THE RAFFLES BULLETIN OF ZOOLOGY 2005 Supplement No. **13**: 101-113

DIAGNOSES OF SIX NEW SPECIES OF *PAROSPHROMENUS* (TELEOSTEI: OSPHRONEMIDAE) FROM MALAY PENINSULA AND BORNEO, WITH NOTES ON OTHER SPECIES

Maurice Kottelat
Route de la Baroche 12, Case postale 57, 2952 Cornol, Switzerland (corresponding address);
Honorary Research Associate, Raffles Museum of Biodiversity Research, National University of Singapore, Kent Ridge, Singapore 119260, Republic of Singapore
Email: mkottelat@dplanet.ch

Peter K. L. Ng
Department of Biological Sciences, National University of Singapore, Kent Ridge, Singapore 119260, Republic of Singapore
Email: peterng@nus.edu.sg

***ABSTRACT.* –** Six new species of licorice gouramies of the genus *Parosphromenus* are described from Peninsular Malaysia, Sumatra and Borneo. *Parosphromenus alfredi* (from southeastern Johor, Peninsular Malaysia), *P. opallios* (from southwestern Kalimantan Tengah, Borneo), *P. rubrimontis* (from Perak, Peninsular Malaysia) and *P. tweediei* (from southwestern Johor, Peninsular Malaysia) were earlier identified as *P. deissneri*, a species restricted to Bangka Island; they are distinguished by details of coloration and dorsal and anal fin ray formulae. *Parosphromenus pahuensis* (from Mahakam Basin, Borneo), is distinguished in having 1-3 conspicuous black spots in the middle of the lower lateral dark stripe, a rounded caudal fin, 6-9 segmented rays in anal fin, 12-14 spines in dorsal fin and details of colour pattern. *Parosphromenus quindecim* (from southeastern Kalimantan Barat, Borneo) is distinguished in having 13-15 spines in dorsal fin, the absence of conspicuous black blotches on the lower lateral stripe, a black subdistal band in the dorsal, anal and caudal fins of the male, a rounded caudal fin, and unpaired fins of female grey with numerous hyaline spots. The taxonomy of *P. harveyi*, *P. allani* and *P. sumatranus* are also discussed and lectotypes designated for the first two species.

***KEY WORDS.* –** *Parosphromenus*, taxonomy, six new species, key, Southeast Asia.

INTRODUCTION

The osphronemid genus *Parosphromenus* Bleeker, 1877, comprises several species of very small fishes inhabiting swamps, standing or slowly flowing waters of the Malay Peninsula, Borneo and Sumatra. They generally occur in the acidic blackwaters of heavily vegetated water bodies in coastal lowlands. The genus was originally established for a single species, *P. deissneri* (Bleeker, 1859), described on the basis of a single specimen, most likely a female, from Bangka. As a result of their small to very small sizes, these fishes have long been overlooked and there were no subsequent records of this genus until Herre & Myers (1937) reported '*P. deissneri*' from the Malay Peninsula. Eleven nominal species of *Parosphromenus* have been described since, and several additional ones have been known to us for many years now. These species are relatively popular among specialised aquarists. The identity of the real *P. deissneri* has long been in limbo and it is only recently that, on the basis of fresh material, we have been able to redescribe it (Kottelat & Ng, 1998), with its identity fixed by the designation of a neotype, the original holotype been deemed useless for taxonomic work (Ng & Kottelat, 1998; ICZN, 2000).

The real *P. deissneri* is endemic to Banka and the several populations which have been identified under that name (especially in the aquarium literature) represent distinct species. Material from Sumatra is referred to *P. sumatranus* Klausewitz, 1955, a name revived from the synonymy of *P. deissneri*. We here describe six new species from Peninsular Malaysia and Borneo. The type material of *P. harveyi* and *P. allani* is also treated, and a key is provided for all the named species of the genus. With the present study, the genus *Parosphromenus* contains 18 species, viz. *P. alfredi*, new species, *P. allani* Brown, 1987, *P. anjunganensis* Kottelat, 1991, *P. bintan* Kottelat & Ng, 1998, *P. filamentosus* Vierke, 1981, *P. deissneri* (Bleeker, 1859), *P. harveyi* Brown, 1987, *P. linkei* Kottelat, 1991, *P. nagyi* Schaller, 1985, *P. opallios*,

new species, *P. ornaticauda* Kottelat, 1991, *P. pahuensis*, new species, *P. paludicola* Tweedie, 1952, *P. parvulus* Vierke, 1979, *P. quindecim*, new species, *P. rubrimontis*, new species, *P. sumatranus* Klausewitz, 1955, and *P. tweediei*, new species.

MATERIAL AND METHODS

Methods for taking counts and measurements follow Kottelat (2001) and Kottelat et al. (1993), with the following changes: body depth is measured at pelvic fin origin, body width behind pectoral fin base. Scales in lateral row are counted from the scale immediately behind the pored scale situated above and slightly in front of the upper extremity of the gill slit and do not include scales on the caudal fin; transverse row scales do not include the smaller scales forming a sheath along anal-fin base. We found measurements difficult to replicate as the specimens are small (most under 15 mm SL), easily dehydrated and easily damaged; in addition, measurements yielded no character useful to diagnose the species, and thus we only give measurements for the holotypes. These measurements, combined with the photographs, are sufficient to convey general information on body shape. Fin rays were counted only in specimens with stretched fins. Numbers in brackets after a given count is the frequency at which this count was observed. Asterisks indicate the values observed in the holotype.

The species concept used is the phylogenetic species concept (Cracraft, 1989; Warren, 1992; see discussion in Kottelat, 1997). For practical purposes, and especially as used in the present context, the phylogenetic species concept does not differ significantly from the evolutionary species concept; see Mayden & Wood (1995) for a discussion of the hierarchy of species concepts. See Kottelat (1995b) and Kottelat & Ng (1994: 65-67) for discussions of our approach of systematics with regards to biodiversity research. We consider that the male colour pattern is an important parameter for species recognition and mating. Admittedly, the differences between some of the species are subtle, these species are nevertheless diagnosable, distinct units with discrete distributions and without known intermediates. It should be noted that species occurring in adjacent areas (e.g. *P. harveyi*, *P. tweediei*, *P. alfredi* and *P. nagyi* in Peninsular Malaysia; *P. linkei*, *P. opallios*, *P. quindecim* and *P. anjunganensis* in western Kalimantan) exhibit more striking differences than do some geographically distant species (e.g. *P. alfredi* and *P. opallios*).

Abbreviations used are: MZB, Muzium Zoologicum Bogoriense, Bogor; ZRC, Zoological Reference Collection, Raffles Museum of Biodiversity Research, Department of Biological Sciences, National University, Singapore; SMF, Senckenberg Museum, Frankfurt; CMK, first author's collection; SL, standard length. For the comparative material, in order to minimise space, we have listed only the catalogue numbers and summarized locality information. Only for three species (*P. harveyi*, *P. allani*, *P. sumatranus*), where the taxonomy is discussed in more depth, is the full data cited. The colour data applies to live aquarium acclimatised adult males, unless otherwise stated.

TAXONOMY

Parosphromenus alfredi, new species

(Fig. 1)

Material examined. – Holotype - ZRC 28377, male, 20.1 mm SL; Peninsular Malaysia: Johor: Kota Tinggi, Mawai-Desaru road; coll. P. K. L. Ng et al., 15 Oct.1992.

Paratypes – ZRC 28378-28393, 16 specimens, 16.7-25.7 mm SL; same data as holotype. - ZRC 16983-16996, 14 specimens, 9.5-22.9 mm SL; CMK 7859, 19 specimens, 11.8-21.0 mm SL; Peninsular Malaysia: Johor: stream along road between Mawai and junction with Kota Tinggi-Desaru road, 25 km before junction; coll. M. Kottelat, P. K. L. Ng & K. K. P. Lim, 14 Aug.1991. – ZRC 47766, 77 specimens; Peninsular Malaysia: Johor: Kota Tinggi, Mawai-Desaru road; coll. P.K.L. Ng et al., late 1990s. – ZRC 21131-21132, 2 specimens; Peninsular Malaysia: Johor: Sungai Selangi, 15 km mark along Kota Tinggi-Tanjung Sedili Road, coll. P. K. L. Ng et al., 27 Mar.1992.

Diagnosis. – *Parosphromenus alfredi* is distinguished from the other species of the genus by the following unique combination of characters: 12-13 spines in dorsal fin; 11-13 spines in anal fin; 8-10 segmented rays in anal fin; in live male, dorsal, anal and caudal fins with a narrow bluish margin and a black subdistal band bordered proximally by a bluish iridescent band, sometimes turning to reddish posteriorly; proximal part of dorsal and anal fins from dark red to black; proximal part of caudal fin red, darker in basal area; pelvic fin blue, with white filament.

Description. – General body shape and appearance is shown in Figure 1. Dorsal origin above 3rd scale of lateral row. Dorsal with XII,6 (2), XIII,5* (9), XIII,6 (1) or XIV,5 (1) rays, total 18* (11) or 19 (2); posterior extremity pointed and reaching slightly beyond caudal base in male, rounded and not reaching vertical of base of last anal ray in female. Anal fin origin under 3rd spine of dorsal fin and under 6th* (4) or 7th (2) scale of lateral row; XI,10* (3), XII,8 (1), XII,9 (5), XII,10 (2), XIII,8 (1) or XIII,9 (1) rays; total 20 (1), 21* (9) or 22 (3); posterior extremity pointed in male, rounded in female, reaching about one third of caudal fin in male. Caudal fin rounded, with 3 simple, 5 + 6 branched and 2 simple rays. Pectoral rounded, with 12 (2) or 13* (4) rays. Pelvic fin with a spine, one simple and 4 branched rays, with a filament reaching about to base of 11th anal spine in male, 6th anal spine in female; 29 (4), 30 (1) or 31* (1) scales on lateral row (+ 2-3 on base of caudal fin), and 9 in transverse row from base of 4th anal spine upwards. Morphometric data of holotype, in % SL: total length 138.3; head length 33.8; predorsal length 35.8; prepelvic length 39.3; preanal length 46.3; body depth 24.9; depth of caudal peduncle 14.4; body width 13.4; eye diameter 10.4; snout length 10.4; interorbital width 9.0; length of dorsal base 39.8; length of anal base 54.7; length of pelvic 23.9; length of pectoral 39.3; length of caudal 33.3.

