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Four new species of Rainbowfishes (Melanotaeniidae) from Arguni Bay, West Papua, Indonesia

by

KADARUSMAN (1, 2), Renny K. HADIATY (3), Gilles SEGURA (4), Gigih SETIAWIBAWA (5), Domenico CARUSO (1, 5) & Laurent POUYAUD* (1)

ABSTRACT. - Four new species of Rainbowfishes are described from the Arguni region. These species are allied to the species already known from the Bomberai Peninsula and the Bird's Neck, namely *Melanotaenia ammeri*, *M. irianjaya*, *M. kokasensis*, *M. parva* and *M. angfa*. The new species *M. urisa* is characterised by a thin and elongated body, a long predorsal length, a short preanal length, a long and thin caudal peduncle, short fins and by relatively large eyes. In contrast, *M. arguni* sp. nov. is distinguished from all of its congeners by small eyes, a thin body, a moderately long predorsal length, a long preanal length, and a short and thin caudal peduncle. *Melanotaenia veoliae* sp. nov. displays an original pattern of colouration, few cheek scales, a large interorbital width and a long spine length on the anal fin. *Melanotaenia wanoma* sp. nov. is recognised by an elongated body with a short and thin caudal peduncle, a short predorsal length with a long total dorsal fin, a long preanal length and a prominent margin stripe present on anal and second dorsal fin.

RÉSUMÉ. - Quatre nouvelles espèces de poissons arc-en-ciel (Melanotaeniidae) de la baie d'Arguni en Papouasie occidentale, Indonésie.

Ces espèces nouvelles présentent des affinités avec les espèces décrites sur la péninsule de Bomberai et sur l'isthme de la Tête d'Oiseau, à savoir *Melanotaenia ammeri*, *M. irianjaya*, *M. kokasensis*, *M. parva* et *M. angfa*. La nouvelle espèce *M. urisa* se caractérise par une forme générale très fine et allongée, une longue distance prédorsale, une courte distance préanale, un pédoncule caudal long et fin, des nageoires très courtes et des yeux relativement développés. *Melanotaenia arguni* sp. nov. se distingue de ses congénères par de petits yeux, un corps fin, une distance prédorsale modérément longue, une longue distance préanale et un pédoncule caudal court et fin. *Melanotaenia veoliae* sp. nov. présente un profil de coloration original, peu d'écailles jugales, une distance inter-orbitale importante et un long rayon épineux sur la nageoire anale. *Melanotaenia wanoma* sp. nov. se distingue par un corps allongé et un pédoncule caudal court et fin, une distance prédorsale courte et des nageoires dorsales longues à leur base, une longue distance préanale et un liseré clair bien marqué sur la marge de la nageoire anale et de la deuxième dorsale.

Key words. - Melanotaeniidae - Rainbowfishes - *Melanotaenia arguni* - *Melanotaenia urisa* - *Melanotaenia veoliae* - *Melanotaenia wanoma* - West Papua - Indonesia - New species.

Rainbowfishes of the family Melanotaeniidae are distributed throughout New Guinea and Australia below elevations of 1500 m in most freshwater habitats including streams, lakes, swamps and frequently in isolated rocky pools of underground origin in karst limestone (Allen, 1991; Kadarusman *et al*., 2010). Rainbowfishes are brightly coloured and are very popular ornamental fish with their peaceful disposition and their ease of breeding. They are generalist omnivores, feeding on algae as well as on aquatic and terrestrial insects and small crustaceans (Coates, 1990; Arthington, 1992; Allen, 1995; Pusey *et al*., 1995).

Melanotaeniids belong to the order Atheriniformes (Nelson, 2006) and are considered to be the sister-group of blue-eyes (Saeed *et al*., 1989; Sparks and Smith, 2004). They are characterised by a compressed body covered by relatively large cycloid scales, two separate dorsal fins (the first with 3-7 spines and the second with a single spine and 6-22 segmented rays), a long-based anal fin, and no lateral line (Allen *et al*., 2008).

A total of 79 species in seven genera are currently recognized within Melanotaeniidae (Allen *et al*., 2008; Kadarusman *et al*., 2010; Allen and Hadiaty, 2011; Kadarusman *et*

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al., 2011). The greater diversity of the family occurs on the island of New Guinea where new species are still being discovered in remote and previously unsampled regions.

Five genera are represented on the mainland of New Guinea and on islands of the Sahul Shelf namely Waigeo, Batanta, Salawati and Misool to the west; Aru Islands to the south; and Yapen to the north in Cendrawasih Bay. Those are: *Chilatherina* Regan, 1914, *Glossolepis* Weber, 1907, *Iriatherina* Meinken, 1974, *Melanotaenia* Gill, 1862 and *Pelangia* Allen, 1998. The genus *Melanotaenia* is by far the most diverse with 40 species described in New Guinea (Allen and Cross, 1980, 1982; Allen, 1991, 1996a, 1996b; Allen and Renyaan, 1996, 1998; Allen and Unmack, 2008; Allen *et al*., 2008; Allen and Hadiaty, 2011; Kadarusman *et al*., 2010, 2011).

The island of New Guinea has been formed by the collision of the westward-moving Pacific tectonic plate with the northward-moving Indo-Australian plate. This collision resulted at the Late Miocene by the uplift of an impressive mountain range running east to west through the centre of New Guinea (Hall, 2002). At the same time, a northeast-southwest compression coupled with a subduction process resulted in the orogeny of the Lengguru fold-and-thrust belt in West Papua (Bailly *et al*., 2009). These intense tectonic and orogenic events extended from the end of the Miocene to the beginning of the Pliocene and resulted in the isolation of three distinct biogeographic provinces: northern New Guinea, southern New Guinea/Australia, and western New Guinea with the Bird's Head region (McGuigan *et al*., 2000).

The Bird's Head region is a centre for rainbowfish diversity (Allen, 1995; McGuigan *et al*., 2000; Allen *et al*., 2008; Kadarusman *et al*., 2010). Currently, 15 species have been described from this region: *Melanotaenia ajamaruensis* Allen & Cross, 1980, *M. ammeri* Allen *et al*., 2008, *M. angfa* Allen, 1990, *M. arfakensis* Allen, 1990, *M. batanta* Allen & Renyaan, 1996, *M. boesemani* Allen & Cross, 1980, *M. catherinae* (de Beaufort, 1919), *M. fasinensis* Kadarusman *et al*., 2010, *M. fredericki* (Fowler, 1939), *M. irianjaya* Allen, 1985, *M. kokasensis* Allen *et al*., 2008, *M. misoolensis* Allen, 1982, *M. parva* Allen, 1990, *M. salawati* Kadarusman *et al*., 2011, *M. synergos* Allen & Unmack, 2008.

Following Allen *et al*. (2008), rainbowfishes from the Bomberai Peninsula and the Bird's Neck Region (namely *M. irianjaya*, *M. angfa*, *M. parva*, *M. ammeri* and *M. kokasensis*) form a distinct species group from other species distributed on the Bird's Head.

The present paper describes four new species of *Melanotaenia* that were collected in separate creeks flowing into the eastern and western parts of the Arguni Bay (Fig. 1). The new species are geographically close to *M. ammeri,* which is known from small creeks in the northern part of Arguni and to *M. irianjaya,* which is more widely distributed on the Bomberai Peninsula. The morphological comparisons of the new species will be done with the 5 known species from the Bomberai and the Bird's Neck regions of western New Guinea.

