



Hazeus paucisquamatus, a new sand-dwelling goby (Teleostei: Gobiidae) from Papua New Guinea

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Abstract

A new species belonging to the gobiid genus *Hazeus* is described from the Louisiade Archipelago of Milne Bay Province, Papua New Guinea. *Hazeus paucisquamatus* n. sp. is described on the basis of 4 specimens, 21.8–25.1 mm SL. Diagnostic features include thickened, rigid, and pungent first spines of both the first and second dorsal fins and the third dorsal-fin spine longest. It can be further separated from its 8 congeners by head scalation patterns (three scales on the upper rear corner of the preopercle and head scales limited to the upper half of the opercle) and markings on the male, specifically a mid-lateral row of dark-brown spots, a dark anal fin, and a characteristic medial black stripe on the pelvic-fins. The new species is currently known only from the Louisiade Archipelago and the Deboyne Islands east of the Papua New Guinea mainland. The new species occurs on sheltered silty-sand bottoms of fringing reefs and lagoons in 15–20 m depth.

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

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Introduction

Hazeus otakii Jordan & Snyder, 1901 was originally described as a new genus and species from a single 44 mm SL specimen from Nagasaki, Japan. This genus, previously considered as being monotypic, was primarily defined by a fully scaled cheek and opercle, as well as the presence of a thickened pungent spine at the beginning of both dorsal fins (Akihito 1984, Larson & Murdy 2001). The latter feature is shared by three other related genera, *Oplopomus* Valenciennes, 1837; *Oplopomops* Smith, 1959; and *Opua* Jordan, 1925; which differ slightly in having one or two additional thickened spines in the first dorsal fin. Allen & Erdmann (2023), following the advice of gobiid specialist Douglass Hoese of the Australian Museum, Sydney (pers. comm. 2020), consider both *Oplopomops* and *Opua* as synonyms of *Hazeus*, which now includes species with a thickened spine at the origin of each dorsal fin, the absence of spines on the preopercular margin, and possessing either a scaled or naked cheek and opercle. The genus presently contains the following 8 valid species: *H. ammophilus* Allen & Erdmann, 2023 from the western Pacific Ocean (South China Sea east to Papua New Guinea and north to Amami Islands, Japan); *H. diacanthus* (Schultz, 1943) from the Indo-West and central Pacific region (Seychelles and Maldives east to Marshall Islands and Kiribati); *H. elati* (Goren, 1984) from the Red Sea and northern Australia; *H. ingressus* Engin, Larson & Irmak, 2018 from the Red Sea and Mediterranean Sea; *H. maculipinna* (Randall & Goren, 1993) from the Maldives and western Pacific Ocean (West Papua, Indonesia, Negros, Philippines, and Milne Bay, Papua New Guinea); *H. nephodes* (Jordan, 1925) from Palau and the Hawaiian and Marshall islands; *H. otakii* Jordan & Snyder, 1901 from Japan; and *H. profusus* Allen & Erdmann, 2023 from Indonesia, Philippines, Papua New Guinea, and Solomon Islands. Allen & Erdmann (2012) provisionally reported *H. otakii* from Taiwan, Philippines and Indonesia, but these records were based on misidentifications. Therefore, this species is probably restricted to Japanese seas. *Hazeus diacanthus* is frequently misidentified (e.g. Randall 2005) as *Oplopomops atherinoides* (Peters, 1855) which was described from Mozambique. However, the two syntypes of *O. atherinoides* represent two different species: *Arcygoobius baliurus* (Valenciennes, 1837) and an undetermined species of *Favonigobius* Whitley, 1930 (D. Hoese, pers. comm. 2024).

The present paper describes a new species of *Hazeus* that was collected by MVE and WMB, during a research cruise to the Louisiade Archipelago of Milne Bay Province, Papua New Guinea during November 2023.

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 presented as percentages of the standard length and the frequency distribution of diagnostic fin-ray and scale counts are included in Tables 1 and 2. The range of meristic counts for paratypes is indicated in parentheses, if different from the holotype. Proportional measurements include the value for the holotype followed in parentheses by the range of values for the paratypes and the mean value for all specimens. Type specimens are deposited at the Western Australian Museum, Perth, Australia (WAM).

Hazeus paucisquamatus, n. sp.

