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A new species of the congrid eel genus *Bathycongrus* (Order Anguilliformes) from eastern Taiwan

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Abstract

A new species of the congrid eel genus *Bathycongrus* is described on the basis of three specimens collected from the deep waters of eastern Taiwan. *Bathycongrus melanostomus* **sp. nov.**, belongs to the few vertebrae species complex and is distinct in having a short and broad snout; a much reduced caudal fin; abdomen, mouth cavity and gill chamber blackish; small conical blunt teeth on vomer forming an elongate patch; total vertebrae 133–135, and total lateral-line pores 108–109.

Key words: Biodiversity, taxonomy, Ichthyology, Congrinae

Introduction

The genus *Bathycongrus* is a group of small to medium-size eels that inhabits the tropical and subtropical waters around the world. It differs from other genera in the family Congridae by having the body moderately elongated, tail slender, markedly attenuate to filiform; snout projecting beyond lower jaw, fleshy part of snout extending anteriorly beyond intermaxillary teeth; intermaxillary teeth conical or fang-shaped, separated from maxillary and vomerine teeth, mostly excluded from closed mouth; vomerine teeth forming a small patch on head of vomer (Smith, 1989). The genus comprises about 30 species worldwide and many of them were described in recent two decades (Karmovskaya & Smith, 2008; Karmovskaya, 2009, 2011; Huang *et al*., 2018; Smith & Ho, 2018; Smith *et al*., 2020). In Taiwan, ten *Bathycongrus* species had been previously recorded or described: *Bathycongrus guttulatus* (Günther, 1887), *Bathycongrus wallacei* (Castle, 1968), *Bathycongrus retrotinctus* (Jordan & Snyder, 1901), *Bathycongrus bleekeri* Fowler, 1934, *Bathycongrus macroporis* (Kotthaus, 1968), *Bathycongrus albimarginatus* Huang *et al*., 2018, *Bathycongrus brunneus* Huang *et al*., 2018, *Bathycongrus bimaculatus* Smith & Ho, 2018, *Bathycongrus castlei* Smith & Ho, 2018, *Bathycongrus graciliceps* Smith & Ho, 2018 (Ho *et al*., 2015a, Ho *et al*., 2018). In the context of reviewing all known eels of Taiwan, 3 subfamilies, 32 genera and total 232 species were recognized. The diversity of Taiwan of eels is relatively highest compared to other countries in the world (Ho *et al*., 2015a, b, Ho *et al*., 2018) and many species are still waiting to be described or documented.

Recently, three specimens of *Bathycongrus* were collected, which represent an undescribed species. The species can be further classified into *Bathycongrus dubius* species group (*sensu* Karmovskaya, 2009) by having many small teeth forming a large patch and less than 140 total vertebrae. Here we described this new species, which can be further distinguished from its congeners by having different morphology, body coloration and meristic characters.

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Material and methods

Methods for taking measurements and counts followed Böhlke (1989). Vertebral counts were made by x-ray films or digital images taken by X-ray machines set up in the National Taiwan Ocean University and National Museum of Marine Biology & Aquarium.

Specimens were collection from the eastern coast of Taiwan. Fishermen capture their from a depth of around 300 m by hook and line. Specimens were fixed in 10% formalin for a week before being transferred to 70% ethanol for long-tern preservation and registered to the collections of the Laboratory of Aquatic Ecology, Department of Aquaculture, National Taiwan Ocean University (TOU-AE) and National Museum of Marine Biology & Aquarium (NMMB-P).

Taxonomy

***Bathycongrus melanostomus* sp. nov.**
English name: Black mouth conger
Figs. 1A–D, 2A–C, 3, 4; Table. 1

Holotype. TOU-AE 7271 (439 mm TL), ca. 23°29'N, 121°30'E, off Shihtiping, Hualien, eastern Taiwan, hook and line, ca. 300 m, 23 Jan. 2015, coll. J.-S. Chiu.

