



## ***Tomiyamichthys emilyae*, a new species of shrimpgoby (Gobiidae) from North Sulawesi, Indonesia**

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### **Abstract**

The new species of gobiid fish, *Tomiyamichthys emilyae*, is described from the Lembah Strait in North Sulawesi Province of Indonesia, on the basis of 4 specimens, 32.4–43.7 mm SL. Diagnostic features include a large sail-like first dorsal fin without filamentous rays; the bases of the dorsal fins confluent; 10 segmented dorsal and anal-fin rays; 15–17 (usually 17) pectoral-fin rays; scales entirely cycloid, 66–72 lateral and 19–21 transverse scales, no prepectoral or prepelvic scales; the anterior nostril sheathed in an elongate, partially enclosed tube; and a cephalic sensory-canal pore system composed of pores B', C, D, E, F, G, M', and O'. The new species is overall brown with 10 or 11 poorly contrasted, darker-brown bars on the lateral body; a dense patch of small white spots on the dorsal surface of the head; the first dorsal fin orange or blue-grey with a mosaic of irregular, dark brown markings; the second dorsal fin yellowish to brown with blue bands or rows of dark brown spots; and the anal, caudal, and pelvic fins dark brown with blue streaks. Type specimens were collected from a gradually sloping, sand/rubble-bottom exposed to periodic strong currents in 17–23 m depth.

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

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## Introduction

The Indo-Pacific gobiid fishes of the genus *Tomiyamichthys* Smith, 1956 dwell symbiotically with alpheid snapping shrimps, occurring on sand-rubble bottoms in the vicinity of coral reefs. There are 16 currently recognized species (Fricke et al. 2019): *T. alleni* Iwata, Ohnishi & Hirata, 2000 from the Western Pacific Ocean (Japan and Bali to Fiji); *T. dorsostigma* Bogorodsky, Kovačič & Randall, 2011 from the Red Sea; *T. fourmanoiri* (Smith, 1956) from the Western Indian Ocean; *T. gomezi* Allen & Erdmann, 2012 from the Philippines and Indonesia; *T. lanceolatus* (Yanagisawa, 1978) from the Western Pacific (Japan, Philippines, Indonesia, New Guinea, and Guam); *T. latruncularius* (Klausewitz, 1974) from the Red Sea to the Western Pacific (Indonesia, New Guinea, and Great Barrier Reef); *T. levisquama* Hoese, Shibukawa & Johnson, 2016 from northern Australia; *T. nudus* Allen & Erdmann, 2012 from Brunei, Malaysia, Indonesia, and New Guinea; *T. oni* (Tomiyama, 1936) from the Western Pacific (Japan to Andaman Sea and eastward to New Caledonia); *T. praealtus* (Lachner & McKinny, 1980) from Seychelles; *T. reticulatus* Greenfield, 2017 from Fiji; *T. russus* (Cantor, 1849) from the Eastern Indian Ocean and Western Pacific; *T. smithi* Chen & Fang, 2003 from Japan, Taiwan, Sabah and Papua New Guinea; *T. stuarti* Allen, Erdmann & Brooks, 2018 from Papua New Guinea; *T. tanyspilus* Randall & Chen, 2007 from Indonesia and New Guinea; and *T. zonatus* Allen, 2015 from Papua New Guinea. Eleven species from the East Indies region (Andaman Sea to Solomon Islands), including two undescribed species, were diagnosed and illustrated in color by Allen & Erdmann (2012). Hoese et al. (2016) provided valuable data for differentiating the various species on the basis of fin-ray counts, cephalic sensory-canal pore patterns, and scalation.

The present paper describes a new species that we recently collected at Lembah Strait near the extreme northern tip of Sulawesi, Indonesia. It was previously illustrated with underwater photographs from Japan and Kalimantan and Bali in Indonesia (Kuitert & Tonozuka 2001, Senou et al. 2004, Allen & Erdmann 2012) and also observed and photographed by us on several earlier visits to North Sulawesi. The combination of its dark brown coloration, enlarged anterior nostrils, and spectacular sail-like first dorsal fin are distinctive features that readily distinguish it from congeners, as well as all other shrimp-associated gobiids.