Coloration. – Male, preserved: head and body yellowish brown; a dark brown stripe from tip of snout through eye and upper extremity of base of pectoral to lower half of caudal base; a second stripe from upper margin of eye to upper

extremity of caudal base. Lower half of head with some vermiculations. Belly dark brown. Caudal, dorsal and anal fins grey with a hyaline margin and a pale (yellowish) median stripe. Pelvic fin and filament blackish. Pectoral hyaline.

Male, alive (based on field and aquarium observations and slides): Background pale yellowish brown; stripes and head markings blackish. Dorsal, anal and caudal with a narrow bluish margin and a black subdistal band bordered proximally by a bluish iridescent band, sometimes turning to reddish posteriorly. Proximal part of dorsal and anal fins from dark red to black; posterior edge of dorsal fin red. Proximal part of caudal fin red, darker in basal area. Pelvic fin blue, with white filament. Pectoral fin hyaline.

Female, preserved: Body and head as male but paler, belly same colour as space between stripes. Throat markings very faint or absent. Pectoral fin hyaline, other fins greyish. Anal and dorsal fins with a hyaline margin and a brownish narrow subdistal margin.

Etymology. **–** Named for Eric Alfred, former director of the National Museum of Singapore, and whose work on Malayan fishes has been most useful for recent studies.

Distribution and habitat. **–** Only known from peat swamps of eastern Johor, in the area of Kota Tinggi, Mawai and Desaru. The water from the type locality near Desaru is light tea colour with a pH of ca. 4.5-5, and is the remnant of a peat swamp. The area now basically is an oil palm estate with the stream been used for irrigation. At the time of collection, the fish was relatively common in that and adjacent streams and have been collected by various aquarists, although not on a commercial scale (to our knowledge).

Parosphromenus opallios, new species
(Fig. 2)

Parosphromenus spec. von Sukamara - Linke, 1990: 115 (Sukamara).

Parosphromenus deissneri (non Bleeker, 1859) - Kottelat et al., 1993: pl. 2.

Parosphromenus sp. from Sukamara - Kubota et al., 1996: 80 (Sukamara).

Material examined. **–** Holotype - MZB 5996, 24.5 mm SL; Borneo: Kalimantan Tengah: Kalimati, area of Pangkalanbun, Arut River basin; 2°45'S 111°36'E; don. K. Kubota, 9 Mar.2001.

Paratypes – CMK 16355, 3 specimens, 23.0-24.1 mm SL; same data as holotype. - ZRC 50266, 3 specimens, CMK 16720, 7 specimens, 20.1-23.7 mm SL; same locality as holotype; coll. T. Idei, 22 Jul.2000. - ZRC 46201, 5 specimens, 18.0-18.9 mm SL; Borneo: Kalimantan Tengah: Sukamara; aquarium trade, Jan.2001. – ZRC 46427, 14 specimens, Borneo: Kalimantan Tengah: Sukamara; aquarium trade, 24 Jul.2001.

Diagnosis. **–** *Parosphromenus opallios* is distinguished from the other species of the genus by the following unique combination of characters: 11-13 spines in dorsal fin; 11-12 spines in anal fin; 10-11 segmented rays in anal fin; in live male, dorsal, anal and caudal fins with a narrow greenish-bluish margin and a black subdistal band bordered proximally by a blue iridescent band, very narrow in caudal, wider (especially anteriorly) in anal and dorsal; proximal part of dorsal and anal black along body, grading into red distally, usually forming a conspicuous black blotch at posterior end of dorsal base; proximal part of caudal fin deep black, grading into bright red patch; pelvic fin and filament blue.

Description. **–** General body shape and appearance is shown in Figure 2. Dorsal origin above 3rd scale of lateral row. Dorsal with XI,7* (3), XI,8 (1), XII,7 (4) or XIII,6 (1) rays, total 18* (3) or 19 (6); posterior extremity pointed and reaching at most caudal base in male, rounded, not reaching vertical of base of last anal ray in female. Anal fin origin under 6th* (3) or 7th (3) spine of dorsal fin and under 8th* (5) or 9th (1) scale of lateral row; XI,10 (2), XI,11* (4), XII,10 (2) or XII,11 (1) rays, total 21 (2), 22* (6) or 23 (1); posterior extremity rounded and reaching about caudal base. Caudal fin rounded, with 3-4 simple, 5 + 6 branched and 3 simple rays. Pectoral rounded, with 12* (3) or 13 (3) rays. Pelvic fin with a spine, one simple and 4 branched rays, with a filament reaching base of 8th anal spine in male, 6th spine in female; 28 (1), 29 (2) or 30* (3) scales on lateral row (+ 2 on base of caudal fin), and 9* (5) or 10 (1) in transverse row from base of 4th anal spine upwards. Morphometric data of holotype in % SL: total length 124.9; head length 34.7; predorsal length 40.8; prepelvic length 37.1; preanal length 46.1; body depth 25.7; depth of caudal peduncle 13.5; body width 13.1; eye diameter 11.4; snout length 9.8; interorbital width 7.3; length of dorsal base 36.7; length of anal base 55.5; length of pelvic 28.6; length of pectoral 21.6; length of caudal 27.3.

Coloration. **–** Male, preserved: head and body pale brown; a broad dark brown stripe from tip of snout through eye and upper extremity of base of pectoral to lower half of caudal base; a second stripe from upper margin of eye to upper extremity of caudal base. Pale area between stripes and between upper stripe and dorsal profile distinctly narrower than stripes. Lower half of head heavily mottled. Belly dark brown. Dorsal and anal fins with a narrow hyaline distal margin, a black subdistal band bordered interiorly by a narrow hyaline band, and a black proximal band; area between proximal and subdistal bands from reddish to grey. Black proximal band in dorsal much darker and denser posteriorly, often forming a conspicuous black blotch. Black proximal band in anal darker and wider anteriorly, sometimes in contact with subdistal band. Caudal fin with a narrow hyaline distal margin, a blackish subdistal band bordered interiorly by a narrow hyaline band and a reddish central area grading into a black blotch at fin base. Pelvic fin blackish, anterior edge and filament whitish. Pectoral hyaline.

Male, alive (cf. Linke, 1990: 115, Kubota et al., 1996: 80): Background yellowish brown; stripes and head markings dark brown. Dorsal, anal and caudal with a narrow greenish-bluish margin and a black subdistal band bordered proximally by a blue iridescent band, very narrow in caudal, wider (especially anteriorly) in anal and dorsal. Proximal part of dorsal and

anal black along body, grading into red distally; posterior edge of dorsal fin red. Proximal part of caudal fin deep black, grading into a bright red patch. Pelvic fin and filament blue with a black distal blotch. Pectoral fin hyaline.

Female, preserved: Body and head as male but paler, belly same colour as space between stripes. Throat markings very faint or absent. Pectoral fin hyaline, other fins greyish. Anal and dorsal fins with a hyaline margin and a brownish narrow subdistal margin.

Etymology. **–** From the Greek opallios (opal), reference to opal, a gemstone which can be of almost any colour. A noun in apposition.

Distribution. **–** Only known from the area of Sukamara in Jelai Bila basin (Linke, 1990: 115) and Kalimati in Arut drainage (Lamand basin, near Pangkalanbun), Kalimantan Tengah, Borneo.

Parosphromenus pahuensis, new species
(Fig. 3)

Parosphromenus sp. n. - Kottelat, 1995a: 416 (Mahakam basin).

Material examined. – Holotype - MZB 5995, male, 21.8 mm SL; Borneo: Kalimantan Timur: Mahakam R. basin: swift blackwater stream entering Mahakam R. downriver of Muarapahu at 0°14'S 116°07'E; coll. M. Kottelat, 5 Aug.1991.

Paratypes – CMK 7806, 1 juvenile, 16.5 mm SL; same data. - ZRC 50265, 1 specimen, CMK 16781, 5 specimens, 15.2-20.4 mm SL; Borneo: Kalimantan Timur: Mahakam River basin: area of Tangjung Isui; 0°28'S 116°29'E; coll. T. Idei, 28 Sep.2000. - CMK 14379, 1 specimen, 20.0 mm SL; Borneo: Kalimantan Timur: Mahakam R. basin: 8 km before Kotabangun on road from Samarinda; coll. T. Idei, Jul.1997.

Diagnosis. **–** *Parosphromenus pahuensis* uniquely shares with *P. linkei* and *P. paludicola* the presence of 1-3 conspicuous black spots in the middle of the midlateral dark stripe. It is distinguished from both in having a rounded caudal fin (vs. lanceolate, usually ending by a filament). It is distinguished from *P. linkei* by having fewer segmented anal rays (6-9, vs. 10-12) and a different colour pattern in the dorsal (blackish stripe, proximal anteriorly, subproximal posteriorly, bordered externally by a row of lighter spots), anal (almost hyaline proximal stripe, with blackish mark on soft anal) and caudal (with indistict vertical rows of darker spots anteriorly) fins (vs. all unpaired fins uniformly greyish brown with several rows of minute hyaline spots). It is distinguished from *P. paludicola* in having 12 spines in the dorsal fin (vs. 17-19). *Parosphromenus pahuensis* further differs from most other congeners by a combination of dorsal and anal fin ray formulae (Table 1) and details of colour pattern.

