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A new sponge-dwelling goby (Gobiidae: *Bathygobius*) from Indonesia, Philippines, and Australia

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Abstract

A new species of goby, *Bathygobius mero*, is described from eastern Bali, Indonesia on the basis of 8 adult specimens, 26.3–36.0 mm SL. There are also photographic records from Sumba, Indonesia, Cebu, Philippines, and Queensland, Australia. Diagnostic features include 19–21 (usually 20) pectoral-fin rays with the upper three rays free from the membranous portion of the fin and each with two filamentous tips, a mostly scaleless predorsal midline except for two or three scales in front of first dorsal-fin origin, and 33 or 34 lateral scales. The live coloration is overall pale greyish with a dense covering of reddish-brown freckles, a brown spot (about one third of pupil size) at the uppermost part of the gill opening, and reddish-brown spotting on the fins. The new species has a commensal association with the large barrel sponge (*Xestospongia testudinaria*), unlike other members of the genus, which are typically free-living bottom dwellers. It also inhabits deeper water (9–30 m, but usually below about 15 m) than most *Bathygobius*, which are mainly confined to shallow water less than 10 m deep.

Key words: taxonomy, ichthyology, systematics, coral-reef fishes, gobies, tropical western Pacific Ocean, Indo-Pacific, commensal.

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Introduction

The circumtropical genus *Bathygobius* Bleeker, 1878 contains about 24 currently valid species (Larson 2022, Fricke et al. 2024), including 15 species from the Indo-West Pacific region. The genus contains small (maximum size about 45–100 mm SL), relatively drab, benthic coral-reef dwellers with a flattened to rounded head, a distinctly lobed mental frenum, and particularly diagnostic pectoral fins in which several of the upper rays are free from the fin membrane. The present paper describes an unusual member of the genus that we first became aware of through the efforts of Christiane Waldrich, who photographed the new species on reef slopes in front of her Bali, Indonesia dive resort. The new taxon is apparently the only member of the genus that exhibits a commensal relationship with sponges and occurs at greater depths (9–30 m, but usually below about 15 m) than most *Bathygobius*, which are mainly confined to shallow reefs.

Materials and Methods

Lengths are given as standard length (SL), measured from the median anterior point of the upper lip to the base of the caudal fin (posterior end of the hypural plate); body depth is measured at both the origin of the pelvic fins and the origin of the anal fin; head length (HL) is taken from the upper lip to the posterior end of the opercular membrane, and head width over the posterior margin of the preopercle; orbit diameter is the greatest fleshy diameter; snout length is measured from the median anterior point of the upper lip to the nearest fleshy edge of the orbit; upper-jaw length from the same anterior point to the posterior end of the maxilla; cheek depth is the distance between ventral edge of the fleshy orbit at mid-pupil level and the ventral edge of the preoperculum directly below; caudal-peduncle depth is the least depth, and caudal-peduncle length the horizontal distance between verticals at the rear base of the anal fin and the caudal-fin base; caudal and pectoral-fin lengths are the length of the longest ray; pelvic-fin length is measured from the base of the pelvic-fin spine to the tip of the longest pelvic-fin soft ray.

Terminology and abbreviations for cephalic sensory-canal pores follow Akihito (1984). Cyanine Blue 5R (acid blue 113) stain was used to make pores, papillae, and scale outlines more obvious (Akihito et al. 1993, Saruwatari et al. 1997). Lateral scales are counted from the inner pectoral-fin base to the posterior edge of the hypural plate; scales in the transverse series are counted from the origin of the anal fin posterodorsally to the base of the dorsal fin; gill rakers are counted on the first gill arch, those on the upper limb listed first; rudiments are included in the counts.

Morphometric data are percentages of the standard length for the holotype followed by the range for paratypes in parentheses. Type specimens are deposited at the MERO Foundation (Indonesian Marine Education and Research Organisation), Tulamben, Bali, Indonesia and the Western Australian Museum, Perth, Australia (WAM).



Figure 1. *Bathygobius mero*, n. sp., approximately 35 mm SL, on surface of barrel sponge (*Xestospongia testudinaria*), Bali, Indonesia (C. Waldrich).

Bathygobius mero, n. sp.

Sponge Frillgoby

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Figures 1–7, Table 1

Holotype. MERO A.00021.01.W, female, 35.3 mm SL, -8.2939°, 115.6109°, Seraya, eastern Bali, Indonesia, 18 m, clove oil, M.V. Erdmann & N.K. Ichida, 19 January 2024.

