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## Description of five new species of marine gobies (Teleostei: Gobiidae) of the genus *Grallenia* from the tropical western Pacific Ocean

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### Abstract

Five new species belonging to the gobiid fish genus *Grallenia* of the tropical western Pacific Ocean are described from sand-bottom habitats. *G. compta* n. sp. (11 specimens, 14.9–17.3 mm SL) from Milne Bay Province, Papua New Guinea and *G. rubrilineata* n. sp. (81 specimens, 8.8–15.8 mm SL) from Luzon, Philippines share a suite of features that comprises an absence of cephalic sensory-canal pores, a rectangular first dorsal fin without a filamentous extension of the first spine, and the anterior and posterior scales separated by a scaleless gap, with 15–22 longitudinal scales in the posterior series. The two species differ from each other in dorsal- and anal fin-ray counts (8–9 for *G. compta* n. sp. vs. 9–11, usually 10, for *G. rubrilineata* n. sp.), scalation patterns, and coloration. A third new species, *Grallenia dimorpha* n. sp. (34 specimens, 9.8–16.7 mm SL) from Papua New Guinea is similar, except it has a continuous series of longitudinal scales without a gap, and females possess a triangular first dorsal fin featuring a filamentous extension of the first spine. The last two species, *Grallenia lauensis* n. sp. (two females, 11.1–11.4 mm SL) and *G. solomonensis* n. sp. (three females, 11.4–12.5 mm SL), are described from Fiji and the Solomon Islands, respectively. They exhibit similar diagnostic features including the presence of cephalic sensory-canal pores, usually 7 segmented dorsal- and anal-fin rays, and most body scales restricted to the caudal peduncle. *Grallenia solomonensis* n. sp. differs from *G. lauensis* n. sp. in having several mid-lateral scales immediately behind the pectoral-fin base (vs. none), 16 (vs. 15) pectoral-fin rays, pelvic-fin rays with 2–3 branch points (vs. a single point), and a truncate (vs. slightly emarginate) caudal fin. An additional 33 non-type specimens, 7.0–15.6 mm SL, from Australia (southern Great Barrier Reef and northwestern Coral Sea) are provisionally identified as *G. lauensis* n. sp. However, at least some Australian specimens differ slightly in possessing branched segmented dorsal-fin rays and pelvic-fin rays with more than one branch point. Although fins are damaged in most specimens, two Australian males exhibit a long, filamentous first dorsal-fin spine.

**Key words:** taxonomy, systematics, ichthyology, coral-reef fishes, Indo-Pacific Ocean, Papua New Guinea, Philippines, Solomon Islands, Fiji, Australia, sand habitat

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## Introduction

The gobiid fishes of the genus *Grallenia* Shibukawa & Iwata, 2007 are among the most inconspicuous of coral reef fishes due to their tiny size (< 23 mm SL) and excellent camouflage. They generally inhabit sandy substrates and easily escape notice unless the diver swims slowly with an outstretched hand in contact with the bottom, which elicits an escape response from the nearly invisible fish. The genus is now known from Japan, Philippines, Malaysia (Sabah), Indonesia, Papua New Guinea, Solomon Islands, Fiji, and Australia. It contains three previously described species, i.e. *Grallenia arenicola* Shibukawa & Iwata, 2007 (Kashiwa-jima, Japan); *Grallenia baliensis* Allen & Erdmann, 2012 (Bali and Sulawesi, Indonesia); and *Grallenia lipi* Shibukawa & Iwata, 2007 (Ambon and West Papua, Indonesia). We describe herein five new species from Papua New Guinea, Philippines, Solomon Islands, Fiji, and Australia.

*Grallenia* is unique among gobiids in possessing a combination of 15 segmented caudal-fin rays, a greatly reduced papilla row *e*, and a pair of characteristic diagonal black markings at the base of the caudal fin (Shibukawa & Iwata 2007). The most useful features for separating the various species include the number of dorsal- and anal-fin rays, patterns of body scalation, dorsal-fin shape, and the presence or absence of cephalic sensory-canal pores and a filamentous extension of the first dorsal-fin spine.

## Materials and Methods

Type specimens are deposited at the National Museum of Natural History, Smithsonian Institution, Washington, D.C. (USNM) and the Western Australian Museum, Perth (WAM). Non-type specimens of *Grallenia* from the Australian Museum, Sydney (AMS) and the Museum and Art Gallery of the Northern Territory, Darwin (NTM) were also examined.

The range of counts and proportional measurements is indicated in parentheses when different from the holotype. 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 depth and width at the level of 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; 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 spine to the tip of the longest segmented pelvic-fin ray.

Terminology and abbreviations for cephalic pores follow those presented by Shibukawa & Iwata (2007). Cyanine blue 5R (acid blue 113) stain was used to make pores and papillae more obvious (Saruwatari *et al.* 1997, Akihito *et al.* 1993) and closer observation was assisted by use of an air jet.

Proportional measurements for the new species are presented in Tables 1–4. Counts for segmented dorsal- and anal-fin rays, pectoral fin-rays, and total longitudinal scales for all *Grallenia* species are compared in Table 5. The longitudinal scale count includes the mid-lateral row of scales beginning immediately behind the pectoral-fin base and continuing to the caudal-fin base. The body scales are composed of two parts in several species, an anterior section immediately behind the pectoral-fin base consisting of a single row of 2–5 scales, and a highly variable posterior section that usually commences behind the level of the second dorsal-fin origin or is sometimes

restricted to the caudal peduncle; transverse scales are counted between the middle of the second dorsal and anal fins, except for the much-reduced scalation of *G. solomonensis*, in which case the transverse rows on the caudal peduncle are counted; gill rakers include rudiments and are counted on the first gill arch, those on the upper limb given first and separated by a plus sign from the lower arch total.