Description. **–** General body shape and appearance is shown in Figure 3. Dorsal origin above 4th scale of lateral row. Dorsal with XII,7 (1), XIII,6* (2), XIV,5 (1) or XIV, 6 (3) rays, total 19* (4) or 20 (3); posterior extremity pointed, reaching about caudal base in male or about vertical of base of last anal ray in female. Anal fin origin under 6th* (3) or 7th (1) spine of dorsal fin and under 9th scale of lateral row; XIII,8 (2), XIII,9 (1), XIV,6 (1), XIV,7* (1) or XIV,8 (2) rays, total 20 (1), 21* (3) or 22 (3); posterior extremity pointed and reaching only slightly beyond caudal base. Caudal fin rounded, with 3 simple, 5 + 6 branched and 2-3 simple rays. Pectoral rounded, with 12* (3) or 13 (2) rays. Pelvic fin with a spine, one simple and 4 branched rays, with a filament reaching as far back as base of 11th anal spine in male; . 28 (1), 29* (2) or 30 (3) scales on lateral row (+ 2-3 on base of caudal fin), 9 in transverse row from base of 4th anal spine upwards. Vertebrae 9 + 18 = 27 (1) and 9 + 18 = 28 (1). Morphometric data of holotype in % SL: total length 133.0; head length 34.9; predorsal length 37.6; prepelvic length 38.1; preanal length 45.4; body depth 27.1; depth of caudal peduncle 12.8; body width 12.8; eye diameter 9.2; snout length 8.7; interorbital width 6.9; length of dorsal base 39.9; length of anal base 51.8; length of pelvic 39.9; length of pectoral 22.9; length of caudal 29.8.

Coloration. **–** Preserved: head and body yellowish brown; a dark brown stripe from tip of snout through eye and upper extremity of base of pectoral to lower half of caudal base; a second stripe from upper margin of eye to upper extremity of caudal base. Midlateral stripe with 1-3 conspicuous black blotches about at midlength. Lower half of head with some very faint vermiculations. Caudal, dorsal and anal fins reddish grey with a hyaline margin; dorsal with a blackish stripe, proximal anteriorly, occupying a subproximal position in soft dorsal, bordered externally by a row of lighter spots; anal with an almost hyaline proximal stripe and with blackish mark on soft anal; caudal with indistict vertical rows of darker spots anteriorly. Pelvic uniformly blackish. Pectoral hyaline. No sexual dimorphism observed, some juveniles possibly females with fins hyaline with a dark margin.

It was not possible to accurately observe the live coloration at the type locality due to heavy rain at the time of collecting. Body was reddish brown with darker stripes and dorsal and anal fins were reddish with paler spots, darker posteriorly.

Etymology. **–** Named for the type locality, Muarapahu. An adjective.

Distribution and habitat. **–** The species is presently known only from the Mahakam basin in Kalimantan Timur, Borneo. The holotype was collected in a small blackwater stream in a forest; the water was very swift on the day of collecting, but this was the result of the rain of the previous days and is probably not representative of the normal habitat.

Parosphromenus quindecim, new species
(Figs. 4, 5)

Material examined. **–** Holotype - MZB 5997, 26.9 mm SL; Borneo: Kalimantan Barat: Sungai Pawan basin: Sungai Liong, 4 km north of Nanga Tayap on road to Sandai; 1°30'02"S 110°34'19"E; coll. H. Kishi, 11 Apr.2001.

Paratypes – CMK 16829, 4 specimens, 17.7-28.6 mm SL; same data

as holotype. - ZRC 46428, 15 specimens, 23.7-28.4 mm SL; Indonesia: Borneo: southeastern Kalimantan Barat; aquarium trade, 24 Jul.2001.

Diagnosis. **–** *Parosphromenus quindecim* is distinguished from all other species of the genus except *P. linkei* and *P. pahuensis* in having 14-15 spines in dorsal fin (vs. 9-13 or 17-18; 12-14 in *P. linkei* and *P. pahuensis*). It differs from these two species in the absence (vs. presence) of 1-3 conspicuous black blotches on the middle of the lower lateral stripe, by the presence (vs. absence) of a black subdistal band in the dorsal, anal and caudal fins of the male (live and preserved) and the absence (vs. presence) of hyaline spots on the same fins. It further differs from *P. linkei* in having a rounded caudal (vs. lanceolate, with middle ray produced as a filament). It also differs from all congeners by the colour pattern of the unpaired fins of the female (grey with numerous hyaline spots, vs. plain grey or hyaline).

Description. – General body shape and appearance is shown in Figures 4, 5. Dorsal origin above 3rd scale of lateral row. Dorsal with XIII,6 (1), XIV,6 (2), XIV,7* (1), XV,6 (1) rays, total 19 (1), 20 (2) or 21* (2); posterior extremity pointed, reaching about middle of caudal in male, about vertical of caudal base in female. Anal fin origin under 6th (1) or 7th* (4) spine of dorsal fin and under 8th (1) or 9th* (4) scale of lateral row; XIII,9* (4) or XIII,10 (1) rays, total 22* (4) or 23 (1); posterior extremity pointed, reaching beyond caudal base. Caudal fin rounded, with 3 simple, 5 + 6 branched and 2-3 simple rays (4,4+6,3 in holotype whose caudal has apparently been biten off and regenerated). Pectoral rounded, with 13* (4) or 14 (1) rays. Pelvic fin with a spine, one simple and 4 branched rays, with a filament reaching to base of 11th anal spine in male, 7th anal spine in female; . 29* (3) or 30 (2) scales on lateral row (+ 2-3 on base of caudal fin), and 9 in transverse row from base of 4th anal spine upwards. Morphometric data of holotype in % SL: total length 135.3; head length 30.9; predorsal length 37.5; prepelvic length 39.0; preanal length 50.2; body depth 26.0; depth of caudal peduncle 14.9; body width 14.1; eye diameter 11.2; snout length 8.6; interorbital width 8.2; length of dorsal base 45.4; length of anal base 51.7; length of pelvic 42.8; length of pectoral 27.1; length of caudal 36.4.

Coloration. **–** Male, preserved: head and body pale yellowish brown; a dark brown stripe from tip of snout through eye and upper extremity of base of pectoral to lower half of caudal base (continued by black blotch at caudal base); a second stripe from upper margin of eye to upper extremity of caudal base. Lower half of head plain. Belly not darker than space between stripes. Caudal, dorsal and anal fins with a hyaline margin and a blackish subdistal band, darker and wider anteriorly in dorsal and anal fins, bordered interiorly by a narrow bluish band. Rest of anal and dorsal brownish red. Most of caudal brownish red, except for a conspicuous irregular black botch at end of lower lateral stripe, bordered by a row of ovoid hyaline spots. Pelvic fin and filament bluish to blackish. Pectoral hyaline. No data on live coloration.

Male, alive (based on slides of aquarium specimens; Fig. 5): Background beige to pale yellowish brown; stripes and head markings dark brown to blackish. Dorsal, anal and caudal with a narrow greenish or bluish margin and a black subdistal band bordered proximally by a narrow bluish iridescent band. Proximal part of dorsal and anal fins iridescent blue, area between proximal and subdistal bands fin red. Proximal part of caudal fin deep black, surrounded by a yellow to orange area and a few bluish spots; rest of fin red. Pelvic fin and filament black.

Female, preserved: Body and head as male but paler, belly same colour as space between stripes. Dark vertical marks across upper stripe distinct in adult. Throat with 1-4 faint markings radiating from eye. Pectoral fin hyaline, other fins greyish. Anal, dorsal and caudal fins with a hyaline margin and a brownish narrow subdistal margin, rest of fins with numerous hyaline spots, more or less organised in rows.

Etymology. **–** From the Latin quindecim (15), a reference to the 15 dorsal fin spines, a number present in no other species. An indeclinable numeral adjective.

Distribution and habitat. **–** The species is presently known only from the Sungai Pawan basin, a small coastal basin in southeastern Kalimantan Barat.

***Parosphromenus rubrimontis*, new species**
(Fig. 6)

Parosphromenus deissneri (non Bleeker, 1859) - Linke, 1990: 101 (Bukit Merah).

Material examined. **–** Holotype - ZRC 50264, male, 20.7 mm SL; Malaysia: Perak: after km-stone 21 from Taiping to Segama, Sungai Beriang; 5°07'18"N 100°39'04"E; coll. H. H. Tan et al., 18 Nov.1995.

Paratypes – ZRC 38810, 7 specimens, CMK 17696, 2 specimens, 13.7-21.0 mm SL; same data as holotype. - CMK 4151, 5 specimens, 22.2-24.7 mm SL; Malaysia: Perak: Bukit Merah, near Selama; coll. R. Ottinger, 5 Jan.1984.

Diagnosis. **–** *Parosphromenus rubrimontis* is distinguished from the other species of the genus by the following unique combination of characters: 11-12 spines in dorsal fin; 13-14 spines in anal fin; 6-8 segmented rays in anal fin; in live male, dorsal, anal and caudal fins with a narrow bluish margin and a black subdistal band bordered proximally by a narrow bluish iridescent band; proximal part of dorsal and anal fins from black along body, grading into red distally; proximal part of caudal fin deep black, surrounded by a bright red patch; pelvic fin and filament black, except for iridescent blue basal third (sometimes entirely blue).