Louisiade Sand-goby

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Figures 1–7, Tables 1 & 2

Holotype. WAM P.35577-001, female, 24.9 mm SL, Papua New Guinea, Milne Bay Province, Louisiade Archipelago, Nimoa Island, Sudest, -11.3082°, 153.2380°, 20 m, clove oil, M.V. Erdmann & N.K. Ichida, 8 November 2023.

Paratypes. WAM P.35577-002, 2 males, 21.8 & 25.1 mm SL, collected with holotype; WAM P. 35576-001, female, 22.7 mm SL, Papua New Guinea, Milne Bay Province, Louisiade Archipelago, Deboyne Islands, Panapompom Island, -10.7846°, 152.3821°, 20 m, clove oil, M.V. Erdmann & W.M. Brooks, 7 November 2023.

Diagnosis. Dorsal-fin elements VI+I,9 or 10 (usually 9), first spine of first and second dorsal fins thickened, rigid, and pungent; all spines without filamentous tips, third spine longest; anal-fin elements I,8–10; pectoral-fin rays 15–17; branched caudal-fin rays 12 or 13 (usually 12); caudal fin rounded, shorter than HL; lateral scales 24 or 25; transverse scales 8; predorsal scales 7 or 8; ctenoid scales covering body and nape, except embedded cycloid scales on prepelvic area and pectoral-fin base; preopercle with three small weakly ctenoid scales on upper



Figure 1. *Hazeus paucisquamatus* n. sp., paratypes: (A) 25.1 mm SL male from Nimoa Island and (B) 22.7 mm SL female from Panapompom Lagoon, both at about 20m depth in the Louisiade Archipelago, Milne Bay Province, Papua New Guinea (M.V. Erdmann).

rear corner, opercle with large weakly ctenoid scales confined to upper half; “mixed” pattern of cephalic sensory papillae including two primary longitudinal rows and several transverse rows; adult male in life generally semi-translucent greyish with variable-sized brown and white spots and markings on head and body; 5 large tannish saddles along nape and upper back; a mid-lateral row of 6 dark-brown spots along middle of side; blackish spots and bands on dorsal and caudal fins; anal fin brownish; pelvic fin white with a black median stripe; female similar to male, but lacking dark markings on fins (Fig. 1); maximum known size to about 25 mm SL.

Description. Dorsal-fin elements VI+I,9 (one paratype with 10); anal-fin elements I,9 (one paratype each with 8, 9 and 10), pectoral-fin rays 17 (one paratype each with 15, 16, and 17); all dorsal, anal, and pectoral-fin segmented rays branched, except uppermost and lowermost pectoral-fin rays; pelvic-fin rays I,5, all segmented rays branched, first and second rays with 4 branch points, and third to fifth rays with 8–10 branch points; frenum well-developed and connecting membrane complete; branched caudal-fin rays 12 (one paratype with 13); dorsal non-segmented caudal-fin rays 6 (5–7); ventral non-segmented caudal-fin rays 5 (2 paratypes with 6); lateral scales 25 (2 paratypes with 24); transverse scales 8; predorsal scales 8 (one paratype with 7); prepelvic scales 6 (one paratype with 7); circumpeduncular scales 12; gill rakers on first branchial arch 1+5 (1+6); total vertebrae 26.

Body elongate and laterally compressed, more strongly posteriorly; body depth at pelvic-fin base 5.0 (4.5–5.2, mean 4.8) in SL; body depth at anal-fin origin 5.4 (5.3–5.8, mean 5.5) in SL; head width 0.9 (1.0–1.1, mean 1.0) in head depth at level of preopercular margin; head depth 1.8 (1.5–1.6, mean 1.6) in HL; HL 3.2 (3.1–3.2, mean 3.2) in SL; snout short and rounded, length 4.2 (3.8–4.4, mean 4.1) in HL; eye diameter 3.2 (3.0–3.3, mean 3.2) in HL; eyes of each side nearly in contact with each other on interorbital; distance between snout and origin of first dorsal fin 2.7 (2.5–2.8, mean 2.6) in SL, between snout and origin of second dorsal fin 1.8 (1.7–1.8, mean 1.7), between snout and origin of anal fin 1.7, and between snout and origin of pelvic fins 2.8 (2.7–3.0, mean 3.1), all in SL.

