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## *Callogobius swifti*, a new goby (Teleostei: Gobiidae) from Papua New Guinea

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### Abstract

A new species of gobiid fish, *Callogobius swifti*, n. sp. is described from five specimens 15.5–23.4 mm SL, collected from coastal reef slopes in 40–65 m depth at Milne Bay Province, Papua New Guinea. Diagnostic features include: segmented dorsal-fin rays 9; segmented anal-fin rays 8; lateral scales 21 or 22; predorsal scales 7 or 8; cephalic sensory-canal pores reduced, with only posterior nasals (B'), posterior interorbital (D), anterior otics (F), and intertemporals (H'); cephalic sensory papillae rows 20 and 21 separate and 10 transverse mandibular papillae rows; no pelvic frenum and the connecting membrane restricted to the basal half of the fin; and cycloid scales anteriorly, becoming ctenoid posteriorly below the level of the base of the second or third segmented dorsal-fin ray. The live color pattern is mottled brown with gray lateral stripes corresponding to lateral-scale rows, the dorsal fins and upper edge of caudal fin with orange vermiculations and whitish margins, and a yellow-edged partial ocellus on the basal half of the first dorsal fin. The new species can be distinguished from all congeners by the combination of the cephalic sensory-canal pore pattern, a low lateral-scale count, and the absence of a pelvic frenum.

**Key words:** taxonomy, ichthyology, coral-reef fishes, Indo-Pacific Ocean, Milne Bay

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## Introduction

The gobiid genus *Callogobius* Bleeker, 1874 of the Indo-West Pacific Ocean contains 38 species that are currently recognized as valid (Fricke et al. 2020) and many potentially undescribed species. These small fishes (usually less than 50 mm SL) typically occur on coral reefs, usually hidden among crevices and under rocks. Consequently, they are seldom seen unless collection chemicals are used or the bottom cover is disturbed. Although several species are frequently collected, at least one-third of the species are poorly documented, in some cases on the basis of only a few original specimens. The genus is readily recognizable on the basis of its pattern of cephalic sensory papillae, which mainly occur in distinct rows that form conspicuous elevated ridges. Despite the number of species, the genus has not been comprehensively reviewed, although several publications are particularly useful for assessing the status of individual species, including Akihito & Meguro (1977), Goren (1980), McKinney & Lachner (1978a, 1978b, 1984), Chen & Shao (2000), Chen et al. (2006), Delventhal & Mooi (2013), and Delventhal et al. (2016).

We describe here a new *Callogobius* species collected by the authors at Milne Bay Province, Papua New Guinea while diving on relatively deep coastal reefs during 2018 and 2019. The color pattern, particularly the partial ocellus on the first dorsal fin and pale margins on the dorsal and caudal fins, indicated a species not previously seen by us despite extensive collecting in Papua New Guinea and surrounding regions. Also, the depth they were found, 40–65 m, was greater than that usually associated with the members of this genus.

## Materials and Methods

Type specimens are deposited at the Western Australian Museum, Perth, Western Australia (WAM). 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, and body width at the origin of the pectoral fins; 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; head depth is taken at the level of the rear edge of the preoperculum; orbit diameter is the greatest fleshy diameter; interorbital width is the least bony width; 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; 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 soft ray; predorsal, preanal, prepelvic distances are measured from the snout tip to the origin of the respective fins.

Lateral scales were counted from the dorsalmost extent of the opercular opening to the mid-posterior edge of the hypural plate; scales in transverse series were counted diagonally from the first dorsal-fin origin downwards and backwards to the ventral midline at or near the anal-fin base; predorsal scales were counted from the origin of the first dorsal-fin spine along the midline towards the occiput, and included scales with at least one-third their width crossing the midline as well as any emarginate scale partially surrounding the first dorsal-fin spine; vertebral counts were made from digital x-rays.