Description. **–** General body shape and appearance is shown in Figure 6. Dorsal origin above 3rd scale of lateral row. Dorsal with XI,5* (1), XI,6 (5), XII,6 (6) or XII,7 (1) rays, total 16* (1), 17 (5), 18 (6) or 19 (1); posterior extremity pointed and reaching about one third of caudal fin in male, rounded and reaching about vertical of base of last anal ray in female. Anal fin origin under 5th* (1), 6th (4) or 7th (1)

spine of dorsal fin and under 7th* (2) or 8th (4) scale of lateral row; XIII,6 (1), XIII,7* (6), XIII,8 (5) or XIV,6 (1) rays, total 19 (1), 20* (7) or 21 (5); posterior extremity pointed and reaching slightly beyond caudal base. Caudal fin rounded, with 3 simple, 5 + 6 branched and 2-3 simple rays. Pectoral rounded, with 12* (3) or 13 (2) rays. Pelvic fin with a spine, one simple and 4 branched rays, with a filament reaching to base of first segmented anal-fin ray in male, 7th anal spine in female; . 28 (1), 29 (4) or 30* (1) scales on lateral row (+ 2-3 on base of caudal fin), and 8 (2) or 9* (4) in transverse row from base of 4th anal spine upwards. Morphometric data of holotype in % SL: total length 133.8; head length 37.2; predorsal length 40.1; prepelvic length 37.7; preanal length 47.3; body depth 25.1; depth of caudal peduncle 14.0; body width 12.6; eye diameter 11.1; snout length 9.2; interorbital width 8.6; length of dorsal base 31.4; length of anal base 52.2; length of pelvic 46.4; length of pectoral 23.7; length of caudal 33.3.

Coloration. **–** Male, preserved: head and body yellowish brown; a dark brown stripe from tip of snout through eye and upper extremity of base of pectoral to lower half of caudal base; a second stripe from upper margin of eye to upper extremity of caudal base. Lower half of head with some vermiculations. Belly dark brown. Dorsal and anal fins with a narrow hyaline distal margin, a greyish-blackish subdistal band and blackish proximal band; area between proximal and subdistal bands from hyaline to greyish-pinkish. Caudal fin with a narrow hyaline distal margin, a blackish subdistal band bordered interiorly by a narrow hyaline band and a reddish band; a conspicuous blackish blotch at fin base, usually darker in lower half. Pelvic fin and filament blackish, except for greyish proximal third. Pectoral hyaline.

Male, alive (based on field and aquarium observations and slides): Background beige to pale yellowish brown; stripes and head markings blackish. Dorsal, anal and caudal with a narrow bluish margin and a black subdistal band bordered proximally by a narrow bluish iridescent band. Proximal part of dorsal and anal fins from black along body, grading into red distally; a bluish patch in posterior basal part of dorsal fin. Proximal part of caudal fin deep black, surrounded by a bright red patch. Pelvic fin and filament black, except for iridescent blue basal third (sometimes entirely blue). Pectoral fin hyaline.

Female, preserved: Body and head as male but paler, belly same colour as space between stripes. Throat markings absent. Pectoral fin hyaline, other fins greyish. Anal and dorsal fins with a hyaline margin and a brownish narrow subdistal margin.

Etymology. **–** From the Latin ruber (red) and mons, montis (hill, mountain); named for Bukit Merah, a town near the type locality whose name means Red Hill. A noun in apposition.

Distribution and habitat. **–** The species was collected from a tea-coloured water peat swamp stream (H. H. Tan, pers. comm.) next to a plantation, some three metres wide. The specimens were collected at a depth of 1-1.5 m. The species is known from several other places in Bukit Merah and has been collected as part of surveys of the area by staff from Universiti Sains Malaysia over the few years (H. H. Tan, K. Lim, pers. comm.).

***Parosphromenus tweediei*, new species**

(Fig. 7)

Parosphromenus deissneri (non Bleeker, 1859) - Herre & Myers, 1937: 72 (Tasek Chin Chin near Jasin, Melaka); Tweedie, 1952: 67 (Ayer Hitam, Johor).

Parosphromenus deissneri (non Bleeker, 1859) - Kubota et al., 1996: 74 (Pontian).

Material examined. **–** Holotype - ZRC 24460, male, 23.7 mm SL; Peninsular Malaysia: Johor: Pontian, Sri Bunian, Kampong Pt. Tekong, 1°27’59.2"N 103°26’07.7"E; coll. P.K.L. Ng, 8 May.1992.

Paratypes – ZRC 24461-24494, 24 specimens, CMK 17697, 10 specimens, 13.2-25.1 mm SL; same data as holotype. - ZRC 28903-28907, 5 specimens, 20.2-22.5 mm SL; Peninsular Malaysia: Johor: Pontian: Kampong Jasa Sepakat, 1°31’30.5"N 103°27’47.7"E; coll. P.K.L. Ng, 8 May.1992. - ZRC 50263, 4 specimens; Peninsular Malaysia: Johor: Pontian: Kampong Jasa Sepakat, 1°31’30.5"N 103°27’47.7"E; coll. P.K.L. Ng, 8 May.1992. – ZRC 39979, 2 specimens; Peninsular Malaysia: Johor: Pontian, Kampung Jasa Sapakat; coll. Tan H. H. et al., 15 Aug.1995. - ZRC 40000, 30 specimens, 12.4-24.6 mm SL; Peninsular Malaysia: Johor: Pontian, Kampung Jasa Sapakat; coll. Tan H. H. et al., 15 Aug.1995. - ZRC 47746, 12 specimens, Peninsular Malaysia: Johor: Layang-Layang; coll. P. Yap, 14 Jan.2003. - ZRC 396, 10 specimens; Peninsular Malaysia: Johor: roadside ditch between Ayer Hitam and Yong Peng, coll. M.W.F. Tweedie, Jan.1939. – ZRC 397, 14 specimens; Peninsular Malaysia: Johor: roadside ditch between Ayer Hitam and Kluang, coll. M. W. F. Tweedie, Oct.1941.

Diagnosis. **–** *Parosphromenus tweediei* is distinguished from the other species of the genus by the unique coloration of the unpaired fins of the male, especially by the broad red band between two broad black bands and the absence of blue markings.

Description. **–** General body shape and appearance is shown in Figure 7. Dorsal fin origin above 3rd* (5) or 4th (1) scale of lateral row. Dorsal fin with X,7 (2), XI,6* (8), XI,7 (5), XII,6 (3) or XII,7 (2) rays, total 17* (10), 18 (8) or 19 (2); posterior extremity pointed and reaching about one fourth of caudal fin in male, rounded and reaching about vertical of base of last anal ray in female. Anal fin origin under 6th* (5) or 7th (1) spine of dorsal fin and under 8th (3), 9th* (2) or 10th scale of lateral row; X,12 (1), X,13 (3), XI,10 (5), XI,11 (4), XI,12* (3), XII,9 (1), XII,10 (2) or XII,11 (1) rays, total 21 (6), 22 (7) or 23* (7); posterior extremity pointed in male, rounded in female, and reaching only slightly beyond caudal base in male. Caudal fin rounded, with 3 simple, 5 + 6 branched and 2 simple rays. Pectoral rounded, with 11 (1), 12 (1) or 13* (4) rays. Pelvic fin with a spine, one simple and 4 branched rays, with a filament reaching to 3rd branched anal ray in male, 6th anal spine in female; . 28 (1), 29* (3) or 30 (2) scales on lateral row (+ 2-3 on base of caudal fin), and 9 in transverse row from base of 4th anal spine upwards.

Morphometric data of holotype, in % SL: total length 131.6; head length 30.0; predorsal length 39.7; prepelvic length 37.1; preanal length 46.0; body depth 26.2; depth of caudal peduncle 12.7; body width 11.0; eye diameter 10.5; snout length 9.7; interorbital width 8.4; length of dorsal base 33.8; length of anal base 56.5; length of pelvic 35.0; length of pectoral 20.7; length of caudal 31.6.

Coloration. **–** Male, preserved: head and body yellowish brown; a dark brown stripe from tip of snout through eye and upper extremity of base of pectoral to lower half of caudal base; a second stripe from upper margin of eye to upper extremity of caudal base. Lower half of head and belly dark brown, vermiculations on throat sometimes organized in irregular markings radiating from eye. Caudal, dorsal and anal fins grey with a hyaline margin and a pale (yellowish) median stripe. Pelvic fin and filament blackish. Pectoral hyaline.

Male, alive (based on field and aquarium observations and slides): Background yellowish brown; stripes and head markings black. Dorsal, anal and caudal with a white to bluish narrow margin and a broad black subdistal band bordered proximally by a broad vivid red band; red and black bands sometimes separated by a narrow white or bluish line; proximal part of fin black; sometimes a small vivid red patch at posterior lower edge of dorsal fin. Pelvic fin and filament black; proximal part iridescent emerald green. Pectoral fin hyaline.

Female, preserved: Body and head as male but paler, belly same colour as space between stripes. Throat markings very faint or absent. Pectoral fin hyaline, other fins greyish. Anal and dorsal fins with a hyaline margin and a brownish narrow subdistal margin.

Etymology. **–** Named for the late Michael W. F. Tweedie (1907-1993), former director of the Raffles Museum, whose series of ichthyological papers in the 1950s has been most helpful in furthering our knowledge of Malayan freshwater fishes.

Distribution and habitat. **–** This species has only been recently collected in western Johor State, Malaysia, but is (or was) likely to be found also in Malacca which is only a short distance to the north. The stream where it was most recently collected (in Pontian) is semi-degraded, but with very acidic black waters (pH ca. 4). The site is partially shaded. The fish were all collected in the deeper parts (ca. 1-1.5 m depth) with submerged vegetation. The species is still being collected by aquarists from this and nearby areas, and it is exploited on a semi-commercial level, with oversea exports made by some local dealers. The sites listed by Tweedie (1952) were still extant in the 1980s but have since been reclaimed for agricultural, industrial or urban uses. *Parosphromenus tweediei* is probably the best known species in the genus, and much of the older (pre-1990s) aquarium literature citing '*P. deissneri*' in fact refers to this species. Most of these publications show a fish identical to *P. tweediei* and many were from Ayer Hitam and environs.

