamp forests, which typically have a pH of between 3 and 4.

Betta simorum is a commercially valuable aquarium fish. Every dry season large numbers are exported. The species is not caught by net or by hook and line, but with native cane cages or bubus. These are baited with dead fish and left overnight in the swamps (Thomas Sim, pers. comm.). Singapore, a major ornamental fish trade centre, receives large consignments of *B. simorum* from Sumatra, which are then re-directed to overseas markets in Europe and Japan.

ACKNOWLEDGEMENTS

We are grateful to the following: Mrs. C. M. Yang (ZRC) for access to the material under her care; Kelvin K. P. Lim for his advice and suggestions; Maurice Kottelat for his discussions on *Betta* matters and loan of specimens; Darrell Siebert (BMNH) for the loan of material; Daphne S. L. Chung for providing the neotype specimen of *Betta bellica*; Thomas and Farah Sim for their hospitality and showing us the gastronomic delights of Jambi; S. C. Yong (Department of Anatomy, National University of Singapore) and S. H. Tan for radiographing the specimens; Daphne S. L. Chung, H. H. Ng, Tommy H. T. Tan and S. H. Tan, for their help in the collection of the specimens; and Koji Yamazaki, for providing the picture of *Betta bellica*. This paper was supported by research grant RP 910410 to the second author from the National University of Singapore. This is contribution no. 96/3 for the Systematics & Ecology Laboratory, Department of Zoology, National University of Singapore.

LITERATURE CITED

Bleeker, P., 1877. *Atlas Ichthyologique des Indes orientales néérlandaises*, Frederic Muller, Amsterdam **9**: 1-80, pls. 355-360, 363-420.

Bleeker, P., 1879. Mémoire sur les Poissons à Pharyngiens Labyrinthiformes de L'inde Archipélagique. *Natuurk. Verh. der Koninkl. Akademie*, **19**: 1-56.

Chung, D. S. L., P. K. L. Ng & D. H. Murphy, 1994. Preliminary studies of the feeding ecology of blackwater Belontiidae of North Selangor, Peninsular Malaysia. In: *Proceedings - Fourth Indo-Pacific Fish Conference*. Bangkok, Thailand, 28 Nov. - 4 Dec. 1993, 502 pp.

Herre, A. W. C. T., 1940. Additions to the fish fauna of Malaya and notes on rare or little known Malayan and Bornean fishes. *Bull. Raffles Mus.*, **16**: 27-61.

Kottelat, M., 1989. Zoogeography of the fishes from Indochinese inland waters with an annotated check-list. *Bull. Zool. Mus. Univ. Amsterdam*, **12**(1): 1-56.

Kottelat, M., A. J. Whitten, S. N. Kartikasari & S. Wirjoatmodjo, 1993. *Freshwater Fishes of Western Indonesia and Sulawesi*. Periplus Editions (HK) Ltd., 221 pp., 84 pls.

Kottelat, M. & P. K. L. Ng, 1994. Diagnoses of five new species of fighting fishes from Banka and Borneo (Teleostei: Belontiidae). *Ichthyol. Explor. Freshwaters* **5**: 65-78.

Mohsin, A. K. M. & M. A. Ambak, 1983. *Freshwater fishes of Peninsular Malaysia*. Penerbit Universiti Pertanian Malaysia, 284 pp.

Ng, P. K. L., J. B. Tay, K. K. P. Lim & C. M. Yang, 1992. *The conservation of the fish and other aquatic fauna of the north Selangor peat swamp forest and adjacent areas*. Asian Wetland Bureau, Natn. Univ. Singapore, World Wide Fund for Nature-Malaysia & Univ. Malaya; 90 pp., 110 figs.

Ng, P. K. L., 1994. Peat swamp fishes of Southeast Asia - diversity under threat. *Wallaceana*, **73**: 1-5.

Ng, P. K. L. & M. Kottelat, 1994. Revision of the *Betta waseri* species group (Teleostei: Belontiidae). *Raffles Bull. Zool.*, **42**(3): 593-611.

Ng, P. K. L., J. B. Tay & K. K. P. Lim, 1994. Diversity and conservation of blackwater fishes in Peninsular Malaysia, particularly in the North Selangor peat swamp forest. *Hydrobiologia*, **285**: 203-218.

Nieuwenhuizen, van den, A., 1993. *Betta bellica*. *Aquar. Terrar. Zeitschr.*, **46**: 365-369.

Quek, T.-L., P. K. L. Ng & D. S. L. Chung, 1994. The feeding preferences of the swamp fighting fish *Betta bellica*. *Proc. Sci. Res. Congr.*, Natn. Univ. Singapore, 1994, **7**: 247-252.

Regan, C. T., 1910. The Asiatic fishes of the family Anabantidae. *Proc. Zool. Soc. London*, 1909[1910]:767-787, pls. 77-79.

Sauvage, H.-E., 1884. Note sur une collection de poissons recueillie à Pérak, presquîle de Malacca. *Bull. Soc. Zool. France*, **9**: 216-220.

Vierke, J., 1987. Breeding *Betta bellica*. *Trop. Fish Hobbyist magazine*, 1987: 10-15.

Vierke, J., 1991. Brutplflegestrategien bei Belontiiden (Pisces, Anabantoidei). *Bonn. Zool. Beitr.*, **42**: 299-324.

Weber, M & L. F. de Beaufort, 1922. *The fishes of the Indo-Australian archipelago*. **4**. Brill, Leiden, xiii + 410 pp.

Whitten, A. J., S. J. Damanik, J. Anwar & N. Hisyam, 1987. *The Ecology of Sumatra*. Gadjah Mada Univ. Press, i-xvii, 583 pp.

Witte, K.-E. & J. Schmidt, 1992. *Betta brownorum*, a new species of anabantoids (Teleostei: Belontiidae) from northwestern Borneo, with a key to the genus. *Ichthyol. Explor. Freshwaters*, **2**(4): 305-330.

Received 23 Feb 1996
Accepted 09 Apr 1996