Paratypes. TOU-AE 7272 (371 mm TL), ca. 23°45'N, 121°34'E, off Shuilien, Hualien, eastern Taiwan, hook and line, ca. 300 m, 27 Jan. 2015, coll. J.-S. Chiu. NMMB-P36072 (formerly TOU-AE 5560) (420 mm TL), ca. 23°18'N, 121°26'E, off Changbin, Taitung, eastern Taiwan, hook and line, ca. 300 m, 13 Jun. 2010, coll. J.-S. Chiu.

Diagnosis. A moderately elongate species of *Bathycongrus* with uniformly small teeth on vomer forming an oval patch; a strongly reduced caudal fin; abdomen, mouth cavity and gill chamber blackish. It can be further distinguished from the congeners by dorsal and anal fins grayish with black margins; a short, broad and blunt snout, intermaxillary teeth barely exposed when mouth closed; pre-anal vertebrae 31, precaudal vertebrae 41; total vertebrae 133–135; and pre-anal lateral-line pores 31.

Description. The following values are given for the holotype, followed by the range of the two paratypes in parentheses.

Body rather stout, robust, rounded in cross section anteriorly, becoming more compressed behind anus and posterior portion; head moderately slender, head depth and width slightly smaller than those of trunk; trunk moderately long, its length 1.5 (1.6–1.7) times of head length; tip of tail rounded, not filiform; anus situated at near anterior two fifths of total length (when tail complete), pre-anal length 36.4 in TL; tail relatively short, tail length 63.6 in TL.

Dorsal-fin origin behind tip of pectoral fin, continuous around tip of tail with caudal and anal fins. Anal fin begans immediately behind anus. Pectoral fin well developed, pointed distally with a narrow base. Caudal-fin rays strongly reduced, with membranes forming a small flap. Gill opening large, similar to eye diameter or slightly smaller in length, its upper end nearly opposite to middle of pectoral-fin base. Interbranchial width much broad, more than twice of width of gill opening (Fig. 1).

Head relatively large and robust, its length 14.6% (13.5–14.6%) TL, deepest at about occiput, slightly tapering anteriorly to this point; dorsal profile nearly flat from occiput to internasal space; snout short and rounded, its length 1.7 (1.6–1.7) times eye diameter, slightly projecting beyond lower jaw; lower jaw longer than snout; fleshy part of snout without median keel on underside, projecting anteriorly beyond anterior end of intermaxillary tooth patch; rictus below middle of eye.

Anterior nostril tubular, near tip of snout, directed ventrolaterally. Posterior nostril elliptical, with clear rim, in front of eye above mid-eye level. Upper lip with flange strongly reduced, lower lip with a well-developed down-turned flange. Tongue free, long, and broad.

Lateral line complete, first pore on each side slightly enlarged, the canal extended to caudal-fin base; 13 pores before dorsal-fin origin, 5 pores before pectoral-fin base, 31 pores before anal-fin origin; total pores 109 (108–109), last one running to about 1 head length before rear tip.