DISCUSSION

Although already recorded as early as 1859, owing to their very small size and specialised habitat (peat swamps) the diversity of species of *Parosphromenus* has only been recognized in recent years. The first species (*P. deissneri*) was described on the basis of a single specimen from Bangka island by Bleeker (1859) and was figured by Bleeker (1877-78). This was a female. Most species of *Parosphromenus* are highly sexually dimorphic in colour pattern and fin development. Males have a brillant coloration and a contrasted colour pattern which usually convey most of the information usable to identify the species. Females and juveniles have a dull coloration and most species have the same colour pattern. It is thus not surprising that many subsequent authors have identified *Parosphromenus* specimens from throughout the range of the genus as *P. deissneri* until it was realised that several species were involved.

The resolution of the taxonomy of these species required the redescription of *P. deissneri* based on fresh material from Bangka, especially males. Field work on Bangka revealed that two species occur on that island that can be distinguished by colour pattern and by structure of the caudal-fin rays. This last character can also be observed in female specimens and it was hoped that this would allow an unambiguous identification of one of the two species with the holotype of *P. deissneri*. Unfortunately, when we examined it, the caudal fin was missing rendering the identification impossible (Ng & Kottelat, 1998; Kottelat & Ng, 1998). The designation of a neotype to replace the holotype was proposed (Ng & Kottelat, 1998; Kottelat & Ng, 1998) and accepted (ICZN, 2000). This defines *P. deissneri* and now allows the naming of the various populations earlier referred to under that name. The second species from Bangka (also recorded on Bintan Island) was named *P. bintan* by Kottelat & Ng (1998).

A few species of *Parosphromenus* are very distinctive. *Parosphromenus paludicola* is easily distinguished by having more spines in dorsal fin than any other species (17-19, vs. 9-15); *P. parvulus* and *P. ornaticauda* have a very small size (maximum 20 mm SL), fewer anal spines (7-9, vs. 10-15) and a diffent type of colour pattern (see photographs in Kottelat et al., 1993; Linke, 1990, Kubota et al., 1996); *P. linkei*, *P. paludicola* and *P. pahuensis* have 1-3 black blotches on the middle of the lower lateral stripe (vs. no such blotches); *P. deissneri*, *P. filamentosus* and *P. linkei* have a lanceolate caudal fin with a simple median ray projecting as a filament (vs. rounded); *P. paludicola* has a lanceolate caudal fin with the lower branch of the fifth branched ray (counted from top) produced as a filament (vs. rounded); *P. anjunganensis* has plain brownish red unpaired fins (except for pale distal margin) (vs. with at least one conspicuous black band on unpaired fins); males of *P. filamentosus* and *P. quindecim* have the dorsal and anal fins with a narrow subdistal black band bordered interiorly with a narrow blue band and the rest of the fin plain brownish red (vs. with a black proximal band in most other species).

Other characters distinguishing the new species *P. quindecim* and *P. pahuensis* are listed in their respective diagnoses.

The remaining species share a general habitus and male colour pattern with conspicuous and contrasted colour marks on the unpaired fins made of longitudinal bands on the anal and dorsal and concentric bands on the caudal. In life, when these fins are erected during displays, the black, red and blue marks of these fins are continuous with those of the adjacent one(s). This pattern shows little variability within a population (but there is some variability induced by the water quality, with specimens from clear acidic waters having the more contrasted and vivid colours, those from less acidic and turbid waters having less contrasted and vivid colours; dominant adult males have more colourful fins than younger or less dominant males) and the differences between populations are constant. These differences can be observed in live specimens and in well preserved ones. They usually cannot be observed in 'average' museum material or in specimens not fixed with expanded fins. Of course, the colours would fade quite quickly in preserved specimens, but the pattern usually remains distinct. We observed differences in details of patterning (e.g. width of lateral stripes) in some species but we are not certain whether these are not possibly induced by habitat or water quality, or stress at time of fixation (this is especially true for specimens obtained through the aquarium trade) and have refrained from using them to distinguish species. The coloration and colour pattern of the pelvic fin also allows to distinguish some species.

There are some (but very limited) differences in anal and dorsal fin ray counts (Table 1). We have not observed usable differences in fin counts in other fins and in scale counts. As mentioned under our 'Material and methods', we found measurements difficult to replicate as the specimens are small, easily dehydrated and easily damaged; in addition, they yielded no character useful to diagnose the species.

We are thus left with mainly coloration and colour pattern characters to diagnose the species. As these characters are constant within populations and within naturally delimited geographic areas, with the data available to us we consider them as reliable characters.

A few of these species have been formally named in the aquarium literature, mainly on the basis of coloration. *Parosphromenus nagyi* is known from coastal peat swamps areas near Kuantan, eastern Peninsular Malaysia (see Schaller & Kottelat, 1989, for a discussion of type material). It is a small-sized species (wild caught specimens up to 23 mm SL) characterized by the absence of red pigment on all fins. All colour bands on unpaired fins are emerald green. The pelvic fins are emerald green with a black blotch at base and a subdistal black spot, a pattern apparently shared with no congener. The pelvic filament is very short, shorter than the rest of the fin.

A similar species from peat swamps of Selangor, Peninsular Malaysia, is known under the name *P. harveyi*. Brown (1987: 34) notes that *P. harveyi* differs from *P. nagyi* by a "slightly different range of dorsal fin spines and rays counts" but does not list any explicit values. We have not seen a difference in dorsal ray count (Table 1). The other differences reported by the author ("black bars radiating from the eye to the lip, throat and belly", absence of dense dark coloration, presence of "alternating light and dark horizontal bars") are erroneous as we observe no difference between the two species on these characters. In our preserved material, *P. harveyi* differs in having a longer pelvic fin filament (conspicuously longer than rest of fin, vs. shorter in *P. nagyi*), dorsal fin rays extending backwards as a filament (reaching beyond caudal fin base, vs. not reaching to caudal fin base), a wider black subdistal band in caudal fin (not quantifiable, but obvious when species are placed side by side), melanophores on anal and dorsal fins more or less equally and densely set (vs. more sparsely set, except on lower posterior part of dorsal where they form a black blotch). Live specimens differ in having a plain blue pelvic fin (vs. emerald green with a black blotch at base and a black subdistal spot).

A note about the taxonomy of *Parosphromenus harveyi* is necessary. The species was first "announced" in a brief one page note in an aquarium magazine by Brown (1987: 34) on the basis of specimens collected from Batu Arang (Peninsular Malaysia). The author explicity stated that the male specimen figured is not the holotype. Through the courtesy of Barbara and Allan Brown, the second author examined the specimens of *P. harveyi* still in their possession, including an F1 adult male. The specimens available to Brown at the time of the description (stated as collected in "July and Aug.1984 and 1985") (Brown, 1987: 34) are syntypes, and all subsequent material is not part of the syntype series. F1 cannot be part of the syntype series. Unfortunately the few remaining syntypes are not in good condition. We select the best remaining syntype (ZRC 50234, male, 23.5 mm SL) as the lectotype of the species. *Parosphromenus harveyi* is a distinctively coloured species and cannot be confused with others. Where it is found, there is also no other similar species occurring. The type locality is being rapidly cleared and much of the swamp forests in the area has been destroyed. *Parosphromenus harveyi* is still common, however, in the peat swamps of north Selangor, which are about 100 km north of Batu Arang (see Linke, 1990; Ng, 1993; Ng et al., 1992, 1994). It is also found further north in peat swamps in Perak (Lim et al., 1993; Ng et al., 1994).

The next record of a specimen of *Parosphromenus* after Bleeker (1859) was by Herre & Myers (1937) who recorded specimens from Lake Chinchin (Melaka, Malaysia). We have not been able to obtain material from that area, but Herre & Myers's brief description and the mention of only red and black marks on the fins suggest that their material is conspecific with the one we describe here as *P. tweediei*. Live males of *P. tweediei* are distinguished from all congeners by the colour pattern of the unpaired fins without blue pigment and with very contrasting black and red bands of about equal widths. Except for *P. sumatranus*, the other species misidentified as *P. deissneri* have a blue band between the subdistal black band and the red band in at least one fin; in some the red pigment may be completely missing (*P. harveyi*, *P. nagyi*).

Table 1. Dorsal and anal fin ray counts of the species of *Parosphromenus*.