The new species were collected in November 2010 during the Lengguru-Kaimana Expedition led by Balai Riset Budidaya Ikan Hias in Depok, Indonesia (BRBIH-KKP), the Akademi Perikanan Sorong, Indonesia (APSOR-KKP), the Lembaga Ilmu Pengetahuan Indonesia (LIPI) and by the

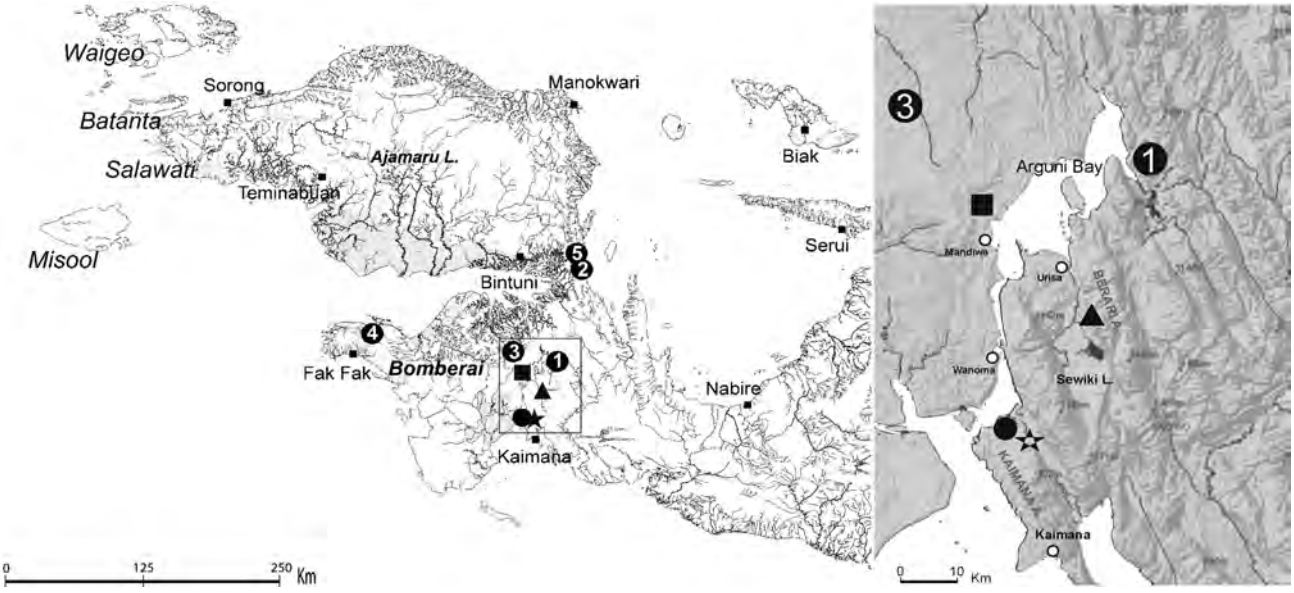

Figure 1. - Type localities of *Melanotaenia arguni* (■), *M. urisa* (▲), *M. veoliae* (●), *M. wanoma* (★) and all nominal species (1-5) from the Bomberai Peninsula and the Bird's Neck.

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MATERIAL AND METHODS

Specimens of the new species are deposited at the Museum Zoologicum Bogoriense (MZB, Indonesia), the Naturalis Museum in Leiden (RMNH, Netherlands) and the Muséum national d'histoire naturelle de Paris (MNHN, France).

The methods of counting and measuring are derived from Allen and Cross (1980) with some modifications and additions (Kadarusman *et al.*, 2010). Measurements were taken with digital dial callipers under lightening monocular lens (x2) and counts were made under lightening binocular lens (x4). Measurements were taken on the left side and are expressed to the nearest 0.1 mm. All proportions are expressed as percentage of the standard length.

Counts are as follow. - Lateral scales are the number of scales in horizontal row from the upper corner of the gill cover to the caudal-fin base, excluding the small scales posterior to the hypural junction. Transverse scales are the number of scales in vertical row between the base of the first dorsal fin and the base of the anal fin origin. Predorsal scales are the number of scales along the midline of the nape in front of the first dorsal fin. Cheek scale is the total number of scales covering the suborbital and preoperculum. Dorsal rays are the number of spines in the first dorsal fin and the spine and soft rays in second dorsal fin. Anal rays are the single spine and number of soft rays. The last soft ray of the anal and second dorsal fins is divided at the base and counted as a single ray. Pectoral rays are the total number of segmented rays. Pelvic rays are the single spine and number of soft rays. Gillrakers are the total number on the first branchial arch.

Measurements are as follow. - Standard length is measured from the anteriormost tip of the upper lip to the posteriormost point of the hypural fold formed when the caudal peduncle is bent. Head length is measured from the tip of the upper lip to the upper rear edge of the gill opening. Snout length is the least distance measured from the tip of the upper lip to the fleshy anterior border of the eye. Interorbital width is the least width between the eyes anteriorly to the suture between frontal and nasal bones. Eye diameter is the maximal horizontal width of the orbital cavity. Body depth is measured from the base of the first dorsal spine to the base of the first anal spine. Body width is the maximal width measured posteriorly just behind the pectoral-fin base. Caudal peduncle depth is the minimum depth. Caudal peduncle length is measured from the base of the last dorsal fin ray to the vertebral-hypural junction at the caudal-fin base. Predorsal length is measured from the tip of the upper lip to the base of the spine at the origin of first dorsal fin. Prepelvic length is measured from the tip of the upper lip to the base of the spine at the origin of pelvic fin. Preanal length is measured from the tip of the upper lip to the base of the spine at the origin of anal fin. Pectoral fin length is measured from the anteriormost part of pectoral-fin base to the tip of the longest soft ray. Pelvic fin length is measured from the anteriormost part of pelvic-fin base to the tip of the longest soft ray. Spine length of the first dorsal fin is measured from the base to the tip of the first spine on the first dorsal fin. Spine length of the second dorsal fin is measured from the base to the tip of the spine on the second dorsal fin. Spine length of the anal fin is measured from the base to the tip of the single anal spine. Dorsal-fin base length is measured from the posterior base of the first spine of first dorsal fin to the posterior base of last soft ray of second dorsal fin. Second dorsal-fin base length is measured on the second dorsal fin from the posterior base of the first spine to the posterior base of last soft ray. Anal-fin base length is measured from the posterior base of the spine to the posterior base of the last soft ray. Anal fin height is measured from the base to the tip of the second soft ray.

Comparative material

The comparative material included all five nominal species described from the Bird's Neck and the Bomberai Peninsula. This material includes type specimens and additional specimens caught at or near the type localities during three surveys (2007-2008-2010). These additional specimens were deposed at MZB, RMNH and MNHN. Their geographic locations are presented on figure 1.

Melanotaenia ammeri. - Indonesia, West Papua. MZB 16455 (holotype), 82 mm SL; Gusimawa, Arguni Bay; MZB 16456 (paratypes), 4 spms (55.9-71.0 mm SL), same data as holotype; MZB 17709, 9 spms (62.4-101.8 mm SL), same data as holotype (site 1: 3°02.438'S, 133°52.844'E).

Melanotaenia angfa. - Indonesia, West Papua. MZB 17698, 3 spms (69.2-86.2 mm SL), MNHN 2009-1620, 5 spms (62.1-68.6 mm SL), RMNH.PISC.35675, 5 spms (59.5-62.6 mm SL), Pondok Creek, type locality, River Yakati (site 2: 2°11.067'S, 134°05.584'E).

Melanotaenia irianjaya. - Indonesia, West Papua. MZB 4952 (holotype), 58.8 mm SL, Fruata, type locality; MZB 4953 (paratypes), 3 spms (39.6-57.8 mm SL), same data as holotype (site 3: 2°58.980'S, 133°31.977'E); MZB 17708, 10 spms (67.7-102.6 mm SL), Wat Creek, Fruata vicinity, about 7 km west from type locality (site 3: 2°58.576'S, 133°27.971'E).

Melanotaenia kokasensis. - Indonesia, West Papua. MZB 16453 (holotype), 57.2 mm SL, Kokas, type locality; MZB 16454 (paratypes), 2 spms (49.1-53.7 mm SL), same data as holotype (site 4: 2°42.185'S, 132°25.697'E).

Melanotaenia parva. - Indonesia, West Papua. MZB 17699, 2 spms (65.4-67.0 mm SL), MNHN 2009-1621, 3 spms (57.7-62.0 mm SL) and RMNH.PISC.35676, 3 spms (50.7-58.6 mm SL), Lake Kurumoi, type locality (site 5: 2°09.761'S, 134°05.155'E).

