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Descriptions of two new species of shrimpgobies (Gobiidae: *Cryptocentrus* and *Tomiyamichthys*) from Papua New Guinea

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Abstract

Two new species of alpheid-shrimp-associated gobies are described from Milne Bay Province, Papua New Guinea. *Cryptocentrus epakros* n. sp. is described from a single female specimen, 34.2 mm SL. Diagnostic features include 47 longitudinal scales (most species in the genus with more than 70), scales entirely cycloid, and the seventh and eighth anal-fin rays prolonged to form a distinctly pointed posterior anal-fin profile. It also possesses a unique color pattern featuring six brown bars with yellowish interspaces, vertical orange markings on the dorsal fins, a dusky brown anal fin except the last few rays bright yellow, a yellowish caudal fin with blue streaks, and narrow, oblique orange bands on the cheek and opercle of males. *Tomiyamichthys zonatus* n. sp. is described on the basis of three specimens, 24.1–30.6 mm SL. Diagnostic features include 11 dorsal and anal-fin soft rays; 52–54 longitudinal scales; cycloid scales anteriorly, becoming ctenoid posteriorly; preopercular sensory canal and pores absent; first four dorsal-fin spines with short, filamentous tips; distinct sexual dichromatism with the male characterized by five brown saddles on the back, seven orange-brown bars on the ventral half of the body, a prominent black bar across the outer two thirds of last two anal-fin rays, and pale yellow pelvic fins with bright yellow spots. Both sexes possess a mid-lateral row of alternating large and small rectangular blotches enclosed within a pair of thin stripes from the pectoral fin to the caudal-fin base. Females have darker brown markings, lack ventral body bars, and possess more ornate fins, consisting of variable dark stripes or blotches on the dorsal, anal, and pelvic fins.

Key words: taxonomy, gobies, shrimp-associated fishes, Indo-Pacific, western Pacific Ocean.

Introduction

Shrimpgobies are a common element of coastal fish communities throughout the Indo-Pacific region. The group is composed of 11 genera and approximately 150 valid species (Eschmeyer 2015), with the most speciose groups including *Amblyeleotris* Bleeker 1874 (38 species), *Cryptocentrus* Valenciennes 1837 (35), *Tomiyamichthys* Smith 1956 (12), and *Vanderhorstia* Smith 1949 (28). The East Indian Archipelago, particularly Indonesia, Philippines, and Papua New Guinea, is home to at least 85 species (Allen & Erdmann 2012). These fishes generally inhabit soft substrates, consisting of mixed mud, sand, and rubble, generally in the vicinity of coral reefs or mangrove shores. As the common name suggests, they live in close association with alpheid shrimps, which excavate and continuously maintain a mutually shared burrow. The goby, with its superior sensory systems, serves as the sentinel near the burrow entrance. Because shrimp-associated gobies quickly take shelter in the burrow, they are frequently difficult to collect.

The present paper describes two new species of shrimpgobies that were obtained during recent fish surveys near the town of Alotau in Milne Bay Province, Papua New Guinea. A prolonged period of calm seas without rains allowed rare access to shoreline mud-slope habitat with relatively good underwater visibility (to 10–15 m). A series of 19 dives were made to depths of 18 m along a 200 m extent of shoreline adjacent to a shipyard. This afforded an excellent opportunity to gain safe access to an area that is normally difficult to dive. Although similar mud-slope habitat is abundant at Milne Bay, diving is generally discouraged due to high levels of river discharge and resultant poor visibility, as well as the threat of crocodiles, which thrive along mangrove shores.

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 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; orbit diameter is the greatest fleshy diameter, and interorbital width 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; cheek depth is the distance between the posteriormost edge of the maxilla and ventral edge of the fleshy orbit; 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; 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 spine to the tip of the longest pelvic soft ray.

Terminology and abbreviations for cephalic pores and papilla rows follow those presented by Akihito (1984). Scales in longitudinal series are counted from the scale above the pectoral-fin base, continuing in a longitudinal row to the posterior edge of the hypural plate; scales in transverse series are counted from the origin of the anal fin anterodorsally to the base of the first dorsal fin; gill rakers are counted on the first gill arch, those on the upper limb listed first; rudiments are included in the counts. Circumpeduncular scales are counted in a vertical "zigzag" row around the caudal peduncle, immediately anterior to the caudal-fin base.

Morphometric data presented as percentages of the standard length are listed in Table 1. In the description of the new *Tomiyamichthys*, the values for the holotype are presented first, followed in parentheses by the range for paratypes, if different. Type specimens are deposited at the Western Australian Museum, Perth (WAM).

Figure 1. *Cryptocentrus epakros*, preserved holotype, WAM P.34319-001, female, 34.2 mm SL, Alotau, Papua New Guinea (G.R. Allen).

Cryptocentrus epakros Allen, n. sp.

Pointedfin Shrimpgoby

Figures 1–3, Table 1.

Holotype. WAM P.34319-001, female, 34.2 mm SL, Alotau, Papua New Guinea, 4.8 km east of main wharf, 10º 18.256' S, 150º 24.768' E, 14.5 m, clove oil & hand net, G.R. Allen, Dec. 13, 2014.

Diagnosis. Dorsal-fin rays VI-I,10; anal-fin rays I,9; pectoral-fin rays 15; scales in longitudinal series 47; median predorsal scales 19; body scales entirely cycloid, including abdomen, and prepelvic region; pectoral-fin base and head naked except side of nape and predorsal region; preopercular-canal pore N absent; gill opening extending forward to a vertical at posterior edge of preopercle; seventh and eighth anal-fin rays prolonged, resulting in distinctly pointed posterior anal-fin profile; longest anal-fin rays 1.1 in HL; caudal fin rounded, longer than head, 3.1 in SL; pelvic fins relatively short, not reaching posteriorly to anus, 4.7 in SL; color of female generally golden brown with six faint dark bars from nape to caudal-fin base, interspersed with yellowish, slightly narrower interspaces; both dorsal fins with vertical, dark-edged orange markings between each spine and ray, interrupted to form spots on outer half of fin; second dorsal fin with pale blue submarginal stripe; anal fin dusky yellow brown, except posteriormost portion (encompassing last three rays) bright yellow; caudal fin yellow to brownish with longitudinal blue streak between most rays of middle portion; pelvic-fin rays dusky brownish; male (not collected, but presumed to be the same species) with four oblique, narrow orange bands (usually wavy and interrupted) on cheek and opercle and more vivid dark bars on body.

Description. Dorsal-fin rays VI-I,10; anal-fin rays I,9; all dorsal and anal-fin soft rays branched, the last to base (each major branch of last ray divided); pectoral-fin rays 15 (both sides counted), all rays branched except uppermost and lowermost; pelvic-fin rays I,5, all soft rays branched, fifth rays joined medially with membrane and frenum well developed; branched caudal-fin rays 13; segmented caudal-fin rays 15; upper and lower unsegmented caudal-fin rays 5 and 5 respectively; longitudinal scale series 47; transverse scale rows 12; predorsal scales 19; median prepelvic scales 9; circumpeduncular scales 14; gill rakers 3 + 12.

Body elongate and laterally compressed, depth at pelvic-fin origin 4.2 in SL; depth at anal-fin origin 4.5 in SL; body compressed, width at pectoral-fin origin 2.1 in HL; head length 3.5 in SL; head compressed, width 1.3

in HL; snout short, length 5.5 in HL; orbit diameter 3.8 in HL; interorbital space narrow, eyes nearly in contact with each other; caudal-peduncle depth 2.4 in HL; caudal-peduncle length 1.6 in HL.

Mouth oblique, forming angle of about 44° to horizontal axis of body, upper and lower jaw slightly projecting; mouth large, maxilla reaching a vertical at rear edge of orbit, upper-jaw length 2.1 in HL; upper and lower jaws with 4–6 rows of sharp, retorse villiform teeth, gradually narrowing to 1–2 rows posteriorly; no greatly enlarged canine teeth, but two pairs of larger teeth in outer row at front of upper jaw and three pairs of relatively large teeth on innermost row on each side of lower jaw; no teeth on vomer; edge of lips smooth; tongue with truncate tip; no distinct mental flap.

Gill opening broad, extending forward to vertical at posterior edge of preopercle; gill membranes attached to side of isthmus, with no free fold across it; gill rakers relatively short and slender, longest about two-thirds length of longest gill filaments of first branchial arch.

