

# *Parosphromenus barbarae*, a new species of Licorice Gourami from Sarawak, Borneo (Teleostei: Osphronemidae)

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## Abstract

In Sarawak, there are two main populations of *Parosphromenus* known, the eastern population linked to the Rejang River basin being *P. allani*, and the western population linked to the Batang Kayan basin, is herein described as *P. barbarae*, new species. *Parosphromenus barbarae* differs from its most similar species, *P. allani*, in having a distinct black ocellus on caudal-fin base, indistinct dark brown ocellus on posterior base of dorsal-fin; presence of clearly demarcated subdistal hyaline band on anal fin (vs. faint); dorsal-fin rays XI–XIV, 4–5 (total count 15–18, mode 17); anal-fin rays XI–XIII, 6–10 (total count 19–21, mode 21); lateral scales 29–31½ (mode 29).

## Key words

Allopatric speciation, Anabantiformes, biodiversity, peat swamps, Southeast Asia.

## Introduction

*Parosphromenus* is a genus of small-sized labyrinth fish, not growing larger than 30–35 mm SL, endemic to Sundaland (KOTTELAT & NG, 1998; 2005). The history of species discovery and taxonomic issues have been detailed by KOTTELAT & NG (1998; 2005). They are stenotopic inhabitants of acidic water swamp forest streams and peat swamp habitats. Their distribution is very patchy and restricted to lowlands. Currently, there are 20 described species of *Parosphromenus* (fide Kottelat & Ng, 2005; Schindler & Linke, 2012). Six species (*P. alfredi* Kottelat & Ng, 2005, *P. harveyi* Brown, 1987, *P. nagyi* Schaller, 1985, *P. paludicola* Tweedie, 1952, *P. tweediei* Kottelat & Ng, 2005, *P. rubrimontis* Kottelat & Ng, 2005) are restricted to Malay Peninsula; five species (*P. bintan* Kottelat & Ng, 1998, *P. deissneri* (Bleeker, 1859), *P. gunawani* Schindler & Linke, 2012, *P. phoenicurus* Schindler & Linke, 2012, *P. sumatranus* Klausewitz, 1955) are located in Sumatra and its islands; and nine species (*P. allani*

Brown, 1987, *P. anjunganensis* Kottelat, 1991, *P. filamentosus* Vierke, 1981, *P. linkei* Kottelat, 1991, *P. opalios* Kottelat & Ng, 2005, *P. ornaticauda* Kottelat, 1991, *P. pahuensis* Kottelat & Ng, 2005, *P. parvulus* Vierke, 1979, *P. quindecim* Kottelat & Ng, 2005) are restricted to Borneo.

BROWN & BROWN (1987) conducted a labyrinth fish (specifically looking for *Betta* and *Parosphromenus*) survey in Sarawak. However, due to different objectives, they only kept living material that they subsequently bred in captivity. From that survey material, *Parosphromenus allani* had been described by BROWN in 1987, and subsequently *Betta brownorum* was described by WITTE & SCHMIDT in 1992. In BROWN & BROWN'S 1987 survey, they discovered three main populations of *Parosphromenus*. One population (type locality of *P. allani*; listed as 1/86/B&B and 17/86/B&B; basically the same general location) found along the outskirts of Sibu town, one

location at 23/86/B&B (labeled as Sungei Stunggang [sic, should be Stunggang], near Lundu) and another location at 30/86/B&B (near Matang; this location is not listed with *Parosphromenus*, but Plate XVI lists a figure of *Parosphromenus* from that location). BROWN (1987) provided a scanty description for *P. allani* based on material near Sibü. KOTTELAT & NG (2005) resolved the descriptions of *P. allani* and *P. harveyi* with designation of lectotypes, and described six new species. KOTTELAT & NG (2005) also commented that there was possibility of other species looking similar to *P. allani* from southern Sarawak.

This current study will follow up on the southern Sarawak population near Lundu area. Herein, this new species will be described.

## Material and methods

Material was collected with push nets and hand nets. The specimens were initially fixed in 10 % formalin solution and stored long term in 70 % ethanol. Specimens are deposited in Naturhistorisches Museum Bern (NMBE), Bern, Switzerland; Institute of Biodiversity and Environmental Conservation, Universiti Sarawak Malaysia (UNIMAS), Kuching, Sarawak; Lee Kong Chian Natural History Museum (ZRC), National University of Singapore, Singapore; and the collection of Maurice Kottelat (CMK), Delémont, Switzerland.

