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## ***Psammogobius pisinnus*, a new species of reef goby (Teleostei: Gobiidae) from Papua New Guinea and Australia**

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### **Abstract**

A new miniature species of gobiid fish, *Psammogobius pisinnus* n. sp., is described from West New Britain Province, Papua New Guinea on the basis of 10 specimens, 10.8–17.9 mm SL. Diagnostic features include dorsal-fin rays VI+I,9 (rarely I,10), the third dorsal-fin spine sometimes with a short, filamentous extension; anal-fin rays I,9 (rarely I,8); pectoral-fin rays 16–19 (usually 17); the pelvic fins reaching the anal-fin origin; the pelvic frenum weakly developed; longitudinal scales 25–28; the tongue distinctly bilobed, and a live color pattern that is generally light gray to whitish with three broad brown saddles on the dorsal half of the body. The new species differs from the three previously described species of *Psammogobius* (*P. biocellatus*, *P. knysnaensis*, and *P. viet*) on the basis of its tiny adult size (less than 20 mm SL vs. about 70–80 mm SL), fully marine habitat (vs. brackish estuaries and tidal streams), possession of cheek and opercular scales (scaleless in other species, except *P. biocellatus* with scales on the upper portion of the opercle), only 5–7 predorsal scales (vs. 10–16), and color pattern. The new species is also reported from the northern Great Barrier Reef of Australia on the basis of a single specimen.

**Key words:** taxonomy, systematics, ichthyology, coral-reef fishes, Indo-Pacific Ocean.

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## Introduction

The gobiid genus *Psammogobius* Smith, 1935 is a relatively obscure assemblage, which was thought to contain only a single species, *P. knysnaensis* Smith, 1935, an inhabitant of estuarine waters of South Africa. However, some recent authors, e.g. Larson & Murdy (2001) and Hoese & Larson (2006), included the widely distributed Indo-Pacific species formerly referred to as *Glossogobius biocellatus* (Valenciennes in Cuvier & Valenciennes, 1837) in this genus. More recently, a third species, *P. viet* Prokofiev, 2016, was described from Vietnam.

*Psammogobius* is closely related to the genus *Glossogobius* Gill, 1859, which contains approximately 35 currently recognized species, mainly found in estuarine and freshwater habitats in the Indo-Pacific region. Both genera exhibit similar morphology that includes key features such as 27–30 vertebrae, about 25–35 longitudinal scales, a longitudinal pattern of head papillae, a gill opening that extends far forward to about the posterior edge of the eye, a characteristic deep cleft in the middle of a strongly bilobed tongue, and a relatively large mouth. The close relationship of these two genera was discussed by Hoese *et al.* (2015), who noted they differ with regards to the attachment of the gill opening (a free fold across the isthmus in *Psammogobius* vs. attachment to the side of the isthmus in *Glossogobius*), as well as in the pattern of head papillae (lacking line 7 below the eye in *Psammogobius*). Additional nuclear and mitochondrial genetic evidence for their close relationship was provided by Thacker & Roje (2011) and Agoretta *et al.* (2013), who placed *Psammogobius* and *Glossogobius* in the same lineage, forming a sister clade to *Bathygobius* Bleeker, 1878.

The present paper describes a fourth species of *Psammogobius* that was recently collected by the author from New Britain Island in eastern Papua New Guinea. Unlike its congeners, which are restricted to estuaries and tidal streams, the new species was encountered in the vicinity of coral reefs. Although morphologically similar, it differs dramatically with regards to its small maximum size, which does not exceed 20 mm SL, compared to about 70–80 mm SL for the other three species. The new species also occurs on the northern Great Barrier Reef of Australia, based on a single non-type specimen and underwater photographs.

## Materials and Methods

Terminology and abbreviations for cephalic pores follow those presented by Akihito (1984). Measurements were made to the nearest 0.1 mm using digital dial calipers, and are presented as percentage of standard length (SL). Cyanine Blue 5R (acid blue 113) stain and an airjet was used to make the pores more obvious (Akihito *et al.* 1993, 2002, Saruwatari *et al.* 1997). Digital x-rays were utilized for vertebral counts. Type specimens are deposited at the Western Australian Museum, Perth (WAM).