SYSTEMATICS

Melanotaenia arguni, sp. nov.
Kadarusman, Hadiaty & Pouyaud
(Figs 2, 3; Tab. I)

Type material

Holotype. - MZB 17712, male, 54.9 mm SL, 3°5.292'S-133°37.879'E, Egerwara village, Jasu Creek, 61 km north of Kaimana, District Arguni Bawah, Papua Barat, Indonesia. Kadarusman, P. Ruwe, E. Wamburie, 1 Nov. 2010.

Paratypes. - MZB 17713, 6 spms (58.7-67.6 mm SL); MNHN 2010-0029, 4 spms (59.1-64.3 mm SL); RMNH. PISC.35876, 4 spms (58.9-72.6 mm SL); same data as for holotype.

Type locality

Jasu Creek is a stream of less than 5 m width and flowing to the western side of the Arguni Bay (Figs 1, 4). The habitat in the vicinity of Egerwara village consists of shallow and slow flowing water over sandy substrate in secondary forest and cocoa plantations.

Etymology

The species is named *arguni*, with reference to the Arguni Bay close to the type locality.

Distribution

The new species is currently known only from the Jasu Creek.

Diagnosis

Melanotaenia arguni is distinguished from all of its congeners present on the Bomberai Peninsula and on the Bird's Neck region by the combination of the following characters: dorsal rays IV to V-I,12 to 16; anal rays I,20-24; lateral scales 34-37; transverse scales 10-11; predorsal scales 16-18; cheek scales 14-20; gillrakers 17-18; a short snout length, 8.3-9.1% of SL; a thin interorbital width, 8.3-9.0% of SL; a small eye diameter, 6.6-7.2% of SL; a thin body width, 11.0-13.0% of SL; a short and thin caudal peduncle (its length, 14.1-16.1 and depth, 10.0-10.8% of SL); a moderately long predorsal length, 36.8-39.7% of SL; a long preanal length, 49.7-52.9% of SL.

Description

Counts and proportions that appear in parentheses refer to the range for paratypes (based on 14 specimens, 58.7-72.6 mm SL) if different from the holotype. Morphometric data are given in table I.

Dorsal rays V-I,13 (IV to V,12-16); anal rays I,21 (I,20-24); pectoral rays 13 (12-15); pelvic rays I,5; branched caudal rays 18 (17-18); lateral scales 36 (36-37); transverse scales 10 (10-11); predorsal scales 19 (17-20); cheek scales 20 (16-20); total gillrakers on first arch 17 (17-18).

Snout short and pointed, its length about equal to interorbital width and larger than eye diameter; jaws about equal, oblique, premaxilla with an abrupt bend between the anterior horizontal portion and lateral part; maxilla ends below anterior edge of eye; lips thin; teeth conical with slightly curved tips, arranged in dense bands in upper and lower jaws; teeth at front of upper jaw in about 4 irregular rows, reduced to 1 or 2 rows posteriorly; teeth of upper jaw and middle portion of lower jaw extending outside of mouth onto lip; teeth at front of lower jaw in about 4-5 irregular rows, reduced to a single row posteriorly; several small and conical teeth on vomer and palatines.

Scales of body cycloid, large, and arranged in regular horizontal rows; most of body scales with slight crenulations along posterior margin; predorsal scales extending to posterior half of interorbital.

First dorsal fin originates behind anal fin origin, between base of first to third anal soft ray; tip of first dorsal fin when depressed, reaching base of first to third soft ray of second dorsal fin; tips of second dorsal and anal fins reaching middle region of caudal peduncle; soft dorsal and anal fins somewhat rectangular in outline, longest anterior rays

Table I. - Measurements taken on the holotype and 14 paratypes of *Melanotaenia arguni* sp. nov.

	Holotype	Paratypes				
SL (mm)	54.9	58.7-72.6				
in % standard length		n	min	max	mean	SD
Head length	26.9	14	24.2	26.0	25.1	0.6
Snout length	8.8	14	8.3	9.1	8.7	0.3
Interorbital width	8.8	14	8.3	9.0	8.7	0.2
Eye diameter	7.1	14	6.6	7.2	7.0	0.2
Body depth	32.3	14	30.7	33.8	32.2	1.1
Body width	11.5	14	11.0	13.0	11.9	0.7
Caudal peduncle depth	10.8	14	10.0	10.8	10.4	0.3
Caudal peduncle length	15.1	14	14.1	16.1	15.4	0.6
Predorsal length	52.1	14	49.8	52.1	50.6	0.8
Prepelvic length	39.7	14	36.8	39.5	38.2	0.9
Preanal length	52.1	14	49.7	52.9	51.2	1.0
Pectoral fin length	19.6	14	18.1	20.9	19.4	0.8
Pelvic fin length	19.1	14	16.2	20.2	17.6	1.1
Spine length of first dorsal fin	10.6	14	9.4	11.8	10.7	0.7
Spine length of second dorsal fin	10.8	14	8.6	12.1	10.4	1.2
Spine length of anal fin	8.4	14	7.2	9.5	8.5	0.6
Dorsal-fin base length	36.5	13	34.7	41.4	38.1	2.2
Second dorsal-fin base length	24.0	13	22.0	26.8	24.3	1.7
Anal-fin base length	39.1	13	37.0	42.3	39.8	1.6
Anal fin height	13.5	14	11.3	16.3	13.5	1.3

with length decreasing progressively posteriorly; pectoral fins pointed; caudal fin moderately forked with moderately pointed extremities.

Colour of mature male when fresh (Fig. 2): brown dorsally; body scales with narrow dark outline; lower half of side of body and belly whitish; narrow yellowish stripes between each horizontal scale row on lower half of body side; a diffuse dark blotch immediately behind eye on uppermost part of operculum; a dark midlateral stripe about one scale wide extending from upper edge of preopercle to caudal-fin base; pectoral fin translucent; remaining fins with grey tint increasing from the base to the tip. Overall colour of females is similar but paler than males (Fig. 3).

Sexual dimorphism: excepting for the colouration, which is less intense for the female, there appears to be little differences between male and female. Males lack the pronounced depth of the body and the elongation of the posterior dorsal and anal fin rays. This is an unusual feature for *Melanotaenia* because males are generally deeper bodied than females and have a more elongate and pointed shape posteriorly on the soft dorsal and anal fins (Allen *et al*., 2008).

Comparisons

Melanotaenia arguni sp. nov. is allied to the species occurring on the Bomberai Peninsula and on the Bird's Neck.

Melanotaenia arguni is easily distinguished from *M. ammeri* by the colour pattern (a dark midlateral stripe and some narrow yellowish stripes *vs*. numerous alternating mauve to blue-grey and yellow stripes below and above midlateral stripe), a smaller eye diameter (6.6-7.2 *vs*. 7.3-7.8% SL) and a slender caudal peduncle depth (10.0-10.8 *vs*. 11.6-13.8% SL). The new species differs from *M. irianjaya* by a shorter snout length (8.3-9.1 *vs*. 9.2-10.3% SL), a smaller eye diameter (6.6-7.2 *vs*. 7.4-8.4% SL) and fewer gillrakers (17-18 *vs*. 19-21). The new species differs from *M. kokasensis* by a narrow interorbital width (8.3-9.0 *vs*. 9.0-9.2% SL), a smaller eye diameter (6.6-7.2 *vs*. 8.2-8.7% SL), a shorter and slender caudal peduncle (its length 14.1-16.1 *vs*. 17.5-18.9 and depth 10.0-10.8 *vs*. 11.2-11.5% SL), and a shorter spine length on first dorsal fin (9.4-11.8 *vs*. 12.3-12.9% SL).

Melanotaenia arguni differs from *M. angfa* and *M. parva* by a smaller eye diameter (6.6-7.2 *vs*. 7.3-8.4% SL) and a thinner body width (11.0-13.0 *vs*. 13.6-16.0% SL). The new species has a longer predorsal length than *M. angfa* (49.8-52.1 *vs*. 45.9-49.5% SL) and has a shorter and slender caudal peduncle (its length 14.1-16.1 *vs*. 16.8-19.4 and depth 10.0-10.8 *vs*. 11.6-12.5% SL) and more gillrakers (17-18 *vs*. 13-16) than *M. parva*.