Posterior nostril a large, nearly round aperture in front of center of eye; anterior nostril a short membranous tube, anteroventral to posterior nostril just above edge of upper lip.

Pattern of cephalic sensory pores and papilla rows illustrated in Fig. 2. Anterior oculoscapular-canal pores B', C (single), D (single), E, F, G, H', K' and L'; preopercular-canal pores M' and O'; right and left sides of anterior oculoscapular canals fused medially in interobital space.

Head naked except predorsal region; body scales exclusively cycloid, those on posterior half of body about twice size of those on anterior half; scales absent on pectoral-fin base and all fins except for about 4–5 rows at base of caudal fin, smaller than last row on caudal peduncle.

Origin of first dorsal fin above rear base of pelvic fins, predorsal length 2.9 in SL; spines slender and flexible, none filamentous; first dorsal-fin spine 1.7 in HL; second to fifth dorsal-fin spines subequal, third and fourth slightly longer, 1.4 in HL; last membrane of first dorsal fin ending at origin of second dorsal fin; spine of second dorsal fin 2.5 in HL; ninth dorsal soft ray longest, 1.6 in HL; origin of anal fin below base of third dorsal soft ray,

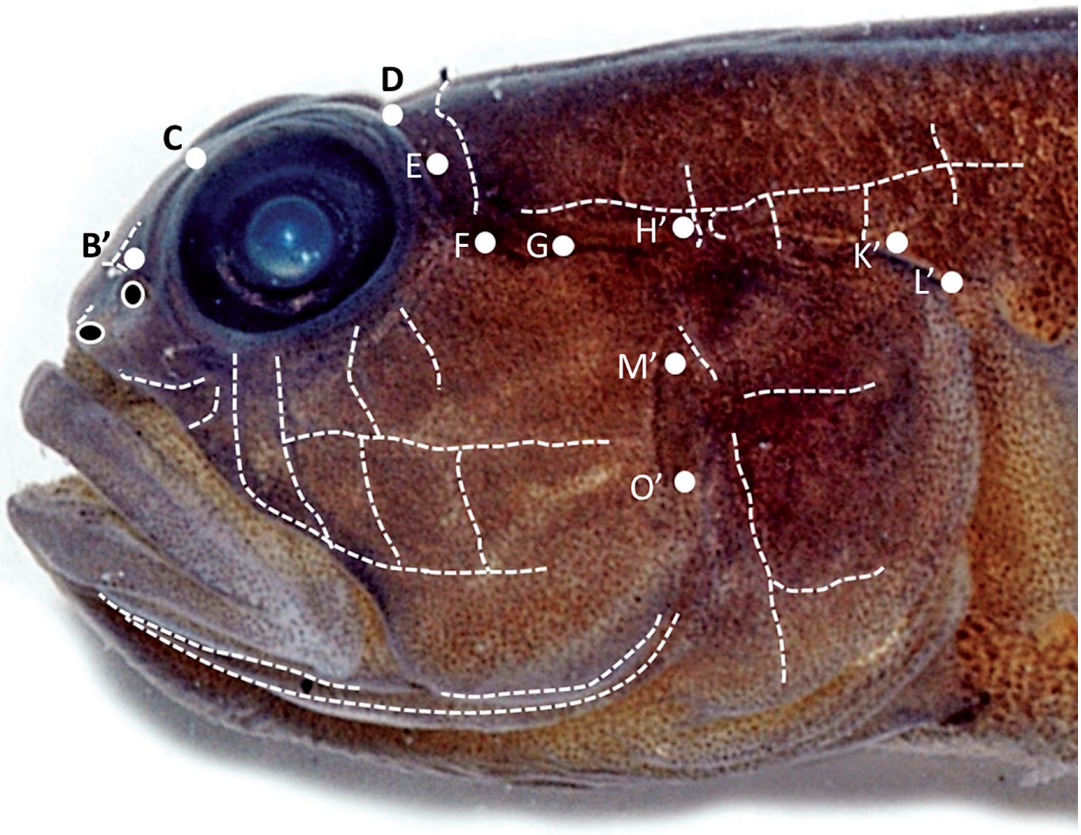

Figure 2. *Cryptocentrus epakros*, preserved holotype, WAM P.34319-001, female, 34.2 mm SL, Alotau, Papua New Guinea, lateral view of head with sensory pores and main rows of papillae indicated by solid white dots and broken lines, respectively. Nostrils are shown by white-edged black spots (G.R. Allen).

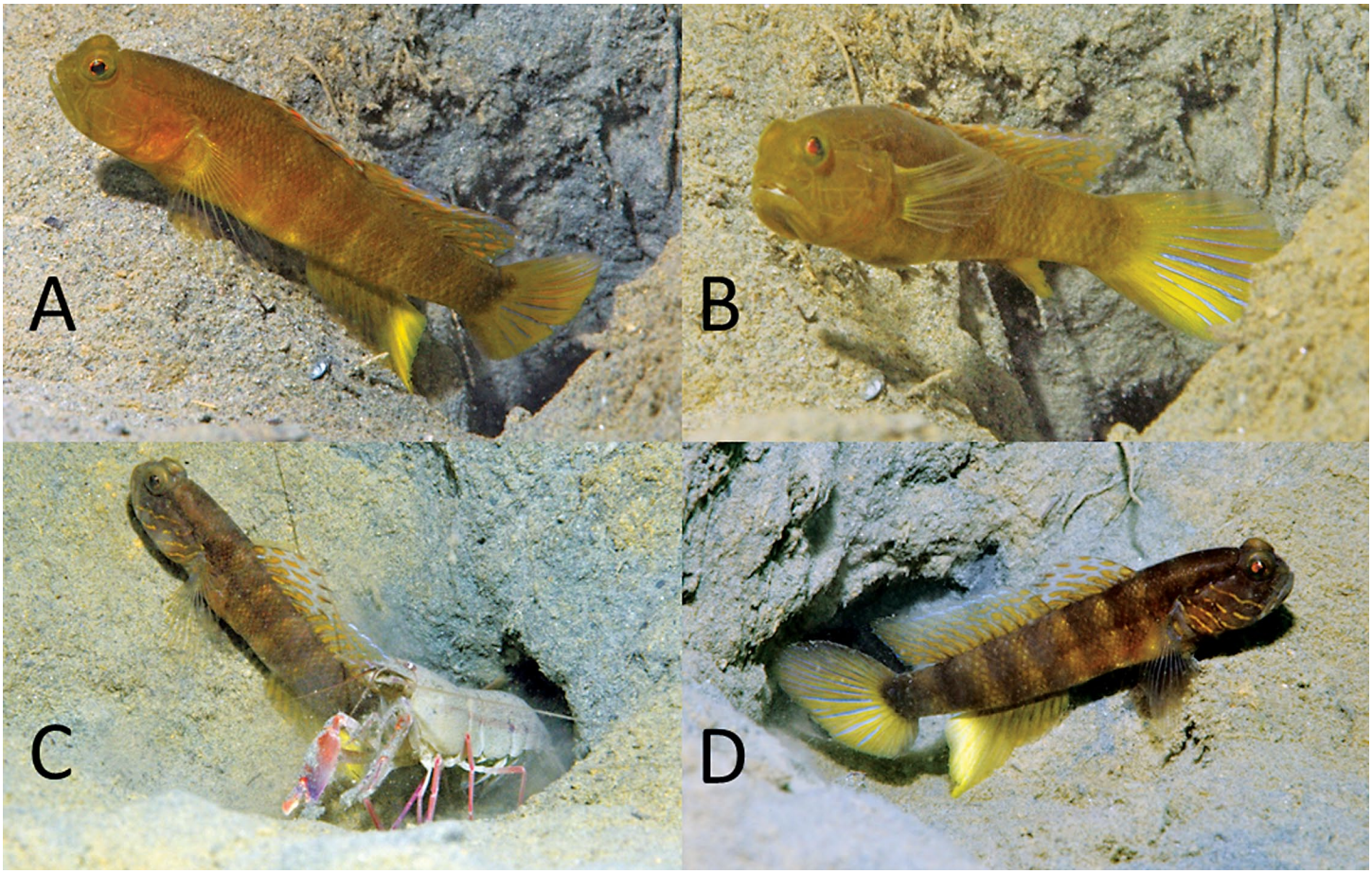

Figure 3. *Cryptocentrus epakros*, underwater photographs of holotype, female, 34.2 mm SL (A and B) and male (not collected, but presumed to be the same species), approx. 50 mm SL (C and D); both Alotau, Papua New Guinea (G.R. Allen).

preanal length 1.6 in SL; anal spine 4.2 in HL; seventh and eighth anal-fin soft rays longest, 1.1 in HL; caudal fin longer than head with rounded posterior margin, its length 3.1 in SL; pectoral fins rounded, middle rays longest, 3.9 in SL; prepelvic length 3.0 in SL; adpressed pelvic fins not reaching to anus, 4.7 in SL; pelvic spine 2.5 in length of longest pelvic-fin ray; pelvic frenum thin, the membrane connecting tip of pelvic spines.