Paratypes. MERO A.00021.02.W, male, 30.6 mm SL & female, 32.9 mm SL, collected with holotype; WAM P.35289-001, 3 males, 26.3–36.0 mm SL & 2 females 25.9 & 32.1 mm SL, same locality as holotype, 18 m, clove oil, M.V. Erdmann, 24 October 2020.

Diagnosis. Dorsal-fin elements VI+I,9; anal-fin elements I,8; pectoral-fin rays 19–21 (usually 20); lateral scales 33 or 34; transverse scales backwards 11 or 12; median predorsal scales 2 or 3; no skin flaps on pores or anterior nasal tube; upper three rays of pectoral fin each with two free filamentous tips and upper branch of fourth ray with short, free tip; mental frenum with a straight margin and short lateral lobes; cheek and operculum without scales; pectoral-fin base, abdomen, and prepelvic region with embedded cycloid scales; cheek with slight fold; pelvic interspinal membrane without median lobe; tongue tip with median notch; live coloration overall pale greyish with a dense covering of reddish-brown freckles, a brown spot about one-third of pupil size at uppermost part of gill opening, and reddish-brown spotting on fins; commensally associated with large barrel sponges (*Xestospongia testudinaria*) (Fig. 1).

Description. Dorsal-fin elements VI+I,9; anal-fin elements I,8; all segmented dorsal and anal-fin rays branched; pectoral-fin rays 20 (5 paratypes with 20 on both sides, one 20 and 19, one 21 both sides); all rays branched except lowermost and upper three rays with two free, filamentous tips (Fig. 2) and upper branch of fourth ray with short, free tip; pelvic-fin rays I,5, interspinal membrane without median lobe; segmented caudal-fin rays 17 and branched rays 14; predorsal scales on midline 3 (2 or 3); scale rows on side of nape 10 (10 or 11); lateral scales 33 (one



Figure 2. *Bathygobius mero*, n. sp., approximately 35 mm SL, Bali, Indonesia, showing uppermost three pectoral rays (white highlight) with filamentous free tips (C. Waldrich).

paratype with 34); transverse scales (TRB) 10 (two paratypes with 11); gill rakers on outer face of first arch 2+1+7 (two paratypes with 2+1+6); lower rakers on outer face of second arch 9 (three paratypes with 8); vertebrae 10+17.

Cephalic sensory-canal pores and papilla rows well developed (Fig. 3), consisting of a pair of large pores (B') lateral and slightly anterior to posterior nostril; two unpaired pores (C and D) at anterior and posterior interorbital; two postocular pores (E and F) followed by pair of pores (G and H') above preoperculum; pair of pores (K' and L') above operculum; and three pores (M', N, and O') along posterior margin of preoperculum. Longitudinal pattern of cheek papillae as shown in Fig. 3. Inner and outer papillae rows also present ventrally on each side of lower jaw, with inner row of each side continuous across chin, just behind mental frenum.

