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Betta omega, a new species of black water fighting fish (Teleostei: Osphronemidae) from Malaysia

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Abstract. A new species of *Betta* from the *B. waseri* group is described based on museum material, and is very likely near extinction in the wild. It is most similar to *B. hipposideros* but differs from it in having a different throat pattern in which the black markings on the lower jaw are continuous with two black downward curved bars on the anterior throat, ending with rounded expanded tips near the edge of lower jaw (vs. downward slender black bars); it further differs in the opercle being uniform brown with light dark brown mottling; in having black transverse bars on the dorsal and caudal fin interradial membranes; and in the absence of a dark distal border on anal fin.

Key words. *Betta*, new species, Malaysia, peat swamp, biodiversity

INTRODUCTION

The *Betta waseri* species group was first proposed by Ng & Kottelat (1994). They redescribed *B. waseri* Krummenacher (1986) based on fresh material from Pahang (Malaysia) and described the following new species: *B. hipposideros* from Selangor (Malaysia), *B. tomi* from Johor (Malaysia), and *B. spilotogena* from Pulau Bintan (Indonesia). Kottelat & Ng (1994) described *B. chloropharynx* from Pulau Banka (Indonesia) as part of the *B. akarensis* group, but Tan & Kottelat (1998) demonstrated that *B. chloropharynx* belongs to the *B. waseri* group. Tan (1998) described an additional two species of the *B. waseri* group, *B. pi* from Sungei Kolok (southern Thailand) and *B. renata* from central Sumatra (Indonesia). In 2009, Tan added *B. pardalotos* from South Sumatra (Indonesia) to this species group, in which it is closely allied to *B. chloropharynx*. Thus the *B. waseri* group presently consists of eight species.

Schmidt (1988) reported on specimens of *Betta macrophthalma* from the blackwater swamps in Pekan Nanas area in Johor, which he had obtained from Allan and Barbara Brown's collection. Schmidt (1988) synonymised *B. waseri* with *B. macrophthalma*, however, both species actually belong to two separate species groups, as elaborated upon by Ng & Kottelat (1994: 596). Tan & Tan (1996) discussed the status and identity of Regan's (1910) *B. macrophthalma* and synonymised it with *B. pugnax*. However, Schmidt's (1988) '*Betta macrophthalma*' is in fact a member of the *B. waseri* species group, which is diagnosed by distinct throat colour patterns, a large adult size and plain body colouration. The Pekan Nanas population was hypothesised to be a distinct species by Ng & Kottelat (1994), but due to lack of specimens, they did not progress further. Schmidt (1998) depicted the Pekan Nanas species and this was subsequently used in the colour plates in Kottelat et al. (1993, pl. 77), where it was referred to as *B. waseri*.

Recently, preserved specimens and a donated series of *Betta* from Pekan Nanas were made available. From initial examination of photographic material, they resembled *B. hipposideros*, but differ from this species in several aspects. The southern Malaysian population is herein described as a new species – *B. omega*.

MATERIAL AND METHODS

Specimens obtained were initially fixed in 10% formalin solution and then transferred to 70% ethanol solution for long-term storage. Material examined is deposited in the Zoological Reference Collection (ZRC) of the Lee Kong Chian Natural History Museum, National University of Singapore.

Meristic and morphometric measurements follow that of Ng & Kottelat (1994) and Tan & Ng (2005a). All measurements are taken with a pair of digital Mitutoyo® calipers. Abbreviations used are SL – standard length, TL – total length, HL – head length. Trunk length is measured from posterior edge of opercle to base of caudal fin. Vertebral counts were taken from digital radiographs using a Faxitron LX-60.

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Fig. 1. *Betta omega*, new species – ZRC 59663, 70.0 mm SL holotype, life colouration (photograph by Z. Zakaria).

TAXONOMY

Betta omega, new species
(Figs. 1–3)

Betta macrophthalma (non-Regan, 1910) – Schmidt, 1988: 341 (illustrated in Kottelat et al., 1993: pl. 77).

Material examined. – Holotype: ZRC 59663, 70.0 mm SL; Peninsular Malaysia: Johor: Pekan Nanas area, Sungai Burong near Jeram Batu; J. J. Foo, 19 Feb 2016.

Paratypes: ZRC 59664, 1 ex., 74.0 mm SL; same locality data as holotype. – ZRC 59665, 3 ex., 60.4-81.2 mm SL; Peninsular Malaysia: Johor: Pekan Nanas area; Allan & Barbara Brown, (preserved in) 1984.

Non-type material: ZRC 59666, 14 ex., 30.1–35.1 mm SL; ZRC 59667, 9 ex., 69.5–79.2 mm SL; Peninsular Malaysia: Johor: Pekan Nanas area; F1 generation from wild caught individuals; Allan & Barbara Brown, (preserved in) 1988.