Color of live female holotype. (Fig. 3 A & B) Head and body generally golden brown with six faint dark bars between dorsal-fin origin and caudal-fin base, interspersed with diffuse yellowish interspaces; both dorsal fins with vertical, dark-edged orange markings between each spine and ray, interrupted to form spots on outer half of fin; second dorsal fin with pale blue submarginal stripe; anal fin dusky yellow brown, except posteriormost portion (encompassing last three rays) bright yellow; caudal fin brownish yellow with longitudinal blue streak between rays of middle portion of fin; pelvic-fin rays dusky brownish; pectoral fins translucent yellowish.

Color of live male, approx. 50 mm SL. (Fig. 3 C & D) A male specimen (based on size and color) was photographed in an adjacent burrow and is presumed here to represent the male of the same species. Color generally similar to female, but overall darker and lacking pronounced golden hue; dark body bars more distinct and generally narrower with wider pale interspaces compared to those of female; head dark brown with four oblique, narrow orange bands (usually wavy and interrupted) on cheek and opercle; fin coloration similar to female except caudal fin generally brighter yellow and fleshy pectoral-fin base with orange bar.

Color in alcohol. (Fig. 1) Generally light brown with darker brown scale margins; four posteriormost dark body bars evident between anal-fin origin and caudal fin; vertically elongate, dark-edged spots on dorsal fin, conspicuous on first dorsal, but faint on second dorsal; dorsal-spine tips dark brown; anal fin mainly dark brown except posteriormost portion translucent whitish; caudal fin translucent whitish except dusky brown on ventral margin; pelvic fins dusky brown; pectoral fins translucent whitish

Distribution and habitat. The new species is known only from the type locality near the town of Alotau in Milne Bay Province, Papua New Guinea. The habitat consists of moderately sloped (about 20 degrees) mud

substratum. The slope begins in approximately 1.5 m depth and flattens out at about 18 m. The first impression is a featureless bottom with very few fishes, but closer inspection reveals numerous burrows occupied by a variety of fishes and invertebrates. Three individuals of the new species, including the female holotype, a presumed male, and another female were observed in 12.5–15.0 m depth. Collection attempts on several dives for the other two fish were unsuccessful. Each fish was invariably associated with an unidentified alpheid shrimp (Fig. 3), which was overall pale greyish with bright pink legs and a pink claw with a bluish tip. The female holotype was found in close proximity (about 30 cm) to the presumed male, which occupied a separate burrow.

Etymology. This species is named *epakros* (Greek: pointed at the end) in reference to the diagnostic anal fin shape, consisting of elongated seventh and eighth fin rays that result in a conspicuous pointed posterior fin profile.

Comparisons. The new species is distinguished from most *Cryptocentrus* on the basis of its unusually low longitudinal scale count (47). Most members of the genus have counts ranging from about 70–120 (Allen & Randall 2011). The only other species in the western Pacific with relatively low counts include *C. caeruleomaculatus* (Herre 1933) with 56–61, *C. cyanospilotus* Allen & Randall 2011 with 49–54, *C. strigilliceps* (Jordan & Seale 1906) with 50–71, and *C. insignitus* (Whitley 1956) with 50–55. These species are easily differentiated from *C. epakros* on the basis of color pattern (Figs. 4–5), as well as their slightly higher number of pectoral-fin rays (16–17 versus 15). *Cryptocentrus cyanospilotus* (Fig. 4) from the western Pacific (Java Sea to Solomon Islands, Palau, and Yap, northward to Yaeyama Islands) is either mostly brown with small blue spots on the head and body or brown with 7–8 narrow whitish bars and blue spotting on the head. *Cryptocentrus insignitus* (Fig. 5 C) from northern Australia is characterized by a prominent ocellus on the first dorsal fin. The remaining two species are distinguished by a series of large blackish, midlateral spots on the body, large red spots on the head of *C. caeruleomaculatus* (Fig. 5 A), and absence of blue spots on the head of *C. strigilliceps* (Fig. 5 B). The latter also differs in having a series of short transverse rows of papillae just below the lower lip. Both of these species are widely distributed in the tropical western Pacific, with *C. strigelliceps* ranging westward to the Arabian Sea and eastern Africa.

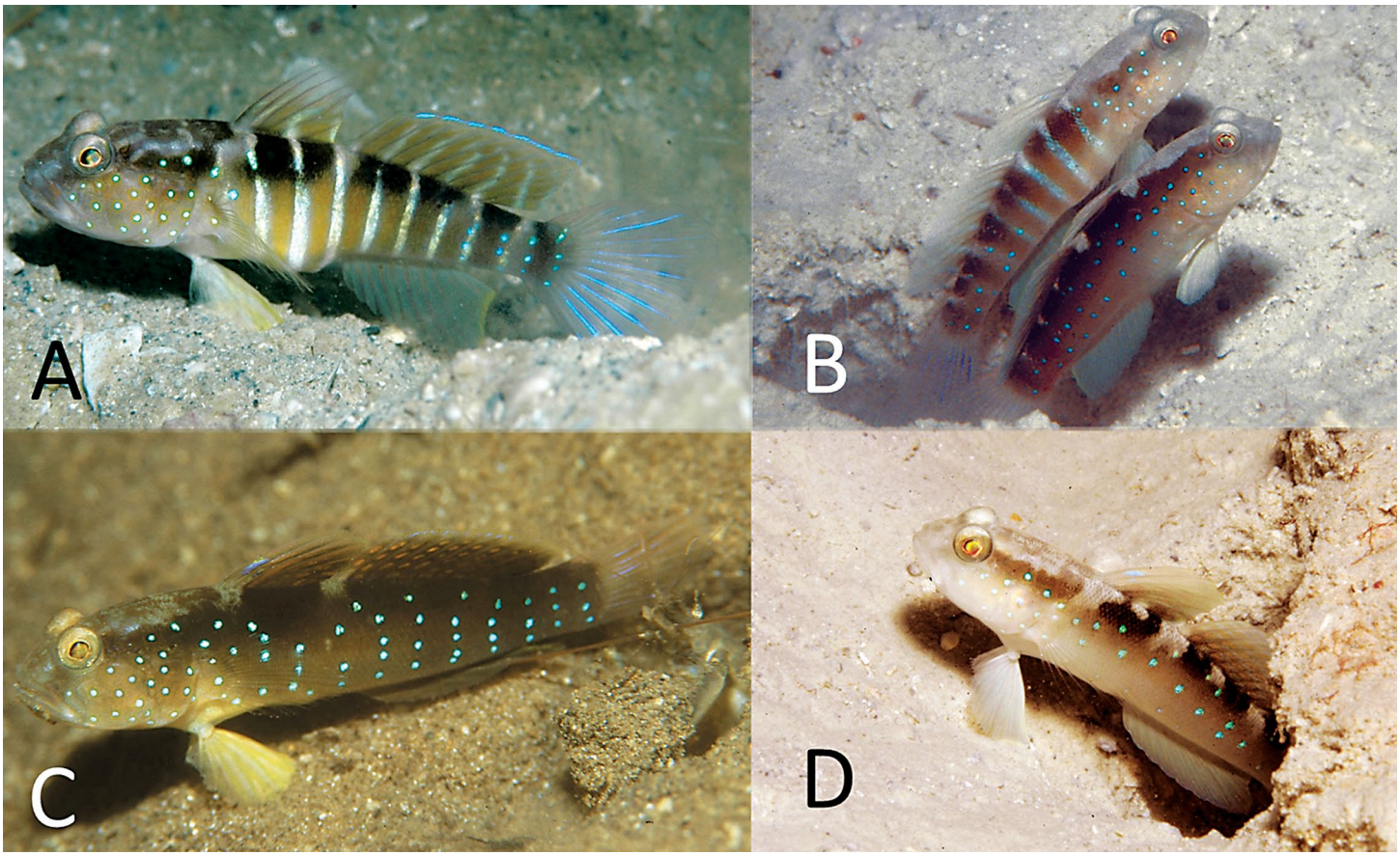

Figure 4. Underwater photographs of *Cryptocentrus cyanospilotus* showing color variation: A) male, about 45 mm SL, Guadalcanal, Solomon Islands; B) adult pair, about 45 mm SL, Sabah, Malaysia; C) adult, about 50 mm SL, Kimbe Bay, New Britain, Papua New Guinea; and D) adult about 40 mm SL, Yap, Federated States of Micronesia (G.R. Allen).