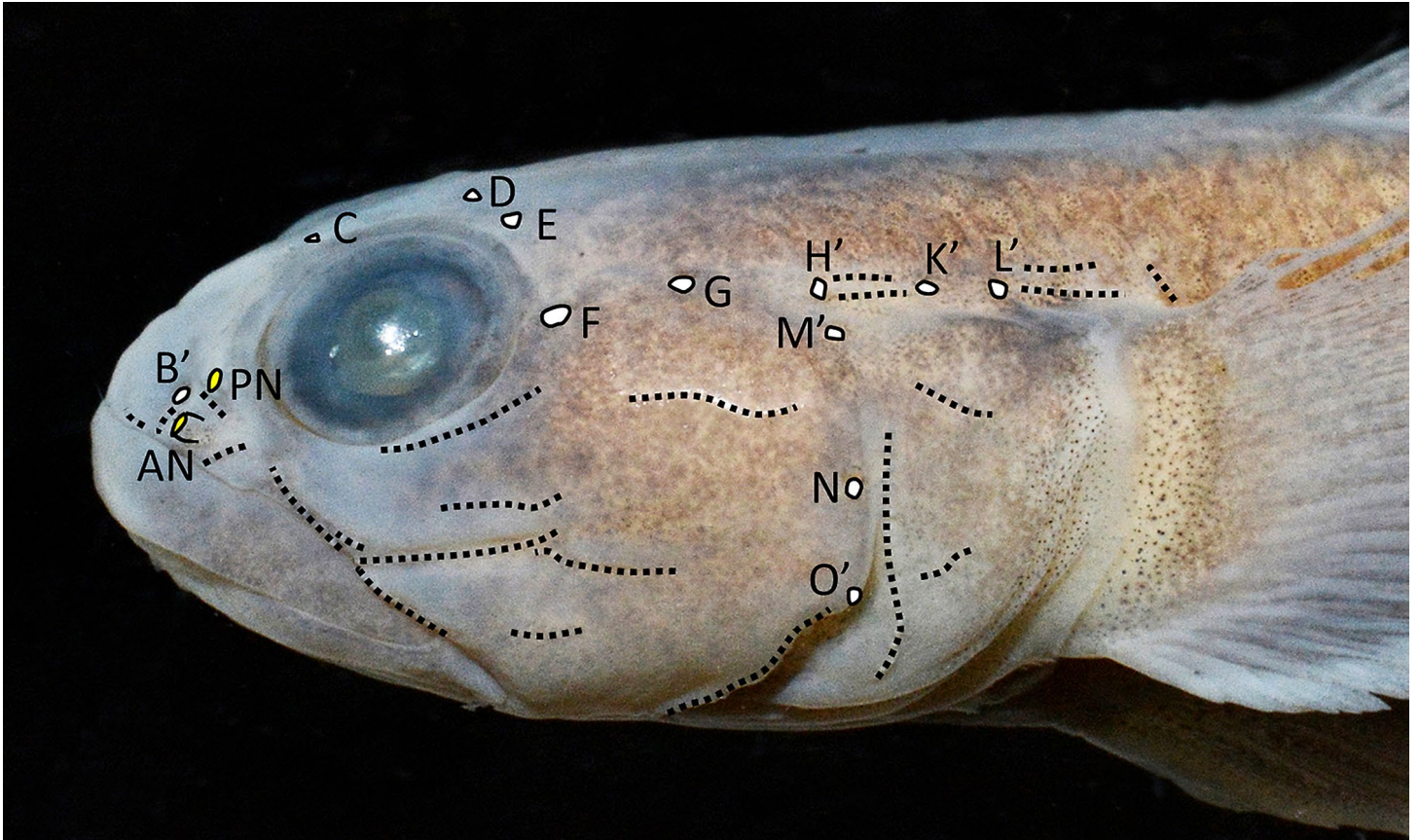
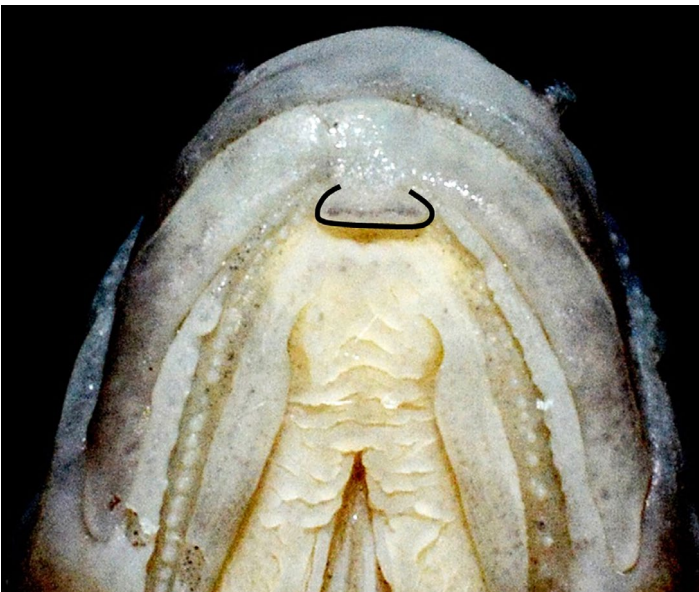


Figure 3. *Bathygobius mero*, n. sp., head of preserved male paratype (WAM P.35289-001), 36.0 mm SL, showing pattern of cephalic sensory-canal pores (black-edged white spots) and papilla rows (black dots). Anterior and posterior naris are labelled as AN and PN respectively (G.R. Allen).