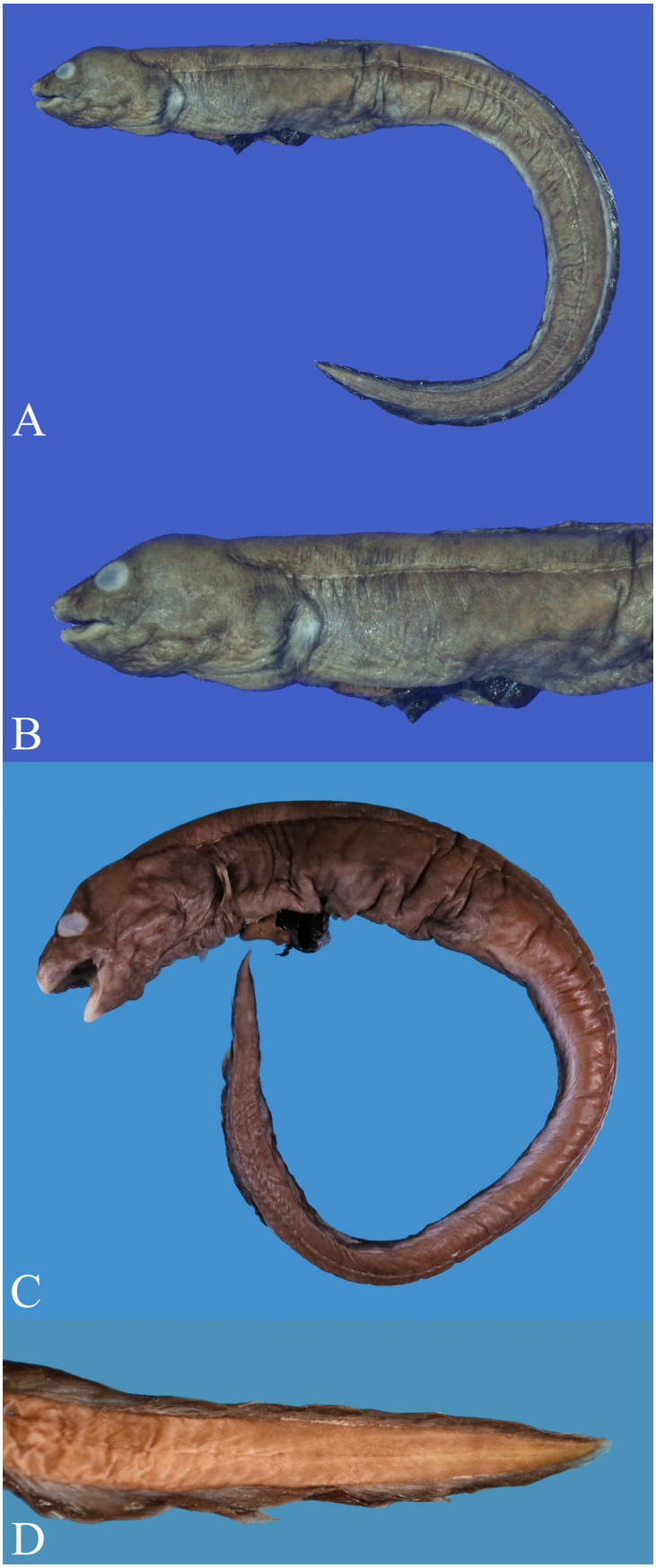

FIGURE 1. ***Bathycongrus melanostomus*** **sp. nov.** Holotype, TOU-AE 7271, 439 mm TL. A–B. Fresh color after frozen. C. Preserved. D. Lateral view of tail.