Meristic counts and morphometric measurements were taken according to KOTTELAT & NG (2005). KOTTELAT & NG (2005) also listed the difficulties of proper morphometric measurements, and that the meristic counts that were of diagnostic use were the dorsal-fin ray and anal-fin ray counts; and fresh colouration and body pattern were important diagnostic characters.

## Taxonomy

### *Parosphromenus barbarae*, new species

Figs. 1–3

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*Parosphromenus* species – BROWN & BROWN, 1987: 166, Plate XVI (?).

*Parosphromenus allani* (non Brown) – KOTTELAT & LIM, 1995 (part); KOTTELAT & NG, 2005: 110 (part).

*Parosphromenus* sp. cf. *allani* “Sungai Stunggang” – FINKE & HALLMANN, 2013: 82.

*Parosphromenus* spec. Sungai Stunggang – FINKE, 2013: 43.

*Parosphromenus* sp. Sungai Stunggang – LINKE, 2013: 291; LINKE, 2014: 489.

**Material examined.** *Holotype*: ZRC 61243, 1 ex., 24.5 mm SL; Borneo, Sarawak: Batang Kayan; Sg. Stunggang, 4.8 km before Lundu ferry point at Batang Kayan; 1°37.48'N 109°53.18'E; colls. H. H. Tan *et al.*, 2 Sep 1996

*Paratypes*: ZRC61244, 3 ex., 20.4–22.9 mm SL; same locality as holotype. --- UNIMAS 20056123, 2 ex., CMK 28788, 2 ex., ZRC 61245, 1 ex., 23.1–25.7 mm SL; Borneo, Sarawak: Lundu, Batang Kayan; Sg. Stunggang; coll. Michael Lo, 8 Nov 2006. --- NMBE 1078329–1078337, 9 ex., ZRC 61246, 5 ex., 18.0–25.2 mm SL; Borneo, Sarawak: Lundu, Batang Kayan; Sg. Stunggang (1°37.20'N 109°52.80'E); colls. L. Rüber *et al.*, 27 Mar 2010. --- ZRC 43661, 8 ex., 11.7–23.0 mm SL; Borneo: Sarawak, Bau-Lundu area, Sungai Stunggang, swampforest, 51.0 km towards Lundu from Bau on Bau-Lundu road, 01°37.44'N 109°53.18'E, pH 4.6; H. H. Tan & P. Yap, 2 Oct 1998.

*Other material*: From BROWN & BROWN (1987) collection (details in KOTTELAT & NG, 2005).

**Diagnosis.** *Parosphromenus barbarae* can be differentiated from its congeners with the following unique combination of characters: presence of faint ocellus on posterior base of dorsal-fin; presence of distinct ocellus on caudal fin base; presence of distinct three cream and two and half dark brown stripes on body; dorsal-fin rays XI–XIV, 4–5 (total count 15–18, mode 17); anal-fin rays XI–XIII, 6–10 (total count 19–21, mode 21); lateral scales 29–31½ (mode 29).

**Description.** For meristic and morphometric data, see Table 1. For general appearance, refer to Figures 1–3. Head pointed and deep, relatively long (head length 29.8–36.6 % SL), eyes large (eye diameter 24.7–32.9 % HL). Body compressed, relatively long (trunk length 62.5–72.6 % SL), deepest at dorsal-fin origin (22.4–28.2 % SL), tapering towards caudal peduncle, most narrow at caudal peduncle (11.4–14.7 % SL). Dorsal fin with posterior portion pointed, relatively long (dorsal-fin base length 37.1–46.0 % SL); caudal fin rounded with middle rays evenly elongated; anal fin with posterior portion pointed, longer than half of body (anal-fin base length 50.0–56.4 % SL); relatively long pelvic fin (25.0–41.7 % SL), with long filamentous ray, adpressed fin up to 12<sup>th</sup> anal-fin ray; pectoral fin rounded, vertical from adpressed fin extend to 8<sup>th</sup> anal-fin ray. Lateral scales 29–31½ (mode 29), transverse scales at dorsal-fin origin 11–12 (mode 12), predorsal scales 11, subdorsal scales 17–19 (mode 17), postdorsal scales 12–16 (mode 12). Dorsal-fin rays XI–XIV, 4–5 (total ray count 15–18, mode 17), principle caudal-fin rays 6+7, anal-fin rays XI–XIII, 6–10 (total ray count 19–21, mode 21), pelvic-fin ray i,5, pectoral-fin rays 12.