Melanotaenia urisa, sp. nov.
Kadarusman, Setiawibawa & Pouyaud
(Figs 5, 6; Tab. II)

Type material

Holotype. - MZB 17715, male, 71.4 mm SL, 3°15.061'S-133°47.735'E, a karst spring emerging from Berari Anticline at the altitudinal level of Sewiki Lake, 6 km SE from Urisa village, 44 km north of Kaimana, District Arguni Bawah, Papua Barat, Indonesia. A. Ajambua, N. Lemauk, M. Legendre, B. Pouyaud, 1 Nov. 2010.

Paratypes. - MZB 20025, 6 spms (60.6-71.0 mm SL); MNHN 2010-0031, 5 spms (63.7-87.8 mm SL); RMNH. PISC.35877, 5 spms (57.4-62.0 mm SL); same data as for holotype.

Type locality

The type locality is a karst spring emerging from the Berari Anticline on the north side of the Sewiki Lake outlet (Figs 1, 7). The spring consists of an artesian resurgence of blue freshwater in a brackish swampy environment with a size and volume varying with the season and with the tidal fluctuation. The bottom of the spring consists of white sand and limestone boulder with substantial dead tree branches. This confined habitat is also home of an unknown species of crayfishes (*Cherax* sp.).

Etymology

The species is named *urisa*, with reference to the village name near the type locality.

Distribution

The new species is currently known only from the type locality.

Diagnosis

Melanotaenia urisa is distinguished from all of its congeners present on the Bomberai Peninsula and on the Bird's Neck region by the combination of the following characters: Dorsal rays IV to V-I,12 to 15; anal rays I,21-23; lateral scales 36-39; transverse scales 10-11; predorsal scales 18-20; cheek scales 13-16; gillrakers 17-18; a short head length, 23.7-25.2% of standard length; a short snout length, 7.6-8.7% of SL; a thin interorbital width, 7.9-8.8% of SL; a large eye diameter, 8.0-9.0% of SL; a very thin body width, 10.0-11.2% of SL; a long predorsal length, 50.6-54.5% of SL; a short prepelvic length, 36.3-39.2% of SL; a short preanal length, 47.0-49.1% of SL; a long and thin caudal peduncle (its length, 16.3-19.0 and depth, 8.6-10.0% of SL); a very short pectoral fin length, 15.2-17.4% of SL and a very short pelvic fin, 11.0-13.7% of SL; a very thin anal fin height, 6.8-9.9% of SL; a short spine length on the anal fin, 7.1-8.5% of

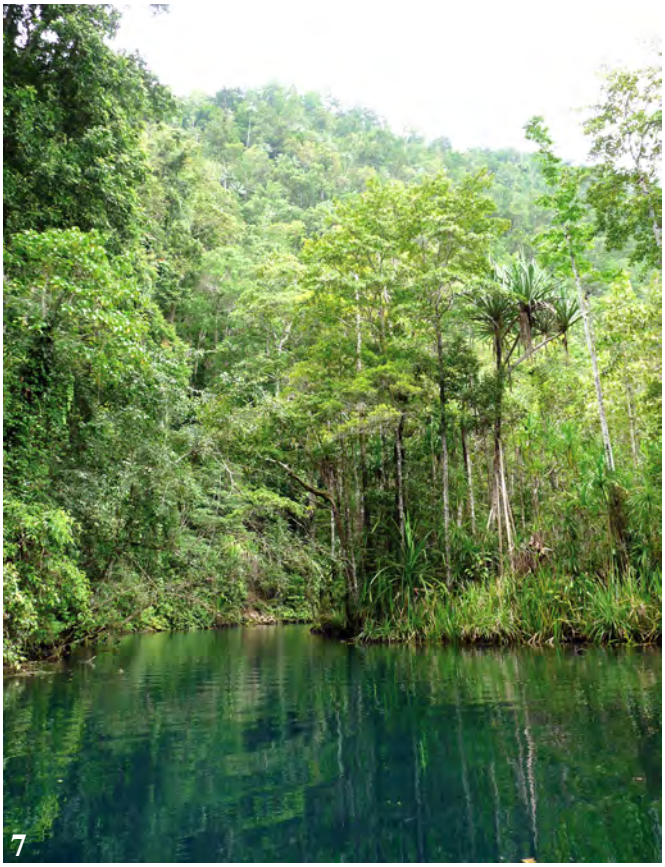

Figure 2. - *Melanotaenia arguni*, MZB 17712 (holotype), male, 54.9 mm SL, near Egerwara, Jasu Creek, Arguni Bawah, Kaimana, West Papua, Indonesia.

Figure 3. - *Melanotaenia arguni*, a female, 53.0 mm SL, same data as for holotype.

Figure 4. - Type locality of *Melanotaenia arguni*, Jasu Creek, near Egerwara, Arguni Bawah, Kaimana, West Papua, Indonesia.

Figure 5. - *Melanotaenia urisa*, MZB 17715, male, 71.4 mm SL, karst spring near Sewiki Lake, Arguni Bawah, Kaimana, West Papua, Indonesia.

Figure 6. - *Melanotaenia urisa*, MZB 20025, female, 60.6 mm SL, same data as for holotype.

Figure 7. - Type locality of *Melanotaenia urisa*, a karst spring emerging from the Berari Anticline at the level of Sewiki Lake, Arguni Bawah, Kaimana, West Papua, Indonesia.

Figure 8. - *Melanotaenia veoliae*, MZB 20026, male, 92.3 mm SL, Gebiasi Creek, Arguni Bawah, Kaimana, West Papua, Indonesia.

Figure 9. - *Melanotaenia veoliae*, MNHN 2010-0032, female, 75.5 mm SL, same data as for holotype.

Figure 10. - Type locality of *Melanotaenia veoliae*, Gebiasi Creek, a karst resurgence emerging from the Kaimana Anticline, Arguni Bawah, Kaimana, West Papua, Indonesia.

Figure 11. - *Melanotaenia wanoma*, MZB 20028, male, 71.9 mm SL, Wermura Creek, Arguni Bawah, Kaimana, West Papua, Indonesia.

Figure 12. - *Melanotaenia wanoma*, MZB 20029, female, 72.8 mm SL, same data as for holotype.

Figure 13. - Type locality of *Melanotaenia wanoma*, Wermura Creek, a karst resurgence emerging from the Kaimana Anticline, Arguni Bawah, Kaimana, West Papua, Indonesia.

SL; a short dorsal-fin base length, 30.8-35.7% of SL and a short second dorsal-fin base length, 20.4-23.5% of SL.

Description

Counts and proportions that appear in parentheses refer to the range for paratypes (based on 16 specimens, 57.4-87.8 mm SL) if different from the holotype. Morphometric data are given in table II.

Dorsal rays V-I,13 (IV to V,12-15); anal rays I,23 (I,21-23); pectoral rays 13 (13-14); pelvic rays I,5; branched caudal rays 18 (17-18); lateral scales 37 (36-39); transverse scales 10 (10-11); predorsal scales 18 (18-20); cheek scales 16 (13-16); total gillrakers on first arch 18 (17-18).

Body elongated; snout short and pointed, its length about equal to interorbital width and smaller than eye diameter; jaws about equal, oblique, premaxilla with an abrupt bend between the anterior horizontal portion and lateral part; maxilla ends below anterior edge of eye; lips thin; teeth conical with slightly curved tips, arranged in reduced bands in upper and lower jaws; teeth at front of upper jaw in about 2-3 irregular rows, reduced to 1 rows posteriorly; teeth of upper jaw and middle portion of lower jaw extending outside of mouth onto lip; teeth at front of lower jaw in about 2-3 irregular rows, reduced to a single row posteriorly; vomer and palatines edentate.

Scales of body cycloid, large, and arranged in regular horizontal rows; most of body scales with slight crenulations along posterior margin; predorsal scales extending to posterior half of interorbital.

First dorsal fin originates behind anal fin origin, between base of third to sixth anal soft ray; tip of first dorsal fin when depressed, reaching base of first to third soft ray of second dorsal fin; tips of second dorsal and anal fins not reaching middle region of caudal peduncle; soft dorsal and anal fins somewhat rectangular in outline, longest anterior rays with length decreasing progressively posteriorly; pectoral fins pointed; caudal fin moderately forked with moderately pointed extremities.