## *Grallenia compta*, n. sp.

### Ornamented Goby

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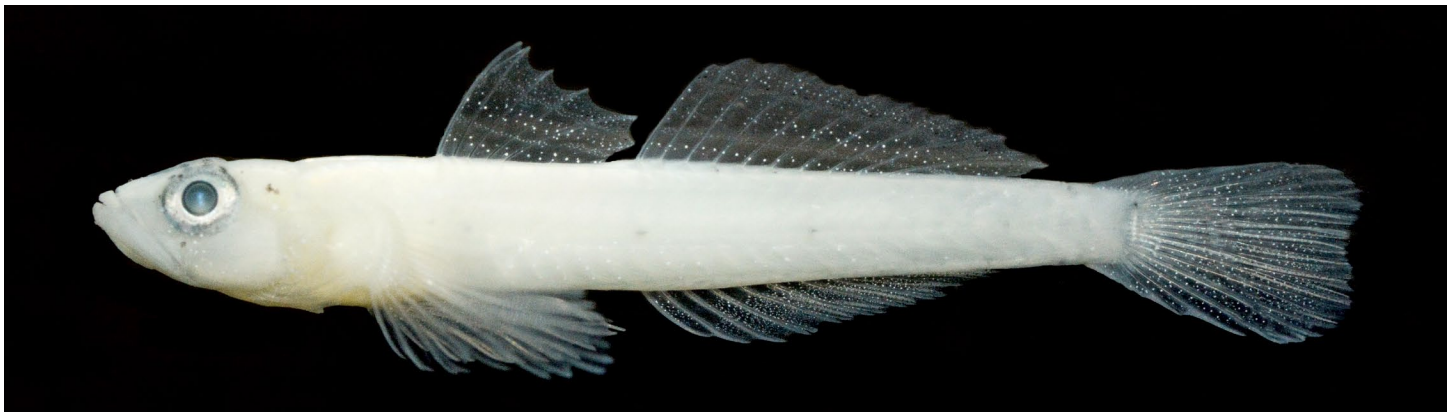
Figures 1–2, 3A, 4 & 5A; Table 1.

**Holotype.** WAM P.34656-001, male, 15.4 mm SL, Papua New Guinea, Milne Bay Province, patch reef off Sideia Island, 10° 35.772' S, 150° 46.005' E, 14 m, clove oil & handnet, M.V. Erdmann & C.S. Erdmann, 26 December 2016.

**Paratypes.** (collected with holotype) USNM 432543, 4 specimens, 14.9–16.7 mm SL; WAM P.34656-002, 6 specimens, 15.2–17.3 mm SL.

**Diagnosis.** Dorsal-fin rays VI + I,8–9; anal-fin rays I,8–9; fully erect first dorsal fin rectangular, first spine not produced into filament in either sex; head pores absent; posterior longitudinal scales 15–20, usually extending forward to about level of second dorsal-fin origin, but body anterior to level of middle of second dorsal fin mainly scaleless; body depth at pelvic-fin origin 14.0–16.4% SL; color in life translucent with scattered orange-brown to orange markings consisting of a mid-lateral row of short, horizontal, orange-brown lines; small orange spots on back, row of horizontally ovate spots on lower side; iris pinkish orange and 4–5 dark-brown spots on dorsal scleral surface of each eye; fins translucent with numerous white speckles, sometimes with a pair of orange stripes on first and second dorsal fins.

**Description.** Dorsal-fin rays VI–I,9 (8–9); anal-fin rays I,9 (8–9); most segmented dorsal-fin rays branched (last to base), except first 1 or 2 in some paratypes; most segmented anal-fin rays branched (last to base) except first 1 or 2; pectoral-fin rays 16 (2 paratypes with 15), most rays branched except 1–2 uppermost and 1–3 lowermost; pelvic-fin rays I,5, all segmented rays with 2 branch points, fifth rays completely joined medially with membrane; pelvic frenum absent; branched caudal-fin rays 11; segmented caudal-fin rays 15; upper unsegmented caudal-fin rays 8 (6–8); lower unsegmented caudal-fin rays 7 (5–7); total longitudinal scale rows 24 (20–26), consisting of 4 (4–5) anterior scales and 20 (15–19) posterior scales; gill rakers 3+7 (1–3 + 7–8); pseudobranch filaments 4; vertebrae 27 (4 specimens).



**Figure 1.** *Grallenia compta*, preserved holotype, WAM P.34656-001, male, 15.4 mm SL, Sideia Island, Milne Bay Province, Papua New Guinea (G.R. Allen).

Body elongate and slender, depth at pelvic-fin origin 7.0 (6.3–7.2) in SL; depth at anal-fin origin 7.9 (7.5–8.4) in SL; body compressed, width at pectoral-fin origin 2.2 (2.2–2.5) in HL; head length 3.6 (3.2–4.0) in SL; head compressed, width 0.9 (0.8–1.0) in HL; snout short, much less than eye diameter, length 6.5 (5.0–6.2) in HL; eye diameter 3.0 (3.0–3.5) in HL; interorbital very narrow, eyes nearly in contact with each other; caudal-peduncle depth 3.6 (3.3–4.0) in HL; caudal-peduncle length 1.1 (1.1–1.3) in HL.