Standard length (SL) was 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 was measured at the origin of the anal fin; head length (HL) was taken from the upper lip to the posterior end of the opercular membrane; snout length (SL) was measured from the median anterior point of the upper lip to the nearest fleshy edge of the eye; head width and depth were measured at the preopercular margin; nape width was measured between the dorsalmost margins of the gill openings; eye diameter is the greatest fleshy diameter, and interorbital width the least fleshy width; 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; predorsal, prepelvic, and preanal lengths were measured from the snout tip to the origin of each fin; lengths of spines and rays are measured to their extreme bases; 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 segmented ray; the longitudinal scale count is the number of oblique (anterodorsal to posteroventral) rows starting from just above the pectoral-fin base and proceeding posteriorly to the mid-base of the caudal fin; transverse scale counts were taken upward and backward from the anal-fin origin to the second dorsal-fin base; circumpeduncular scales were counted in zigzag rows around the narrowest point of the caudal peduncle; gill rakers include all rudiments and were counted on the outer side of the first branchial arch; pseudobranch counts include all rudiments.

*Psammogobius pisinnus*, n. sp.

Sandslope Goby

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Figures 1–3.

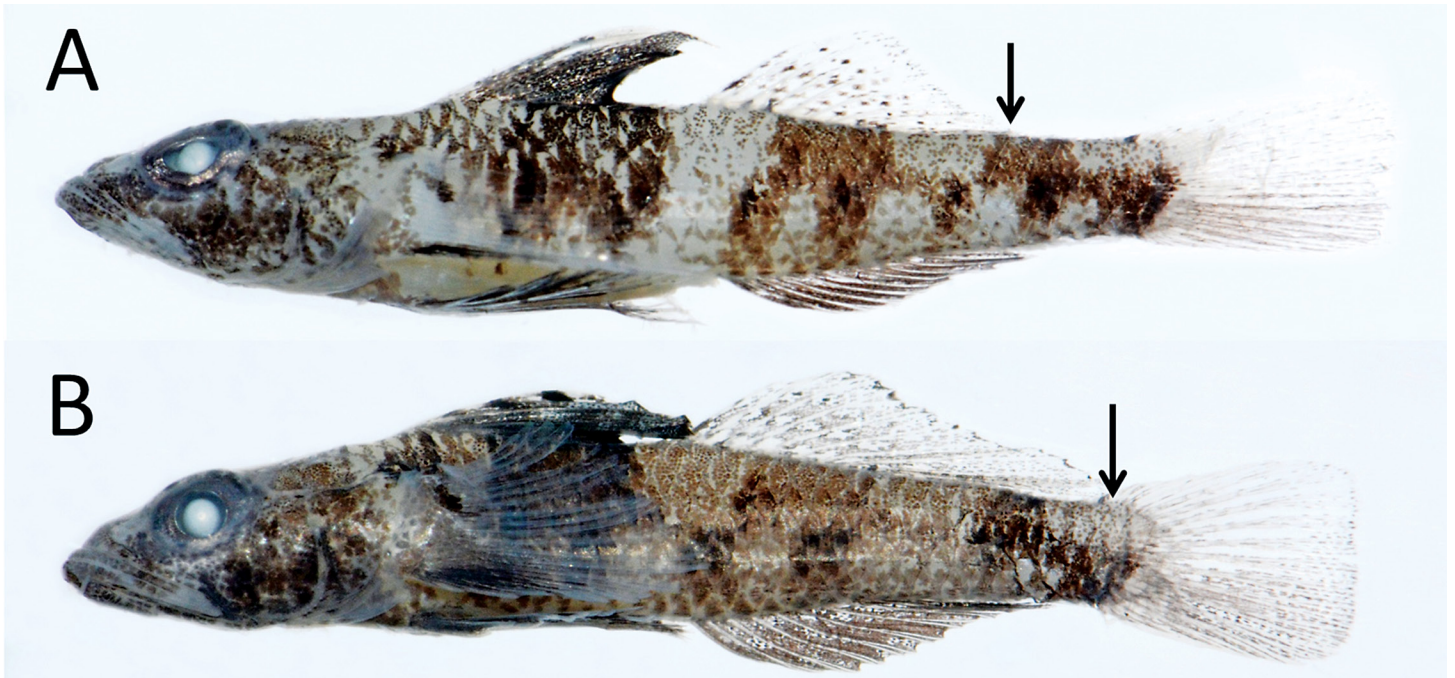
**Holotype.** WAM P. 34660–001, female, 15.9 mm SL, Papua New Guinea, West New Britain Province, 1 km SW of Baronga Village, Sharon’s Island, 6°15.235’ S, 150°27.429’ E, 14–18 m, clove oil and hand net, G. Allen & A. Joseph, 3 February 2017.