Colour of mature male when fresh (Fig. 5): brown dorsally; body scales with narrow dark outline dorsally and below pectoral region; lower half of side of body and belly whitish; eight brown stripes, corresponding with horizontal scale rows on side of body, alternating with narrower orange to yellowish stripes; a diffuse dark blotch immediately behind eye on uppermost part of operculum; a darkest midlateral stripe of one scale wide with blue hues extending from upper edge of preopercle to caudal-fin base; pectoral fin translucent with rays marked with several melanophores ; remaining fins uniformly orange to reddish. Overall colour of females is similar but paler than males (Fig. 6). Body stripes less vivid and median fins slightly yellow.

Sexual dimorphism: excepting for the colouration, which is less intense for the female, there appears to be little differences between male and female.

Table II. - Measurements taken on the holotype and 16 paratypes of *Melanotaenia urisa* sp. nov.

	Holotype	Paratypes				
SL (mm)	71.4	57.4-87.8				
in % standard length		n	min	max	mean	SD
Head length	24.1	16	23.7	25.2	24.6	0.4
Snout length	8.2	16	7.6	8.7	8.4	0.3
Interorbital width	8.7	16	7.9	8.8	8.5	0.2
Eye diameter	8.3	16	8.0	9.0	8.4	0.3
Body depth	33.4	16	27.0	34.2	30.5	2.1
Body width	11.1	16	10.0	11.2	10.5	0.4
Caudal peduncle depth	10.0	16	8.6	10.0	9.6	0.4
Caudal peduncle length	16.7	16	16.3	19.0	17.4	1.0
Predorsal length	51.8	16	50.6	54.5	52.3	0.9
Prepelvic length	37.2	15	36.3	39.2	37.3	0.7
Preanal length	47.3	16	47.0	49.1	48.4	0.6
Pectoral fin length	16.8	14	15.2	17.4	16.1	0.6
Pelvic fin length	12.4	16	11.0	13.7	12.5	0.6
Spine length of first dorsal fin	9.6	16	9.0	12.8	10.7	1.2
Spine length of second dorsal fin	9.4	16	8.3	14.3	10.8	1.8
Spine length of anal fin	7.7	15	7.1	8.5	7.8	0.4
Dorsal-fin base length	35.7	15	30.8	35.4	33.6	1.6
Second dorsal-fin base length	23.5	15	20.4	23.5	21.9	1.0
Anal-fin base length	41.3	15	35.4	39.9	37.9	1.5
Anal fin height	8.6	16	6.8	9.9	8.5	0.9

Comparisons

Melanotaenia urisa sp. nov. is allied to *M. ammeri* and to other species occurring on the Bomberai Peninsula and on the Bird's Neck.

Melanotaenia urisa is easily distinguished from *M. ammeri* by a larger eye diameter (8.0-9.0 *vs*. 7.3-7.8% SL), a narrow body width (10.0-11.2 *vs*. 11.7-14.2% SL), a longer and a slender caudal peduncle (its length 16.3-19.0 *vs*. 13.9-16.1 and depth 8.6-10.0 *vs*. 11.6-13.8% SL), a shorter preanal length (47.0-49.1 *vs*. 49.7-53.3% SL), shorter pectoral and pelvic fins (15.2-17.4 *vs*. 18.9-21.1 and 11.0-13.7 *vs*. 17.8-23.4% SL), a smaller anal fin height (6.8-9.9 *vs*. 14.0-17.2% SL) and a shorter spine length on the anal fin (7.1-8.5 *vs*. 8.6-10.2% SL).

Melanotaenia urisa differs from *M. irianjaya* and *M. kokasensis* by a shorter head length (23.7-25.2 *vs*. 25.3-27.0% SL), a narrow body width (10.0-11.2 *vs*. 11.3-15.3% SL), shorter pectoral and pelvic fins (15.2-17.4 *vs*. 18.2-20.9 and 11.0-13.7 *vs*. 16.3-30.0% SL) and a shorter spine length on the anal fin (7.1-8.5 *vs*. 8.7-11.6% SL). The new species has also a shorter snout length (7.6-8.7 *vs*. 9.2-10.3% SL) and fewer

gillrakers (17-18 *vs*. 19-21) than *M. irianjaya*. Compared to *M. kokasensis*, the new species has a narrower interorbital width (7.9-8.8 *vs*. 9.0-9.2% SL), a slender caudal peduncle depth (8.6-10.0 *vs*. 11.2-11.5% SL), a longer predorsal length (50.6-54.5 *vs*. 49.6-49.7% SL) and a shorter preanal length (47.0-49.1 *vs*. 50.2-50.6% SL).

Melanotaenia urisa differs from *M. angfa* and *M. parva* by a shorter head length (23.7-25.2 *vs*. 25.2-27.6% SL), a narrow body width (10.0-11.2 *vs*. 13.6-16.0% SL), a slender caudal peduncle depth (8.6-10.0 *vs*. 10.2-12.5% SL), a longer preanal length (47.0-49.1 *vs*. 49.4-53.3% SL) and a shorter pelvic fin length (11.0-13.7 *vs*. 15.1-19.9% SL). In comparison with *M. angfa*, the new species has a shorter snout length (7.6-8.7 *vs*. 9.0-9.5% SL), a longer predorsal length (50.6-54.5 *vs*. 45.9-49.5% SL), a shorter dorsal-fin base length (30.8-35.7 *vs*. 38.5-41.0% SL) and a shorter second dorsal-fin base length (20.4-23.5 *vs*. 24.1-28.6% SL). In comparison with *M. parva*, the new species has a shorter pectoral fin length (15.2-17.4 *vs*. 18.1-19.3% SL) and more gillrakers (17-18 *vs*. 13-16).

Melanotaenia urisa sp. nov. differs from *M. arguni* sp. nov. by a larger eye diameter (8.0-9.0 *vs*. 6.6-7.2% SL), a shorter preanal length (47.0-49.1 *vs*. 49.7-52.9% SL), a longer and slender caudal peduncle (its length 16.3-19.0 *vs*. 14.1-16.1 and depth 8.6-10.0 *vs*. 10.0-10.8% SL) and a smaller anal fin height (6.8-9.9 *vs*. 11.3-16.3% SL).

Melanotaenia veoliae, sp. nov.
Kadarusman, Caruso & Pouyaud
(Figs 8, 9; Tab. III)

Type material

Holotype. - MZB 20026, male, 92.3 mm SL, 3°27.607'S-133°41.071'E, Gebiasi Creek, 22 km north of Kaimana and 14 km south of Wanoma village, District Arguni Bawah, Papua Barat, Indonesia. G. Segura, D. Caruso, G. Setiawibawa, S. Sauri, A. Suruwaky, 7 Nov. 2010.

Paratypes. - MZB 20027, 5 spms (62.8-87.2 mm SL); MNHN 2010-0032, 5 spms (53.9-84.5 mm SL); RMNH.PISC.35878, 5 spms (64.5-65.0 mm SL); same data as for holotype.

Type locality

The Gebiasi Creek is a karst resurgence emerging from the north side of the Kaimana Anticline (Figs 1, 10). It is a typical fragmented hydrologic system in a karstic environment. The creek emerges from a karstic cave (3°27.607'S, 133°41.071'E) then flows on about 60 m before disappearing in a subterranean outlet (3°27.586'S, 133°41.048'E. This aerial river segment is the home of the new species. The creek reappears in the mangrove after 200 m underground from a small cave (3°27.500'S, 133°41.092'E) and flows to the Arguni Bay 7 km east of Syirnusu Island. The type locality (altitude 40 m) consists of a blue and crystalline stream, narrow (to about 2-3 m wide), relatively shallow (up to about 1 m) and flowing in primary forest.

Etymology

The species is named *veoliae*, in honour of the Foundation Veolia Environment which sponsored among others the Lengguru-Kaimana Expedition in October-November 2010.

Distribution

The new species is currently known only from the Gebiasi Creek.