## Materials and Methods

Type specimens are deposited at the Museum Zoologicum Bogoriense, Cibinong, Java, Indonesia (MZB) and the Western Australian Museum, Perth, 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 pelvic fins and the origin of the anal fin, and body width at the origin of the pectoral fins; head length 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 is from the same anterior point to the posterior end of the maxilla; cheek depth is the least distance between the ventral edge of the preoperculum and the lower edge of the eye; 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.

The count of scales in longitudinal series is made from above the dorsal end of the gill opening to the base of the caudal fin; scales in transverse series are counted from the origin of the anal fin upwards and backwards 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.

Counts and measurements in the description are given for the holotype followed by the paratypes in parentheses if different. Proportional measurements expressed as percentage of the standard length is presented in Table 1.

Terminology and abbreviations for cephalic sensory-canal pores follows Akihito (1984, 1993).

*Tomiyamichthys emilyae*, n. sp.

Emily's Shrimpgoby

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Figures 1–6; Tables 1–3.

**Holotype.** MZB 25114, female, 43.7 mm SL, Indonesia, North Sulawesi Province, Lembeh Strait off southwestern Lembeh Island, 1.43238°, 125.18585°, 23–25 m, clove oil, M.V. Erdmann & G.R. Allen, 22 August 2019.

**Paratypes.** MZB 25115, male, 32.4 mm SL; WAM P.35015-001, females, 39.1–40.5 mm SL, collected with holotype.

**Diagnosis.** A species of *Tomiyamichthys* with the following combination of characters: first dorsal fin enlarged and sail-like without filamentous rays; dorsal fin bases confluent; segmented dorsal-fin and anal-fin rays 10; pectoral-fin rays 15–17; caudal fin ovate, longer than head length, 2.5–3.0 in SL; gill opening extending forward to level of middle of opercle; anterior nostril sheathed in elongate, partially enclosed tube; scales entirely cycloid, lateral scales 66–72, transverse scales 19–21; cephalic sensory-canal system including pores B', C, D, E, F, G, M', and O'; overall brown with 10 or 11 poorly contrasted, darker-brown bars on lateral body; a dense patch of small white spots on dorsal surface of head; first dorsal fin orange or blue-grey with a mosaic of irregular, dark brown markings; second dorsal fin yellowish to brown with blue bands or rows of dark brown spots; anal, caudal, and pelvic fins dark brown with blue streaks.



**Figure 1.** *Tomiyamichthys emilyae*, preserved female holotype, MZB 25114, 43.7 mm SL, Lembeh Strait, North Sulawesi Province, Indonesia (G.R. Allen).





**Figure 2.** *Tomiyamichthys emilyae*, underwater photograph of female holotype, MZB 25114, 43.7 mm SL, Lembah Strait, North Sulawesi Province, Indonesia (D. Seifert).