Mouth terminal, jaws extending to a vertical at anterior edge of pupil; chin relatively smooth, without mental frenum; jaw teeth small, slender, and pointed, arranged in several rows at front of jaws, gradually narrowing to 1 or 2 rows posteriorly; upper-jaw teeth in 3 or 4 rows, strongly angled posteriorly; lower-jaw teeth in about 4 rows at front of jaws, outermost row largest; tongue broad with slightly emarginate, bilobed anterior margin, broadly attached to floor of mouth; anterior extent of gill opening below middle of opercle; pattern of papillae rows and sensory-canal pores on head as shown in Figs. 2 and 3; anterior oculoscapular pores include snout 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 two posterior oculoscapular pores (K' and L'); cheek papillae in a “mixed” pattern consisting of a pair of longitudinal rows and several shorter transverse rows both above and between longitudinal rows; chin papillae in two longitudinal rows converging posteriorly (Fig. 3, lower).

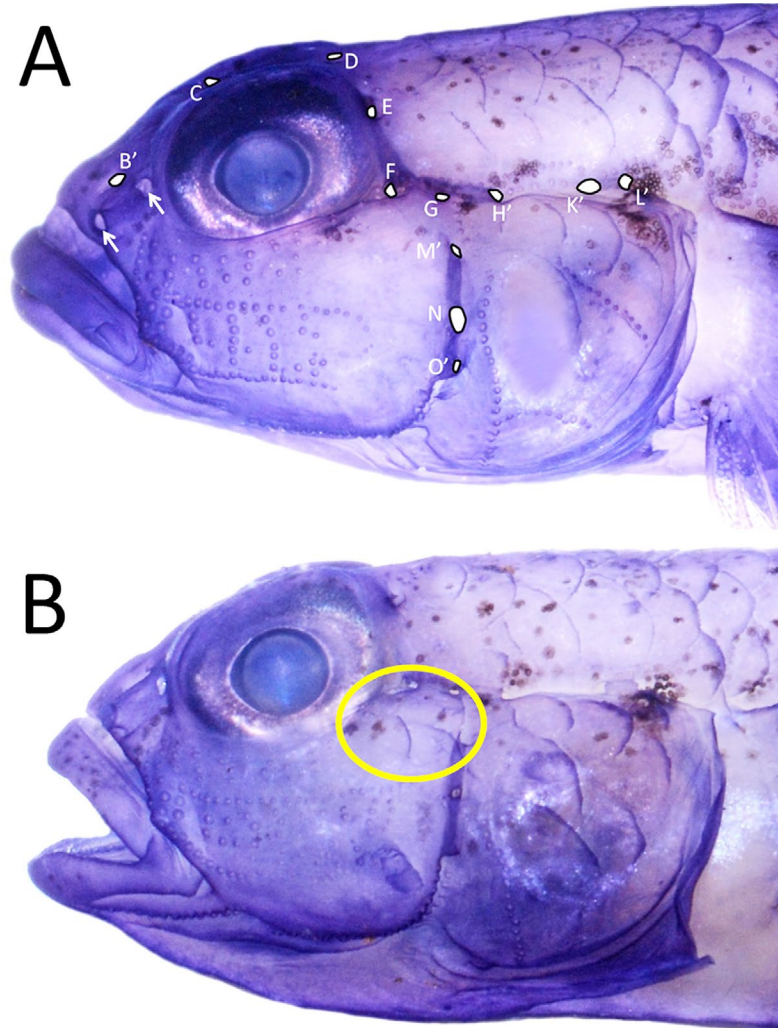


Figure 2. *Hazeus paucisquamatus* n. sp., preserved and cyanine-blue stained lateral head of 24.9 mm SL female holotype (A) and 21.8 mm SL male paratype (B) showing sensory-canal pores (B', C, D, etc.) and papillae; the yellow circle shows embedded preopercular scales that are not visible in the holotype in (A) (G.R. Allen).

Ctenoid scales cover body, nape, and predorsal region (Figs. 2 & 3); preopercle with three small weakly ctenoid scales on upper rear corner (Fig. 2B), opercle with large weakly ctenoid scales confined to upper half (Fig. 2); embedded cycloid scales present on prepelvic region (Fig. 3) and pectoral-fin base; no dermal crest, barbels, or preopercular spines present on head.