**Live coloration.** See Fig. 3. Colouration notes pertain to mature male only. Body and head yellowish-brown. Yellowish-brown stripe running along whole dorsum. First dark brown stripe starting at upper jaw, running to pre-orbital, running obliquely upwards and along dorsal half of body to upper part of caudal peduncle. Second dark brown stripe running postorbital directly behind eye to opercle edge and along mid-body to caudal-fin base. Sub-



**Fig. 1.** *Parosphromenus barbarae*, ZRC 61243, 24.5 mm SL male holotype, photographed on black (top) or white (bottom) background.



**Fig. 2.** *Parosphromenus barbarae*, NMBE 1078329, 24.0 mm SL female paratype, photographed on black (top) or white (bottom) background.



**Fig. 3.** *Parosphromenus barbarae*, ZRC 61245, ca. 25.0 mm SL male paratype (when live; right-side reversed).

orbital area with grey pigments, forming into two broken oblique streaks to opercle area. Belly silvery gold. Dorsal fin reddish, with mid section brighter red, bright blue margin, indistinct darker red ocellus on posterior basal area. Caudal fin reddish, bright blue margin, subdistal black band with a second grey band around mid-section; distinct black ocellus at base of caudal fin. Anal fin reddish, with basal area dark grey, thin black stripe along mid-section, bright blue margin. Pelvic fins with bright blue iridescence, with two dark grey bands, one at base of filamentous ray, another at mid-section. Pectoral fin hyaline.

Female (see Fig. 2) and juvenile with drab colouration. Body with two distinct dark brown stripes, first stripe running near dorsum from top of head to caudal peduncle, second stripe running directly post-orbital to just below mid-body to caudal-fin base. Juvenile often with irregular dark brown blotches all over body, giving a mottled appearance (which is typical of this genus).

**Preserved coloration.** See Figure 1 and 2. Body with three alternating cream stripes and three dark brown stripes. Head with dorsum dark brown, upper jaw dark brown continuous to preorbital stripe and two postorbital stripes (see below), lower jaw area and throat dark brown, suborbital area with two distinct broken oblique dark brown bars. First dark brown stripe from head dorsum running along dorsal half of body to end of dorsal-fin base. Second dark brown stripe running from tip of upper jaw, covering entire upper jaw, to preorbital and continuous with post-orbital to opercle edge, running along dorsal half of body to dorsum of postdorsal region to caudal peduncle. Third dark brown stripe running obliquely downwards from eye to opercle edge, continuous with stripe on body just below middle to caudal-fin base. First cream stripe from behind head to posterior end of dorsal-fin base. Second cream stripe between 2<sup>nd</sup> and