Terminology, including abbreviations and number system for cephalic sensory-canal pores and papilla rows follow those illustrated and defined by Delventhal & Mooi (2013) and Delventhal et al. (2016). Cyanine Blue 5R (acid blue 113) stain was used to make pores, papillae, and scale outlines more obvious (Akihito et al. 1993, 2002, Saruwatari et al. 1997).

The collection of the Western Australian Museum was helpful for gaining a better understanding of the diagnostic features associated with this genus. This collection contains more than 400 specimens of *Callogobius* in 246 lots, including *Callogobius bifasciatus* (Smith, 1958), *Callogobius clitellus* McKinney & Lachner, 1978, *Callogobius depressus* (Ramsay & Ogilby, 1886), *Callogobius flavobrunneus* (Smith, 1958), *Callogobius hasseltii* (Bleeker, 1851), *Callogobius maculipinnis* (Fowler, 1918), *Callogobius mucosus* (Günther, 1872), *Callogobius okinawae* (Snyder, 1908), *Callogobius sclateri* (Steindachner, 1879), and many unidentified taxa, including several potential new species.

## *Callogobius swifti*, n. sp.

### Swift's Goby

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Figures 1–4

**Holotype.** WAM P.35048-006, male, 22.4 mm SL, Papua New Guinea, Milne Bay Province, East Cape region, Lawadi Village, Deakin's Reef dive site, -10.2613°, 150.6964°, 45 m, rotenone, M.V. Erdmann, & W.M. Brooks, 22 September 2019.

**Paratypes.** WAM P.34851-004, 2 females 15.5 & 18.8 mm SL & male, 23.4 mm SL, same data as holotype except collected at 65 m, 2 May 2018; WAM P.34852-001, female, 19.9 mm SL, Papua New Guinea, Milne Bay Province, East Cape region, Ka Point, -10.2083°, 150.5850°, 60–65 m, rotenone, M.V. Erdmann, & W.M. Brooks, 3 May 2018.

**Diagnosis.** A species of *Callogobius* with the following combination of characters: segmented dorsal-fin rays 9; segmented anal-fin rays 8; lateral scales 21 or 22; predorsal scales 7 or 8; cephalic sensory-canal pores reduced, with only posterior nasals (B'), posterior interorbital (D), anterior otics (F), and intertemporals (H'); cephalic sensory papillae rows 20 and 21 separate and 10 transverse mandibular papillae rows; pelvic frenum absent and connecting membrane restricted to basal half of fin; cycloid scales anteriorly, becoming ctenoid posteriorly below level of base of second or third segmented dorsal-fin ray; live color pattern mottled brown with gray lateral stripes corresponding to lateral-scale rows, whitish margins with orange vermiculations on dorsal fins and upper edge of caudal fin, and a yellow-edged partial ocellus on basal half of first-dorsal fin.

**Description.** Dorsal-fin elements VI-I,9 with distal edge of first dorsal fin moderately incised between spinous rays, fourth spine longest; anal-fin elements I,8, all segmented dorsal-fin and anal-fin rays branched; pectoral-fin rays 16 (one paratype with 17 on one side), all branched except uppermost and lowermost sometimes unbranched; pelvic-fin elements I,5, all segmented rays branched, fourth ray longest; no pelvic frenum; pelvic-fins joined by a connecting membrane for slightly less than half length of fifth rays; caudal-fin rays 15 branched and 17 segmented rays (one paratype with 16 and 17 respectively), 3 unsegmented (procurrent) rays dorsally and ventrally (one paratype with 4 and 2 respectively); vertebrae 10+16=26.



**Figure 1.** *Callogobius swifti*, freshly collected male holotype, 22.4 mm SL, East Cape region, Milne Bay Province, Papua New Guinea (Mark V. Erdmann).

Cheek and opercle with relatively large, embedded, cycloid scales; cycloid scales covering nape and anterior body (including prepelvic region and pectoral-fin base), becoming ctenoid posteriorly below level of base of second or third segmented dorsal-fin ray, ctenii of caudal peduncle scales slightly more elongated; lateral scales 22 (one paratype with 21); transverse scale rows 10; predorsal scales 8 (two paratypes with 7); all scales deciduous.