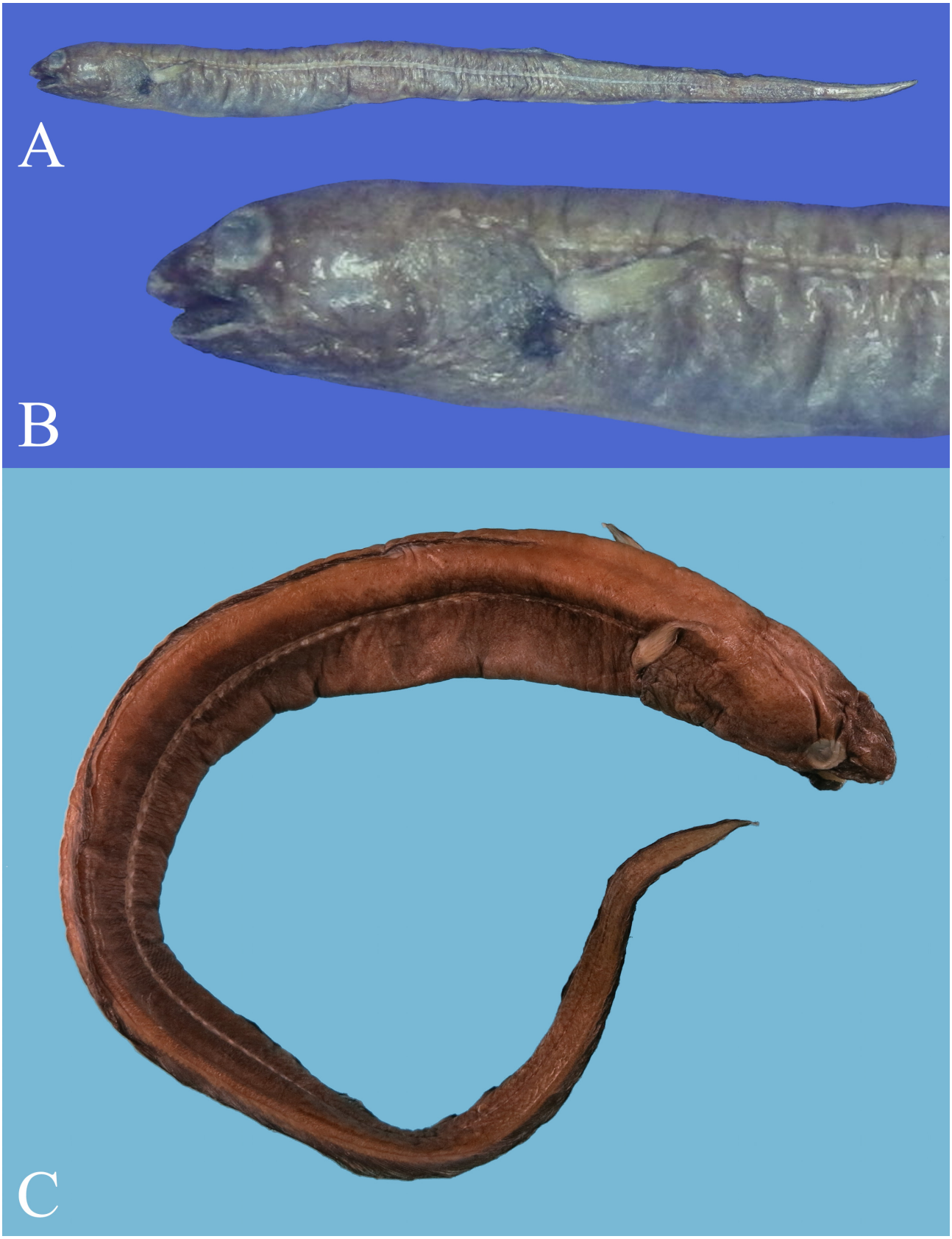

FIGURE 2. ***Bathycongrus melanostomus*** **sp. nov.** Paratype, TOU-AE 7272, 371 mm TL. A–B. Fresh color after frozen. C. Preserved.

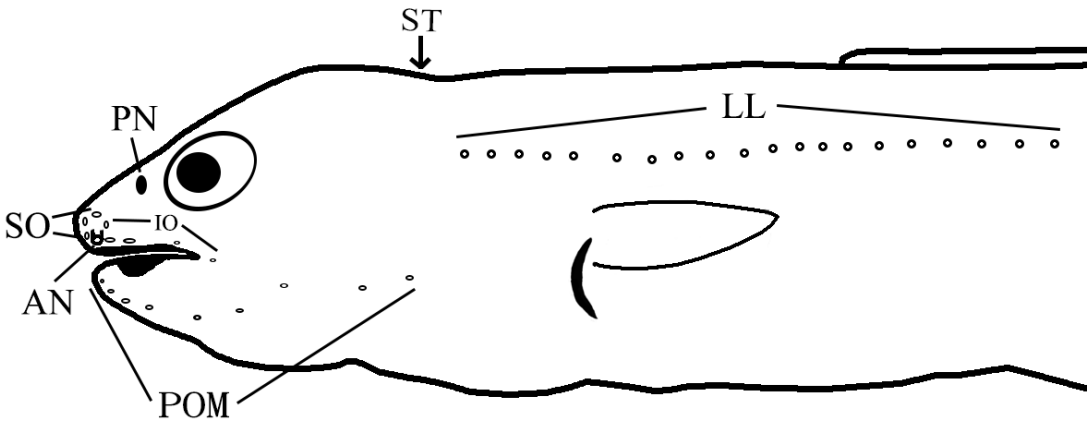

FIGURE 3. ***Bathycongrus melanostomus*** **sp. nov.**, holotype, TOU-AE 7271, 439 mm TL, showing location of head pores, lateral line pores, gill opening, pectoral fin and dorsal fin.