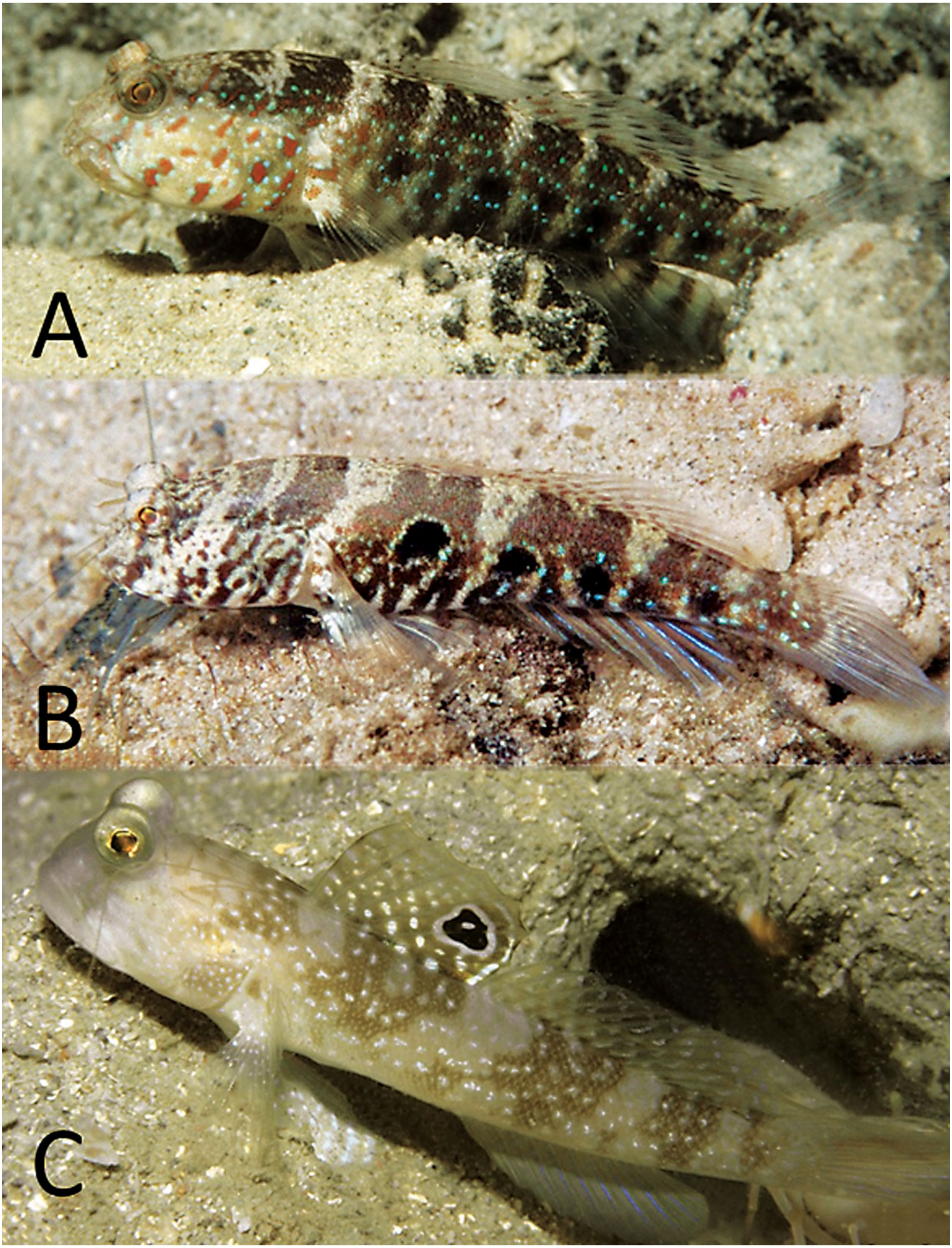

Figure 5. Underwater photographs of large-scaled species of *Cryptocentrus*: A) *C. caeruleomaculatus*, about 50 mm SL, Raja Ampat Islands, West Papua, Indonesia; B) *C. strigelliceps*, about 50 mm SL, Weh Island, Sumatra, Indonesia; and C) *C. insignitus*, about 50 mm SL, Cassini Island, Western Australia (G.R. Allen).

TABLE 1

Proportional measurements (as percentage of SL) for type specimens of *Cryptocentrus epakros* and *Tomiyamichthys zonatus*

	Cryptocentrus epakros	*Tomiyamichthys zonatus*		
	holotype	holotype	paratypes	
	WAM P. 34319-001	WAM P. 34319-002	WAM P. 34319-003	WAM P. 34319-003
Sex	female	male	male	female
Standard length	34.2	30.6	28.1	24.1
Body depth (pelvic origin)	23.4	17.4	18.2	18.2
Body depth (anal origin)	22.3	14.0	15.5	15.6
Body width	11.4	9.9	10.1	11.2
Head length	28.7	26.6	27.8	27.8
Head width	17.4	15.5	15.8	13.6
Snout length	5.2	5.1	4.7	4.7
Orbit diameter	7.5	8.3	8.4	8.5
Interorbital width	0.2	0.5	0.8	1.0
Cheek depth	6.4	6.7	7.0	5.3
Upper-jaw length	14.0	12.4	12.9	12.1
Caudal-peduncle depth	11.7	9.9	9.6	9.6
Caudal-peduncle length	17.5	14.1	13.5	13.6
Predorsal length	34.4	31.6	32.4	34.8
Preanal length	62.6	54.1	56.4	59.3
Prepelvic length	33.4	27.3	29.4	32.6
Base of dorsal fins	51.6	56.0	57.6	54.5
First dorsal spine	16.6	28.3	26.2	20.4
Fourth dorsal spine	20.6	32.3	27.0	21.5
Fifth dorsal spine	19.5	19.1	14.3	12.4
Spine of second dorsal fin	11.3	9.1	9.8	7.4
Longest dorsal ray	17.6	21.9	18.0	15.9
Base of anal fin	19.3	32.6	32.2	27.8
Anal spine	6.8	5.8	6.5	5.8
Longest anal ray	26.6	18.8	19.6	14.8
Caudal-fin length	32.5	39.1	42.6	37.7
Pectoral-fin length	25.9	28.1	28.9	25.1
Pelvic-spine length	8.5	6.4	6.8	6.3
Pelvic-fin length	21.1	25.8	26.3	20.4

Figure 6. *Tomiyamichthys zonatus*, A) preserved male holotype, WAM P.34319-002, 30.6 mm SL; and B) preserved female paratype, WAM P.34319-003, 24.1 mm SL; both Alotau, Papua New Guinea (G.R. Allen).

Tomiyamichthys zonatus Allen, n. sp.

Brownband Shrimpgoby

Figures 6–9, Table 1.

Holotype. WAM P.34319-002, male, 30.6 mm SL, Alotau, Papua New Guinea, 4.8 km east of main wharf, 10º 18.256' S, 150º 24.768' E, 15 m, clove oil & hand net, G.R. Allen, Dec. 10, 2014.

Paratypes. WAM P.34319-003, female, 24.1 mm SL, and male, 28.1 mm SL, both collected with holotype.