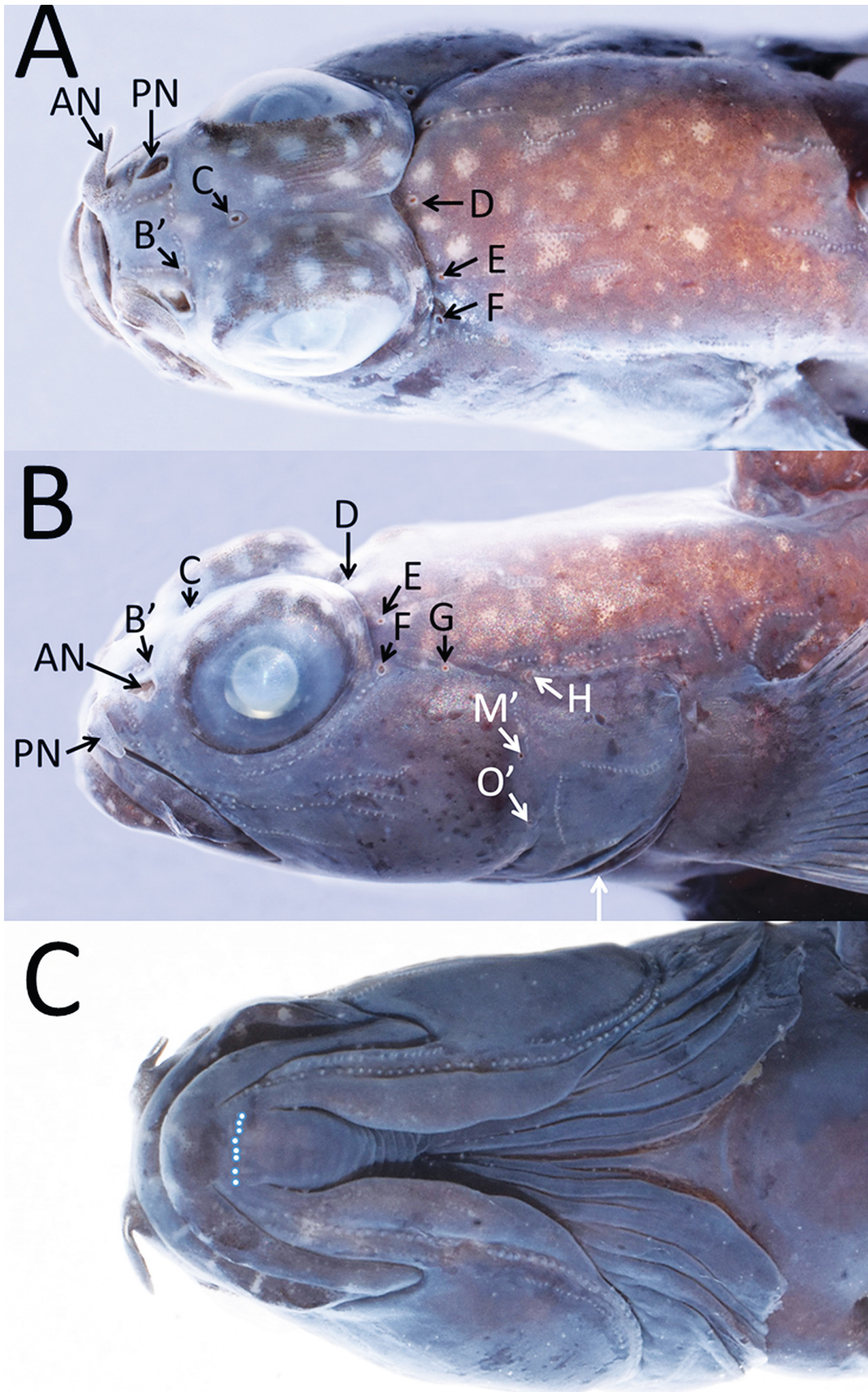
**Description.** Dorsal-fin elements VI+I,10, dorsal fin bases confluent, first dorsal fin enlarged and sail-like without filamentous rays; anal-fin elements I,10, all segmented dorsal- and anal-fin rays branched, last to base; pectoral-fin rays 17/15 (17 except 16 on one side of largest paratype), all rays branched; pelvic-fin rays I,5, first soft ray with 3 branch points, second and third rays with 4 branch points and fourth and fifth rays with 5 branch points; pelvic fins joined medially with membrane and frenum present; segmented caudal-fin rays 13 (14 in one paratype), upper and lower unsegmented rays 5 (4–5); lateral scales 69 (66–72); transverse scale rows 21 (19–21); circumpeduncular scales 28 (23–32); predorsal, prepelvic, and prepectoral scales absent; gill rakers on first branchial arch 1+6; total vertebrae 26.