Diagnosis. *Betta omega* can be distinguished from other members of the *B. waseri* group in having the following combination of characters: black markings on lower jaw continuous with two black downward curved bars on throat, ending with rounded bulging ends near edge of lower jaw (vertical line projection downwards from lower jaw posterior end; see Fig. 4i); opercle uniform brown with light dark brown mottling, operculum without lower distal margin black; black transverse bars on the dorsal and caudal fin interradial membranes; absence of a dark distal border on anal fin.

Betta omega differs from its putative closest relative *B. hipposideros* in having an omega (Ω) pattern on throat (vs. downward slender black bars, resembling a horseshoe shape), lateral scale 15 below the dorsal-fin origin (vs. mode 16), lateral scale 6 above the anal-fin origin (vs. mode 7) and postdorsal scales 10–12, mode 11 (vs. 9–10, mode 9½).

Description. General body form as in Figs. 1, 2; meristic and morphometric information listed in Table 1. Body relatively long and stout (body depth at dorsal-fin origin 27.1–28.5% SL); head stout with pointed snout and evenly sloping or with slight convexity at supra-orbital area (head length 28.4–32.1% SL); dorsal fin pointed, situated nearer to caudal fin (predorsal length 62.2–68.9% SL), dorsal-fin base short (dorsal fin base length 12.6–15.4% SL), covering 6½ subdorsal scales; caudal fin rounded with middle rays elongate; anal fin with posterior rays elongate, anal fin base more than half of SL (anal-fin base length 55.3–60.7% SL); pelvic fin falcate with first ray filamentous, relatively long (pelvic fin length 29.8–36.4% SL), reaching up to base of 12th anal fin ray; pectoral fin rounded.

Vertebral count: 10–11 + 19–21 (total 29–32, mode 31 or 32, n=5).

Live colouration. See Figs. 1, 3 for live colouration.

Head and dorsum of body brown. Eye with unique colouration zones of the *B. waseri* group (as defined by Tan, 1998). Mouth with lower and upper lips black, lower jaw black, black marking continuous with two black downward curved bars on throat, ending with bulging rounded tips around near edge of lower jaw (vertical line projection downwards from lower jaw posterior end). Opercle with faint greenish-yellow

Table 1. Meristic and morphometric data of *Betta omega*, new species (data from holotype and 4 paratypes).

	Holotype	**Paratypes**		
Standard length (mm)	70.0	60.4–81.2		
Meristics			Mode	
Anal-fin rays	II,29	I–II,28–30	29 or 30 (total)	
Dorsal-fin rays	I,9	I,8–9	I,9	
Caudal-fin rays	ii,6+7,i	ii,6+7–8,i	ii,6+7,i	
Pelvic-fin rays	i,1,4	i,1,4	i,1,4	
Pectoral-fin rays	14	13–14	14	
Subdorsal scales	6½	6½	6½	
Body depth scales	9½	9½	9½	
Lateral scales	32	31–33	31 or 32	
Predorsal scales	24	23	23	
Postdorsal scales	11	10–12	11	
Morphometrics				
% Standard length		Range	Mean	Standard deviation
Total length	143.7	139.2–147.7	143.6	3.1
Trunk length	71.3	71.2–73.2	72.0	0.9
Predorsal length	65.0	62.2–68.9	65.6	2.4
Postdorsal length	22.9	19.9–24.1	22.3	1.7
Caudal peduncle depth	20.0	19.2–20.6	20.0	0.6
Preanal length	45.4	42.7–46.0	44.1	1.5
Head length	30.4	28.4–32.1	30.6	1.4
Body depth at dorsal-fin origin	27.9	27.1–28.5	27.6	0.6
Pelvic-fin length	36.4	29.8–36.4	32.3	2.6
Anal-fin base length	56.4	55.3–60.7	57.2	2.0
Dorsal-fin base length	12.6	12.6–15.4	13.7	1.1
% Head length				
Orbit diameter	21.1	21.1–25.8	23.1	1.7
Postorbital length	47.9	47.9–51.9	50.0	2.0
Interorbital width	43.7	39.2–45.7	42.6	2.4
Snout length	27.7	20.9–27.7	24.2	2.5

Fig. 2. *Betta omega*, new species – ZRC 59663, 70.0 mm SL holotype, preserved specimen.