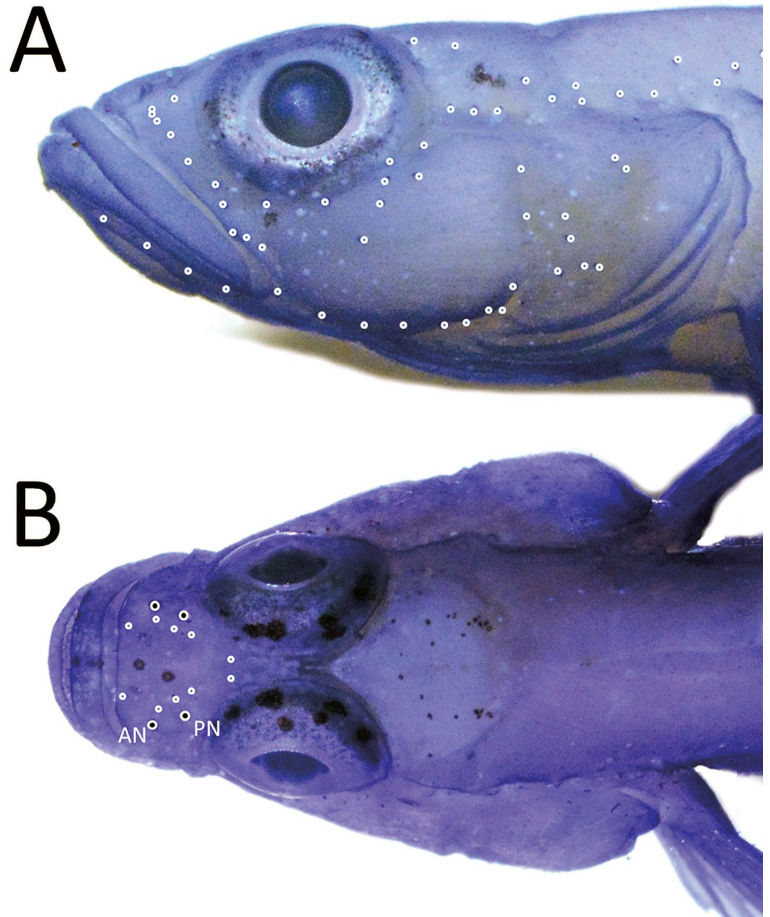
Mouth oblique, forming angle of about  $48^\circ$  to horizontal axis of body; lower jaw protruding; mouth relatively large, maxilla reaching beyond vertical at front of pupil, upper-jaw length 2.5 (2.5–2.8) in HL; teeth of jaws unicuspid, villiform, in 2–3 rows; row of 8–10 slender teeth in outer row on each side of upper jaw; lower jaw with three rows of teeth anteriorly, narrowing to single row posteriorly; pair of moderately enlarged, recurved teeth on anterolateral part of middle row; no teeth on vomer or palatine; edge of lips smooth; anterior margin of tongue concave; gill opening extending forward to level of middle of opercle.

Anterior nostril opening tubular, its distal tip not reaching to upper jaw when adpressed; posterior nostril opening with low rim, situated about midway between anterior nostril and eye; cephalic sensory-canal pores absent; pattern of head papillae as shown in Fig. 2.

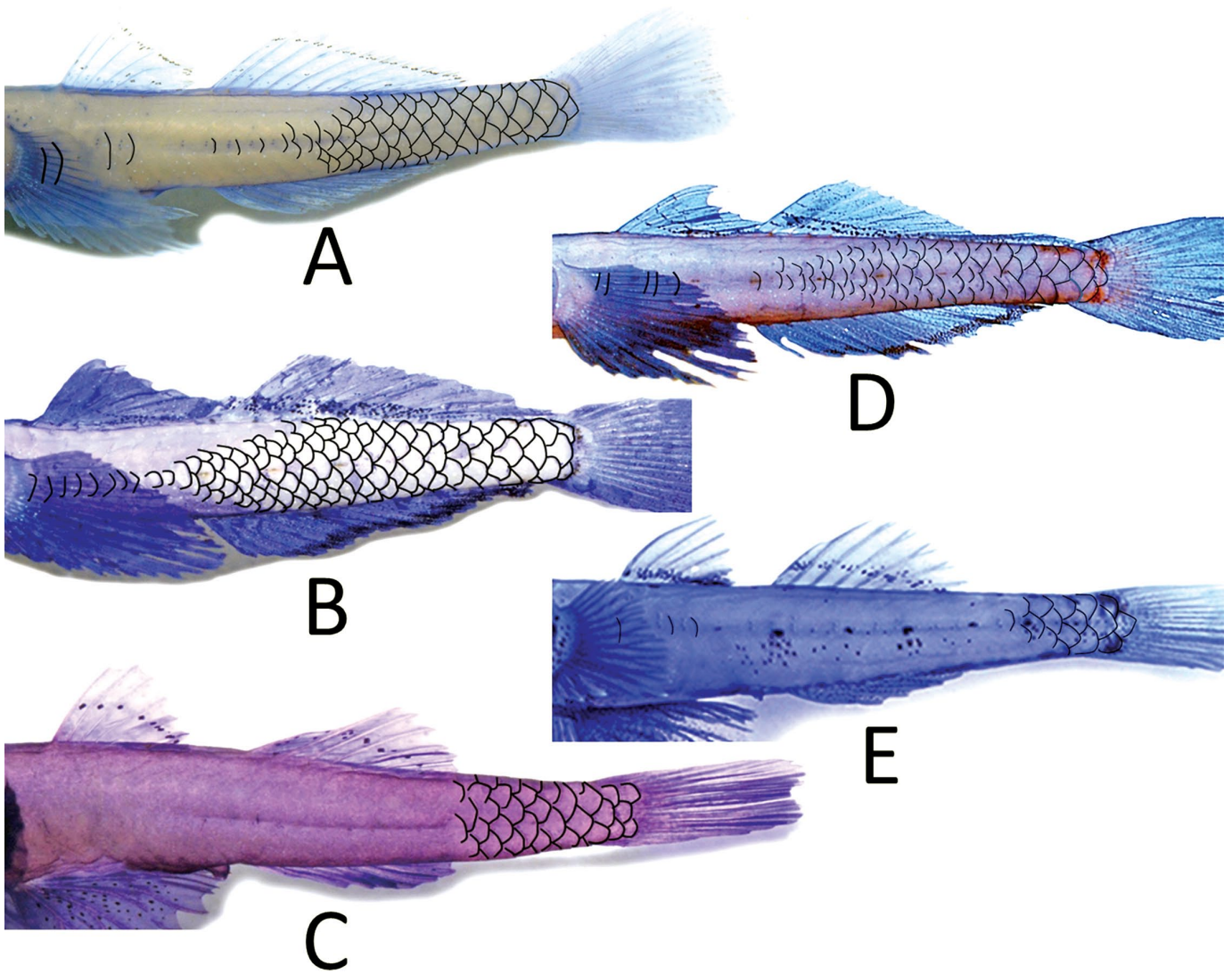
Head and most of anterior body without scales; body scales ctenoid, scale pattern as shown in Fig. 3A; anterior longitudinal scales 4 (2–5), usually consisting of two groups of 2–3 scales separated by gap behind pectoral-fin base (occasionally uninterrupted row of 5 scales); posterior longitudinal scales 20 (15–19), usually extending forward to about level of second dorsal-fin origin, body anterior to level of middle of second dorsal fin mainly scaleless; transverse scale rows between middle of second dorsal and anal fins 5 (4–6); circumpeduncular scales 8.