Body elongate, depth at pelvic-fin origin 5.8 (5.7–5.8) in SL; compressed, width at pectoral-fin origin 1.3 (1.2–1.3) in body depth; head length 4.2 (3.6–3.8) in SL; head compressed, width 1.4 (1.1–1.3) in body depth at pelvic-fin origin; snout short, length 3.8 (4.1–5.1) in HL; orbit diameter 3.0 (3.2–3.5) in HL; interorbital extremely narrow, eye of each side in contact; caudal-peduncle depth 2.4 (2.6–2.9) in HL; caudal-peduncle length 1.3 (1.3–1.5) in HL.

Mouth terminal, oblique, and large, forming an angle of about 30° to horizontal axis of body, reaching vertical near middle of pupil; upper-jaw length 2.3 (2.4–2.6) in HL; upper jaw with several rows of conical teeth, about 15 teeth on each side, outer row generally larger, more elongate, and slightly incurved, progressively larger and more widely spaced towards front of jaw; lower jaw with several rows of conical teeth, including three pairs of enlarged, recurved, well-spaced teeth at front of jaw; no teeth on vomer or palatines; edge of lips smooth; tongue tip broadly rounded; no distinct mental flap. Gill opening extending forward to level of middle of opercle; gill membranes attached only anteriorly to isthmus, with no free fold; gill rakers poorly developed, first arch with 7 small rakers.

Posterior nostril a large oval aperture in front of center of eye; anterior nostril forming a membranous tube,





**Figure 3.** *Tomiyamichthys emilyae*, preserved holotype, MZB 25114, 43.7 mm SL: dorsal (A), lateral (B) and ventral (C) view of head showing sensory papillae and pores (capital letters); anterior and posterior nasal openings indicated by AN and PN respectively; white arrow at ventral edge of B shows level of gill attachment; transverse row of papillae across chin shown as white dots in C (G.R. Allen).

TABLE 1

Proportional measurements of type specimens of  
*Tomiyamichthys emilyae*, n. sp. as percentages of the standard length

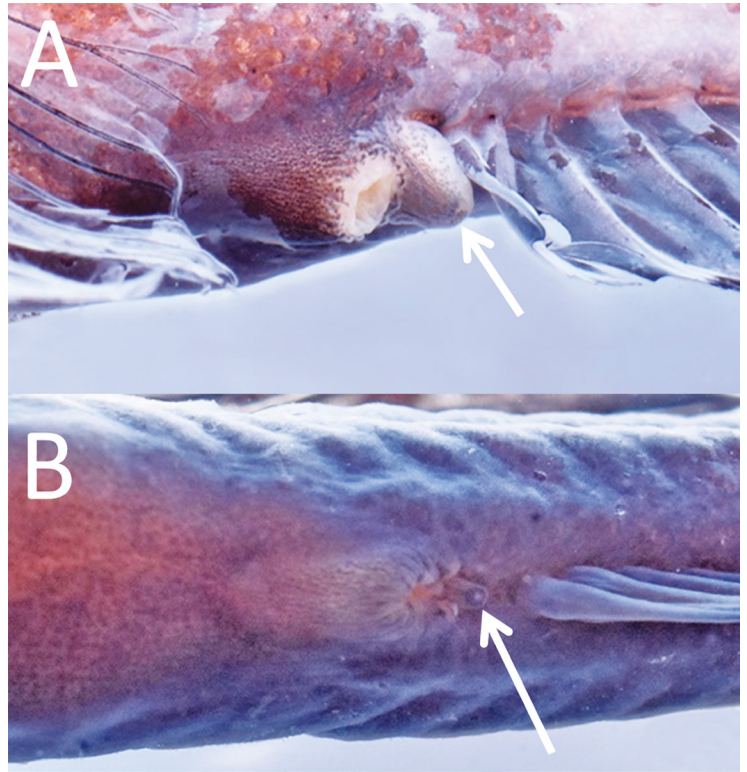
	holotype	paratypes		
	MZB 25114	WAM P.35015 -001	WAM P.35015 -001	MZB 25115
	female	female	female	male
Standard length (mm)	43.7	40.5	39.1	32.4
Body depth (P2 origin)	17.3	17.2	17.2	17.7
Body depth (A origin)	14.7	15.8	15.7	14.9
Body width	13.5	14.1	12.9	14.3
Head length	23.6	26.2	26.8	27.9
Head width	12.4	14.7	13.4	15.5
Snout length	6.2	6.4	5.7	5.5
Orbit diameter	7.8	8.1	7.7	8.8
Cheek depth	8.7	8.8	8.6	9.2
Upper-jaw length	10.2	10.6	10.3	11.5
Caudal-peduncle depth	9.9	10.0	10.4	9.7
Caudal-peduncle length	18.5	17.7	20.3	18.9
Predorsal length	28.5	29.2	28.0	28.9
Preanal length	60.7	60.7	57.8	60.7
Prepelvic length	26.2	27.3	30.0	29.6
Base of dorsal fins	57.3	56.9	58.6	59.0
First dorsal-fin spine	32.0	30.5	31.7	29.0
Third dorsal-fin spine	38.1	34.0	41.4	39.0
Fourth dorsal-fin spine	43.9	41.5	44.9	41.2
Spine of second dorsal fin	10.0	9.3	12.5	13.5
Longest dorsal-fin ray	23.3	23.4	24.3	28.1
Base of anal fin	24.9	24.6	26.2	26.6
Anal-fin spine	6.5	6.4	6.0	7.6
Longest anal-fin ray	22.6	19.7	23.7	28.6
Caudal-fin length	36.9	33.3	35.0	39.9
Pectoral-fin length	29.4	31.1	29.9	32.4
Pelvic-spine length	7.5	7.0	6.3	7.1
Pelvic-fin length	28.3	27.6	damaged	damaged