Diagnosis. Dorsal-fin rays VI-I,11; anal-fin rays I,11; pectoral-fin rays 17; scales in longitudinal series 52–54; scales absent on head, pectoral-fin base, and prepelvic region; body scales entirely cycloid anteriorly, becoming ctenoid posteriorly; preopercular sensory canal and pores absent; gill opening extending forward to a vertical at posterior edge of preopercle; first four dorsal-fin spines with short, filamentous tips; caudal fin lanceolate, longer than head, 2.3–2.7 in SL; distinct sexual dichromatism with male characterized by five brown saddles on back, seven orange-brown bars on ventral half of body from level of dorsal-fin origin to base of last anal ray, prominent black bar across outer two thirds of last two anal-fin rays, and pale yellow pelvic fins with bright yellow spots; both sexes with mid-lateral row of alternating large and small rectangular blotches within pair of thin stripes from the pectoral fin to caudal-fin base; female generally with darker brown markings on body and more ornate fins, consisting of variable dark stripes or blotches on dorsal, anal, and pelvic fins.

Description. Dorsal-fin rays VI-I,11; anal-fin rays I,11; all dorsal and anal-fin soft rays branched, last to base (each major branch of last ray divided); pectoral-fin rays 17 (both sides counted), all rays branched except uppermost and lowermost; pelvic-fin rays I,5, all soft rays branched, fifth rays joined medially with membrane and frenum well developed; branched caudal-fin rays 13; segmented caudal-fin rays 17; upper and lower unsegmented caudal-fin rays 5 and 5 respectively; longitudinal scale series 54 (52); transverse scale rows 13 (13–14); no

predorsal or prepelvic scales; circumpeduncular scales 13 (14); gill rakers 0 + 4.

Body elongate and laterally compressed, depth at pelvic-fin origin 5.7 (5.5) in SL; depth at anal-fin origin 7.1 (6.4–6.5) in SL; body compressed, width at pectoral-fin origin 1.8 (1.6–1.8) in HL; head length 3.8 (3.6) in SL; head compressed, width 1.1 (1.2–1.3) in HL; snout short, length 5.3 (5.9) in HL; orbit diameter 3.2 (3.3) in HL; interorbital space narrow, eyes nearly in contact with each other; caudal-peduncle depth 2.7 (2.9) in HL; caudal-peduncle length 1.9 (2.0–2.1) in HL.

Mouth oblique, forming angle of about 35° to horizontal axis of body, upper and lower jaw slightly projecting; mouth large, maxilla nearly reaching a vertical at rear edge of orbit, upper-jaw length 2.2 (2.2–2.3) in HL; chin with pronounced bulge, both in preserved and live specimens; upper jaw with 2–3 rows of tiny villiform teeth anteriorly, narrowing to single row posteriorly; teeth of posterior row recumbent; single enlarged, slender canine-like tooth on each side at front of upper jaw; lower jaw with band of tiny villiform teeth, narrowing to single row posteriorly; 5–6 enlarged teeth in outer row on each side at front of lower jaw, posteriormost much larger than others, canine-like and strongly recurved; no teeth on vomer; edge of lips smooth; tongue with truncate tip; no distinct mental flap.

Gill opening broad, extending forward to a vertical at posterior edge of preopercle; gill membranes attached to side of isthmus, with no free fold across it; gill rakers relatively short and slender, the longest about two-thirds length of longest gill filaments of first branchial arch.

Posterior nostril a large, nearly round aperture in front of center of eye; anterior nostril a short membranous tube, anteroventral to posterior nostril just above edge of upper lip.

Pattern of cephalic sensory pores and papilla rows illustrated in Fig. 7. Anterior oculoscapular-canal pores B', C (single), D (single), F, G, and H'; posterior oculoscapular-canal pores K' and L' absent, and preopercular-canal pores M', N and O' absent; right and left sides of anterior oculoscapular canals fused medially in interobital space.

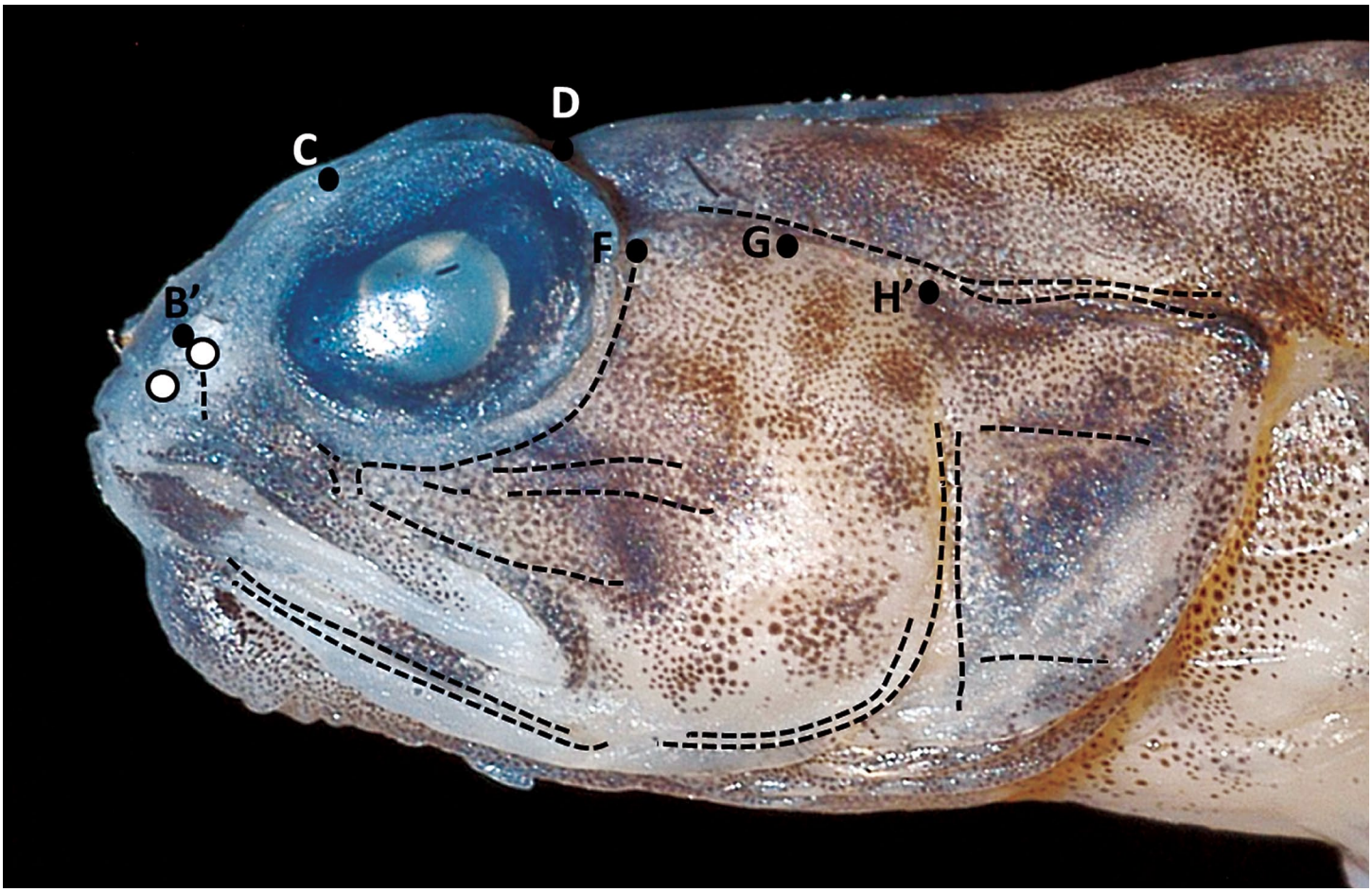

Figure 7. *Tomiyamichthys zonatus*, preserved holotype, WAM P.34319-002, male, 30.6 mm SL, Alotau, Papua New Guinea, lateral view of head with sensory pores and main rows of papillae indicated by solid black dots and broken lines, respectively. Nostrils are shown by black-edged white dots (G.R. Allen).