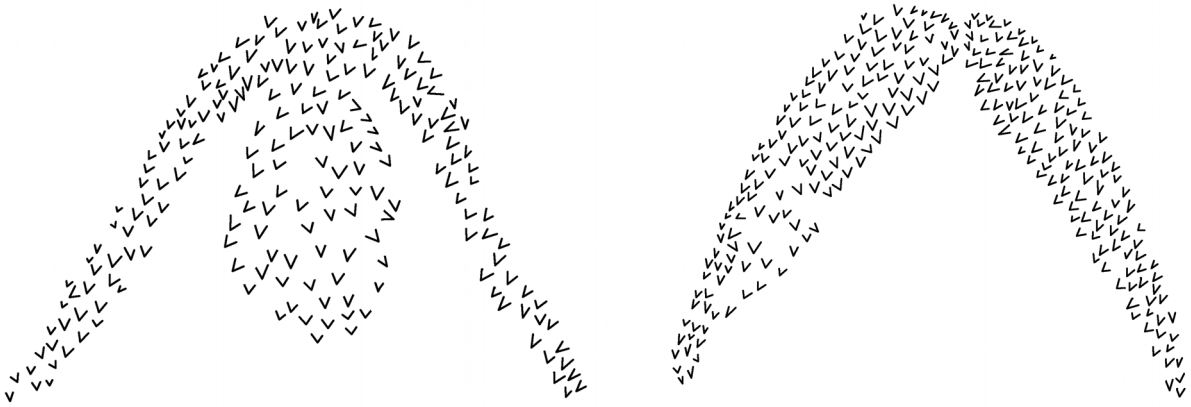

FIGURE 4. ***Bathycongrus melanostomus*** **sp. nov.**, holotype, TOU-AE 7271, 439 mm TL, upper (left) and lower (right) jaw teeth.

Head pores various in size (Fig. 3). Supraorbital canal with 3 pores, the first (ethmoidal pore) on ventral side of snout tip, just ahead of lip; the second enlarged and immediately in front of anterior nostril; the third greatly enlarged and immediately above anterior nostril. Infraorbital canal with 5 pores, first pore at dorsal-posterior corner of anterior nostril; the second and third enlarged, between anterior and posterior nostrils, both shaded by upper flange; the fourth small, below anterior margin of eye; the fifth small, behind rictus. No pore on frontal region and behind eye. Preoperculomandibular canal with 9 pores, 5 before and 4 behind rictus, second and posteriormost 2 pores (preopercular) enlarged. Supratemporal with a single, small medial pore.

Teeth (Fig. 4) uniformly small in size, conical to blunt. Intermaxillary in about 5 transverse rows, not well separated from maxillary and vomerine teeth, barely excluded from closed mouth. Maxillary and mandibular teeth in bands, wider anteriorly, roughly in 4 or 5 rows in anterior three-fourths, followed by a narrower, curved band of 2 or 3 rows of smaller teeth; outermost teeth slightly smaller than those of inner rows. Vomerine teeth blunt, shorter than those of intermaxillary, forming an oval patch, patch with length longer than width, reaches to level of posterior nostril, in about 8 rows middly.

Coloration. When fresh (Figs. 1A–B, 2A–B), body uniformly dark grey to brown; vertical fins black with gray bases. Dark papillae outlining supratemporal canal and along dorsal surface; an indistinct patch of pigments on

opercle in front of pectoral-fin base. Pectoral fin yellowish with black margin. Lateral-line pores white. Anterior portions of snout, lips and chins whitish. Mouth cavity, gill chamber black. When preserved (Figs. 1C, 2C), body uniformly dark brown. Anterior portions of snout, lips and chins whitish. Mouth cavity, gill chamber, peritoneum, stomach, and intestine black. Pectoral fin brown with black margin. Lateral-line pores white.