First dorsal-fin origin well posterior to level of pectoral-fin base and pelvic-fin origin; dorsal-fin spines and segmented rays thin and flexible, except first spine of each fin thickened, rigid, and pungent; first dorsal-fin spine 2.7 (2.5–3.0, mean 2.7), third dorsal-fin spine longest, 1.9 (1.8–2.0, mean 1.9) in HL; spine of second dorsal fin 3.1 (2.5–3.1, mean 2.8) in HL; longest segmented ray of second dorsal fin (first ray in female, seventh or eighth in male) 1.8 (1.7–2.0, mean 1.8), longest ray of anal fin (fourth or fifth in female, penultimate in male) 1.9 (1.7–2.4, mean 1.9) in HL, pectoral fin rounded, middle rays longest, 3.8 (3.3–3.9, mean 3.7) in SL; pelvic fins completely connected by a membrane, with a well-developed frenum, posterior edge of frenum smooth and without fleshy lobes; pelvic-fin length 3.9 (3.3–3.8, mean 3.6) in SL; caudal fin rounded, shorter than HL, 4.1 (3.8–3.9, mean 3.9) in SL.

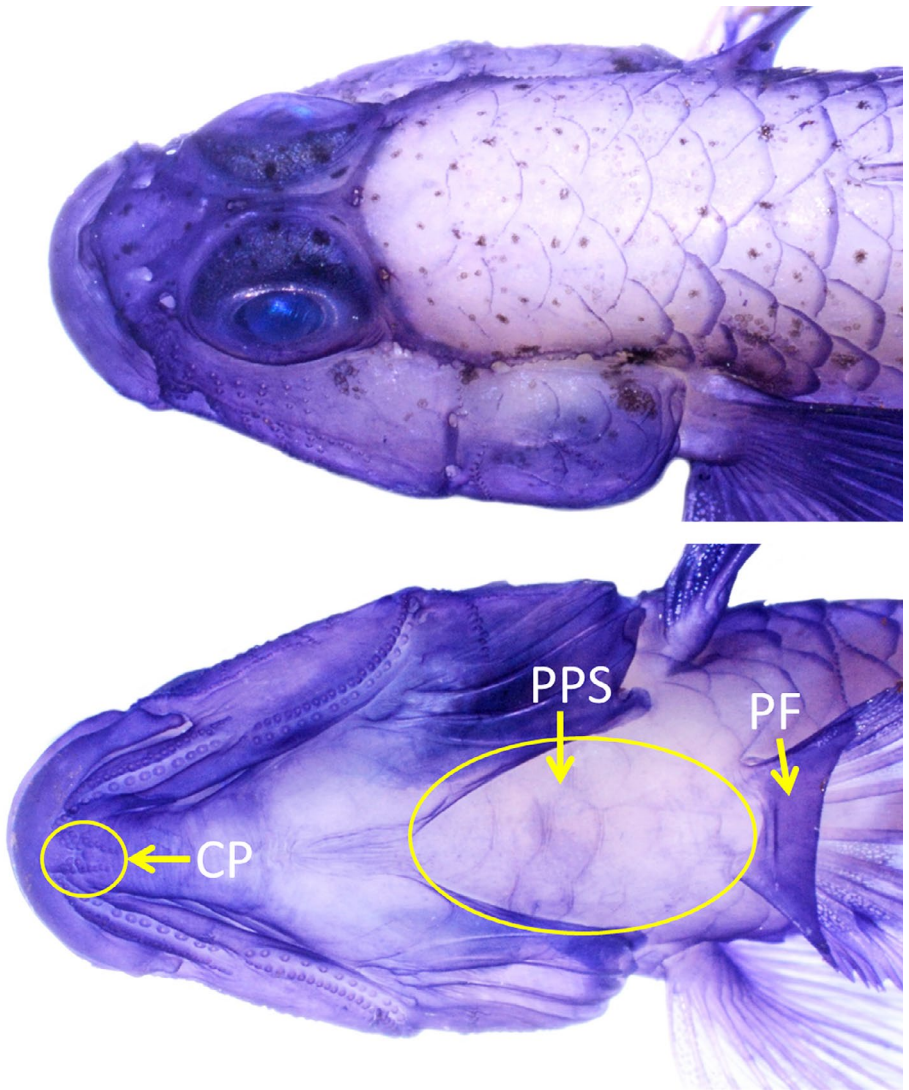


Figure 3. *Hazeus paucisquamatus* n. sp., 24.9 mm SL preserved female holotype, Nimoa Island, Louisiade Archipelago, Milne Bay Province, Papua New Guinea, showing: (A) dorsal view of the head showing predorsal scales; and (B) ventral view of the head showing chin papillae (CP), embedded prepelvic scales (PPS), and the pelvic frenum (PF). Specimen stained with cyanine blue (G.R. Allen).