Diagnosis

Melanotaenia veoliae is distinguished from all of its congeners present on the Bomberai Peninsula and on the Bird's Neck region by the combination of the following characters: dorsal rays IV to V-I,12 to 13; anal rays I,22-27; lateral scales 34-37; transverse scales 10-11; predorsal scales 17-18; cheek scales 12-14; gillrakers 18-20; a short snout length, 8.0-9.1% of SL; a large interorbital width, 9.0-9.5% of SL; a small eye diameter, 6.3-7.9% of SL; a long caudal peduncle length, 16.5-17.7% of SL; a moderately long predorsal length, 49.5-

Table III. - Measurements taken on the holotype and 15 paratypes of *Melanotaenia veoliae* sp. nov.

	Holotype	Paratypes				
SL (mm)	92.3	53.9-87.2				
in % standard length		n	min	max	mean	SD
Head length	25.7	15	25.3	27.0	25.9	0.5
Snout length	8.9	15	8.0	9.1	8.7	0.3
Interorbital width	9.1	15	9.0	9.5	9.2	0.1
Eye diameter	6.3	15	6.9	7.9	7.5	0.2
Body depth	37.5	15	30.8	36.1	33.5	1.6
Body width	12.0	15	11.3	12.6	11.9	0.4
Caudal peduncle depth	11.7	15	10.3	11.6	11.0	0.5
Caudal peduncle length	16.8	15	16.5	17.7	16.9	0.4
Predorsal length	52.1	15	49.5	52.1	50.5	0.8
Prepelvic length	37.4	15	36.9	38.0	37.5	0.4
Preanal length	48.1	15	47.4	49.3	48.4	0.6
Pectoral fin length	19.6	12	18.1	20.7	19.4	0.7
Pelvic fin length	20.1	14	16.4	20.1	18.9	1.0
Spine length of first dorsal fin	11.2	14	10.2	12.8	11.7	0.7
Spine length of second dorsal fin	9.0	15	7.9	11.2	9.7	0.9
Spine length of anal fin	10.1	14	9.1	11.3	10.0	0.6
Dorsal-fin base length	37.9	14	36.7	39.9	38.0	1.1
Second dorsal-fin base length	25.1	14	23.2	25.8	24.2	0.9
Anal-fin base length	43.1	14	37.9	45.1	41.1	1.8
Anal fin height	13.8	10	12.7	16.6	14.3	1.4

52.1% of SL; a short prepelvic length, 36.9-38.0% of SL; a short preanal length, 47.4-49.3% of SL; a long spine length of the anal fin, 9.1-11.3% of SL.

Description

Counts and proportions that appear in parentheses refer to the range for paratypes (based on 15 specimens, 53.9-87.2 mm SL) if different from the holotype. Morphometric data are given in table III.

Dorsal rays V-I,13 (IV to V,12-13); anal rays I,24 (I,22-27); pectoral rays 12 (12-13); pelvic rays I,5; branched caudal rays 18 (17-18); lateral scales 35 (34-37); transverse scales 11 (10-11); predorsal scales 18 (17-18); cheek scales 14 (12-14); total gillrakers on first arch 20 (18-20).

Snout short and pointed with a length smaller than interorbital width and larger than eye diameter; jaws about equal, oblique, premaxilla with an abrupt bend between the anterior horizontal portion and lateral part; maxilla ends below anterior edge of eye; lips thin; teeth conical with slightly curved tips, arranged in dense bands in upper and lower jaws; teeth at front of upper jaw in about 5-7 irregular rows, reduced to 2 or 3 rows posteriorly; teeth of upper jaw and middle portion of lower jaw extending outside of mouth onto lip; teeth at front of lower jaw in about 3-5 irregular rows, reduced to a single short row posteriorly; rare small and conical teeth on vomer and palatines.

Scales of body cycloid, large, and arranged in regular horizontal rows; most of body scales with slight crenulations along posterior margin; predorsal scales extending to posterior half of interorbital.

First dorsal fin originates behind anal fin origin, between base of second to third anal soft ray; tip of first dorsal fin when depressed, reaching base of second to fourth soft ray of second dorsal fin; pectoral fins pointed; caudal fin moderately forked with moderately pointed extremities.

Colour of mature male when fresh (Fig. 8): grey pink on upper back; body scales with narrow brown outline; lower half of side of body and belly whitish; a diffuse dark pink blotch immediately behind eye on uppermost part of operculum; a large blue patch directly above abdomen and behind pectoral fin; lateral flanks with six or seven grey stripes, corresponding with horizontal scale rows, the first stripe directly above the midlateral line sometimes intense, stripes below the midlateral line faint; a dark midlateral stripe of one scale wide extending from upper edge of preopercle to caudal-fin base; pectoral and caudal fins translucent; dorsal and anal fins blood red with soft rays azure blue. Overall colour of females is similar but paler than males (Fig. 9).

Sexual dimorphism: similar to many *Melanotaenia*, mature males are deeper bodied than females (35-38 *vs*. 31-34% SL) and have a more elongate and pointed shape posteriorly on the soft dorsal and anal fins. The longest soft dorsal-fin rays of males are located in the posteriormost portion of the fin, in contrast to that of females, which are situated in the anterior half of the fin. Depressed posterior tip of the dorsal fin extends about two-thirds of caudal peduncle for males and only one half for the females. In addition, the depressed posterior tip of anal fin extends about one half of caudal peduncle for males and only one third for the females.

Comparisons

Melanotaenia veoliae sp. nov. differs from *M. ammeri* by a larger interorbital width (9.0-9.5 *vs*. 8.2-8.8% SL), a longer caudal peduncle (16.5-17.7 *vs*. 13.9-16.1% SL), a shorter prepelvic length (36.9-38.0 *vs*. 38.5-40.5% SL), a shorter preanal length (47.4-49.3 *vs*. 49.7-53.3% SL) and more gillrakers (18-20 *vs*. 16-18).

Melanotaenia veoliae differs from *M. irianjaya* by the ornamentation of the dorsal fin (absence of margin stripe *vs*. present), by a shorter snout length (8.0-9.1 *vs*. 9.2-10.3% SL), by a shorter pelvic fin length (16.4-20.1 *vs*. 20.6-30.0% SL) and by fewer pectoral-fin rays (12-13 *vs*. 13-15).

The new species can be distinguished from *M. kokasensis* by a smaller eye diameter (6.3-7.9 *vs*. 8.2-8.7% SL), a shorter preanal length (47.4-49.3 *vs*. 50.2-50.6% SL) and a longer second dorsal-fin base length (23.2-25.8 *vs*. 21.0-23.1% SL).

Melanotaenia veoliae differs from *M. angfa* and *M. parva* by a slender body width (11.3-12.6 *vs*. 13.6-16.0% SL), a shorter preanal length (47.4-49.3 *vs*. 49.4-53.3% SL) and a larger spine length on the anal fin (9.1-11.3 *vs*. 6.5-8.9% SL). In addition, *M. angfa* has a shorter predorsal length (45.9-49.5 *vs*. 49.5-52.1% SL) and a shorter caudal peduncle length (14.6-16.4 *vs*. 16.5-17.7% SL) than the new species, while *M. parva* displays a larger eye diameter (7.9-8.4 *vs*. 6.3-7.9% SL), a longer prepelvic length (38.3-41.0 *vs*. 36.9-38.0% SL) and fewer gillrakers (13-16 *vs*. 18-20).

Melanotaenia veoliae sp. nov. differs from *M. arguni* sp. nov. by a larger interorbital width (9.0-9.5 *vs*. 8.3-9.0% SL), a shorter preanal length (47.4-49.3 *vs*. 49.7-52.9% SL), a longer peduncle length (16.5-17.7 *vs*. 14.1-16.1% SL), fewer cheek scales (12-14 *vs*. 14-20) and more gillrakers (18-20 *vs*. 17-18). Compared to *M. urisa* sp. nov., the new species displays many diagnostic characters which are: a larger head length (25.3-27.0 *vs*. 23.7-25.2% SL), a larger interorbital width (9.0-9.5 *vs*. 7.9-8.8% SL), a smaller eye diameter (6.3-7.9 *vs*. 8.0-9.0% SL), a larger caudal peduncle depth (10.3-11.7 *vs*. 8.6-10.0% SL), a larger body width (11.3-12.6 *vs*. 10.0-11.2% SL), longer fins (namely pectoral and pelvic fin length, dorsal-fin base length and anal fin height on table II and III respectively), fewer predorsal scales (17-18 *vs*. 18-20) and more gillrakers (18-20 *vs*. 17-18).