Measurements expressed as percentage of SL: Head slightly depressed, length 30.3 (30.3–36.0), depth 17.3 (17.5–19.1), and width 21.0 (20.5–22.0); snout slightly less than eye diameter, length 6.8 (6.8–8.3); eye diameter 7.9 (7.6–9.2); interorbital width 2.3 (1.2–2.6); upper-jaw length 12.7 (11.4–13.0); body depth at pelvic-fin origin 19.3 (18.5–21.7) and at anal-fin origin 17.8 (17.6–19.1); caudal-peduncle length 22.9 (23.4–28.9) and depth 11.6 (11.6–12.9); pectoral-fin length 24.4 (23.1–27.3); pelvic-fin length 26.1 (25.2–30.0); caudal fin rounded, shorter than head, length 24.1 (23.9–24.9).

Figure 4. (left) *Bathygobius mero*, n. sp., ventral view of head of preserved paratype (WAM P.35289-001), 36.0 mm SL, showing outline of mental frenum (black line) (G.R. Allen).

TABLE 1

Proportional measurements of type specimens of
Bathygobius mero, n. sp.
as percentages of the standard length

	holotype		paratypes					
	MERO A.00021 .01.W	WAM P.35289- 001	MERO A.00021 .02.W	WAM P.35289- 001	MERO A.00021 .02.W	WAM P.35289- 001	WAM P.35289- 001	WAM P.35289- 001
Sex	male	male	male	female	female	male	male	female
Standard length (mm)	35.3	36.0	32.9	32.1	30.6	30.4	26.3	25.9
Head length	30.3	31.6	29.2	30.8	30.7	30.5	30.3	30.6
Head width	21.0	22.2	21.6	22.0	20.6	21.5	21.4	20.5
Head depth	17.3	18.7	17.9	17.5	18.0	17.7	19.0	19.1
Postorbital length	17.6	18.4	17.6	17.6	17.0	16.8	16.9	17.3
Snout length	6.8	7.2	7.0	6.8	7.5	7.8	8.3	7.9
Eye diameter	7.9	7.6	7.9	7.7	8.2	8.0	8.7	9.2
Interorbital width	2.3	2.6	2.4	2.5	2.6	2.3	1.3	1.2
Upper jaw length	12.7	13.0	11.9	11.7	11.4	11.4	12.2	12.4
Body depth pelvic-fin origin	19.3	19.9	18.5	18.8	19.3	19.3	21.7	20.7
Body depth anal-fin origin	17.8	18.5	17.9	17.6	18.3	18.7	19.1	18.5
Caudal peduncle depth	11.6	12.9	12.2	12.1	12.1	12.4	11.6	11.6
Caudal peduncle length	22.9	23.4	25.2	25.0	23.9	23.7	24.7	28.9
Third dorsal spine length	13.6	16.5	13.7	13.8	14.1	15.8	14.9	15.1
Fourth dorsal spine length	11.9	12.4	11.9	14.9	12.1	13.1	12.8	11.8
Longest ray 2nd dorsal fin	18.4	18.3	15.8	17.6	14.7	14.6	15.5	15.0
Longest anal-fin ray	14.2	15.0	14.6	14.9	14.4	14.4	14.2	15.0
Pectoral-fin length	24.4	24.7	23.1	24.4	24.5	24.5	27.3	26.0
Pelvic-fin length	26.1	25.9	25.2	25.6	25.8	27.4	30.0	28.3
Caudal-fin length	24.1	24.0	24.3	24.8	23.9	24.1	24.4	24.9

Scales ctenoid, except embedded cycloid scales on pectoral-fin base, midline of abdomen, and prepelvic area; body scales increasing in size posteriorly; cheek and opercle entirely scaleless.

Snout rounded in dorsal and lateral views; anterior naris forming short tube without dermal flap; posterior naris forming a conspicuous pore with a slightly elevated rim adjacent to front of eye; mouth oblique, forming an angle of about 30° to horizontal axis of body; rear edge of upper jaw extending to about level of middle of eye; teeth of jaws conical in multiple rows, those of upper jaw with an outer row of enlarged teeth and several inner rows of small teeth, tapering posteriorly to one or two rows; lower jaw with outer row of slightly enlarged teeth and innermost row of large, stout, posteriorly curved, canine-like teeth with two or three rows of small teeth medial to the outer and innermost rows; gill opening restricted to pectoral-fin base; tongue tip with median notch; mental frenum with straight margin and short lateral lobes (Fig. 4).