anteroventral to posterior nostril and just above edge of upper lip, with an elongate anterodorsal flap, nostril length (tube and flap) 1.9 (1.3–1.9) in snout length. Cephalic pores and papillae rows as illustrated in Fig. 2, pores composed of B', C, D, E, F, G, M', and O'.

Scales entirely cycloid, progressively larger posteriorly; scales absent on head, pectoral-fin base, prepelvic area, and anterior portion of abdomen; no scales on fins except about three rows at base of caudal fin, smaller than last row on caudal peduncle.

First dorsal fin large and sail-like without filamentous rays, its origin slightly behind rear base of pelvic fins and membrane behind last spine confluent with base of second dorsal fin; predorsal length 3.5 (3.4–3.6) in SL; dorsal-fin spines slender and flexible, first dorsal-fin spine 3.1 (3.2–3.4) in SL; fourth dorsal-fin spine longest, 2.3 (2.2–2.4) in SL; spine of second dorsal fin 2.4 (2.1–2.8) in HL; penultimate dorsal-fin soft ray longest, 1.0 (1.0–1.1) in HL; origin of anal fin below base of second dorsal-fin soft ray, preanal length 1.6 (1.6–1.7) in SL; anal-fin spine 3.7 (4.1) in HL; penultimate anal-fin soft ray longest, 1.0 (1.0–1.3) in HL; caudal fin ovate, longer than HL, 2.7



**Figure 4.** *Tomiyamichthys emilyae*, genital papillae of female holotype (A) and male paratype (B) (G.R. Allen).



**Figure 5.** *Tomiyamichthys emilyae*, underwater photo of male, approx. 35 mm SL, Lembah Strait, North Sulawesi Province, Indonesia (D. Seifert).





**Figure 6.** *Tomiyamichthys emilyae*, underwater photo of male, approx. 35 mm SL, Lembah Strait, North Sulawesi Province, Indonesia (G.R. Allen).

(2.5–3.0) in SL; pectoral fins rounded, middle rays longest, reaching to level of base of first dorsal-fin soft ray, 3.4 (3.1–3.3) in SL; prepelvic length 3.8 (3.3–3.7) in SL; adpressed pelvic-fin tips reaching nearly to anus, length of pelvic fin 3.5 (3.6 and damaged in two other paratypes) in SL; pelvic-fin spine about 25% length of longest pelvic-fin ray; pelvic frenum moderately thickened, membrane nearly reaching tip of pelvic-fin spines.