Measurement for holotype (in mm): total length 439.0; head length 64.0; predorsal length 89.0; preanal length 160.0; trunk length 96.0; tail length 279.0; depth at gill opening 34.9; width at gill opening 22.4; depth at mid-anus 34.3; eye diameter 8.6; interorbital width 15.6; snout length 14.5; interbranchial width 17.2; pectoral-fin length 22.3; gill-opening length 9.0; upper-jaw length 17.7; lower-jaw length 16.5.

Size. The largest specimen is a mature male measured 439 mm TL.

Etymology. The specific name is from the Greek *melano*, black and *stomus*, a mouth, in refer to the black mouth.

Distribution. Known from the type series collected from eastern Taiwan off three localities, Changbin, Shihtiping and Shuilien at depth about 300 m.

TABLE 1. Morphometric and meristic data of *Bathycongrus melanostomus* **sp. nov.** LL=lateral line.

	Bathycongrus melanostomus sp. nov.		
	Holotype TOU-AE 7271	Paratype TOU-AE 7272	Paratype NMMB-P36072
TL (mm)	439	371	420
%TL			
Head length	14.6	13.5	14.3
Trunk length	21.9	23.2	22.1
Tail length	63.6	63.3	63.6
Predorsal length	20.3	19.9	20.5
Preanal length	36.4	36.7	36.4
Depth at anus	7.8	6.8	7.7
%HL			
Eye diameter	13.4	15.8	14.2
Interorbital wideh	24.4	21.4	20.5
Snout length	22.6	25.0	24.0
Interbranchial width	26.9	27.5	28.6
Pectoral fin length	34.8	43.5	37.1
Gill opening length	14.1	17.3	14.5
Upper jaw length	27.6	32.0	29.4
Lower jaw length	25.8	26.7	27.3
Predorsal vertebrae	13	13	13
Preanal vertebrae	31	31	31
Precaudal vertebrae	42	41	42
Total vertebrae	135	135	133
Prepectoral LL pores	5	5	5
Predorsal LL pores	13	13	13
Preanal LL pores	31	31	31
Total LL pores	109	108	109
SO pores	3	3	3
IO pores	5	5	5
POM pores	9	9	9
POP pores	2	2	2
M pores	7	7	7
STC pores	1	1	1

TABLE 2. Selected characters for comparing of seven similar species in *Bathycongrus*. Data sources: A. this study; B. Karmovskaya & Smith, 2008; C. Karmovskaya, 2009; D. Karmovskaya, 2011; E. Smith & Ho, 2018.

	B. melanostomus sp. nov.	*B. bimaculatus*	*B. bleekeri*	*B. trimaculatus*	*B. unimaculatus*	*B. dubius*	*B. parviporus*
	n=3	n=6	n=4	n=16	n=1	n=1	n=98
TL (mm)	371–420	157–190	168–185	65–155	175	283	93–207
%TL							
Head length	13.5–14.6	14.3–15.7	15.5–16.1	14.7–16.4	13.1	12.8	14.5–16.6
Trunk length	21.9–23.2	19.9–22.5	20.7–21.4	17.2–20.9	20.0	21.5	–
Predorsal	19.9–20.5	17.3–17.9	17.7–18.5	17.2–19.6	16.3	16.1	–
%HL							
Eye diameter	13.4–15.8	17.1–21.8	18.2–21.5	19.4–23.8	17.4	18.0	19.6–23.8
Snout length	22.6–25.0	23.2–26.7	23.9–25.2	21.5–25.4	21.7	25.0	21.3–27.0
Pectoral fin	34.8–43.5	27.9–37.5	29.1–35.0	31.1–37.5	39.0	36.1	–
Upper jaw	25.8–27.3	35.9–39.7	35.1–37.2	–	–	–	–
PreA pores	27–30	27–29	27–30	26–29	30	31	26–29
PreD-V	13	8	8–9	–	10	13	6–7
PreA-V	31	27–30	27–28	28–30	32	31	29–30
Total-V	133–135	109–111	107–113	117–119	137	140	120–122
Data sources	A	E	E	B	C	C	D

Discussion

The uniform small-sized teeth on the vomer and the relatively fewer vertebrae of *Bathycongrus melanostomus* **sp. nov.** can separate them from most of the congeners, except for the six species known as the member of the "*Bathycongrus dubius*" species group (*sensu* Karmovskaya, 2008). Table 2 shows the selected morphometric and meristic characters among our new species and these members.