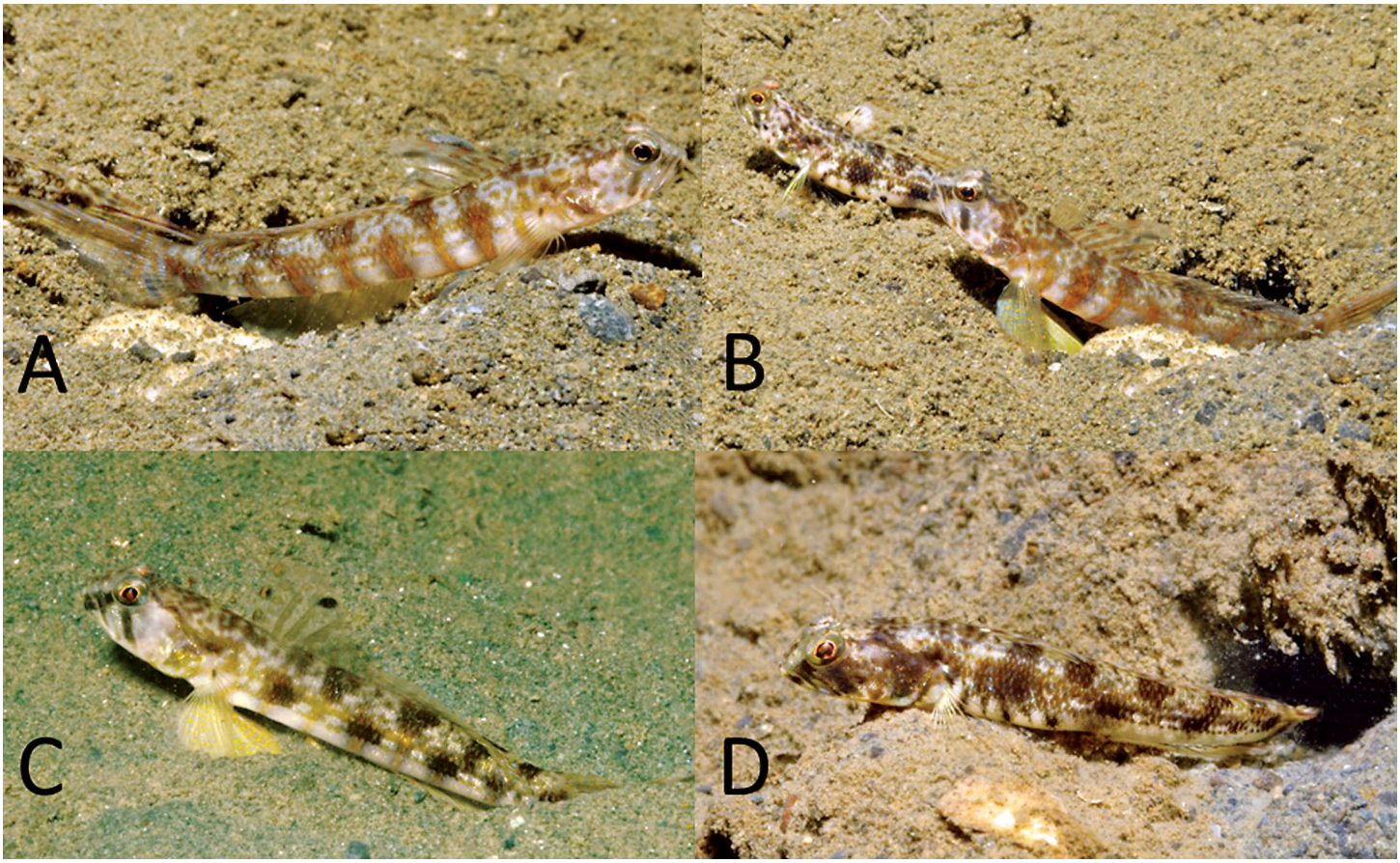

Figure 8. Underwater photographs of *Tomiyamichthys zonatus*: A) male holotype, 30.6 mm SL; B) male holotype and female paratype, 24.1 mm; C) uncollected male, about 30 mm SL; and D) uncollected female, about 25 mm SL (G.R. Allen, except lower left by R. Vanderloos).

Head entirely naked except predorsal region; body scales cycloid to about level of sixth dorsal-fin spine, remaining scales finely ctenoid; scales gradually increasing in size posteriorly, those on caudal peduncle about twice size of those on anterior body; scales absent on breast (prepelvic region), pectoral-fin base, and all fins except for about 4–5 rows at base of caudal fin, smaller than last row on caudal peduncle.

Origin of first dorsal fin above rear base of pelvic fins, predorsal length 3.2 (2.9–3.1) in SL; first (spinous) dorsal fin noticeably taller than second dorsal fin; dorsal-fin spines slender and flexible, first to fourth with short filamentous tips; first dorsal-fin spine 3.5 (3.8–4.9 in SL; first to fourth dorsal-fin spines more or less subequal, third longer, 3.1 (3.7–4.7) in SL; last membrane of first dorsal fin ending at origin of second dorsal fin; spine of second dorsal fin 2.9 (2.8–3.8) in HL; tenth dorsal soft ray longest, 1.2 (1.5–1.8) in HL; origin of anal fin below base of first dorsal soft ray, preanal length 1.8 (1.7–1.8) in SL; anal spine 4.6 (4.3–4.8) in HL; tenth anal-fin soft ray longest, 1.4 (1.4–1.9) in HL; caudal fin lanceolate, longer than head, its length 2.6 (2.3–2.7) in SL; pectoral fins pointed, middle rays longest, 3.6 (3.5–4.0) in SL; prepelvic length 3.7 (3.1–3.4) in SL; adpressed pelvic fins reaching to anus in male, but well short of anus in female, 3.9 (3.8–4.9) in SL; pelvic spine 4.0 (3.2–3.8) in length of longest pelvic-fin ray; pelvic frenum thin, membrane connecting tip of pelvic spines.

Color of live male holotype. (Fig. 8 A & B) Head and body generally pale grey grading to white on ventral surface; operculum mainly brown with irregular orange markings; irregular brown mottling dorsally on head, cheek, and upper half of body; blotching on back interspersed with five, roughly rectangular, dark-brown saddles, increasing in size posteriorly, first at origin dorsal fin and last below posterior half of second dorsal fin; pair of broad, oblique, dark brown bands extending from lower edge of eye, the first across lips to chin, and the second across cheek; seven orange-brown bars on ventral half of body from level of dorsal-fin origin to base of last anal ray; first dorsal fin translucent pale grey with brown coloration along each spine except vertical row of three, large orange-brown spots on membranes between first and second spines, also a blackish spot (sometimes faint)

adjacent to fourth spine tip; second dorsal fin with four orange-brown stripes and irregular blue markings; anal fin greyish brown with orange speckling and prominent black bar across outer two thirds of last two rays; caudal fin translucent greyish with about 10 narrow, orange-brown bars and scattered blue speckles, dusky brown or blackish along lower edge; pelvic fin whitish with yellow spots, more or less arranged in transverse rows; pectoral fins translucent, a diffuse orange-brown band across base, elongate dark brown spot at base of third to fifth rays, and small brilliant white spot at base of uppermost ray.

The live male in Fig. 8 C is generally similar to the holotype except with mid-lateral row of 5–6 rectangular brown blotches consisting of larger, darker blotches alternating with much smaller, lighter blotches; dorsal and ventral edges of previously mentioned blotches in contact with pair of thin brownish stripes, extending from inner pectoral-fin base to caudal-fin base.

Color of live female paratype (Fig. 8 B & D). Head and body generally similar to male with following exceptions: no orange-brown bars on ventral body, instead a large dark brown blotch on middle of side below first dorsal fin with 4–5 narrow dark brown bands extending from lower edge across belly, followed by alternating large and small rectangular markings in contact with pair of thin brown stripes as described above for male paratype; fins generally translucent greyish; first dorsal fin with three rows of large brown spots and prominent black blotch near margin between fourth and fifth rays; anterior margin of first dorsal fin with pair of narrow brown markings; second dorsal fin; with two rows of large brown spots and broad, brown outer margin; anal fin with thin brown stripe across middle portion; caudal fin with dusky brown dorsal and ventral margins, and dusky brown stripe along middle of fin; pelvic fins dusky brown with three, narrow, diagonal black blotches along middle of rays on each side of fin; pectoral fins translucent yellowish, a diffuse orange-brown band across base, dark brown spot on upper base, and small brilliant white spot at base of uppermost ray.

Color in alcohol. (Figs. 6 & 9) Generally light grey with brown markings as described in live color pattern; preserved holotype with mid-lateral row of alternating large and small rectangular brown blotches as described above for male paratype; fins of male paratypes generally translucent except black marking (Fig. 9 B) on posterior anal fin clearly evident and ventral margin of caudal fin slightly dusky brownish; brown markings on head and body of female paratype as described above for live coloration; fins with brown to blackish markings as shown in Fig. 9 A.