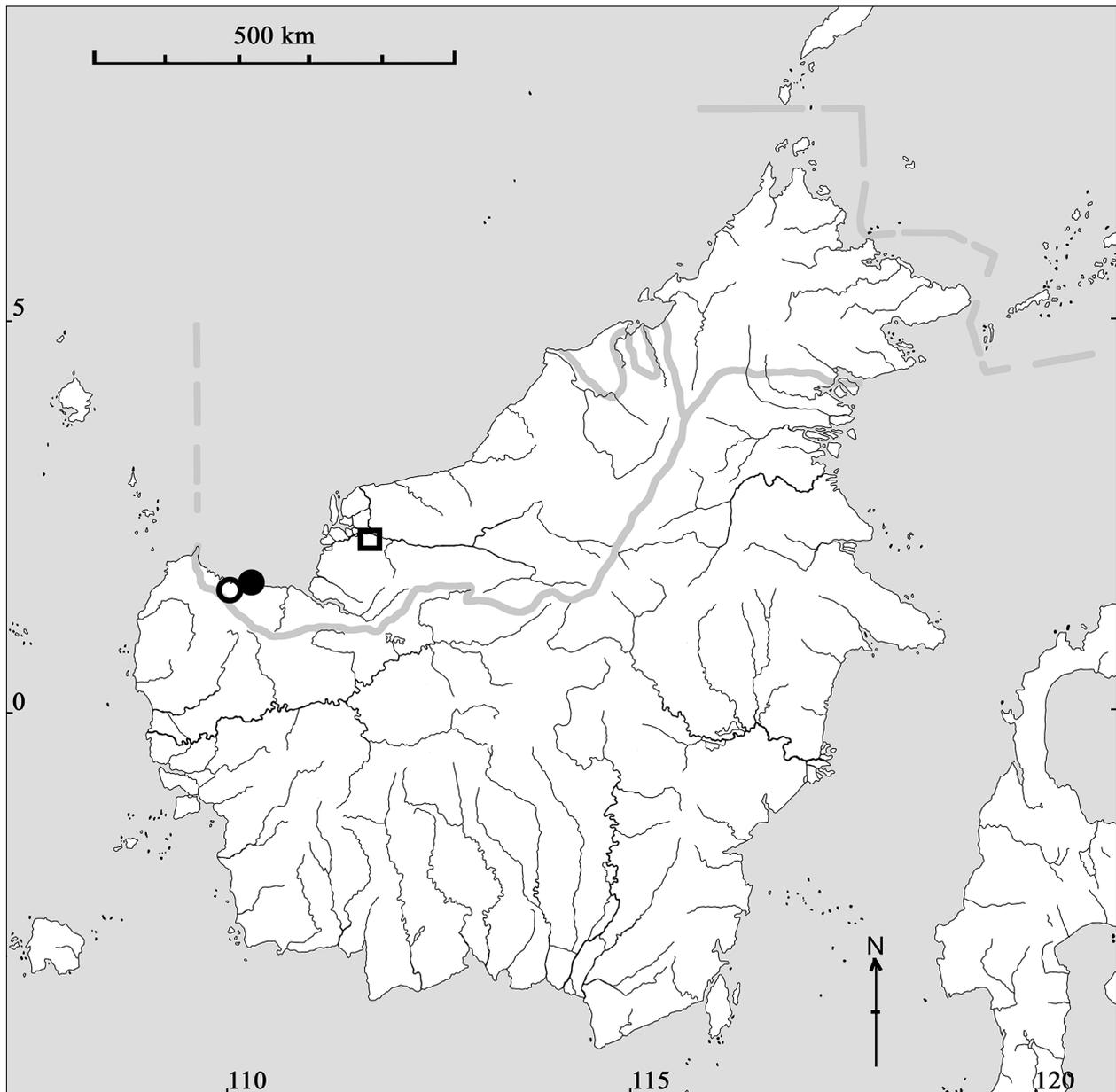
3<sup>rd</sup> dark brown stripes directly running along mid-body, starting from postorbital to opercle edge, to caudal-fin base; always one scale deep. Third cream stripe along ventral half of body, from pectoral-fin origin to end of anal-fin base. Pectoral girdle region dark brown. Dorsal fin with hyaline margin, brownish-red anterior, posterior half with middle part hyaline, base brownish-red, posterior base with dark brown ocellus. Caudal fin with hyaline margin, two distinct crescentic diffused brown bars, distinct dark brown/black ocellus at base. Anal fin with hyaline margin, brown base with posterior half with hyaline base, two distinct brown stripes. Pelvic fin reddish-brown throughout in both fin rays and interradiation membranes. Pectoral fin hyaline.

Female (see Fig. 2) and juvenile with drab colouration described as above.

**Distribution.** This species is currently known only from the remnant peat swamp forest near Batang Kayan in Lundu, near the western tip of Sarawak (Fig. 4).

**Etymology.** Named for Barbara Brown, spouse of Allan Brown, who first collected this species. This is the allopatric species to *P. allani*, being found in southern Sarawak, east of the Lupar divide.

**Comparative notes.** *Parosphromenus barbarae* can be differentiated from its allied *P. allani* (see Fig. 5) in the following characters: reddish unpaired fins with reddish anal-fin and blue pelvic fins, (vs. reddish unpaired fins with bluish anal-fin and blue pelvic fins); body with three distinct cream stripes (vs. two); head dorsum dark brown disrupted with cream stripe (vs. head dorsum and dorsal half of body dark brown, absence of cream stripe); for males only: less distinct dorsal fin ocellus (vs. more distinct ocellus); for males only: caudal fin with distinct ocellus, clear from two crescentic dark brown bars (vs.



**Fig. 4.** Map of Borneo showing distribution of *Parosphromenus barbarae* (circle) and *P. allani* (square) [hollow symbol denotes type location; each symbol may represent more than one location].

indistinct ocellus, somewhat continuous with crescentic brown bars); upper jaw dark brown (vs. upper  $\frac{2}{3}$  dark brown and lower part cream); longer preanal fin length (42.7–50.0 % SL, mean 46.1, vs. 41.5–47.7, mean 44.5); shorter dorsal-fin base length (37.1–46.0 % SL, mean 39.8, vs. 38.1–48.3, mean 42.1); fewer transverse scales (11–12, vs. 13); fewer lateral scales (29–31½, mode 29, vs. 28–31, mode 30); more predorsal scales (11, vs. 10).