Figure 4. *Hazeus paucisquamatus* n. sp., preserved and cyanine-blue stained male paratype, 25.1 mm SL, Nimoa Island, Louisiade Archipelago, Milne Bay Province, Papua New Guinea, showing the pattern of finely ctenoid scales covering body, nape, and predorsal region (G.R. Allen).

TABLE 1

Proportional measurements of type specimens of
Hazeus paucisquamatus, n. sp.
as percentages of the standard length

	holotype		paratypes	
	WAM P.35577-001	WAM P.35577-002	WAM P.35576-001	WAM P.35577-002
Sex	female	male	female	male
Standard length	24.9	25.1	22.7	21.8
Head length	31.2	30.8	30.8	32.6
Head width	19.5	18.7	18.5	19.4
Head depth	17.8	18.7	20.3	20.7
Body depth at pelvic-fin origin	20.2	22.3	19.4	21.5
Body depth at anal-fin origin	18.4	18.8	17.3	18.5
Caudal-peduncle depth	9.6	9.5	9.0	11.4
Caudal-peduncle length	21.7	21.2	22.2	22.0
Snout length	7.4	8.2	7.0	7.9
Eye diameter	9.6	10.3	9.4	10.1
Cheek depth	8.4	7.8	6.8	7.5
Upper-jaw length	10.1	11.3	9.7	11.1
Snout to 1st-dorsal origin	37.6	40.7	35.9	40.3
Snout to 2nd-dorsal origin	56.8	59.0	54.2	60.1
Snout to anal-fin origin	58.5	60.0	59.9	59.9
Snout to pelvic-fin origin	33.1	33.5	37.6	37.0
Base of dorsal fins	44.3	45.2	45.4	46.7
First dorsal-fin spine	11.7	10.2	12.1	12.9
Third dorsal-fin spine	16.2	16.4	15.4	17.7
Fourth dorsal-fin spine	14.1	16.4	13.2	15.7
Second-dorsal-fin spine	10.1	15.2	12.5	12.1
Longest soft dorsal-fin ray	17.7	18.0	18.5	16.4
Anal-fin spine	7.9	6.7	7.9	7.7
Longest soft anal-fin ray	12.3	17.5	12.9	18.8
Pectoral-fin length	26.1	25.3	27.1	30.0
Pelvic-fin length	25.8	27.6	26.6	30.6
Pelvic-fin spine	6.7	6.9	5.5	6.3
Caudal-fin length	24.1	25.9	26.5	25.5