Origin of first dorsal fin about three-fourths eye diameter behind head, snout to first dorsal-fin origin 3.0 (2.8–3.1) in SL; dorsal-fin spines slender and flexible, first spine longest, 2.0 (1.7–2.2) in HL; snout to second dorsal-fin origin 1.9 (1.8–1.9) in SL; spine of second dorsal fin 2.7 (1.9–2.9) in HL; first 3–4 segmented dorsal-fin rays longest, 1.9 (1.7–2.1) in HL; origin of anal fin slightly behind origin of second dorsal fin, snout to anal-fin origin 1.9 (1.7–1.9) in SL; anal-fin spine 3.9 (3.0–4.3) in HL; third or fourth segmented anal-fin ray longest, 3.0 (2.4–3.3) in HL; caudal fin shorter than head with truncate to slightly emarginate posterior margin, its length 4.2 (4.0–4.7) in SL; pectoral fins pointed, middle rays longest, reaching to about origin of anal fin when adpressed, 1.1 (0.9–1.2) in HL; snout to pelvic-fin origin 3.6 (3.2–3.6) in SL; pelvic fins not reaching anal-fin origin, 1.1 (1.0–1.3) in HL.

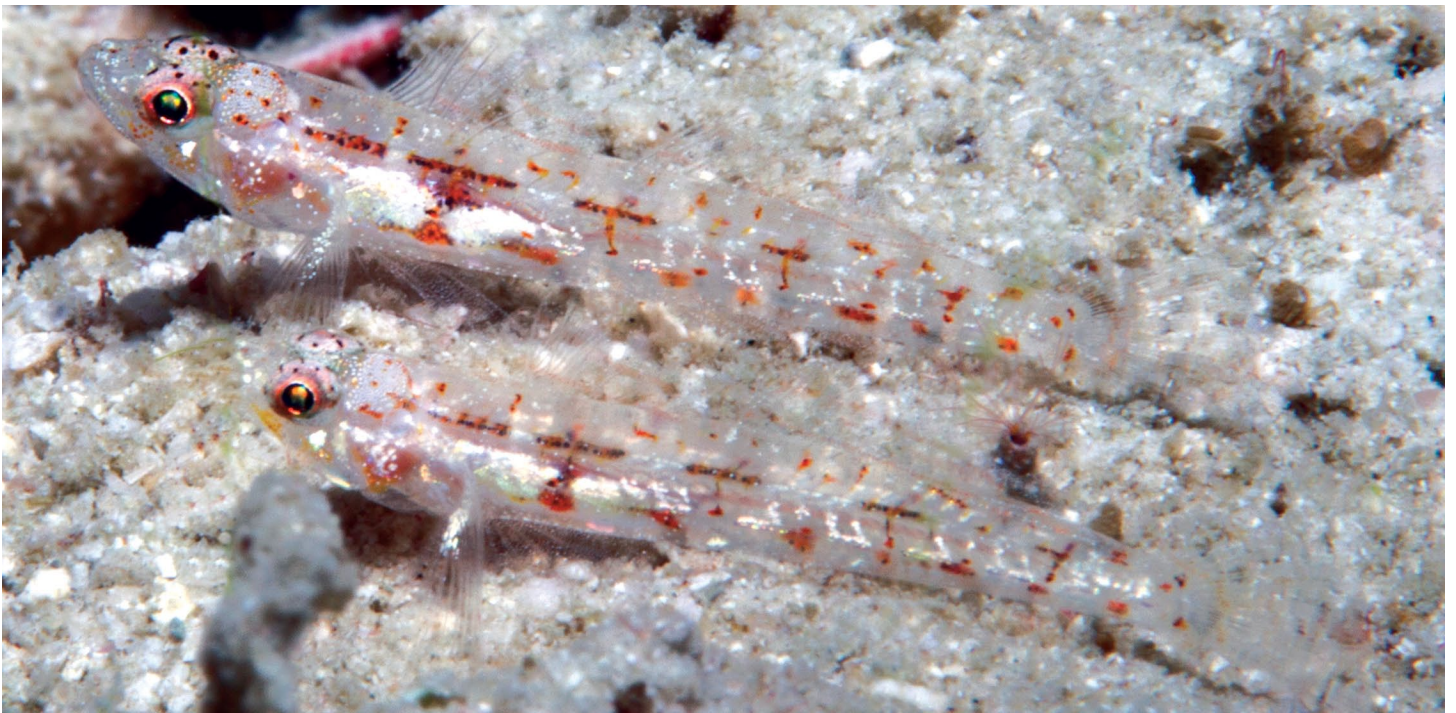
**Color in life.** (Figs. 4 & 5A) Translucent with mid-lateral row of five widely separated and progressively shorter posteriorly, horizontal, orange-brown lines with one or more narrow, vertical, orange lines intersecting ventral edge of most lines; row of irregular, small, orange-to-brown markings on upper side and row of larger, horizontally ovate, orange spots along lower side, including pair overlying white abdomen; additional orange-to-brown spot above first abdominal marking, sometimes in contact with second horizontal orange-brown line; broad white band from lower rear corner of eye to lower edge of preopercle, with equally wide orange band on either side and usually a bright white spot below rear corner of eye; orange pigmentation usually present on lateral surface of maxillary; a few small brown markings immediately behind eye; iris pinkish orange and 4–5 dark-