Lower jaw protruding slightly and mouth steeply inclined, maxilla extending posteriorly to about level of anterior edge of eye; jaws with band of small, sharp villiform teeth, narrowing posteriorly; teeth of outermost row larger, more widely spaced, and curved posteriorly, but none caniniform; anterior naris forming conspicuous, elongate tube that protrudes over edge of snout; posterior naris with low, elevated margin, situated adjacent to rear edge of nasal sac; gill opening restricted to rear margin of operculum with lower extent about even with lower edge of pectoral-fin base.

Cephalic sensory-canal pores (Fig. 3) with conspicuous tubular openings; including only posterior nasals (B'), posterior interorbital (D), anterior otics (F), and intertemporals (H'); temporal, and preopercular sensory canals and their associated pores (K', L', M', N & O') absent.

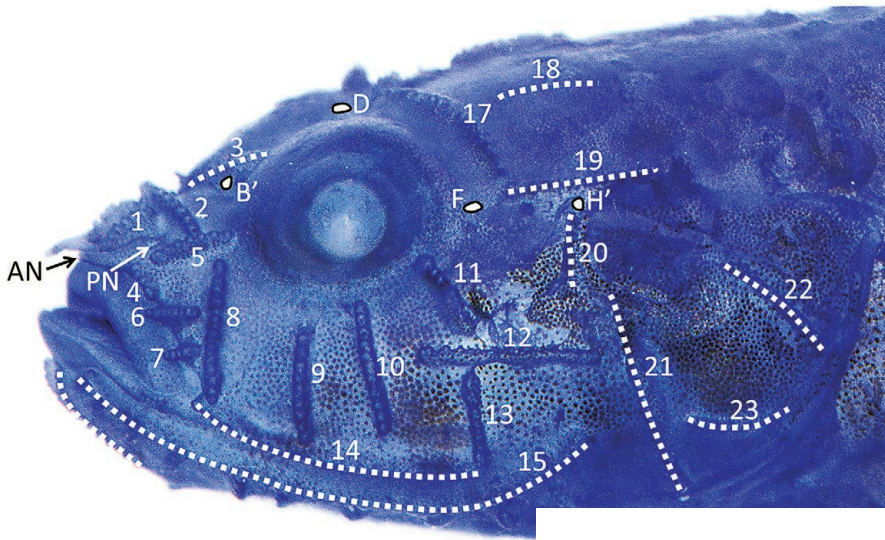
Rows of cephalic sensory papillae arranged in discrete raised ridges as shown in Fig. 3; postnasal rows (row 2) long and joined across dorsal midline; anterior suborbital row (row 9) moderately long and not reaching eye; mid-suborbital row (row 10) relatively long and reaching eye; posterior suborbital rows (row 11) relatively short and either not or barely overlapping; maxillary row (row 14) continuous, extending to just below transverse cheek row (row 13); longitudinal mandibular row (row 15) continuous; usually 10 short transverse mandibular rows (row 16) on each side; postorbital rows (row 17) moderately long and continuous across dorsal midline, or narrowly separate (2 paratypes); preopercular row (row 20) separate from transverse opercular row (row 21).

Urogenital papilla of male with a triangular base and a slender, tubular distal tip, all covered with pepper-like melanophores; female urogenital papilla broad (width and length about equal) with a flattened, darkly-pigmented ventral surface and a pair of tiny cirri laterally at distal edge of each side.

Measurements (percentage of SL; holotype followed by range of paratypes and mean of all types): head depressed, head length 35.0 (35.3–39.6, 37.2), head depth 19.9 (18.6–21.3, 19.8), head width 26.0 (24.0–26.3, 25.2); snout about equal to eye diameter, length 8.9 (7.7–10.3, 9.0); eye diameter 9.4 (9.2–10.5, 9.6); interorbital



**Figure 2.** *Callogobius swifti*, partial ocellus on dorsal fin, freshly collected female paratype, WAM P.34852-001, 19.9 mm SL, East Cape region, Milne Bay Province, Papua New Guinea (Mark V. Erdmann).