	Dorsal fin formula	Total	Anal fin formula	Total	Reference
P. alfredi	XII-XIV,5-6	18-19	XI-XIII,8-10	20-22	present study
P. allani	XI-XIII,5-6	16-19	XII-XIII,8-11	21-22	pers. obs. (n=14, CMK 10976, 16832)
P. anjunganensis	XII-XIII,6-7	18-20	XI-XIV,9-11	21-23	Kottelat (1991: 281)
P. bintan	XI-XIII,5-7	17-20	XI-XIII,8-10	19-22	Kottelat & Ng (1998: 270)
P. deissneri	XII-XIII,6	18-19	XII-XIII,8-10	21-23	Kottelat & Ng (1998: 266)
P. filamentosus	XII-XIII,6-7	18-20	XI-XII,10	21-22	Kottelat et al. (1993: 164)
P. harveyi	XI-XIII,5-7	17-18	XI-XIII,8-11	20-22	pers. obs. (n=6, CMK 10041)
P. linkei	XII-XIV,7-8	19-22	XI-XIV,10-12	22-24	Kottelat (1991: 282)
P. nagyi	XI-XIII,5-7	16-19	XI-XIII,8-11	20-23	pers. obs. (n=21, CMK 8054, 8072)
P. opallios	XI-XIII,6-8	18-19	XI-XII,10-11	21-23	present study
P. ornaticauda	IX-XI,6-7	16-17	VII-IX,10-13	18-21	Kottelat (1991: 284)
P. pahuensis	XII-XIV,5-7	19-20	XIII-XIV,6-9	20-22	present study
P. paludicola	XVII-XIX,5-7	22-25	XIII-XVI,6-9	21-23	pers. obs. (n=25, CMK 12095, 8219)
P. parvulus	X-XI,5-6	15-17	VIII-IX,10-11	18-20	Kottelat et al. (1993: 164)
P. quindecim	XIII-XV,6-7	19-21	XIII,9-10	22-23	present study
P. rubrimontis	XI-XII,5-7	16-19	XIII-XIV,6-8	19-21	present study
P. sumatranus	XI-XII,6-7	17-19	X-XII,8-10	20-22	pers. obs. (n=18, CMK 11160, 6626, 7328)
P. tweedei	X-XII,6-7	17-19	X-XII,10-13	21-23	present study

Males of *P. sumatranus* also lack the blue band in the anal and dorsal fins, but it is present in a few large adult males. In *P. sumatranus*, most males we have seen have a very weakly developed caudal fin pattern; the caudal is usually plain pale red, with a hyaline margin. Only a few have a well developed and contrasted black submarginal band, interiorly bordered by a narrow blue band (hyaline in preserved specimens). In *P. sumatranus*, the proximal black bands on the anal and dorsal are of irregular width (vs. very regular in *P. tweediei*), the one on the dorsal is denser and broader posteriorly, forming a conspicuous black blotch (vs. no such blotch) and there are slightly fewer segmented rays in anal fin (8-10, vs. 10-13). *Parosphromenus sumatranus* was described on the basis of aquarium specimens collected near Jambi, Sumatra (Klausewitz, 1955). The original description does not include information on the characters listed above (except that there are 9 segmented rays in the anal fin) and the figure is not very informative. The types were examined (see comparative material listed) and they agree very well with fresh specimens we have obtained from Jambi (see characters in Table 1). In life, adult males have a very distinct colour pattern, with a large black spot at the base of their dorsal fin and the pelvic fin filament is black (see Kubota et al., 1995: 78, as *Parosphromenus* sp. "Dorsal spot"). *Parosphromenus sumatranus* is thus here regarded as a valid species.

Among the species previously identified as *P. deissneri*, *P. rubrimontis* from Perak (northwestern Peninsular Malaysia), *P. alfredi* from southeastern Johor (Peninsular Malaysia) and *P. opallios* from southeastern Kalimantan Tengah (Borneo) are very similar and share the presence of a blue band between the subdistal black band and the red band in the dorsal, caudal and anal fins. *Parosphromenus rubrimontis* is distinguished from the other two species in having more spines in anal fin (13-14, vs. 11-12, 13 in a single specimen). It also has fewer segmented rays in anal fin than *P. opallios* (6-8, vs. 10-11; 8-10 in *P. alfredi*). *Parosphromenus alfredi* is distinguished from the other two species in having a plain blue pelvic fin with white filament (vs. blue at base, black at tip).

With regards to *P. allani*, the name was made available together with *P. harveyi* (see above) and the same problems are encountered. The original note (Brown, 1987) conveys no diagnostic information other than the fish being similar to *P. deissneri* and differing in having "a horizontal blue band" in the anal and dorsal fins. The accompanying figure shows a fish from a "locality 1/86 in Sarawak", a location which is actually on the outskirts of Sibu (Brown & Brown, 1987: 157). Brown & Brown (1987: 155-156) also mention that the fish shown on this figure "… developed some red colouration in the posterior lower third of the dorsal fin" and that there was a prominent black spot in that area. This is shown on their plate 15. We have seen material from other parts of Sarawak which we tentatively identify as *P. allani* although we are not yet fully convinced that they represent a single species. They include males with blue or red bands in the fins, and both colours have been observed in different specimens of the same population otherwise not distinguishable. It is not clear whether this is attributable to polymorphisms, age or mood of the individual fish. The populations from western Sarawak (Stunggang area) may well be a separate species as their caudal fin pattern appears to be different, and their anal fin often has an additional band. This matter is now under investigation.

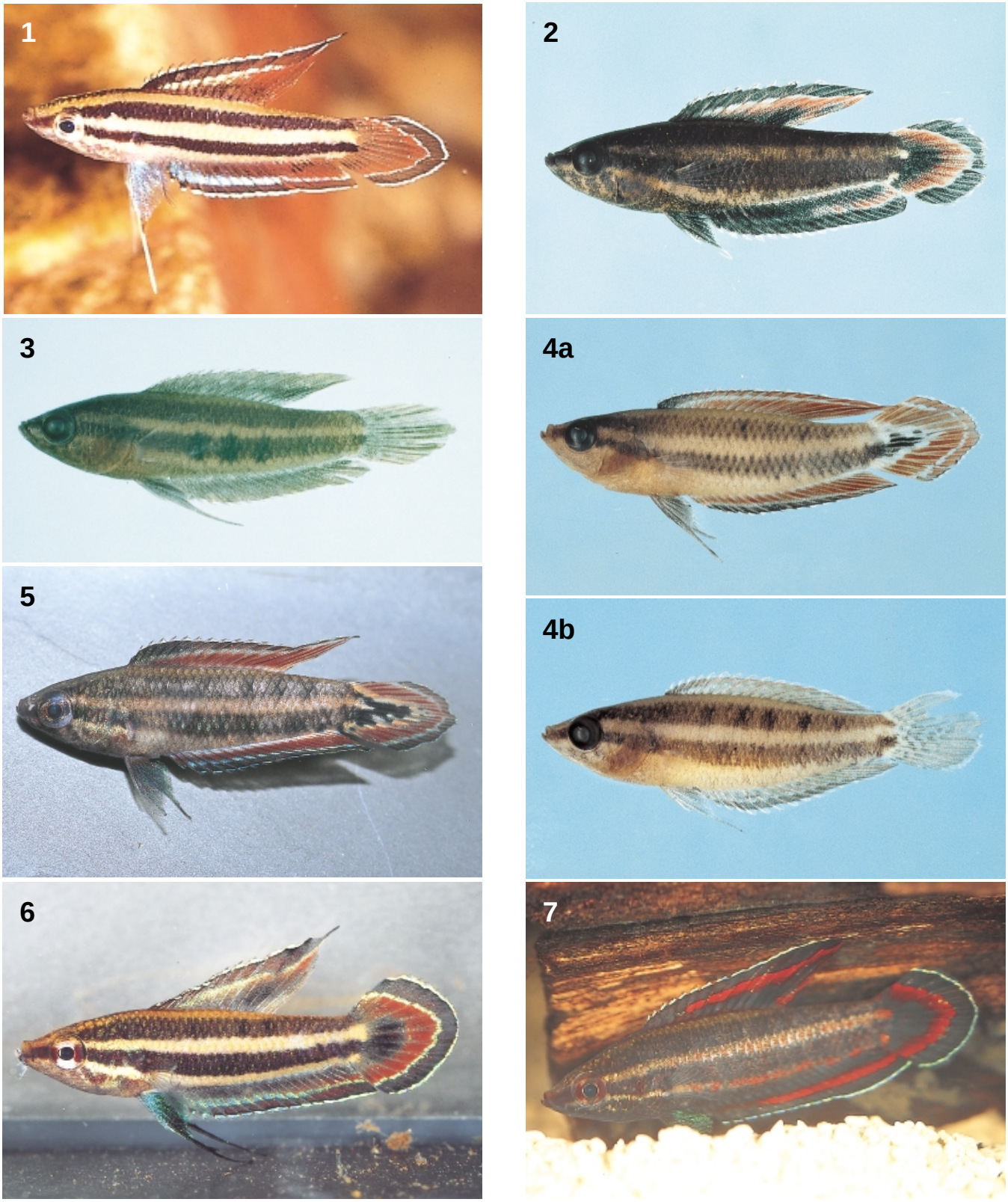
The problems with the type series of *P. harveyi* discussed above are the same as those for the type series of *P. allani*. In this case too, the specimen figured in the original note was explicity stated not to be the holotype. Brown (1987: 34) stated that the species is based on specimens collected in Jul.1986, and as such, only material from this time should be regarded as syntypes. We hereby select the best preserved specimen (ZRC 50243, male, 26.1 mm SL) as the lectotype of *P. allani*.

In our preserved material, large adult males (apparently all with red fins), the soft dorsal bears a conspicuous black round blotch surrounded by a broad area completely devoid of any black pigments (apparently red in life), a character observed in no other species of the genus. This black blotch is not equivalent to the one observed in *P. nagyi* which is not ocellated by a pigmentless ring, or with the one in *P. sumatranus* and *P. opallios* in which it is a widened part of the proximal band. In addition, in *P. allani* the black blotch at caudal fin base is irregularly shaped (as also observed in *P. quindecim*, see Fig. 4) and there is no blue band between the red central patch and the black subdistal margin (in the males with red fins).