**Figure 2.** *Grallenia compta*, preserved holotype, pattern of head papillae, AN= anterior nostril, PN=posterior nostril (G.R. Allen).



**Figure 3.** Pattern of body scales for species of *Grallenia*: A) *G. compta*; B) *G. dimorpha*; C) *G. lauensis*; D) *G. rubilineata*; and E) *G. solomonensis*. Specimens stained with cyanine blue. (G.R. Allen).

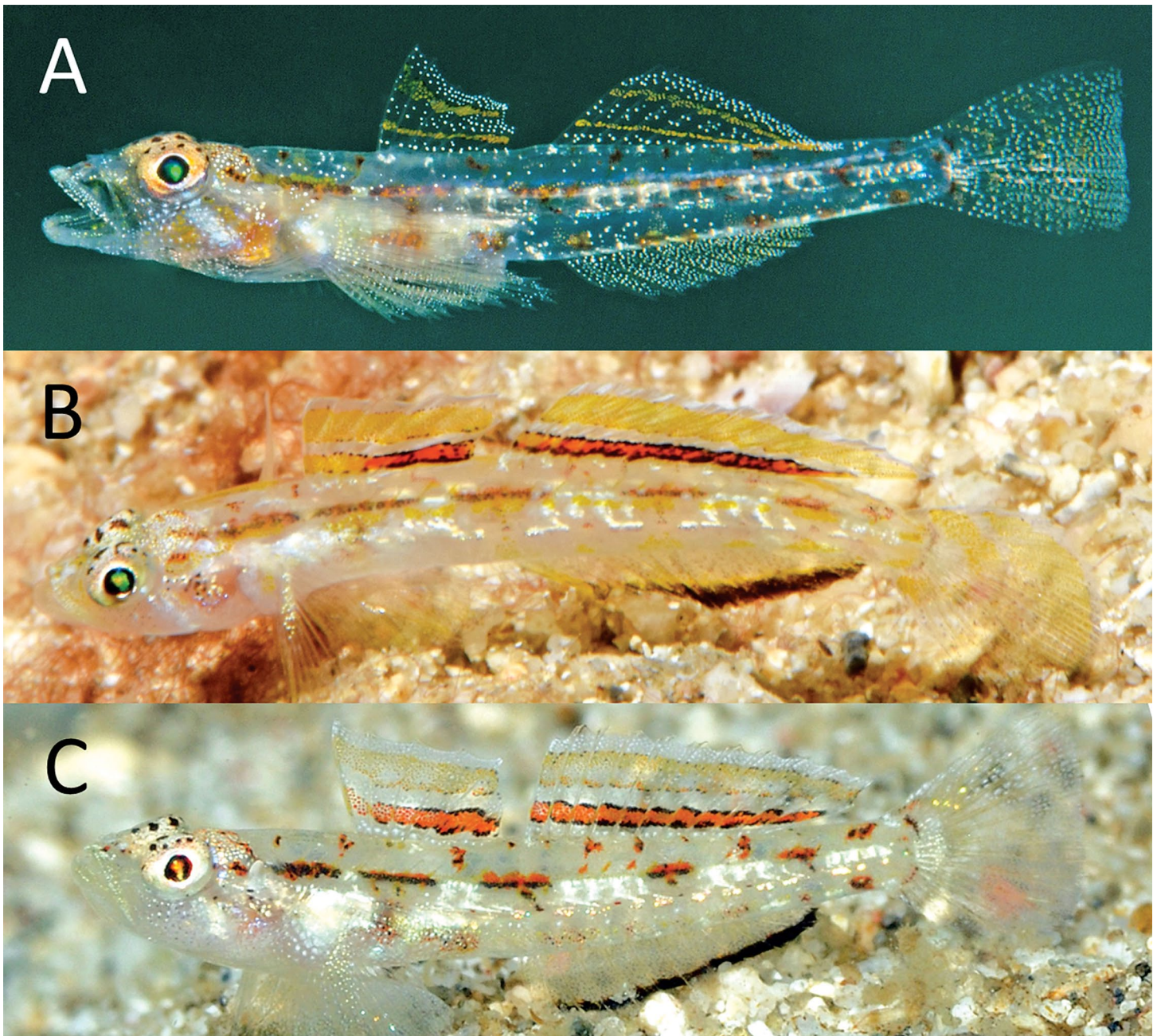


**Figure 4.** *Grallenia compta*, females, approx. 15 mm SL, underwater photograph in 14 m, Sideia Island, Milne Bay Province, Papua New Guinea (M.V. Erdmann).