***Melanotaenia wanoma*, sp. nov.**
Kadarusman, Segura & Pouyaud
(Figs 11, 12; Tab. IV)

Type material

Holotype. - MZB 20028, male, 71.9 mm SL, 3°28.261'S-133°42.770'E, Wermura Creek, 20 km north of Kaimana and 16 km south of Wanoma village, District Arguni Bawah, Papua Barat, Indonesia. G. Segura, D. Caruso, G. Setiawibawa, S. Sauri, A. Suruwaky, 7 Nov. 2010.

Paratypes. - MZB 20029, 5 spms (62.8-72.8 mm SL); MNHN 2010-0033, 6 spms (59.6-65.0 mm SL); RMNH. PISC.35879, 6 spms (61.0-71.9 mm SL); same data as for holotype.

Type locality

The Wermura Creek is a karst resurgence emerging from the NE side of the Kaimana Anticline (Figs 1, 13). It is also a short and fragmented hydrologic system like the Gebiasi Creek. Both creeks are only distant by 4 km but emerge from distinct geological fault. The Wermura Creek emerges from a small cave (3º28.310'S, 133º42.831'E) then flows on about 200 m before disappearing in a subterranean outlet (3º28.251'S, 133º42.744'E. The creek reappears after 1 km in the mangrove from a large cave (3º27.879'S, 133º42.284'E) and flows to the Arguni Bay. The type locality (altitude 42 m) consists of a crystalline stream, narrow (to about 1 m wide), relatively shallow (up to about 1 m) and flowing in primary forest.

Etymology

The species is named *wanoma*, in reference to Wanoma village located some 16 km to the north in Arguni Bay.

Distribution

The new species is currently known only from the Wermura Creek.

Diagnosis

Melanotaenia wanoma is distinguished from all of its congeners present on the Bomberai Peninsula and on the Bird's Neck region by the combination of the following characters: dorsal rays IV to VI-I,14 to 15; anal rays I,22-25; lateral scales 34-36; transverse scales 10-11; predorsal scales 15-17; cheek scales 14-18; gillrakers 15-16; a short snout length, 8.0-9.1% of SL; a moderately thin interorbital width, 8.4-9.0% of SL; an elongated body (its depth 28.7-32.8 and width 11.4-13.5% SL); a short and thin caudal peduncle (its length 14.0-16.1 and depth 10.0-11.1% SL); a short predorsal length, 47.3-49.5% of SL; a long prepelvic length, 38.3-40.4% of SL; a moderately long preanal length, 49.6-52.8% of SL; a long spine length of the first dorsal fin, 10.2-12.1% of SL; a long spine length of the anal fin, 9.1-10.4% of SL; a long dorsal-fin base length, 36.8-40.5% of SL; a long second dorsal-fin base length, 24.3-27.5% of SL; a prominent white margin stripe with a reddish extremity respectively on the second dorsal fin and on the anal fin.

Description

Counts and proportions that appear in parentheses refer to the range for paratypes (based on 17 specimens, 59.6-72.8 mm SL) if different from the holotype. Morphometric data are given in table IV.

Dorsal rays IV-I,15 (IV to VI,14-15); anal rays I,23 (I,22-25); pectoral rays 13 (13-14); pelvic rays I,5; branched caudal rays 15 (15-17); lateral scales 34 (34-36); transverse scales 10 (10-11); predorsal scales 16 (15-17); cheek scales 15 (14-18); total gillrakers on first arch 16 (15-16).

Snout short and pointed with a length equal to interorbital width and larger than eye diameter; jaws about equal, oblique, premaxilla with an abrupt bend between the anterior horizontal portion and lateral part; maxilla ends below anterior edge of eye; lips thin; teeth conical with slightly curved tips, arranged in dense bands in upper and lower jaws; teeth at front of upper jaw in about 5 irregular rows, reduced to 1 row posteriorly; teeth of upper jaw and middle portion of lower jaw extending outside of mouth onto lip; teeth at front

Table IV. - Measurements taken on the holotype and 17 paratypes of *Melanotaenia wanoma* sp. nov.

	Holotype	Paratypes				
SL (mm)	71.9	59.6-72.8				
in % standard length		n	min	max	mean	SD
Head length	25.6	17	24.7	26.4	25.5	0.6
Snout length	8.9	17	8.0	9.1	8.6	0.3
Interorbital width	8.9	17	8.4	9.0	8.7	0.2
Eye diameter	7.4	17	7.3	7.8	7.6	0.1
Body depth	32.8	17	28.7	32.1	30.5	1.0
Body width	11.4	17	11.4	13.5	12.5	0.6
Caudal peduncle depth	10.7	17	10.0	11.1	10.6	0.3
Caudal peduncle length	14.0	17	14.4	16.1	15.5	0.6
Predorsal length	47.6	15	47.3	49.5	48.5	0.8
Prepelvic length	38.5	16	38.3	40.4	39.2	0.7
Preanal length	49.9	16	49.6	52.8	51.0	1.1
Pectoral fin length	20.0	17	18.7	20.7	19.6	0.6
Pelvic fin length	19.5	17	16.3	19.0	17.5	0.8
Spine length of first dorsal fin	11.9	16	10.2	12.1	11.3	0.5
Spine length of second dorsal fin	9.3	17	9.2	12.9	10.7	1.0
Spine length of anal fin	10.1	16	9.1	10.4	9.6	0.3
Dorsal-fin base length	40.5	17	36.8	40.1	38.6	1.0
Second dorsal-fin base length	27.5	17	24.3	27.3	25.5	1.0
Anal-fin base length	41.4	17	36.0	41.0	39.2	1.3
Anal fin height	17.4	17	11.9	13.9	13.0	0.7

of lower jaw in about 5-6 irregular rows, reduced to a single row posteriorly; some small and conical teeth on vomer and palatines.

Body elongated; scales of body cycloid, large, and arranged in regular horizontal rows; most of body scales with slight crenulations along posterior margin; predorsal scales extending to posterior edge of interorbital.

First dorsal fin originates at the level or just behind anal fin origin, between base of second to third anal soft ray; tip of first dorsal fin when depressed, reaching base of first to third soft ray of second dorsal fin; pectoral fins pointed; caudal fin moderately forked with moderately pointed extremities.

Colour of mature male when fresh (Fig. 11): brownish on upper back; body scales with narrow brown outline; lower half of side of body and belly whitish; a diffuse dark blotch immediately behind eye on uppermost part of operculum; a golden patch in middle part of operculum; a broad and oblong blue blotch extending from just below pectoral-fin base to above middle of anal fin; 8 to 9 narrow orange stripes between each scale row; a dark midlateral stripe extending from upper edge of preopercle to caudal-fin base, the stripe more or less solid on rear half body and about 1.5 scale wide on caudal peduncle; pectoral fins translucent; pelvic fins orange; dorsal and anal fins brown with yellowish to orange tint between rays and marked with a prominent white margin stripe with reddish extremities. Overall colour of females is similar but paler than males with a narrow margin stripe on both second dorsal and anal fins (Fig. 12).

Sexual dimorphism: similar to many *Melanotaenia*, mature males have a tendency to be deeper bodied than females (30.8-32.8 *vs*. 28.7-31.7% SL) and have a more elongate and pointed shape posteriorly on the soft dorsal and anal fins. The longest soft dorsal-fin rays of males are located in the posteriormost portion of the fin, in contrast to that of females, which are situated in the anterior half of the fin. Depressed posterior tip of the dorsal fin extends the hypural junction for males and only the half of caudal peduncle length for the females. In addition, the depressed posterior tip of anal fin reaches half of caudal peduncle length for males and only one third for the females.