**Field notes.** This habitat (Fig. 6) has been surveyed several times over the years, the following is a compilation of all the syntopic fish species encountered: *Cyclocheilichthys apogon* (Valenciennes, in Cuvier & Valenciennes, 1842), *Desmopuntius johorensis* (Duncker, 1904) (Cyprinidae), *Rasbora bankanensis* (Bleeker, 1853), *R. hosii* Boulenger, 1895, *Trigonopoma pauciperforatum* (Weber

& de Beaufort, 1916) (Danionidae), *Kottelatlimia pristes* (Roberts, 1989), *Pangio semicineta* (Fraser-Brunner, 1940) (Cobitidae), *Hemibagrus capitulum* (Popta, 1904) (Bagridae), *Hemirhamphodon byssus* Tan & Lim, 2013 (Zenarchopteridae), *Pristolepis grootii* (Bleeker, 1852) (Pristolepididae), *Nandus nebulosus* (Gray, 1835) (Nandidae), *Belontia hasseltii* (Valenciennes, in Cuvier & Valenciennes, 1831), *Betta lehi* Tan & Ng, 2005, *Luciocephalus pulcher* (Gray, 1830), *Trichopodus trichopterus* (Pallas, 1770), *Trichopsis vittata* (Valenciennes, in Cuvier & Valenciennes, 1831) (Osphronemidae), *Channa baramensis* (Steindachner, 1901), *C. lucius* (Valenciennes, in Cuvier & Valenciennes, 1831), and *C. striata* (Bloch, 1793) (Channidae).

At present, this swamp forest habitat has been highly modified by planting of oil palm estates and the construc-



**Fig. 5.** *Parosphromenus allani*, ZRC 61241, 29.0 mm SL male, Sarawak: Sibü, photographed in 2008 (top) and 2020 (middle) on black and on white background (bottom).



Fig. 6. Photograph of type locality habitat, July 2007.

tion of the Pan Borneo Highway and no longer support the above recorded species composition (second author, pers. obs.; Shi W., pers. comm.).

**Remarks.** From ongoing molecular phylogenetic work, *P. barbarae* is not resolved as sister group to *P. allani* (Rüber, L., pers. comm.).

BROWN & BROWN'S (1987) record of *Parosphromenus* from Matang area could not be substantiated, as fresh specimens could not be obtained and is most likely a consequence of urban development (pers. obs.). The population from Matang area is likely to be or similar to *P. barbarae*, sharing similar distributional ranges with several fish taxa with allopatric speciation. Other examples of such species pairs with an east-west division include: *Desmopuntius hexazona/D. pentazona* (Boulenger, 1894) (Cyprinidae), *Rasbora kalochroma* (Bleeker, 1851)/*R. kottelati* (Lim, 1995) (Danionidae), *Pangio semicincla/P. agma* (Burridge, 1992) (Cobitidae), *Hemirhamphodon byssus/H. kuekenhali* Steindachner, 1901 (Zenarchopteridae), *Betta ibanorum* Tan & Ng, 2004/*B. akarensis* Regan, 1910 (Osphronemidae) (see TAN & LIM, 2013, for more details). This present pair of *Parosphromenus barbarae* and *P. allani* further supports the East-West zoogeographic division (coinciding with the Lupar divide; HUTCHISON, 1996; BREITFIELD *et al.*, 2018) in Sarawak.

**Comparative material examined.** *Parosphromenus allani*: ZRC 50243, 1 male, 26.1 mm SL lectotype; Sarawak, outskirts of Sibü; Brown & Brown, July 1986. --- ZRC 61241, 63 ex., 10.6–29.0 mm SL; Borneo: Sarawak: Sibü; Sungei Nibung, just north of Durin

bridge over Rejang River, 02°10.08'N 112°00.93' E, 16 m asl, pH 5.1; colls. H. H Tan *et al.*, 14&16 May 2008. --- ZRC 61242, 9 ex., 16.7–22.7 mm SL; Sarawak: Sibü, Kemuyang area, heath/peat swamp, along road to Sibü Golf Course, leading to city dump, 02°21.67'N 111°57.12' E (16 m asl, pH 5.4); colls. H. H Tan *et al.*, 15 May 2008. See KOTTELAT & NG (2005) for more comparative material.

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