Dorsal and anal fins relatively low and rounded, third dorsal-fin spine usually longest, slightly longer than fourth spine, length 13.6% (13.7–16.5) of SL; longest segmented ray of second dorsal fin 18.4% (14.6–18.3) of SL; longest segmented ray of anal fin 14.2% (14.2–15.0) of SL; first-dorsal-fin origin well behind pectoral-fin insertion; pelvic fins fused to form an oval, cup-shaped disc, origin below pectoral-fin insertion, reaching posteriorly to base of genital papilla.

Genital papilla of male forming a flattened, triangular flap and that of female rectangular with a conspicuous fimbriated posterior margin.

Color in life. (Figs. 1, 2, 5 & 7) Overall pale greyish with a dense covering of reddish-brown freckles, a brown spot (about one-third of pupil size) at uppermost part of gill opening, and reddish-brown spotting on fins. Some individuals (Figs. 5 & 7) exhibit 6–8 diffuse white saddles or bars, more distinct in smaller fish less than about 20 mm SL.



Figure 5. *Bathygobius mero*, n. sp., approximately 35 mm SL, on surface of barrel sponge (*Xestospongia testudinaria*), Bali, Indonesia (C. Waldrich).



Figure 6. *Bathygobius mero*, n. sp., preserved male paratype, WAM P. 35289-001, 36.0 mm SL, Seraya, Bali, Indonesia (G.R. Allen).

Color in alcohol. (Fig. 6) Generally tan with narrow, brown scale margins; diffuse brown blotches and numerous pepper-like melanophores, especially dense on upper half of head and anterior body; fins semi-translucent with brown spotting, especially prominent on median fins; a diffuse brown spot (about one-third of pupil size) at uppermost part of gill opening.

Etymology. The new species is named *mero* with reference to the MERO Foundation (Indonesian Marine Education and Research Organisation, Tulamben, Bali) for their generous sponsorship of this study. The name is treated as a noun in apposition.

Distribution and habitat. The new species is currently known only from 4 locations, including two in Indonesia: the type locality at Bali, and a photographic record by the second author from Sumba. There are two additional photographic records, one from the Gulf of Carpentaria, Queensland, Australia provided by Andrew Green, and another from Cebu, Philippines that appears on a Japanese website featuring Cebu fishes.

All collected and photographed individuals were associated with barrel sponges (*Xestospongia testudinaria*). The type specimens were living on a single sponge in 18 m depth. Numerous other individuals were also observed at this location, all associated with barrel sponges, with up to about 20 individuals on a single sponge, at depths ranging from 9–30 m. The goby inhabits the outer surface of the sponge rather than the hollow central cavity, and occupies the deep, convoluted ravines between the longitudinal ridges and was not seen in the shallower ravines of the sponge. This relationship is unique among species of *Bathygobius*, which are generally free-living on sand or hard surfaces of the reef environment. However, members of the gobiid genera *Bryaninops*, *Phyllogobius*, *Lobulogobius*, *Luposicya*, and *Pleurosicya* form similar associations with sponges, seawhips, gorgonian fans, tunicates, algae, and corals (hard and soft). This group includes another species, *Pleurosicya labiata* (Weber, 2013), also found associated with large barrel sponges. Both that species and the new species associated with this sponge have a freckled appearance that blends well with the sponge (Fig. 7).

Comparisons. The new species differs from all previously described *Bathygobius* particularly by the mainly scaleless median predorsal with only two or three scales, congeners generally possess 6–32 scales. The freckled color pattern with spotted fins is also diagnostic, most congeners have either dark bars or blotches on the lateral body. It is also the only member of the genus that exhibits a commensal relationship with sponges.

Comparisons with the other species of *Bathygobius* that inhabit the Indo-Malaysian region were greatly facilitated by the comprehensive unpublished notes of gobiid expert Douglass Hoese (Australian Museum, Sydney). Comparison specimens of congeners were examined from the collection of the Western Australian Museum: i.e. *B. coalitus* (Bennett, 1832); *B. cocosensis* (Bleeker, 1854); *B. cotticeps* (Steindachner, 1879); *B. cyclopterus* (Valenciennes, 1837); *B. fuscus* (Rüppell, 1830); *B. laddi* (Fowler, 1931); and *B. meggitti* (Hora & Mukerji, 1936). These same species were illustrated in color and briefly reviewed by Allen & Erdmann (2024) and Larson (2022).



Figure 7. *Bathygobius mero*, n. sp., approximately 20 mm SL, on surface of barrel sponge (*Xestospongia testudinaria*), Bali, Indonesia (M.V. Erdmann).

Acknowledgments

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