Fig. 3. *Betta omega*, new species – ZRC 59664, 74.0 mm SL paratype, front view of head showing lower jaw and throat pattern (photograph by Z. Zakaria).

iridescence, iridescence extending to side of body (up to 10 scale rows) above belly area. Body yellowish-brown, with faint dark patches just above anal fin sheath scales. Dorsal fin brownish with up to 10 transverse bars on interradial membranes. Caudal fin brownish with up to 24 transverse bars on interradial membranes. Anal fin brownish, without distal dark border but with narrow white margin. Pelvic fin yellowish-brown with whitish interradial membranes, distal part of filamentous pelvic-fin ray iridescent whitish-green. Pectoral fin hyaline with black sub-basal bar.

Preserved colouration. Preserved colouration illustrated in Fig. 2. Head and body dorsum dark brown. Opercle area with brown mottling. Throat pattern indistinct. Lateral of body with indistinct brown central stripe. Faint brown stripe above anal-fin base. Rest of body yellowish-brown on lateral and cream-yellow on ventrum. Fin rays light brownish and rest hyaline.

Distribution. *Betta omega* is recorded only from the remnant black water habitats near Pekan Nanas in Johor, Peninsular Malaysia. There is a likelihood that this species is near extinction or already extinct.

Field notes. The habitat of *Betta omega* was located in remnant black water swamps, present as roadside ditches along the Pontian Kecil-Pekan Nanas road; also as small streams flowing through oil palm estates. These dug ditches are usually overgrown with vegetation. Fishes were caught using a simple earthworm-baited hand-line. Only a few individuals were caught along every few meters of the ditch, possibly an indication of the territorial behaviour of the fish (Benel Tang, pers. comm.). Syntopic fish species included: *Desmopuntius hexazona*, *Rasbora einthovenii* (Cyprinidae), *Monopterus javanensis* (Synbranchidae), *Betta bellica*, *B. pulchra* (Osphronemidae), and *Channa lucius* (Channidae).

Etymology. From the Greek *Omega*/ Ω (upper case), the last letter of the Greek alphabet; in allusion to the unique throat pattern and in reference to the last members of this species in the quickly disappearing black water habitat type in Malaysia and Southeast Asia. Used as a noun in apposition.

Remarks. *Betta omega* can be distinguished further from *B. waseri* in the following characters: "Ω /omega" shape throat pattern (vs. two tear-drop shaped black marks below but not connected to black lower lip; see Fig. 4); absence of black lower margin of operculum (vs. presence); opercle without any distinct brown markings and with light greenish-yellow iridescence (vs. several short black streaks, and without iridescence); deeper body (27.1–28.5% SL, vs. 23.1–27.6); dorsal fin begins at lateral scale 15 (vs. 17–18); anterior anal-fin base at vertical through lateral scale 6 (vs. 8–9).

Betta omega can be further distinguished from *B. tomi* in the following characters: "Ω /omega" shape throat pattern (vs. throat with two black oval spots which do not merge with black lower lip; see Fig. 4); absence of black lower margin of operculum (vs. presence); opercle without any distinct brown markings and with light greenish-yellow iridescence (vs. several short black streaks, and without iridescence); distal margin of anal fin without black or coloured band (vs. presence); anterior anal-fin base at vertical through lateral scale 6 (vs. 7–8); subdorsal scales 6½ (vs. 5–5½); postdorsal scales 10–12, mode 11 (vs. 10–10½, mode 10).

Betta omega can be further distinguished from *B. spilotogena* in the following characters: "Ω /omega" shape throat pattern (vs. throat with two very broad black oval spots which may appear joined medially, spots do not merge with black lower lip; see Fig. 4); absence of black lower margin of operculum (vs. presence); opercle without any distinct brown markings and with light greenish-yellow iridescence (vs. distinctly covered with several large black spots, without iridescence); anterior anal-fin base at vertical through lateral scale 6 (vs. 7–8, mode 7); subdorsal scales 6½ (vs. 5½–6, mode 5½).

Betta omega can be further distinguished from *B. chloropharynx* and *B. pardalotos* in the following characters: "Ω /omega" shape throat pattern (vs. throat with two cream blotches on a black throat; see Fig. 4); opercle without any distinct brown markings and with light greenish-yellow iridescence (vs. heavily spotted opercle of *B. pardalotos*).