**Paratype.** WAM P. 34660-002, 9 specimens, 10.8–17.9 mm SL, collected with the holotype.

**Diagnosis.** A species of *Psammogobius* with the following combination of characters: dorsal-fin rays VI+I,9 (rarely I,10), third dorsal-fin spine sometimes with short filamentous extension; anal-fin rays I,9 (rarely I,8); pectoral-fin rays 16–19 (usually 17); pelvic fins reaching anal-fin origin; pelvic frenum weakly developed; longitudinal scales 25–28; predorsal scales 5–7; cheek and opercle scaled; tongue distinctly bilobed with a deep cleft between lobes; small maximum size of less than 20 mm SL. Color in life light gray to whitish with three broad brown saddles on dorsal half of body, the anteriormost darkest and positioned below first dorsal fin; operculum and cheek mottled dark brown; whitish streak on middle pectoral-fin rays. Inhabits sand slopes near coral reefs.

**Description.** Dorsal-fin elements VI+I,9 (one paratype with I,10), third dorsal-fin spine sometimes with short, filamentous extension; anal-fin elements I,9 (one paratype with I,8), all segmented dorsal- and anal-fin rays branched; pectoral-fin rays 17 (one paratype with 16 on one side and another with 18 and 19), all rays branched except uppermost and lowermost; pelvic-fin rays I,5, each ray branched twice except fifth ray with three branch points; pelvic-fin membrane fully developed, frenum relatively low and weakly developed; caudal fin with 12 branched and 17 segmented rays and 6 (4–6) unsegmented (procurrent) rays dorsally and 5 (4–6) rays ventrally; gill rakers poorly developed, 0+6; total vertebrae 27 (4 specimens).

Longitudinal scales 26 (25 in 2 paratypes and 27 and 28 in two others); transverse scales 7 (6 in one paratype); scales ctenoid on body, except cycloid anteroventrally on breast, belly, and prepelvic area; head and nape scaled; predorsal scales 6 (one paratype each with 5 and 7); opercular scales 8 (7–9, but missing in some paratypes); cheek scales 9 (8–13).



**Figure 1.** *Psammogobius pisinnus* A) female holotype, WAM P. 34660-001, 15.9 mm SL; B) male paratype, WAM P. 34660-002, 15.7 mm SL, West New Britain Province, Papua New Guinea (G.R. Allen). Arrows denote posterior extent of adpressed second dorsal fin.