TABLE 1

Proportional measurements of selected type specimens of *Grallenia compta*, n. sp.  
as percentages of the standard length

	holotype				paratypes						
	WAM P. 34656	WAM P. 34656	USNM 432543	USNM 432543	WAM P. 34656	WAM P. 34656	WAM P. 34656	WAM P. 34656	USNM 432543	USNM 432543	
Sex	male	female	female	female	female	female	female	female	male	male	male
Standard length (mm)	15.4	17.3	16.9	16.7	16.6	16.5	16.3	16.2	15.1	14.9	
Head length	27.7	27.2	27.5	28.7	27.6	27.7	27.4	25.3	27.7	28.8	
Head width	14.2	14.0	14.7	13.4	16.4	14.7	14.5	14.6	15.2	14.9	
Head depth	12.4	14.4	13.9	13.1	13.6	13.1	14.0	13.1	13.5	14.1	
Body depth (pelvic origin)	14.2	15.5	15.2	15.1	15.7	15.3	16.4	14.0	15.5	15.8	
Body depth (anal origin)	12.7	12.5	12.6	12.5	11.9	12.5	12.5	12.3	13.2	13.3	
Body width	12.4	11.5	11.3	11.4	11.3	11.8	11.6	11.4	12.5	12.9	
Caudal-peduncle depth	7.7	7.7	7.7	7.2	7.5	7.7	7.7	7.7	8.4	7.9	
Caudal-peduncle length	24.7	20.1	22.8	24.0	23.2	21.8	23.7	23.8	21.3	24.9	
Snout length	4.3	5.0	5.5	5.1	5.4	4.4	5.5	4.1	5.3	5.0	
Orbit diameter	9.1	8.8	8.8	9.3	7.8	8.5	9.2	8.2	8.5	8.9	
Upper-jaw length	11.1	10.5	11.1	10.8	11.0	10.4	11.1	9.7	10.6	11.4	
Snout to 1 <sup>st</sup> dorsal origin	33.2	32.9	32.3	33.7	33.9	32.1	34.2	32.4	32.2	33.8	
Snout to 2 <sup>nd</sup> dorsal origin	52.1	51.8	53.6	52.6	52.3	54.5	56.2	52.6	53.5	53.9	
Snout to anal-fin origin	53.4	51.4	53.9	52.2	58.4	54.6	58.2	52.7	52.6	54.5	
Snout to pelvic-fin origin	28.0	28.9	30.2	30.1	27.8	28.8	30.8	28.3	30.1	30.4	
First dorsal-fin spine length	13.7	13.6	14.0	15.9	13.9	13.7	16.5	13.4	14.3	14.3	
First spine of 2nd dorsal	10.4	11.0	11.4	12.0	12.1	11.3	12.2	13.0	11.9	10.0	
Longest soft dorsal-fin ray	15.0	13.6	14.2	15.5	13.9	13.9	13.5	14.9	15.5	14.8	
Anal-spine length	7.2	8.3	8.1	7.8	7.8	7.2	7.7	6.8	9.4	6.7	
Longest soft anal-fin ray	9.1	10.8	10.1	10.2	10.3	9.7	9.2	10.5	11.2	8.8	
Pectoral-fin length	26.0	26.9	28.4	26.9	27.2	27.2	31.6	27.8	29.1	30.6	
Pelvic-fin length	24.7	24.2	23.7	23.4	24.7	23.0	24.2	24.8	24.4	24.8	
Caudal-fin length	23.8	22.5	21.3	21.3	24.1	21.2	23.7	24.8	24.4	23.8	



**Figure 5.** Adult males of species of *Grallenia*: A) *G. compta*; B) *G. dimorpha*; C) *G. rubrilineata* (G.R. Allen & M.V. Erdmann).

brown spots on dorsal scleral surface of each eye; fins generally translucent, but freshly captured anesthetized specimens (Fig. 5A) with a pair of orange stripes on first and second dorsal fins, scattered orange markings on caudal fin, and a pair of small brown-to-orange spots at base of caudal fin; bright white speckling scattered on head and body, especially concentrated on fins, lips, cheek, and post-interorbital nape.