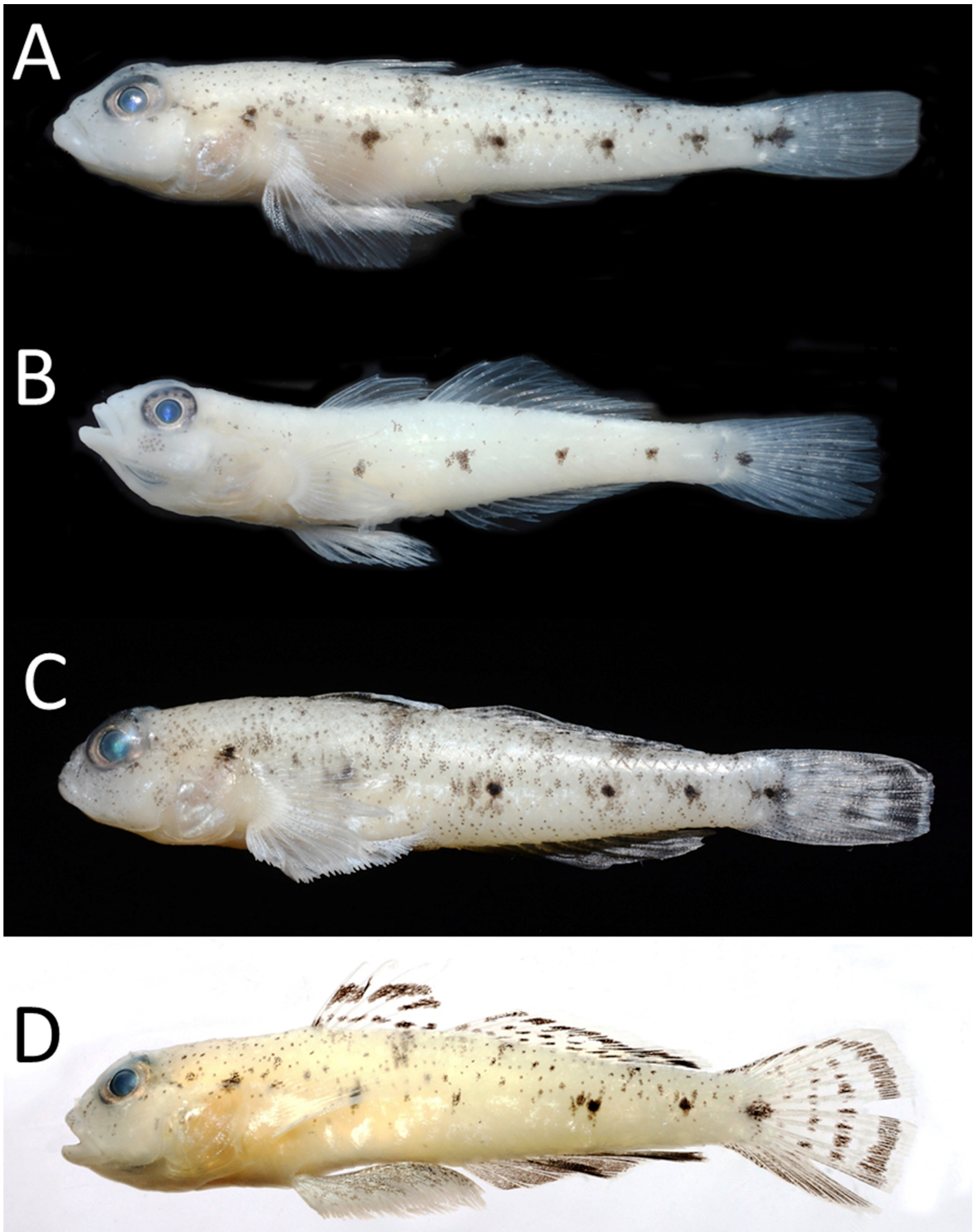


Figure 5. *Hazeus paucisquamatus* n. sp., preserved type specimens, Louisiade Archipelago, Milne Bay Province, Papua New Guinea: (A) 24.9 mm SL female holotype from Nimoa Island; (B) 22.7 mm SL female paratype from Panapompom Lagoon; (C) 25.1 mm SL male paratype from Nimoa Island; and (D) 21.8 mm SL male paratype from Nimoa Island (G.R. Allen).

Color in life. (Fig. 1) Male semi-translucent, slightly greyish head and body with 5 large, indistinct, tannish saddles dorsally extending from nape along upper back to caudal peduncle; a row of 6 mid-lateral dark-brown spots, smaller than pupil and sometimes subdivided, extending from upper rear edge of opercle to middle of caudal-fin base; lower third of head and body with irregular pearl-white markings and/or a horizontal row of small yellowish hash marks; also numerous variable-sized, small, reddish-brown-to-dark-brown spots, clusters of pepper-like melanophores, and irregular whitish markings scattered on head and body; iris pinkish yellow on upper two-thirds and whitish ventrally, dorsal scleral surface of eye with several brown spots; dorsal fins translucent basally with one or two horizontal rows of black spots, a prominent median black stripe, and a pinkish outer margin; caudal fin translucent with 4 or 5 irregular blackish bands, increasing in width posteriorly, and with a pinkish-yellow outer margin; anal fin dusky brownish; pelvic fin pearl white with dusky greyish membranes distally and a black medial stripe; pectoral fins translucent except for a median pearl-white zone. Female lacking dark fin markings of male and hash marks on ventral body are yellowish rather than white; also prominent dark spots on dorsal scleral membrane of eye usually evident. Both sexes possess a series of internal, mid-lateral, dark markings: in males markings form large, diffuse, brown spots while in females markings a combination of diffuse brown spots anteriorly and linear markings posteriorly.