The sexes are distinguished by the color in life and the pattern of spotting of the first dorsal fin as well as the shape of the genital papillae. The mature female has a relatively large rounded barrel-shaped papilla compared with the smaller, more flattened papilla of the male (Fig. 4).

**Color in life.** (Figs. 2, 5 & 6) Head and body generally dark brown except for 10–12 inconspicuous, narrow, lighter-brown bars on side from just behind pectoral-fin base to caudal peduncle, and whitish to pale grey patch dorsally on head with a highly variable number of small white spots on pale patch, snout, nape, side of head, pectoral-fin base, and anteriormost body; white spots (sometimes orange) on side of head and anterior body often faint or absent, but can be quickly intensified; lips brown to pale orange with small white spots; dorsal surface of elongate anterior nostril tube pale grey to white; iris of eye orange-brown with fine white speckling and white spots on dorsal scleral surface; first dorsal fin of female pale grey with leopard-like pattern of brown spots (Fig. 2), first dorsal fin of male pale grey grading to orange, sometimes mainly orange or yellow with a pattern of similar dark spots (Figs. 5 & 6); second dorsal fin with 3 or 4 alternating rows of large, dark-brown spots (often coalesced) and much narrower pale grey bands, and with a relatively narrow outer margin of orange (female) or orangish brown (male); caudal fin mainly dark brown with bright blue streak between each ray on ventral two-thirds, upper third with scattered, large dark-brown and small blue spots, with an orange outer margin; anal and pelvic fins dark brown with a bright blue streak between each ray; pectoral fin variably pigmented, some individuals with entirely transparent membranes and well-contrasted dark fin rays, others mainly dark brown on distal half of fin and transparent on outer portion with well-contrasted dark-brown rays.



**Color in preservative.** (Figs. 1 & 3) Head and body generally dark brown except lighter brown with white spotting on dorsal surface of head and small whitish spots on lips; first dorsal fin brown with darker leopard-like spot pattern; second dorsal fin brown with about 7 oblique rows of large dark-brown spots; caudal fin mainly dark brown, except dorsalmost portion lighter brown with several large dark-brown spots; anal fin and pelvic fins dark brown; pectoral fins dark brown basally and translucent on distal half with well-contrasted dark-brown rays.

**Etymology.** It is a pleasure to name this magnificently ornamented new species in honour of Canadian diver Emily Irving, who has accompanied and assisted the authors on numerous ichthyological expeditions and is a dedicated supporter of marine conservation and exploration efforts worldwide.

**Distribution and habitat.** In addition to the type locality, the new species is currently known on the basis of underwater photographs from several locations in the western Pacific Ocean, including Indonesia (Bali and northeastern Kalimantan) and the Philippines (Mindoro). It was also reported and illustrated as *Flabelligobius* species A from the Ryukyu Islands of Japan (Ryukyu Islands) by Senou et al. (2004). The type locality, situated in Lembeh Strait at the northern extremity of Sulawesi, is exposed to periodic strong currents and cool upwelled water. Sea temperatures at the time of collection during August 2019 ranged from 23–25°. The 4 type specimens and 4 additional individuals were observed in 17–23 m depth on gradually sloping, sand-rubble bottoms. Pairs or solitary individuals shared burrows with the brightly colored alpheid shrimp *Alpheus randalli* Banner & Banner, 1980 (Fig. 2).

**Comparisons.** The new species is easily distinguished from congeners and all other shrimp-associated gobies on the basis of its unique coloration as well as the exceptionally tall and sail-like dorsal fin that lacks filamentous rays. The exaggerated elongate anterior nostril is a diagnostic feature that is shared by only a few other members of the genus, including *T. fourmanoir* from the western Indian Ocean and *T. nudus* and *T. smithi* from the western Pacific. The latter two species have ranges that overlap that of *T. emilyae*, but are easily distinguished on the basis of color pattern and by having filamentous extensions of one or more first dorsal-fin rays (Figs. 7 & 8). Other diagnostic features for members of *Tomiyamichthys* are compared in Tables 1 and 2.