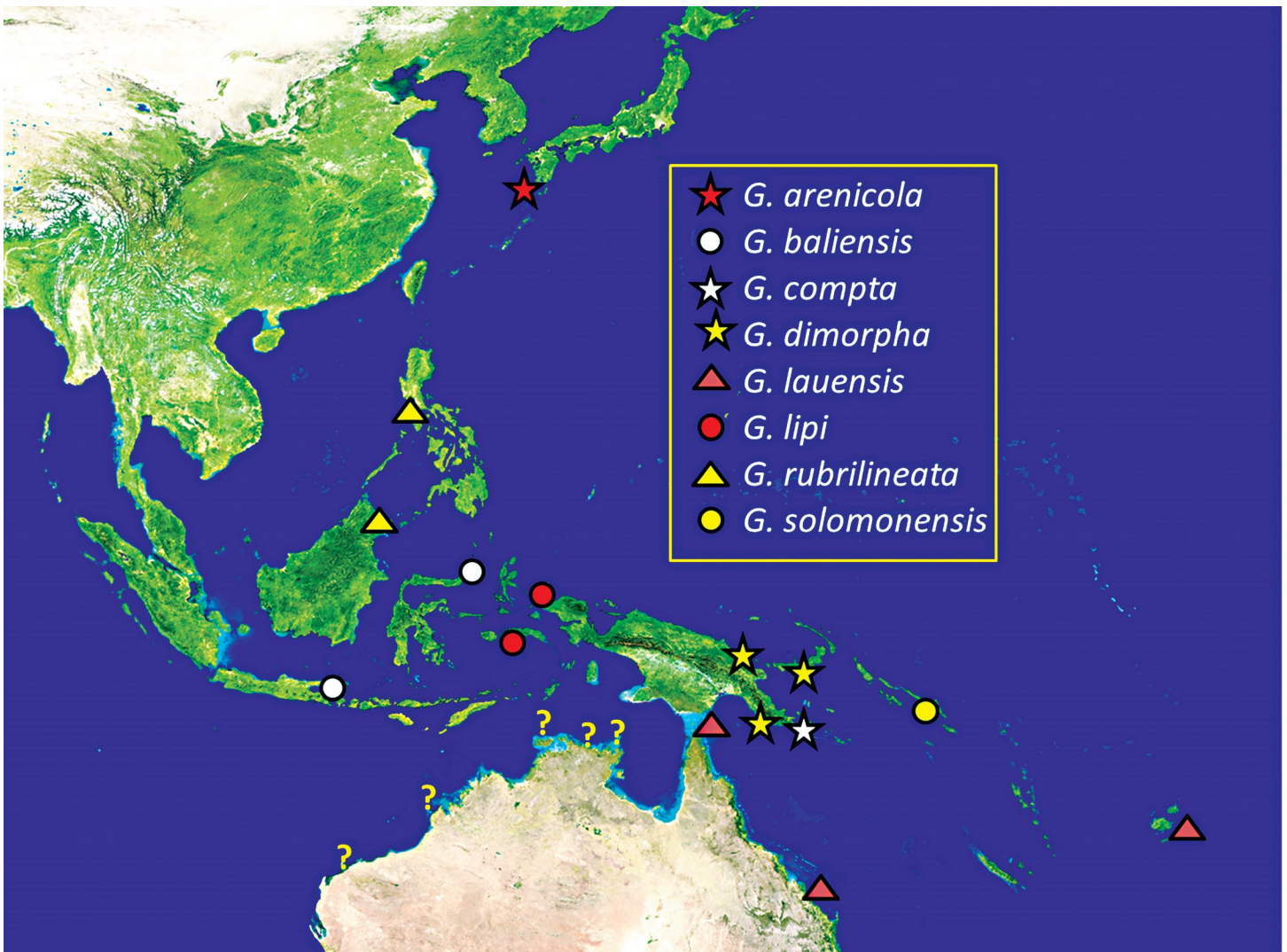
**Color in alcohol.** (Fig. 1) Generally dull white; internal mid-lateral row of four small black spots; several stellate melanophores along base of second dorsal and anal fins as well as along dorsal and ventral edges of caudal peduncle; post-interorbital part of nape with only a few small melanophores (Fig. 2B); 4–5 dark-brown spots on dorsal scleral surface of each eye and concentration of pepper-like melanophores on iris; fins translucent with very fine black and gray speckles; larger white speckles also evident on abdomen, pectoral-fin base, and cheek.

**Sexual dimorphism.** Male urogenital papilla pointed; that of female broad and flattened with circular outline, its posterior margin fringed with several enlarged tubercles.

**Etymology.** The species is named *compta* (Latin: ornamented), with reference to the orange markings on the head, body, and fins. It is treated as a feminine singular adjective.

**Distribution and habitat.** The new species is currently known only from Sideia Island in Milne Bay Province of Papua New Guinea (Fig. 6), but is no doubt more widespread in this large marine province. The habitat consists of large (5–10 m<sup>2</sup>), flat, sandy areas surrounded by live coral, in depths of about 14–15 m.

**Comparisons.** This species is most similar to *G. dimorpha* n. sp. from Papua New Guinea and *G. rubrilineata* n. sp. from the Philippines and Sabah, which are described below. The three species typically lack both cephalic sensory-canal pores and a pelvic frenum, possess similar markings on the dorsal fin of males, and have a more-or-less rectangular-shaped first dorsal fin (when fully erect), characterized by the subequal length of the first five spines, including a fifth spine that arises basally in the middle portion of the fin and extends to the extreme upper rear margin. This shape is found in both males and females of *G. compta* and *G. rubrilineata*, but females of *G. dimorpha* have a distinctly triangular fin with a filamentous first spine (see Fig. 11B). Despite their similarities, the members of this trio differ in dorsal- and anal fin-ray counts (Table 5), as well as in their pattern of body scalation and coloration. The lower number (8 or 9) of segmented dorsal- and anal-fin rays present in *G. compta* is useful for separating it from the other two species, which usually possess 10 rays (Table 5). All three species have a broad, scaleless area on the anterior portion of the body (Fig. 3), but *G. dimorpha* differs in usually having a substantial number of scales on the middle of the body, continuing forward as a single row to just behind the pectoral-fin base (Fig. 3B). In contrast, both *G. compta* and *G. rubrilineata* have the body scales divided into a sparsely scaled anterior section separated by a scaleless gap from the posterior scales (Fig. 3A & D). Although male color patterns are similar (Fig. 5), *G. compta* has a narrower orange submarginal stripe on the dorsal fins and lacks the black margin on the anal fin that is present in *G. dimorpha* and *G. rubrilineata* (see Key below).