**Figure 3.** *Callogobius swifti*, preserved male holotype, 22.4 mm SL stained with Cyanine Blue; sensory pores=outlined white spots; papillae=white dots; nares=AN and PN. Cephalic papillae rows= 1) internasal 2) postnasal 3) interorbital 4) oblique premaxillary 5) preorbital 6) upper longitudinal premaxillary 7) lower longitudinal premaxillary 8) transverse maxillary 9) anterior suborbital 10) mid suborbital 11) posterior suborbital 12) longitudinal cheek 13) transverse cheek 14) longitudinal maxillary 15) longitudinal mandibular 16) transverse mandibular 17) postorbital 18) upper cranial 19) lower cranial 20) preopercular 21) transverse opercular 22) oblique opercular 23) subopercular 24) intermandibular (G.R. Allen).



**Figure 4.** *Callogobius swifti*, preserved male holotype, 22.4 mm SL, East Cape region, Milne Bay Province, Papua New Guinea (Gerald R. Allen).

width 3.6 (3.2–4.3, 3.7); upper-jaw length 8.9 (9.0–10.3, 9.5); body depth at pelvic-fin origin 24.7 (23.2–25.2, 24.5); body depth at anal-fin origin 21.8 (20.4–22.3, 21.3); predorsal distance 41.7 (38.7–43.8, 41.4), snout to second-dorsal-fin origin 60.4 (61.5–64.6, 62.9), preanal distance 64.4 (63.1–68.5, 64.8), prepelvic distance 35.2 (32.9–37.9, 34.8; caudal peduncle relatively stout, length 20.2 (17.2–21.5, 19.3) caudal-peduncle depth 16.6 (13.4–14.4, 14.5); dorsal-fin spines gradually increasing in length to fourth spine, then decreasing, length of fourth spine 18.8 (15.7–18.1, 17.2); penultimate rays of second dorsal and anal fins longest, usually overlapping caudal-fin base; longest dorsal-ray 20.1 (16.6–20.4, 19.0); longest anal-fin ray 24.6 (23.4–26.2, 24.6); pectoral fins relatively long, extending to level of base of third or fourth segmented dorsal-fin rays when adpressed, length 33.7 (27.0–33.4, 31.1); fourth pelvic-fin ray longest, 25.6 (21.3–26.3, 24.7); caudal fin rounded, shorter than head, length 31.0 (27.7–31.5, 30.3).

**Color when fresh.** (Figs. 1 & 2) Generally mottled brown with light gray stripes corresponding to lateral-scale rows; head with slight yellow to reddish (operculum) hue; iris with alternating reddish-brown and pale yellow bands and narrow yellow ring around edge of pupil; dorsal fins with broad, orange-vermiculated, whitish margin and equally broad submarginal blackish band; first dorsal fin black on basal half, surrounded dorsally and ventrally by orange band, forming a partial ocellus (Fig. 2); second dorsal fin with median light-gray band with orange streaks and remaining basal portion of fin gray to brown with a pair of blackish blotches, one at fourth and fifth ray bases, another at seventh and eighth ray bases; caudal fin brown with white flecks and an orange-vermiculated, whitish margin dorsally, grading to a narrow whitish margin posteriorly; anal fin and basal half of pelvic fins brown, with outer portion of pelvic fins translucent whitish; pectoral fins translucent with alternating light brown and whitish bands on individual rays.

**Color of holotype in alcohol.** (Fig. 4) Generally mottled brown with pale gray stripes corresponding to lateral-scale rows; fins as in fresh specimen except loss of orange vermiculations, also yellow band replaced by white band around partial ocellus on first dorsal fin. Under magnification, head and body, including ventral surface, densely covered with tiny melanophores.