Betta omega can be further distinguished from *B. pi* in the following characters: "Ω /omega" shape throat pattern (vs. throat with π-shaped black pattern; see Fig. 4); opercle without any distinct brown markings and with light greenish-yellow iridescence (vs. opercle with several black blotches of variable size, without iridescence); distal margin of anal

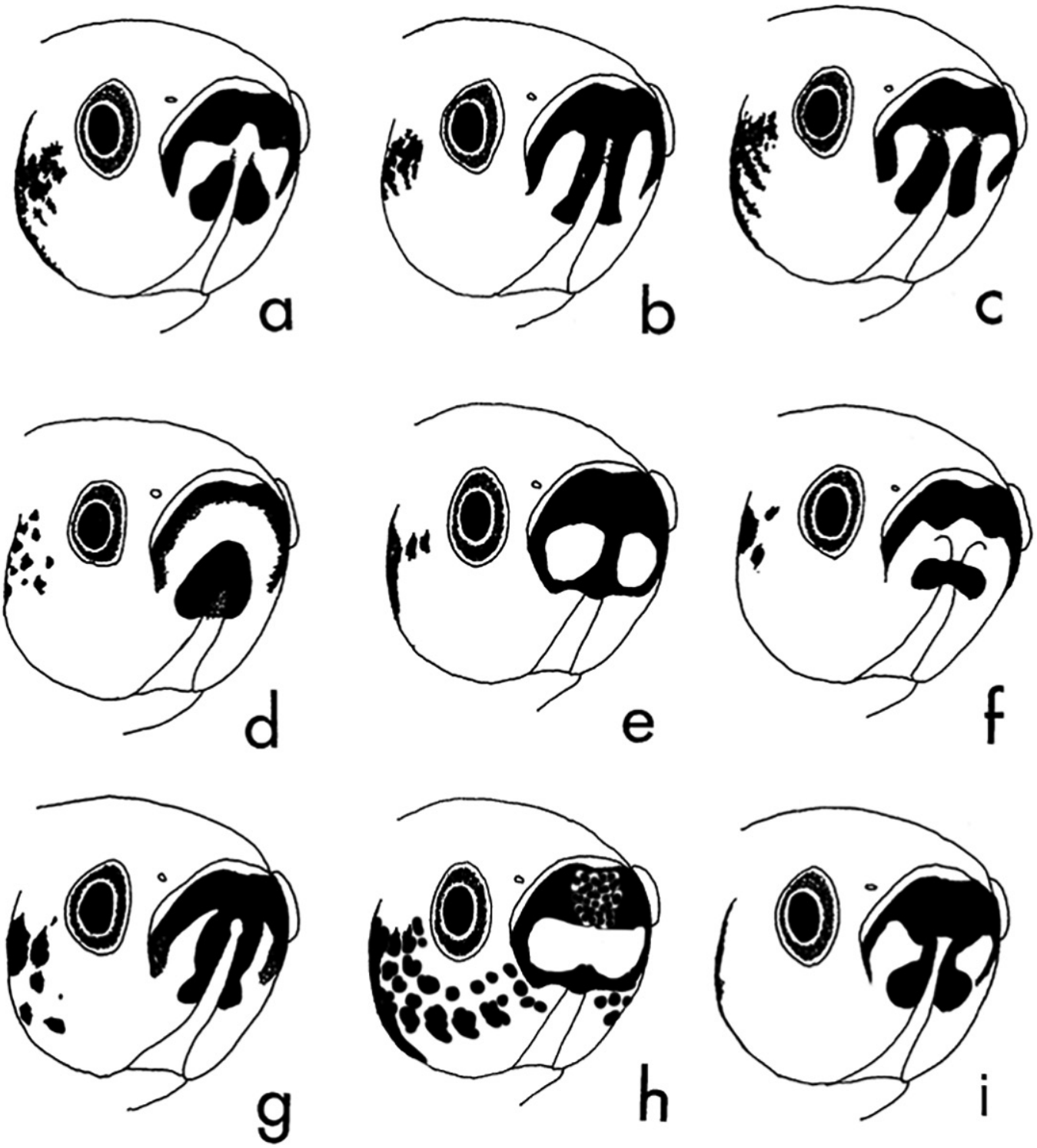

Fig. 4. Schematic diagrams of throat patterns of the *Betta waseri* species group. a, *B. waseri*; b, *B. hipposideros*; c, *B. tomi*; d, *B. spilotogena*; e, *B. chloropharynx*; f, *B. renata*; g, *B. pi*; h, *B. pardalatos*; i, *B. omega*.

fin without black or coloured band (vs. presence); shorter head length (28.4–32.1% SL, vs. 32.3–34.4); deeper caudal peduncle depth (19.2–20.6% SL, vs. 16.3–18.4); subdorsal scales 6 ½ (vs. 5½–6, mode 6).

Betta omega can be further distinguished from *B. renata* in the following characters: "Ω /omega" shape throat pattern (vs. a kidney-shaped black mark on throat, not connected with black lower lip; see Fig. 4); opercle without any distinct brown markings and with light greenish-yellow iridescence (vs. several black spots on opercle); absence of black lower margin of operculum (vs. presence).

COMPARATIVE MATERIAL

See Kottelat & Ng (1994), Ng & Kottelat (1994), Tan (1998), Tan & Ng (2005a, 2005b), and Tan (2009) for a list of comparative material.

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