**Figure 7.** *Tomiyamichthys nudus*, underwater photograph, approx. 35 mm SL, Brunei (G.R. Allen).





**Figure 8.** *Tomiyamichthys smithi*, underwater photo, approx. 45 mm SL, Normanby Island, Milne Bay Province, Papua New Guinea (G.R. Allen).

TABLE 2

Fin ray and scale counts for species of *Tomiyamichthys*, adapted from Hoese et al. (2016) and Allen et al. (2018)

Species	Second dorsal fin	Anal fin	Pectoral fin	Lateral scales	Transverse scales
<i>T. alleni</i>	I,10	I,10	15–17	25–50	7–10
<i>T. dorsostigma</i>	I,12	I,12	17	120–125	27
<i>T. fourmanoiri</i>	I,12	I,12	16	77	24
<i>T. emilyae</i>	I,10	I,10	15–17	66–72	19–21
<i>T. gomezi</i>	I,10	I,10	15	47–56	12–13
<i>T. lanceolatus</i>	I,12	I,12	16–18	54–58	16–18
<i>T. latruncularius</i>	I,9	I,9	17–18	47–49	18
<i>T. levisquama</i>	I,10	I,10	18–19	50–70	22–25
<i>T. nudus</i>	I,10	I,10	14–15	0	0
<i>T. oni</i>	I,11	I,11	17–18	83	20–22
<i>T. praealtus</i>	I,10	I,10	18	54	24
<i>T. reticulatus</i>	I,12	I,13	21	57	13
<i>T. russus</i>	I,10	I,10	17	74–95	24–27
<i>T. smithi</i>	I,12	I,12	18	93–96	25
<i>T. stuarti</i>	I,11	I,11	15	51–56	11
<i>T. tanyspilus</i>	I,12	I,12	17–18	78–80	22
<i>T. zonatus</i>	I,11	I,11	17	52–54	13–14



TABLE 3

Head pores, prepelvic scales, and posterior body scales in *Tomiyamichthys* species; number of pores given for preopercular (POP) and for other categories present (+) or absent (-), abbreviations as follows: LC tube = separate tube above operculum or pores K' and L'; LC1 = lateral canal pore above preoperculum or pore G; PO = postorbital or pore E; n = naked, ps = partly scaled (adapted from Hoese et al. 2016 and Allen et al. 2018)

Species	POP	LC tube	LCI	PO pores	Prepelvic scales	Posterior body scales
<i>T. alleni</i>	0	-	-	-	n	cycloid
<i>T. dorsostigma</i>	3	+	+	+	n	cycloid
<i>T. fourmanoiri</i>	3	+	+	+	n	cycloid
<i>T. emilyae</i>	2	-	+	+	n	cycloid
<i>T. gomezi</i>	2	-	+	+	ps	ctenoid
<i>T. lanceolatus</i>	0	-	+	+	n	ctenoid
<i>T. latruncularius</i>	3	-	-	+	n	ctenoid
<i>T. levisquama</i>	3	-	+	+	ps	cycloid
<i>T. nudus</i>	2	-	+	+/-	n	none
<i>T. oni</i>	0	-	-	+	ps	cycloid
<i>T. praealtus</i>	3	-	+	+	n	cycloid
<i>T. reticulatus</i>	0	-	-	+	n	ctenoid
<i>T. russus</i>	2 or 3	-	+	+	ps	ctenoid
<i>T. smithi</i>	3	+	+	+	n	cycloid
<i>T. stuarti</i>	0	-	+	+	n	ctenoid
<i>T. tanyspilus</i>	0	-	+	+	ps	cycloid
<i>T. zonatus</i>	0	-	+	-	n	ctenoid

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