Color in alcohol. (Figs. 5 & 6) Head and body generally whitish to yellowish with dark markings as described above in life; markings ranging from pale brown to dark brown, including those on dorsal and caudal fins; anal fin of males dusky brownish; pelvic fin of males whitish with a dusky brown outer edge and a blackish median streak.

Sexual dimorphism (Figs 6 & 7) The male is easily distinguished by its spots and bands on the dorsal and caudal fins, as well as the blackish anal fin and dark medial stripe on the pelvic fins. In addition, the posterior dorsal and anal-fin rays are longer in males, reaching nearly to the caudal-fin base when adpressed. In contrast, the adpressed female fins extend to about the middle of the caudal peduncle. The posterior rays of the second dorsal fin in males are usually the longest, in females the longest is the first segmented ray. Similarly, the male pelvic-



Figure 6. *Hazeus paucisquamatus* n. sp., preserved male paratype, 25.1 mm SL, showing medial black stripe on pelvic disk (G.R. Allen).



Figure 7. *Hazeus paucisquamatus* n. sp., preserved type specimens, ventral mid-body, showing genital papilla of 25.1 mm SL male paratype (left, with black outline), and 24.9 mm SL female holotype (right), Nimoa Island, Milne Bay Province, Papua New Guinea (G.R. Allen).

fin disk is generally longer and overlaps the genital papilla, hiding it partially or wholly from view (Fig 7, left), in contrast to the non-overlapping disk of the female, which has a fully exposed papilla (Fig. 6 right). Finally, the male genital papilla is long and tubular and overlaps the anal-fin origin vs. the rounded, dome-shaped female urogenital papilla, which falls short of the anal fin.

Etymology. The specific epithet is the masculine compound adjective *paucisquamatus* (Latin: few scales), with reference to the reduced preopercular scalation.

Distribution and habitat. The new species is known from only two sites situated about 185 and 295 km respectively east of the south-eastern tip of the Papua New Guinea mainland. A photograph from central Raja Ampat, West Papua, Indonesia taken by Janet Eyre (unpublished) appears to also be of the new species, although confirmation with specimens is needed. The habitat consists of sheltered silty-sand bottoms of fringing reefs and lagoons in 15–20 m depth.

Comparisons. Diagnostic features of the 9 species in the genus *Hazeus* are presented in Table 2. The new taxon differs from all congeners in several characters: the unique combination of scales restricted to the upper half of the opercle, three small, partially embedded scales on the upper rear corner of the preopercle, and the male color pattern featuring black bands and spots on the dorsal and caudal fins, a dark anal fin, and a medial black stripe on the pelvic-fin disk. The only other species with a half-scaled opercle is *H. nephodes* from the Hawaiian Islands, but it differs in lacking preopercular scales and has more lateral body and predorsal scales (28 and 9, respectively).

The new species co-occurs within its range with *H. ammophilus* and *H. profusus* (Fig. 8): *H. ammophilus* can be easily distinguished by having no scales on the preopercle and opercle and *H. profusus* is distinguished by having the opercle completely covered with scales. Although *H. ammophilus* bears a superficial resemblance to *H. paucisquamatus* by sharing the mid-lateral row of dark-brown spots, the former species lacks the distinctive markings on the male, i.e. the dark anal fin and medial black stripe on the pelvic-fin characteristic of the new species.

TABLE 2
Diagnostic characters for the species of *Hazeus* (usual count in parentheses)

Species	Dorsal rays	Anal rays	Pectoral rays	Tallest seg ray	Lateral scales	Predorsal scales	Opercle scales	Preopercle scales
<i>H. ammophilus</i>	9–10 (10)	9–10 (10)	13–17 (16)	3–4th	25–28 (26)	6–9 (7)	absent	absent
<i>H. diacanthus</i>	10	10	18	2nd	28	10	absent	absent
<i>H. elati</i>	10	10	19	2nd	23–24	8	present	present
<i>H. ingressus</i>	8	8–9 (8)	17–18	2–4th	25–28 (27)	7	present	present
<i>H. maculipinna</i>	10	10	17	3rd	24	9	absent	absent
<i>H. nephodes</i>	9–11	10–11 (10)	17–19	2–3rd	28	9	upper half	absent
<i>H. otakii</i>	8–9	9	18	3–4th	28	7	present	present
<i>H. paucisquamatus</i>	9–10 (9)	8–10	15–17	3rd	24–25	7–8 (8)	upper half	three*
<i>H. profusus</i>	9–10 (10)	9–10	16–18	3rd	24–26 (25)	6–8 (7)	present	present