**Etymology.** The new species is named *swifti* in honor of John Swift, for his lifelong passion for grassroots conservation in New Guinea as a Board Member of Conservation International and an unflagging patron of the local environmental organization Eco Custodian Advocates in their critical efforts to promote customary marine management across the Milne Bay communities where this new species was discovered.

**Distribution and habitat.** The new species is currently known only from the type locality in Milne Bay Province, Papua New Guinea. However, it is likely more widespread in the East Indian region and has no doubt eluded collectors due to its small size and preference for relatively deep water. The new species was found on steep, volcanic-sand slopes in 40–65 m depth. They were found under small pieces of coral rubble and volcanic rock that were often covered with *Halimeda* algae. Strong thermoclines were frequently encountered between 40–50 m on these slopes; consequently this species is likely exposed to temperatures ranging from about 24–29° C.

**Comparisons.** The new species differs from all congeners by its distinctive color pattern, particularly the orange vermiculations and whitish margin on the dorsal fins and caudal fins and the partial ocellus on the basal

half of the first dorsal fin. The new species is also separated from all congeners by the combination of a reduced pattern of cephalic sensory-canal pores consisting of pores B', D, F and H', no pelvic frenum, and relatively few (21 or 22) lateral scales. Three congeners share the reduced pattern of pores: *Callogobius mannarensis* Rangarajan, 1970 from India and the Andaman Islands; *Callogobius stellatus* McKinney & Lachner, 1978 from Indonesia and Philippines; and *Callogobius sheni* Chen et al., 2006 from southwestern Taiwan. However, *C. mannarensis* and *C. stellatus* have only B', F and H' pores (lacking the D pore) and *C. sheni* has B', C, D and F pores. The three species further differ in having a pelvic frenum and a complete connecting pelvic-fin membrane, more lateral scales (28–35), and whitish bodies with contrasting dark bands or saddles. Furthermore, *C. mannarensis* and *C. stellatus* have exclusively cycloid scales (vs. ctenoid posteriorly in *C. swifti*).

The reduced pattern of cephalic sensory-canal pores of the new species is identical to that of a single 21-mm SL specimen of a potentially undescribed species from Hibernia Reef, Timor Sea presently lodged in the WAM collection (P.31378-013). However, the specimen differs from *C. swifti* in having a weakly developed pelvic frenum and a complete connecting pelvic-fin membrane, 27 or 28 lateral scales, 15 pectoral-fin rays, and an overall whitish color with three dark bars between the first dorsal and caudal fins.

Ten congeners have fewer than 26 lateral scales, i.e. *Callogobius bauchotae* Goren, 1979 from the Marshall Islands (25), *Callogobius centrolepis* Weber, 1909 from the Indo-West Pacific (23–25); *Callogobius crassus* McKinney & Lachner, 1984 from the western Pacific (19–21); *Callogobius dori* Goren, 1980 and *Callogobius irrasus* (Smith, 1959), both from the Red Sea and W. Indian Ocean (24–26); *C. maculipinnis* from the Indo-West Pacific (22–25); *Callogobius nigromarginatus* Chen & Shao, 2000 from the W. Pacific (25–26); *Callogobius pilosimentum* Delventhal et al., 2016 from the Red Sea (21–25); *Callogobius plumatus* (Smith, 1959) from the Indo-West Pacific (22–24); *Callogobius shunkan* Takagi, 1957 from Japan (22–24); and *Callogobius vanaclevei* (Herre, 1950) from the Philippines (21–23).

The new species differs from all of those by the reduced pore pattern and from most (except *C. bauchotae* and *C. crassus*) by lacking a pelvic frenum. It further differs from *C. bauchotae* in having 8 rather than 7 anal-fin rays. Although data on frenum development is unavailable for the poorly known *C. shunkan* and *C. vanaclevei*, these species also have far fewer transverse mandibular papillae rows, usually three on each jaw of *C. vanaclevei* and three plus additional irregular rows in *C. shunkan*, vs. 10 on *C. swifti* (see Delventhal et al. 2016).

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