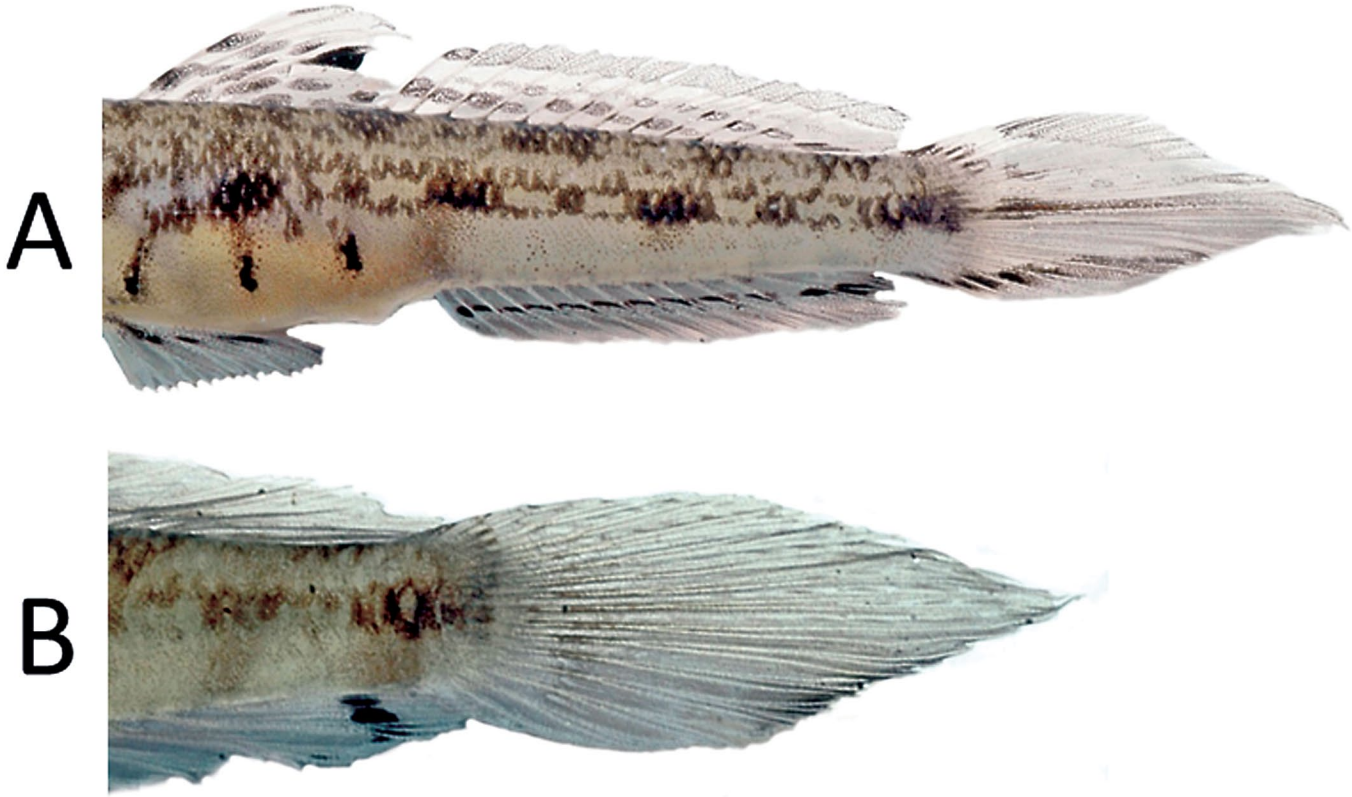

Figure 9. *Tomiyamichthys zonatus*, details of fin coloration in preserved specimens: A) female paratype; and B) male holotype (G.R. Allen).

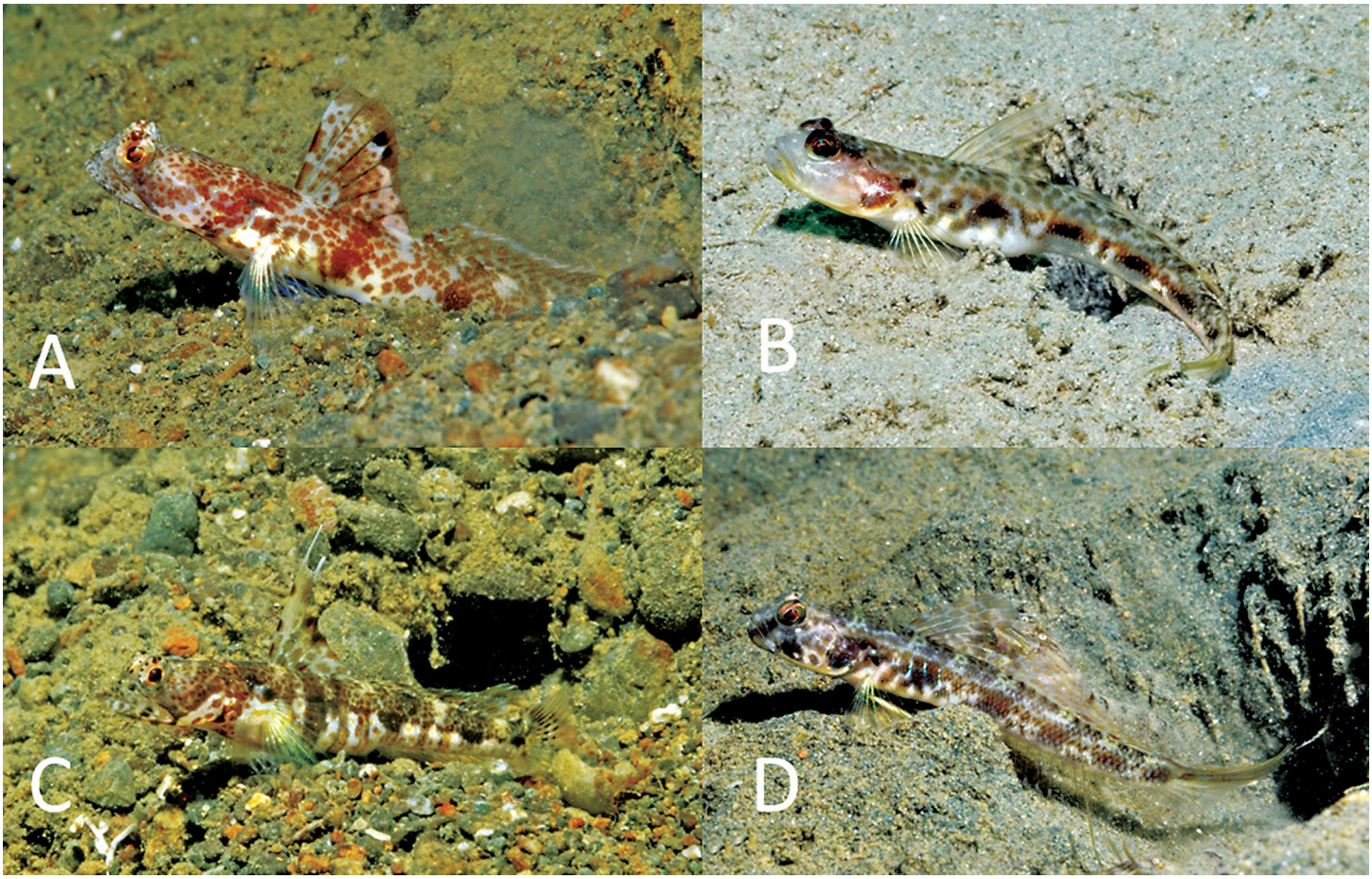

Figure 10. Underwater photographs of selected *Tomiyamichthys* species: A) *T. oni*, about 40 mm SL, Alotau, Papua New Guinea; B) *T. tanyspilus*, about 35 mm, Timor Leste; C) *T. alleni*, about 30 mm SL, Alotau, Papua New Guinea; and D) *T. lanceolatus*, about 35 mm SL (G.R. Allen).

Distribution and habitat. The new species is known only from the type locality near the town of Alotau in Milne Bay Province, Papua New Guinea. It was observed and collected in 11–15 m on moderately sloped (about 20 degrees) mixed substratum composed of mud, sand, and gravel. Five individuals were observed, including three solitary fish and a mixed sex pair (male holotype and female paratype) that shared the same burrow (Fig. 7 B). The fish were invariably associated with an unidentified alpheid shrimp.