Bathycongrus melanostomus is unique in the genera in having a yellowish pectoral fin with a black margin; the body color ranges from dark gray to dark brown; the mouth cavity and gill chamber are uniformly black with, a broad band, and a thin blackish margin with a gray base are noticeable on the dorsal and anal fins, whereas these vertical fins are black with gray bases. These observed characters separate the new species from the six members in the species group. *Bathycongrus bimaculatus* has uniformly light brownish vertical fins where two black blotches on the dorsal fin, pectoral fin pale, gill chamber and mouth cavity pale, and body has a pale to yellowish-brown color. *Bathycongrus bleekeri* has uniformly light brownish vertical fins without any black blotches, pectoral fin pale, gill chamber and mouth cavity pale, and the body has brown color on dorsum and pale elsewhere. *Bathycongrus trimaculatus* has vertical fins uniformly light brownish where the dorsal fin has two black blotches, the anal fin with one black blotch, the pectoral fin pale, the gill chamber cavity pale, and the body has a light yellowish-brown color. *Bathycongrus unimaculatus* has uniformly light (pale in color) vertical and pectoral fins, the gill chamber cavity is uniformly light, and the body has a light-yellow color. *Bathycongrus dubius* has uniformly light vertical and pectoral fins, gill chamber, and mouth cavity uniformly light, and the body has a brown or yellowish-brown to gray color. *Bathycongrus parviporus* has uniformly light vertical and pectoral fins, and gill chamber and mouth cavity are grayish dark, and the body has a light and yellowish-gray color.

Among these characters, *B. melanostomus* also differs in having the dorsal fin originating posterior to the tip of the pectoral fin, the tip is rounded and not filiform, whereas in *B. bimaculatus*, *B. trimaculatus*, and *B. bleekeri*, the fin origin is over the middle of the appressed pectoral fin and the tip of the tail is slender, not filiform; in *B. unimaculatus*, the fin origin is over the end of the pectoral fin and the tip is tapering; in *B. dubius*, the fin origin is above the middle of the pectoral fin and the tip is tapering; and in *B. parviporus*, the fin origin is above pectoral fin base or slightly in front of the pectoral fin and the tail is tapering.

Moreover, *Bathycongrus melanostomus* can be separated from those by having 133–135 total vertebrae (vs. 107–113 in *B. bleekeri*, 109–111 in *B. bimaculatus*, 117–119 in *B. trimaculatus*, 120–122 in *B. parviporus*, and 140 in *B. dubius*), head length 13.5–14.6% TL (vs. 15.5–16.1% in *B. bleekeri*, 14.3–15.7% in *B. bimaculatus*, 14.7–16.4% in *B*, *trimaculatus*, 14.5–16.6% in *B. parviporus*, 13.1% in *B. unimaculatus*, 12.8% in *B. dubius*), predorsal length 19.9–20.5% TL (vs. 17.7–18.5% in *B. bleekeri*, 17.3–17.9% in *B. bimaculatus*, 17.2–19.6% in *B*, *trimaculatus*, 16.3% in *B. unimaculatus*, 16.1% in *B. dubius*) and eye diameter 13.4–15.8% HL (vs. 18.2–21.5% in *B. bleekeri*, 17.1–21.8% in *B. bimaculatus*, 19.4–23.8% in *B*, *trimaculatus*, 19.6–23.8% in *B. parviporus*, 17.4% in *B. unimaculatus*, 18.0% in *B. dubius*) (Karmovskaya & Smith, 2008; Karmovskaya, 2009; Karmovskaya, 2011; Smith & Ho, 2018).

Notably, that the three types of specimens have strongly reduced caudal fins that appeared to be not damaged or regenerated. Such structure of the caudal fin is somewhat similar to that of the garden eels (Heterocongrinae) which may indicate a special habit of borrowing themselves into soft substrates. However, this hypothesis still needs to be proved.

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