* three scales on upper rear corner

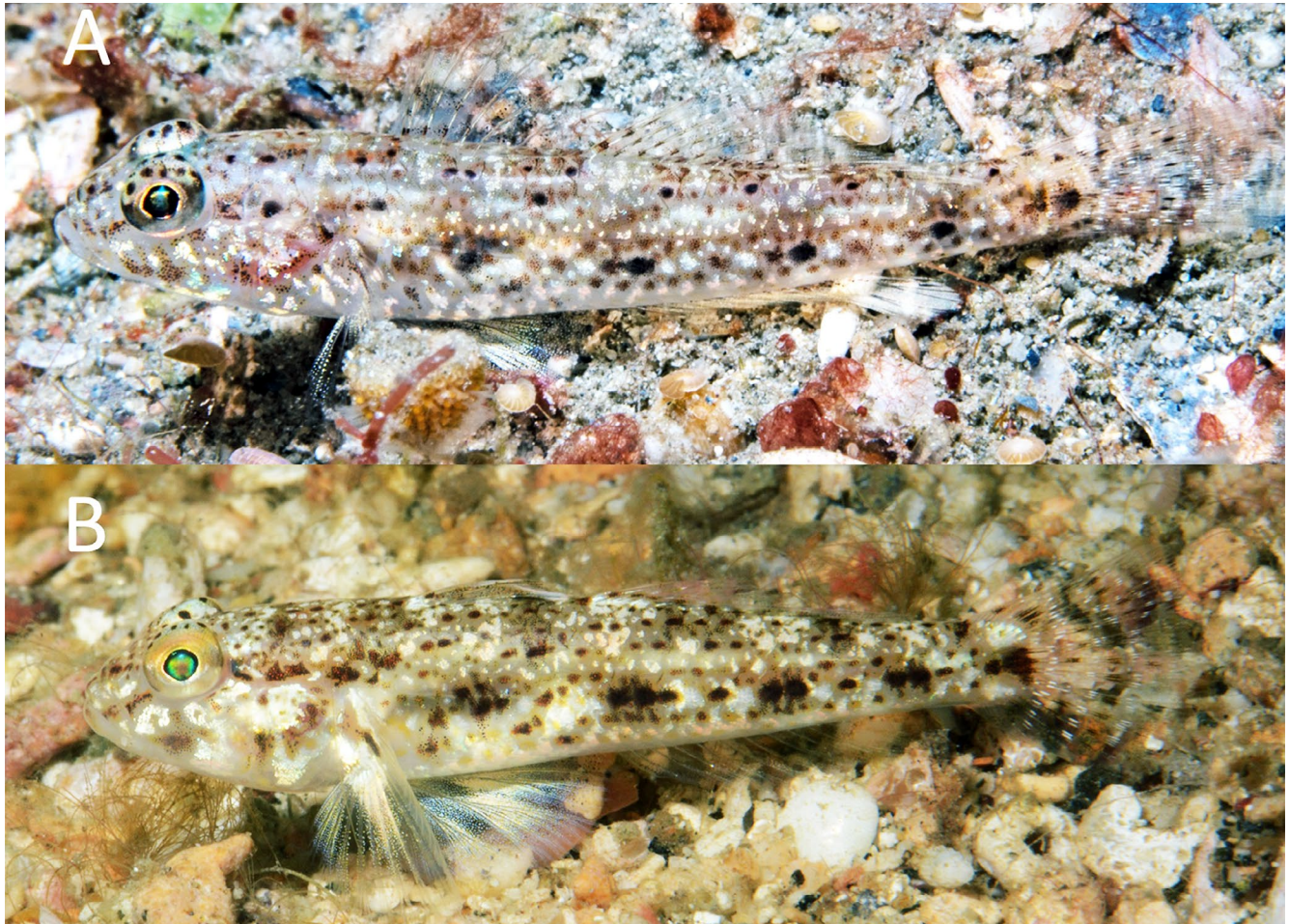


Figure 8. Underwater photographs of sympatric *Hazeus* species, (A) *H. ammophilus* and (B) *H. profusus*, both males, approximately 25 mm SL, Milne Bay Province, Papua New Guinea: (G.R. Allen).

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