Comparative material. – ***Parosphromenus allani***: Lectotype – ZRC 50243, male, 26.1 mm SL; Borneo: Sarawak: roadside pool, east side of Jalan Ulu Oya, 106 km from junction with Jalan Tang Sang, outskirts of Sibu; coll. B. Brown & A. Brown, 16 Jul.1986. Paralectotypes – ZRC 50244, 1 male 24.6 mm SL; ZRC 50245, 1 male, 22.2 mm SL; same data as lectotype. – ZRC 50246, 1 male, 23.1 mm SL; ZRC 50247, 1 male, 24.0 mm SL; ZRC 50248, 1 female, 28.1 mm SL; 1 juvenile, 17.5 mm SL; ZRC 50249, 1 female, 21.6 mm SL; ZRC 50250, 1 female, 21.5 mm SL; roadside pool, east side of Jalan Ulu Oya, 106 km from junction with Jalan Tang Sang, outskirts of Sibu; coll. B. Brown & A. Brown, 23 Jul.1986. Others – ZRC 50251, 3 males, 22.0-24.6 mm SL, 1 female, 21.0 mm SL; Borneo: Sarawak; coll. B. Brown & A. Brown, Apr.1993. – ZRC 50252, 2 males, 23.9 mm, 24.0 mm SL, 6 females, 20.6-27.8 mm SL; coll. B. Brown & A. Brown, Jan.1985. – ZRC 37846, 6 specimens, 18.7-25.7 mm SL; Borneo: Sarawak: outskirts of Sibu, 4.2 km north of airport runway, on Jalan Teku, coll. M. Kottelat et al., 15 May.1994. – ZRC 37863, 15 specimens, 13.7-25.1 mm SL, Borneo: Sarawak: ca. 1 km north of Durin Ferry, on Sri Aman-Sibu road, coll. M. Kottelat et al., 15 May.1994. - CMK 10976, 38 specimens; Sarawak: Daro. - CMK 10933, 2 specimens; Sarawak: Mukah. - CMK 10882, 6 specimens; Sarawak: Sibu. – ZRC 43661, 9 specimens, 10.8-21.3 mm SL; Borneo: Sarawak: Bau-Lindu area, Sungai Stunggang swampforest, 51 km to Lundu from bau, along Bau-Lundu road, coll. H. H. Tan & P. Yap, 2 Oct.1998. - ZRC 50253, 8 specimens, 18.7-24.5 mm SL; ZRC 50254, 8 specimens, 17.0-24.8 mm SL; ZRC 50255, 7 specimens, 21.1-26.0 mm SL; ZRC 50256, 7 specimens, 18.3-24.6 mm SL; Borneo: western Sarawak; Sungai Stinggang, under road 49.4 km west of Bau on road to Lundu, coll. A. Brown and B. Brown, 26 Jul.1986. - ZRC 50257, 9 specimens, 20.0-25.6 mm SL; Borneo: western Sarawak; coll. B. Brown & A. Brown, 1987. – ZRC 50258, 3 specimens, 22.8-23.2 mm SL; Borneo: western Sarawak; B. Brown & A. Brown, 1993. – ZRC 50259, 6 specimens, 22.8-24.5 mm; B. Brown & A. Brown, 1993. - ZRC 50260, 1 specimen, 29.2 mm SL; Borneo: western Sarawak; coll. B. Brown & A. Brown, no date. ***P. anjunganensis***: see Kottelat (1991). ***P. bintan***: see Kottelat & Ng (1998). ***P. deissneri***: see Kottelat & Ng (1998). - ZRC 46184, 2; Biliton. ***P. filamentosus***: CMK 4193, 7 specimens; Borneo: Banjermasin. - CMK 16743, 10; Borneo: Tamiyang Layang. ***P. harveyi***: Lectotype – ZRC 50234, 1 male, 23.5 mm SL; Peninsular Malaysia: Batu Arang, Selangor; coll. B. Brown & A. Brown, 1985. Paralectotypes – ZRC 50235, 1 male, 23.8 mm SL; ZRC 50236, 1 female, 23.0 mm SL; ZRC 50237, 1 female, 20.6 mm SL; ZRC 50238, 1 female, 19.4 mm SL; ZRC 50239, 1 female, 23.2 mm SL; ZRC 50240, 1 male, 21.8 mm SL; same data as lectotype. Others – ZRC 50241, 1 male, 23.1 mm SL, F1 generation of type series. - ZRC 38432, 25 specimens; Peninsular Malaysia: Sabak Bernam. - ZRC 14520-14521, 2 specimens; ZRC 16222, 1 specimen; ZRC 16230-16235, 6 specimens; ZRC 16236-16240, 5 specimens; ZRC 16241-16250, 10 specimens; ZRC 16251-16265, 15 specimens; ZRC 17837-17840, 7 specimens; ZRC 17895-17924, 30 specimens; ZRC 17925-17953, 29 specimens; ZRC 17957-17961, 5 specimens; ZRC 18040-18044, 5 specimens; ZRC 18883-18835, 3 specimens; ZRC 28551-28560, 10 specimens; ZRC 38276, 21 specimens; ZRC uncat., 1 specimen; ZRC uncat., 2 specimens; CMK 10040, 32 specimens; CMK 10041, 6 specimens; Peninsular Malaysia: Sungai Besar-Tanjung Malim. – ZRC 5112-5114, 3 specimens; ZRC 11614-11615, 2 specimens; ZRC 18848-18850, 3 specimens; Peninsular Malaysia: Rawang, near Kuala Selangor. – ZRC uncat., 1 specimen; ZRC uncat., 2; Peninsular Malaysia: Batu Arang, Selangor. ***P. linkei***: see Kottelat (1991). ***P. nagyi***: CMK 8054, 20; CMK 8072, 18; Peninsular Malaysia: Kuantan. **–** ZRC 50261, 1 juvenile; Peninsular Malaysia: Chukai; coll. A. Brown & B. Brown, 6 Aug.1988. ***P. ornaticauda***: see Kottelat (1991). ***P. paludicola***: CMK 8265, 1 specimen; Peninsular Malaysia: Pasir Puteh. - CMK 8219, 30 specimens; Peninsular Malaysia: Kuala Brang. - CMK 12031, 10 specimens; Thailand: Narathiwat. ***P. parvulus***: CMK 7939, 2 specimens: Borneo: Palangkaraya. - CMK 16744, 32 specimens; Borneo: Tamiyang Layang. ***P. sumatranus***: SMF 3566, Holotype, 21.5 mm SL; Sumatra: Jambi. - SMF 3711, 4 paratypes, 22.8-27.7 mm SL; Sumatra: Jambi. - ZRC, 3 juveniles; Sumatra: Jambi: Leibong Sepbaju. – ZRC 50262, 7 specimens, 12.2-25.3 mm SL; Sumatra: Jambi: Sungai Ayer Merah. - ZRC 42406, 50 specimens; Sumatra: Jambi: Sungei Pijoan. – ZRC, 6 specimens, 13.8-4.1 mm SL; Sumatra Selatan: Sungai Sentang. - CMK 7238, 8 specimens: Sumatra: Sungei Siak Kecil. - CMK 11160, 6 specimens; Sumatra: Jambi.

KEY TO THE SPECIES OF *PAROSPHROMENUS*

1. 17-19 spines in dorsal fin (Peninsular Malaysia: Terengganu, Kelantan; Thailand: Narathiwat Province) .. *P. paludicola*
– 9-15 spines in dorsal fin 2
2. 7-9 spines in anal fin 3
– 10-14 spines in anal fin 4
3. Male caudal fin with a broad orange median stripe bordered above and below by a black stripe and a marginal blue stripe (Borneo: western Kalimantan Barat) ..... *P. ornaticauda*
– Male caudal fin reddish in life, uniform blackish when preserved (Borneo: Kalimantan Tengah, Kalimantan Selatan) ..... *P. parvulus*
4. 1-3 conspicuous black blotches in middle of midlateral stripe 5
– No conspicuous black blotches in midlateral stripe 6
5. 10-12 segmented rays in anal fin; caudal fin lanceolate, median ray produced as a filament (Borneo: western Kalimantan Tengah) ..... *P. linkei*
– 6-9 segmented rays in anal fin; caudal fin rounded (Borneo: Kalimantan Timur) ..... *P. pahuensis*
6. Median caudal-fin ray unbranched, produced as a filament ... 7
– Median caudal-fin rays all branched, not produced as a filament 8
7. Dorsal and anal fins plain brownish red in life, with a narrow subdistal black band (Borneo: Kalimantan Selatan) ..... *P. filamentosus*



Figs. 1-7. 1. *Parosphromenus alfredi*, male, about 20 mm SL (part of ZRC 28378-28393); Peninsular Malaysia: Johor: Kota Tinggi; 2. *Parosphromenus opallios*, male, paratype, CMK 16355, 23.0 mm SL; Borneo: Kalimantan Tengah: Pangkalanbun; 3. *Parosphromenus pahuensis*, male, holotype, MZB 5995, 21.8 mm SL; Borneo: Kalimantan Timur: Muarapahu; 4. *Parosphromenus quindecim*, paratypes, CMK 16829; Borneo: Kalimantan Barat: Nanga Tayap. **a,** male, 28.6 mm SL; **b,** female, 26.1 mm SL5; 5. *Parosphromenus quindecim*, paratype, male, about 24 mm SL (part of ZRC 46428); Borneo: Kalimantan Barat (photograph by Tan Heok Hui); 6. *Parosphromenus rubrimontis*, male, about 20 mm SL (part of ZRC 38810); Peninsular Malaysia: Perak: Bukit Merah (photograph by Tan Heok Hui); 7. *Parosphromenus tweediei*, male, about 20 mm SL (part of ZRC 28903-28907); Peninsular Malaysia: Johor: Pontian.