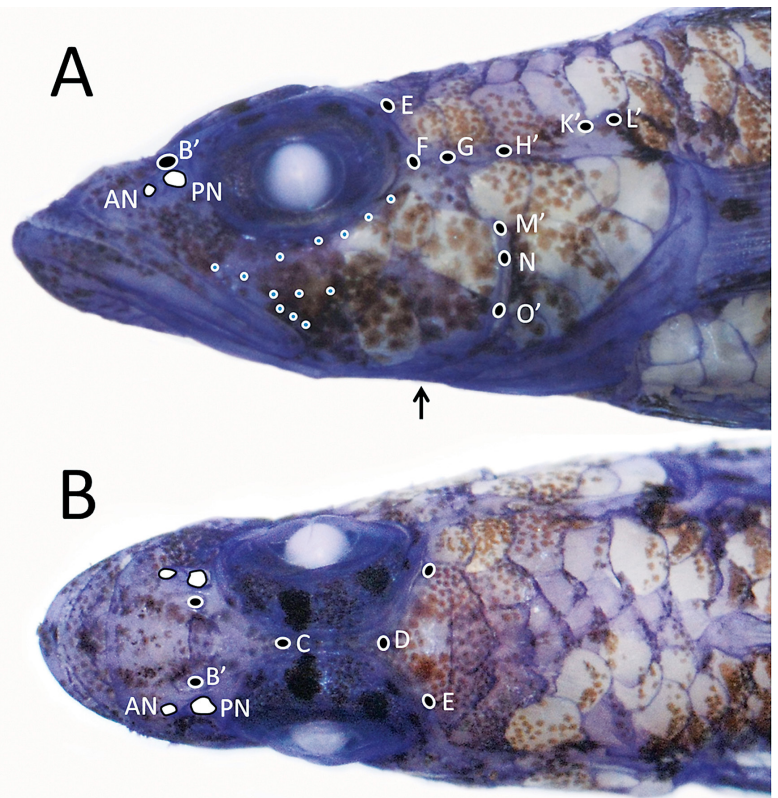


Head/snout profile relatively sharp in lateral view (Fig. 2), forehead and snout sloping gradually forming angle of about 15° to horizontal axis; lower jaw protruding slightly, mouth inclined obliquely downward, forming angle of about 23° to horizontal axis; maxilla extending posteriorly to level of posterior half of pupil; teeth of upper jaw in about 4–5 irregular rows at symphysis, innermost teeth largest, posteriorly directed, and depressible, rows gradually narrowing on lateral portion of jaw with only 1 or 2 rows posteriorly; lower jaw with outer row of relatively short conical teeth, restricted to anterior portion, second row of slightly smaller teeth, extending for full length of jaw, and innermost row of longer, posteriorly directed and depressible villiform teeth; tongue distinctly bilobed with deep cleft between lobes; both nostrils with slightly elevated rim, but not tubular, posterior nostril more than twice diameter of anterior nostril, but slightly smaller than adjacent nasal sensory pore; gill opening extending well forward to below posterior margin of eye; pattern of cephalic sensory pores as shown in Fig. 2: anterior oculoscapular pores include nasal pore (B'), single anterior (C) and posterior (D) interorbital pores, and three postorbital pores (E, F, and G); remaining pores include three preopercular pores (M', N, and O') and three posterior oculoscapular pores (H' K', and L'); cheek papillae (Fig. 2) mainly missing due to abrasion of mucous coat, but appear to be mostly longitudinal as typical of genus.

Urogenital papilla in female barrel-shaped and dorsoventrally flattened with finger-like projection on each side of aperture, that of male elongate and pointed posteriorly. Additionally, the posterior dorsal-fin rays of males are generally longer, reaching to the caudal-fin base in adult males, but to only the middle of the caudal peduncle in females (Fig. 1).

Measurements (percentage of SL; based on holotype and 8 paratypes 13.0–17.6 mm SL; holotype (paratype range, mean for all types): head length 33.6 (31.8–36.4, 34.1); snout to origin of first dorsal fin 34.3 (33.7–39.8, 35.4), dorsal-fin origin lying about level with origin of pelvic fins and slightly behind level of pectoral-fin origin; snout to origin of second dorsal fin 58.5 (56.6–62.6, 60.1), second-dorsal-fin origin slightly anterior to anal-fin origin; origin of anal fin 60.2 (56.9–67.1, 61.0); snout to origin of pelvic fin 33.1 (30.3–37.2, 34.2); caudal-peduncle length 21.0 (19.5–22.6, 21.1); caudal-peduncle depth 8.8 (8.6–10.0, 9.3); body moderately slender, body depth 16.2 (16.8–20.3, 18.0) at level of pelvic-fin origin and 14.7 (13.4–17.6, 15.8) at level of anal-fin origin; eye diameter 10.3 (9.4–11.2, 10.3); snout length 8.3 (7.0–9.8, 8.3); upper-jaw length 15.7 (13.9–17.6, 15.7); pectoral-fin length 27.5 (25.1–30.3, 27.9); pelvic-fin length 29.2 (25.6–29.0, 27.0), longest rays reaching to anal-fin origin; longest (third and fourth) first dorsal-fin spine 19.5 (16.1–19.7, 18.2); longest ray (anteriormost of female and posteriormost 1 or 2 rays of male) of second dorsal fin 15.1 (10.8–17.6, 13.8); caudal-fin length 23.3 (21.2–25.8, 23.8).

**Color in life.** (Fig. 3) Generally light gray to brilliant white with three broad brown saddles on dorsal half of body, first below posterior portion of first dorsal fin, second below middle of second dorsal fin, and third at middle of caudal peduncle, anteriormost saddle darker and wider than others; horizontal row of 5–6 widely-spaced, irregular dark-brown spots immediately below dorsal saddles and sometimes connected to them; cheek and operculum mainly mottled brown with stellate melanophores, also a zone with same markings arching above



**Figure 2.** *Psammogobius pisinnus* paratype, 17.1 mm SL, stained with Cyanine Blue to show pattern of cephalic sensory papillae (small white circles) and pores (large white circles): A) lateral view B) dorsal view (pore abbreviations after Akihito et al. 1993); AN and PN=Anterior and posterior nasal openings; arrow denotes anterior extent of gill opening (G.R. Allen).