Comparisons

Melanotaenia wanoma sp. nov. differs from *M. kokasensis* by a slender interorbital width (8.4-9.0 *vs*. 9.0-9.2% SL), a smaller eye diameter (7.3-7.8 *vs*. 8.2-8.7% SL), a shorter and slender caudal peduncle (its length 14.0-16.1 *vs*. 17.5-18.9 and depth 10.0-11.1 *vs*. 11.2-11.5% SL), a shorter spine length on first dorsal fin (10.2-12.1 *vs*. 12.3-12.9% SL), a longer second dorsal-fin base length (24.3-27.5 *vs*. 21.0-23.1% SL), a shorter predorsal length (47.3-49.5 *vs*. 49.6-49.7% SL) and fewer gillrakers (15-16 *vs*. 16-19). The new species differs from *M. irianjaya* by a shorter snout length (8.0-9.1 *vs*. 9.2-10.3% SL), a shorter predorsal length (47.3-49.5 *vs*. 50.0-52.5% SL), a shorter pelvic fin length (16.3-19.5 *vs*. 20.6-30.0% SL), fewer lateral scales (34-36 *vs*. 36-39), fewer predorsal scales (15-17 *vs*. 17-19) and fewer gillrakers (15-16 *vs*. 19-21).

The new species can be distinguished from *M. ammeri* by the colouration pattern, a shorter predorsal length (47.3-49.5 *vs*. 49.8-52.5% SL), a slender caudal peduncle depth (10.0-11.1 *vs*. 11.6-13.8% SL) and fewer gillrakers (15-16 *vs*. 16-18).

Melanotaenia wanoma can be distinguished from *M. angfa* and *M. parva* by a slender body width (11.4-13.5 *vs*. 13.6-16.0% SL) and by a shorter spine length on the anal fin (9.1-10.4 *vs*. 6.5-8.9% SL). In addition, *M. angfa* has a shorter pectoral fin (16.2-18.5 *vs*. 18.7-20.7% SL) and more gillrakers (16-20 *vs*. 15-16) than the new species, while *M. parva* possesses a larger eye diameter (7.9-8.4 *vs*. 7.3-7.8% SL), a larger body depth (32.8-37.5 *vs*. 28.7-32.8% SL), a longer and deepest caudal peduncle (its length 16.8-19.4 *vs*. 14.0-16.1 and depth 11.6-12.5 *vs*. 10.0-11.1% SL) and a longer predorsal length (50.8-52.8 *vs*. 47.3-49.5% SL).

Melanotaenia wanoma sp. nov. differs from *M. arguni* sp. nov. by a larger eye diameter (7.3-7.8 *vs*. 6.6-7.2% SL), a shorter predorsal length (47.3-49.5 *vs*. 49.8-52.1 SL) and fewer gillrakers (15-16 *vs*. 17-18). Compared to *M. urisa* sp. nov., the new species displays many diagnostic characters which are: a smaller eye diameter (7.3-7.8 *vs*. 8.0-9.0% SL), a larger body width (11.4-13.5 *vs*. 10.0-11.2% SL), a shorter and deepest caudal peduncle (its length 14.0-16.1 *vs*. 16.3-19.0 and depth 10.0-11.1 *vs*. 8.6-10.0% SL), a shorter predorsal length (47.3-49.5 *vs*. 50.6-54.5% SL), a longer preanal length (49.6-52.8 *vs*. 47.0-49.1% SL), longer fins (namely pectoral and pelvic fin length, dorsal-fin base and second dorsal-fin base length, anal fin height on table II and IV respectively), a longer spine on the anal fin (9.1-10.4 *vs*. 7.1-8.5% SL), fewer lateral scales (34-36 *vs*. 36-39), fewer predorsal scales (15-17 *vs*. 18-20) and fewer gillrakers (15-16 *vs*. 17-18).

Despite their close geographic proximity (less than 4 km between both type locality situated on the same anticline slope), the new species differs from *M. veoliae* sp. nov. by a significant number of diagnostic characters: a slender interorbital width (8.4-9.0 *vs*. 9.0-9.5% SL), a shorter predorsal length (47.3-49.5 *vs*. 49.5-52.1% SL), a longer prepelvic length (38.3-40.4 *vs*. 36.9-38.0% SL), a longer preanal length (49.6-52.8 *vs*. 47.4-49.3% SL), a shorter caudal peduncle length (14.0-16.1 *vs*. 16.5-17.7% SL), fewer predorsal scales (15-17 *vs*. 17-18), more cheek scales (14-18 *vs*. 12-14), more soft dorsal rays (14-15 *vs*. 12-13), more pectoral rays (13-14 *vs*. 12-13) and fewer gillrakers (15-16 *vs*. 18-20).

CONCLUSIVE DISCUSSION

Key to the species of *Melanotaenia* from the Bomberai Peninsula and Bird's Head Isthmus.

1a. - Dorsal fins with a prominent margin stripe 2
1b. - Dorsal fins without a margin stripe 3

2a. - Snout length 9.2-10.3% SL. Predorsal length 50.0-52.5% SL. Pelvic fin length 20.6-30.0% SL. Gillrakers 19-21 . . . . . *Melanotaenia irianjaya*
2b. - Snout length 8.0-9.1% SL. Predorsal length 47.3-49.7% SL. Pelvic fin length 16.3-19.5% SL. Gillrakers 15-19. . . . 4

3a. - Pelvic fin length 11.0-13.7% SL. Anal fin height 6.8-9.9% SL. . . . . *.Melanotaenia urisa*
3b. - Pelvic fin length 15.1-23.4% SL. Anal fin height 11.3-17.2% SL. 5

4a. - Eye diameter 8.2-8.7% SL. Predorsal length 49.6-49.7% SL. Caudal peduncle depth 11.2-11.5% SL. Caudal peduncle length 17.5-18.9% SL. Spine length on the first dorsal fin 12.3-12.9% SL. Second dorsal-fin base length 21.0-23.1% SL . . . . . *Melanotaenia kokasensis*
4b. - Eye diameter 7.3-7.8% SL. Predorsal length 47.3-49.5% SL. Caudal peduncle depth 10.0-11.1% SL. Caudal peduncle length 14.0-16.1% SL. Spine length on the first dorsal fin 10.2-12.1% SL. Second dorsal-fin base length 24.3-27.5% SL . . . . . *.Melanotaenia wanoma*

5a. - Caudal peduncle length 16.5-19.4% SL. Anal and dorsal fins with intense blood-red colouration 6
5b. - Caudal peduncle length 13.9-16.4% SL. Anal and dorsal fins with grey to yellow colouration 7

6a. - Prepectoral length 38.3-41.0% SL. Preanal length 50.6-53.3% SL. Body width 13.8-15.9% SL. Gillrakers 13-16. . . . . *Melanotaenia parva*
6b. - Prepectoral length 36.9-38.0% SL. Preanal length 47.4-49.3% SL. Body width 11.3-12.6% SL. Gillrakers 18-20 . . . . . *.Melanotaenia veoliae*

7a. - Predorsal length 45.9-49.5% SL . . *Melanotaenia angfa*
7b. - Predorsal length 49.8-52.5% SL 8

8a. - Eye diameter 7.3-7.8% SL. Caudal peduncle depth 11.6-13.8% SL. . . . . *.Melanotaenia ammeri*
8b. - Eye diameter 6.6-7.2% SL. Caudal peduncle depth 10.0-10.8% SL . . . . . *Melanotaenia arguni*

In many areas of Southeast Asia, karst systems have formed "islands within islands", and these are known to contain high levels of endemism (Clements *et al*., 2006). The high species diversity on karsts is explained by a large array of ecosystems, complex and fragmented terrains, variable local climatic conditions, and also by tectonic and eustatic histories, variable degrees of isolation, and incidence of random events.

Karts covers large section of New Guinea but their exploration is the least advanced of any sector in the Australasian region.

The discovery of four new species of *Melanotaenia* in the western side of the Lengguru limestone karst suggests that this vast unexplored area is probably home of many other undiscovered taxa and motivates the organization of forthcoming scientific expeditions.

The present work rises to 9, the number of *Melanotaenia* species inhabiting the Bomberai Peninsula and seems to indicate that the Lengguru range has played an important role in the diversification of New Guinean rainbowfishes.

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