Etymology. This species is is named *zonatus* (Latin: belted or girdled) in reference to the diagnostic brown bars on the ventral body of males.

Comparisons. In addition to the species described herein, the Indo-Pacific genus *Tomiyamichthys* contains the following 12 described species: *T. alleni* Iwata, Ohnishi & Hirata 2000, *T. dorsostigma* Bogorodsky *et al*. 2011, *T. fourmanoiri* (Smith 1956), *T. gomezi* Allen & Erdmann 2012, *T. lanceolatus* (Yanagisawa 1978), *T. latruncularius* (Klausewitz 1974), *T. nudus* Allen & Erdmann 2012, *T. oni* Tomiyama 1936, *T. praealta* (Lachner & McKinney 1981), *T. russus* (Cantor 1849), *T. smithi* (Chen & Fang 2003), and *T. tanyspilus* Randall & Chen 2007. All except *T. dorsostigma*, *T. fourmanoiri*, and *T. latruncularius* of the western Indian Ocean and Red Sea occur in the East Indian Region, although the last mentioned species also ranges to Indonesia. The genus has not been comprehensively reviewed, but useful references include Iwata *et al*. 2000, Randall & Chen 2007, and Allen & Erdmann 2012. The latter two publications and Shibukawa *et al*. (2005) are followed here in recognizing *Flabelligobius* Smith 1956 as a junior synonym of *Tomiyamichthys*.

The new species is separable from most currently recognized *Tomiyamichthys* by the combination of 11 soft dorsal and anal-fin rays, 17 pectoral-fin rays, 52–54 longitudinal scales, and the presence of both ctenoid and cycloid scales. Most species have either 10 or 12 soft dorsal-fin rays. Only *T. oni* (western Pacific) and *T. tanyspilus* (eastern Indonesia) share the count of 11 soft dorsal-fin rays. However, both of these species (Fig. 10 A & B) differ from *T. zonatus* in having much smaller scales, 74–91 in a longitudinal row, and by the absence of ctenoid

scales (present on the posterior half of the body in *T. zonatus*). The presence of a preopercular sensory canal and associated pores further distinguishes *T. oni* from *T. zonatus*. The color pattern of the new species is also highly diagnostic, particularly the male pattern of orange-brown bars on the lower half of the body in combination with a mid-lateral row of rectangular blotches within a pair of thin stripes, extending from the pectoral fin to the caudal-fin base. The last-mentioned feature is reminiscent of very similar markings (Fig. 11) occurring in non-shrimp-associated gobiids belonging to several genera including *Acentrogobius* Bleeker, *Ancistrogobius* Shibukawa *et al*., *Gladiogobius* Herre, *Glossogobius* Gill, *Istigobius* Whitley, *Macrodontogobius* Herre, and *Oplopomus* Valenciennes. However, this common marking is lacking in all other shrimp gobies, although *T. tanyspilus* has a similar pattern. It was absent on the live male holotype of the new species (Fig. 8 A & B), but was immediately apparent after capture and on the preserved specimen. The black bar across the outer two anal-fin rays of males of the new species is another unique feature for *Tomiyamichthys* and other prawn-associated gobiids.

Congeneric species present at the type locality of *T. zonatus*, which might conceivably be confused with it, include *T. alleni* and *T. lanceolatus* (Fig. 10 C & D). Although both lack the unique color features of *T. zonatus* discussed above, they bear a superficial resemblance and also possess relatively few lateral scales (25–58). Males of both *T. zonatus* and *T. alleni* have orange-brown bars on the ventral body, but the latter species has two filamentous dorsal-fin spines with the first spine longest compared to four filamentous spines with the third longest in *T. zonatus*. *T. alleni* further differs in lacking ctenoid scales and having 10 dorsal and anal-fin soft rays. In addition to its different color pattern (Fig. 10 D), *T. lanceolatus* is distinguished by 12 dorsal and anal-fin soft rays.

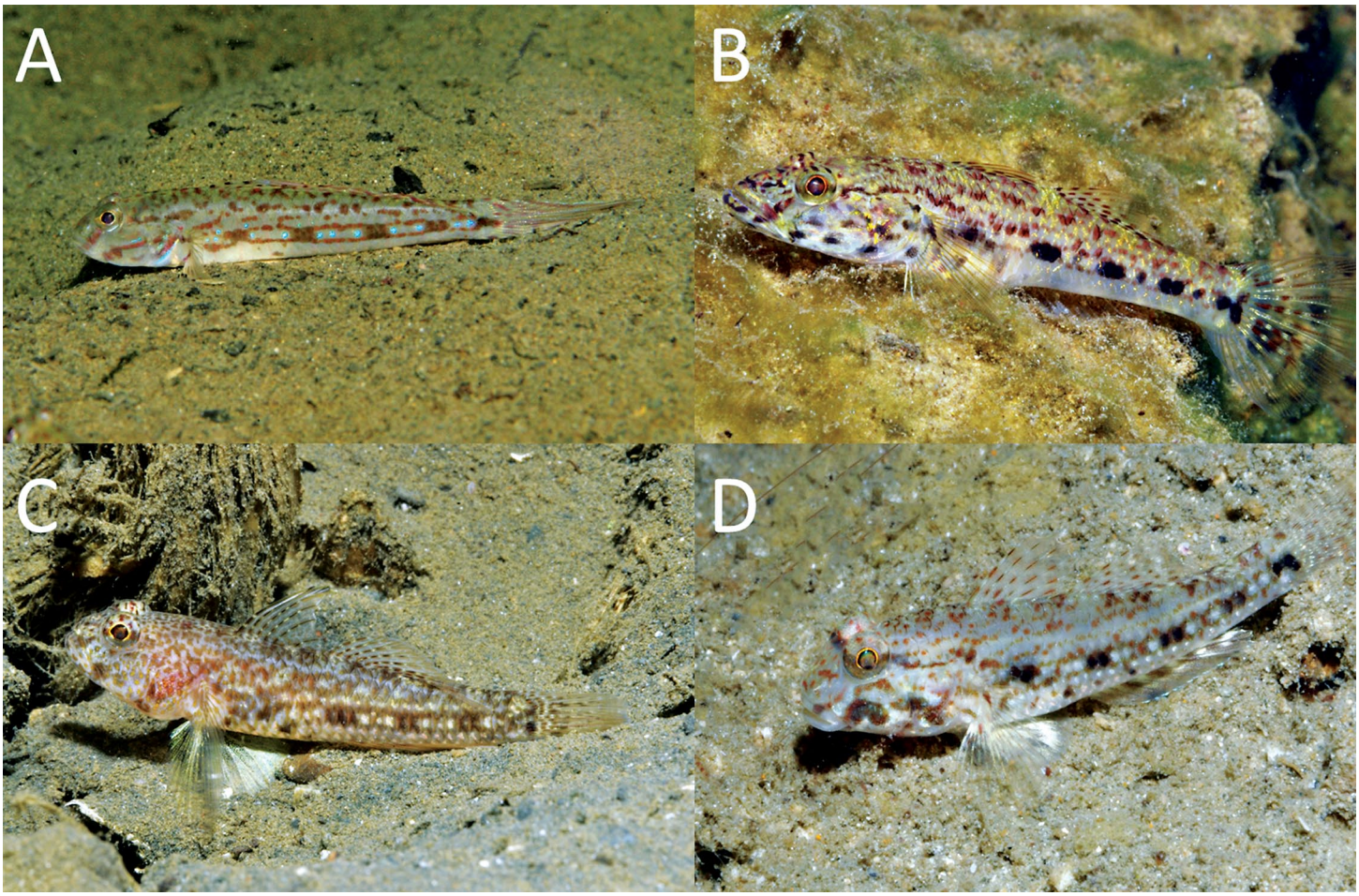

Figure 11. Underwater photographs of of selected gobiid species with colour patterns consisting of mid-lateral row of rectangular blotches within a pair of thin stripes: A) *Acentrogobius suluensis* (Herre 1927), about 40 mm SL, Raja Ampat Islands, West Papua, Indonesia; B) *Glossogobius illimis*, about 55 mm SL, Milne Bay, Papua New Guinea; C) *Ancistrogobius yoshigoui* Shibukawa *et al*. 2010, about 35 mm SL, Milne Bay, Papua New Guinea; and D) *Macrodontogobius wilburi* Herre 1936, about 40 mm SL, Milne Bay, Papua New Guinea (G.R. Allen).

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