**Figure 3.** *Psammogobius pisinnus*, underwater photographs, approx. 13–17 mm SL, all West New Britain Province, Papua New Guinea (G.R. Allen), except lower right taken at Flynn Reef, Great Barrier Reef, Australia (M. Onishi).

pectoral-fin base and connecting with first dorsal saddle; 2 or 3 brilliant white spots on side of snout and on cheek; eye with greenish-to-red pupil and reddish brown iris, becoming pale grey dorsally and sometimes with a pair of short bars on dorsal scleral surface; first dorsal fin mainly brownish due to numerous expandable melanophores, fin darkest posteriorly where merges with first saddle of dorsal half of body, sometimes a small blackish spot near tips of fifth and sixth spines; second dorsal fin mainly plain translucent with a few scattered white dots; anal and pelvic fins translucent with numerous melanophores; pectoral fin with brilliant white base, white extending as elongate streak onto rays of middle portion of fin, also a blackish spot near base of upper rays and elongate blackish streak on lower edge of fin.

**Color in alcohol.** (Fig. 1) Generally mottled brown with three brown saddles on dorsal half of body as described above; ventral half of body with about seven forward-slanting brown bands, including five that contact dorsal saddles; head mottled brown except posterior portion of jaws whitish; first dorsal fin mainly dark brown; second dorsal fin translucent whitish with small black spots on basal two-thirds and narrow dark margin distally; caudal fin translucent whitish with black spotting, more strongly concentrated on ventral portion of fin; anal and pelvic fins with blackish membrane and pale-gray fin rays; pectoral fin translucent with blackish spot near base of upper rays and elongate blackish streak on lower edge of fin.

**Etymology.** The species is named *pisinnus* (Latin: small or little) with reference to the exceptionally small maximum size in comparison to congeners.

**Distribution and habitat.** The new species was collected or observed at two locations on the south coast of New Britain, a 500 km-long island in eastern Papua New Guinea. Type specimens were collected at a small nearshore island in the vicinity of Baronga Village, West New Britain Province. It was also photographed in similar conditions at White Island, Jacquinot Bay, approximately 160 km northwest of the type locality. In addition, a single specimen collected at Flynn Reef on the northern Great Barrier Reef of Australia was examined. The type locality consisted of a gentle slope (approx. 20%) with mixed patches of live coral and sand-rubble at depths of about 10–20 m. The species was encountered solitarily or in loose pairs. Individuals fully erect the first dorsal fin, which is then gently undulated when the fish is approached at close range by a diver.

**Remarks.** Although sharing meristic features and other characters of the genus, such as a strongly bilobate tongue, a gill opening extending well forward to the posterior edge of the eye, and a longitudinal pattern of head papillae, the new species clearly differs from the three previously described species (*P. biocellatus*, *P. knysnaensis*,

and *P. viet*) on the basis of its tiny adult size (less than 20 mm vs. about 70–80 mm SL), fully marine habitat (vs. brackish estuaries and tidal streams), and overall color pattern. The new species also differs from congeners in possessing both cheek and opercular scales (vs. scaleless in other species, except *P. biocellatus* with scales on the upper portion of the opercle) and having only 5–7 predorsal scales (vs. about 10–16).

**Other material examined.** *Psammogobius pisinnus*: WAM P.34668-001, 14 mm SL, Flynn Reef, Great Barrier Reef, Queensland, Australia. *Psammogobius biocellatus*: WAM P.26957-014, 62 mm SL, Queensland, Australia; WAM P.26981-005, 71 mm SL, Queensland, Australia; WAM P. 27776-005, 3 specimens, 25–65 mm SL, Queensland, Australia; WAM P.27410-012, 37 mm SL, Madang, Papua New Guinea; WAM P.28544-008, 3 specimens, 46–53 mm SL; WAM P.29596-003, 56 mm SL, Madang, Papua New Guinea; WAM P.310333-018, Yapen Island, West Papua Province, Indonesia.

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