– Dorsal and anal fin with a black subdistal band, bordered proximally by a bluish to greenish iridescent band, proximal parts of fins dark reddish brown to black (Sumatra: Bangka Island) ..... *P. deissneri*

8. Dorsal, anal and caudal fins plain brownish red with a narrow bluish (in life, whitish when preserved) distal margin (Borneo: western Kalimantan Barat) .... *P. anjunganensis*
– Dorsal, anal and caudal fin variously patterned, with a conspicuous black or blackish subdistal band 9
9. (13)14-15 spines in dorsal fin; caudal fin of female grey, with several rows of hyaline spots; dorsal and anal fins of male with a narrow black subdistal band, bordered interiorly by a narrow bluish band, most of fins brownish red (Borneo: eastern Kalimantan Barat) ..... *P. quindecim*
– 10-13(14) spines in dorsal fin; caudal fin of female plain grey; dorsal and anal fins of male with a different pattern … 10
10. Dorsal and anal fins of preserved male plain black, without conspicuous darker submarginal band or hyaline median band 11
– Dorsal and anal fins of preserved male with a conspicuous black submarginal band, bordered interiorly by a paler or hyaline band 12
11. Pelvic fin filament longer than rest of fin; dorsal fin rays extending backwards as a filament, reaching beyond caudal fin base; melanophores on anal and dorsal fins of preserved male more or less equally and densely set; pelvic fin of live male plain blue (Peninsular Malaysia: Selangor, Perak) .. *P. harveyi*
– Pelvic fin filament shorter than rest of fin; dorsal fin pointed, not reaching to caudal fin base; melanophores on anal and dorsal fins of preserved male sparcely set, except on lower posterior part of dorsal where they form a black blotch; pelvic fin of live male emerald green with a black blotch at base and a black subdistal spot (Peninsular Malaysia: eastern Pahang) ..... *P. nagyi*
12. A conspicuous black blotch in posterior part of dorsal fin 13
– Proximal band in dorsal fin not enlarged and not darkened posteriorly into a conspicuous black blotch at posterior lower corner of fin 15
13. Black blotch on dorsal fin surrounded by a hyaline area without black pigment in preserved specimens (red in life) (Borneo: Sarawak) ..... *P. allani*
– Proximal black to reddish band on dorsal fin with black pigments more densely set at posterior extremity of fin, forming a black blotch 14
14. Dorsal and anal fins with black subdistal and proximal bands, area inbetween plain red (Sumatra: Jambi and Riau Provinces) ..... *P. sumatranus*
– Dorsal and anal fins with black subdistal band, brownish red to black proximal band (black along body, grading into red distally), area inbetween iridescent blue (Borneo: western Kalimantan Tengah) ..... *P. opallios*
15. No red band or patch in dorsal, anal and caudal fins (Sumatra: Bintan and Bangka Islands) …….. *P. bintan*
– Red band or patch present in dorsal, anal and caudal fins 16
16. Dorsal, anal and caudal fins with black subdistal and proximal bands, area inbetween plain red, no blue band or patch in these three fins (Peninsular Malaysia: western Johor) .... *P. tweediei*
– Both blue and red bands or patches present between subdistal and proximal black bands in at least anal or caudal fins . 17
17. 13-14 spines in anal fin; 6-8 segmented rays in anal fin (Peninsular Malaysia: Perak) ..... *P. rubrimontis*
– 11-12(13) spines in anal fin; 8-11 segmented rays in anal fin (Peninsular Malaysia: eastern Johor) …… *P. alfredi*

ACKNOWLEDGEMENTS

A lot of the material used in this paper have been obtained by us or associates during a variety of fieldwork spanning the years 1988-1996, supported by various grants and agencies (notably the National University of Singapore and Fauna & Flora Preservation Society, FFPS, London), and with the field assistance of numerous students and colleagues, most notably Tan Heok Hui and Kelvin Lim. Tan Heok Hui was invaluable in helping with fresh specimens, photography and sorting the specimens studied here. Charles Leh (Sarawak Museum), as well as staff from the Sarawak Forestry Department and Fishery Department, were most helpful in many aspects of the work we did in Sarawak then. We are grateful to Barbara and Allan Brown for putting their material at our disposal and providing their data sets, allowing us to sort out the taxonomic problems. They also provided us with their slides for reference. We thank T. Idei, H. Kishi and K. Kubota for the gift of specimens. This manuscript was completed during a visit of the first author to ZRC supported by a Raffles Museum Research Fellowship. The second author was supported by a research grant from the university.

LITERATURE CITED

Bleeker, P., 1859. Negende bijdrage tot de kennis der vischfauna van Banka. *Natuurkundig Tijdschrift voor Nederlandsch Indië*, **18**: 359-378.

Bleeker, P., 1877-78. *Atlas ichthyologique des Indes orientales néêrlandaises*. Tome IX. Percoïdes III. Muller, Amsterdam, 80 pp., pls. 355-420.

Brown, A. & B. Brown, 1987. A survey of freshwater fishes of the family Belontiidae in Sarawak. *Sarawak Museum Journal*, **37**: 155-170, 3 pls.

Brown, B., 1987. Special announcement - two new anabantoid species. *Aquarist and Pondkeeper*, **1987**(June): 34.

Cracraft, J., 1989. Speciation and its ontology: the empirical consequences of alternative species concepts for understanding patterns and processes of differentiation. Pp. 28-59. In: Otte, D. & J. A. Endler (eds.), *Speciation and its consequences*. Sinauer Associates, Sunderland, MA, xiii+679 pp.

Herre, A. W. C. T. & G. S. Myers, 1937. A contribution to the ichthyology of the Malay Peninsula. *Bulletin of the Raffles Museum*, **13**: 5-75.

ICZN [International Commission on Zoological Nomenclature]. 2000. Opinion 1946. *Osphronemus deissneri* Bleeker, 1859 (currently *Parosphromenus deissneri*; Osteichthyes, Perciformes): holotype replaced by a neotype. *Bulletin of Zoological Nomenclature*, **57**(1): 60.

Klausewitz, W., 1955. See- und Süsswasserfische von Sumatra und Java. *Senckenbergiana Biologica*, **36**: 309-323.

Kottelat, M., 1991. Notes on the taxonomy and distribution of some Western Indonesian freshwater fishes, with diagnoses of a new genus and six new species (Pisces: Cyprinidae, Belontiidae, and Chaudhuriidae). *Ichthyological Exploration of Freshwaters*, **2**: 273-287.

Kottelat, M., 1995a. The fishes of the Mahakam River, East Borneo: an example of the limitations of zoogeographic analyses and the need for extensive fish surveys in Indonesia. *Tropical Biodiversity*, **2**(3, 1994 [1995]): 401-426.

Kottelat, M., 1995b. Systematic studies and biodiversity: the need for a pragmatic approach. *Journal of Natural History*, **29**: 565-569.

Kottelat, M., 1997. European freshwater fishes - an heuristic checklist of the freshwater fishes of Europe (exclusive of former USSR), with an introduction for non-systematists and comments on nomenclature and conservation. *Biologia*, Bratislava, Section Zoology, **52** (Supplement 1): 1-272.

Kottelat, M., 2001. *The fishes of Laos*. Wildlife Heritage Trust Publications, Colombo, 198 pp.

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

Kottelat, M. & P. K. L. Ng, 1998. *Parosphromenus bintan*, a new osphronemid fish from Bintan and Bangka islands, Indonesia, with redescription of *P. deissneri*. *Ichthyological Exploration of Freshwaters*, **8**: 263-272.

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.

Kubota, K., M. Majima, K. Miki & K. Yamazaki, 1995. [*Tropical fish collection. 5. Anabantoids*]. Pisces Publishers, Tokyo, 144 pp. [in Japanese]

Lim, K. K. P., P. K. L. Ng, M. Kottelat & M. Zakaria-Ismail, 1993. *A preliminary working list of native freshwater fishes of Peninsular Malaysia*. Asian Wetland Bureau, Institute of Advanced Studies and World Wide Fund for Nature, Fish Project Series 5, Kuala Lumpur, ii+10 pp.

Linke, H., 1990. *Labyrintfische - Farbe im Aquarium. Ein Handbuch für Bestimmung, Pflege und Zucht*. Tetra-Verlag, Melle, 174 pp.

Mayden, R. L. & R. M. Wood, 1995. Systematics, species concepts, and the evolutionarily significant unit in biodiversity and conservation biology. *American Fisheries Society Symposium*, **17**: 58-113.

Ng, P. K. L., 1993. Schwarzwasserfische aus Nordselangor (Malaiische Halbinsel). *Die Aquarien- und Terrarien-Zeitschrift*, **46**: 112-117.

Ng, P. K. L. & M. Kottelat, 1998. *Osphromenus deissneri* Bleeker, 1859 (currently *Parosphromenus deissneri*; Osteichthyes, Osphronemidae): proposed replacement of holotype by a neotype. (Case 3071). *Bulletin of Zoological Nomenclature*, **55**(3): 155-158.

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.

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 (AWB) Publication No. 81, Kuala Lumpur, pp. i-iv, 1-90, figs. 1-110.

Schaller, D., 1985. *Parosphromenus nagyi* spec. nov., ein neuer Prachtgurami aus Malaysia (vorläufige Mitteilung). *Die Aquarien- und Terrarien-Zeitschrift*, **38**: 301-303.

Schaller, D. & M. Kottelat, 1989. *Betta strohi* sp. n., ein neuer Kampffisch aus Südborneo (Osteichthyes: Belontiidae). *Die Aquarien- und Terrarien-Zeitschrift*, **43**(1990 [1989]): 31-37.

Tweedie, M. W. F., 1952. Notes on Malayan fresh-water fishes. 3. The anabantoid fishes. 4. Some new and interesting records. 5. Malay names. *Bulletin of the Raffles Museum*, **24**: 63-95.

Vierke, J., 1979. Ein neuer Labyrinthfisch von Borneo – *Parosphromenus parvulus* nov. spec. *Das Aquarium*, **13**(120): 247-250.

Vierke, J., 1981. *Parosphromenus filamentosus* n. sp. aus SO Borneo (Pisces: Belontiidae). *Senckenbergiana Biologica*, **61**: 363-367.

Warren, M. L., 1992. Variation of the spotted sunfish, *Lepomis punctatus* complex (Centrarchidae): meristics, morphometrics, pigmentation and species limits. *Bulletin of the Alabama Museum of Natural History*, **12**: 1-47.