**Figure 6.** Distribution map for *Grallenia* of the western Pacific Ocean. ?=Australian records identified as *G. arenicola*, but probably an undescribed species (see Discussion).



## *Grallenia dimorpha*, n. sp.

### Dimorphic Goby

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Figures 3B, 5B, 7–11; Table 2.

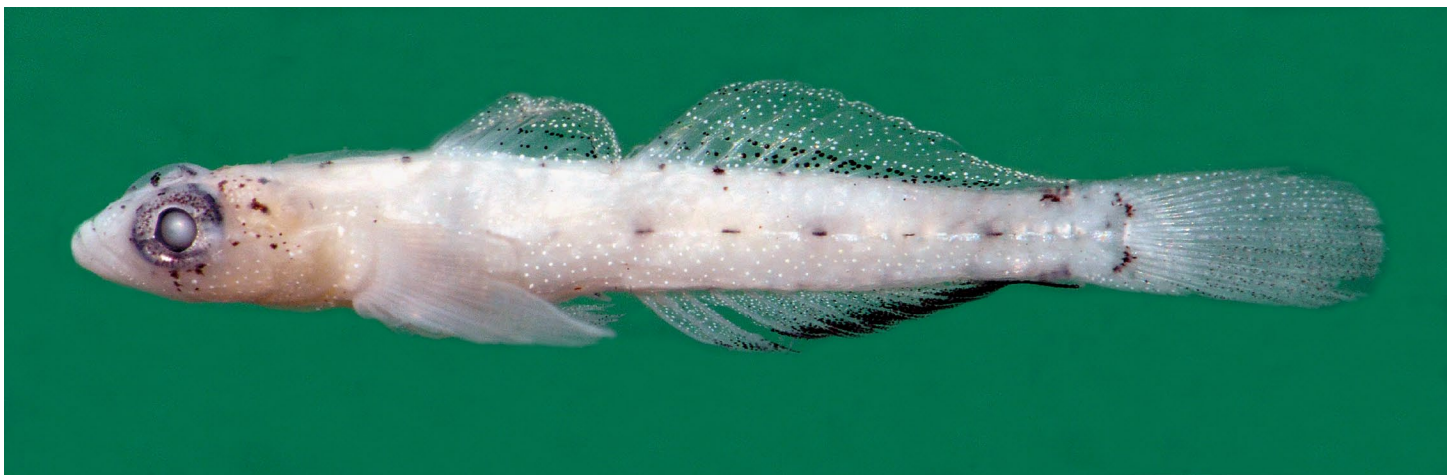
**Holotype.** WAM P.34659-001, male, 13.3 mm SL, Papua New Guinea, West New Britain Province, White Island, 6° 15.856' S, 150° 28.224' E, 14–18 m, clove oil & handnet, G.R. Allen & A. Joseph, 3 February 2017.

**Paratypes.** (collected with holotype) USNM 432528, 13 specimens, 12.8–15.5 mm SL; WAM P.34659-002, 20 specimens, 9.8–16.7 mm SL.

**Non-type specimens.** NTM S.12233-005, 13.0 mm SL, Papua New Guinea, near Port Moresby, Motopure Island, 9° 31.011' S, 147° 16.985' E; NTM S.13670-026, 2 specimens, 14.0–16.0 mm SL, Papua New Guinea, Madang, off NW tip of Tab Island, 5° 10.015' S, 145° 50.343' E; NTM S.13677-042, 11.8 mm SL, Papua New Guinea, Madang, patch reef near former Christensen Research Institute, 5° 10.015' S, 145° 49.026' E; NTM S.13694-013, 13.9 mm SL, Papua New Guinea, Madang, Rasch Passage, 5° 8.954' S, 145° 48.070' E; NTM S.13696-004, 13.8 mm SL, Papua New Guinea, Madang, Rasch Passage, 5° 8.954' S, 145° 48.070' E.

**Diagnosis.** Dorsal-fin rays VI + I, 8–11 (usually 10); anal-fin rays I, 9–11 (usually 10); fully erect first dorsal fin of male and female distinctly different, male fin rectangular with fifth spine longest and female fin triangular with first spine forming elongate filament; pelvic frenum absent; head pores absent; longitudinal scales 25–30, usually continuous from posterior pectoral-fin base to caudal-fin base, but anterior half of body mainly scaleless; body depth at pelvic-fin origin 13.4–15.6% SL; color of male in life translucent with a mid-lateral row of five widely separated and progressively shorter posteriorly, horizontal, orange-brown lines, each surrounded by yellowish hue and with a faint, narrow, vertical, brown line extending ventrally, forming overall T-shaped marking; dorsal fins with a pair of prominent stripes, outermost relatively broad and yellow-orange, inner stripe situated just above fin base, narrower and orange-red with black margin; anal fin yellowish with distinctive black margin; caudal fin yellowish with irregular translucent areas mainly on upper part of basal half; female similar, but fins translucent without both distinctive stripes on dorsal fins and black margin on anal fin; series of five ovate, progressively smaller, brown blotches along lower side interspersed with brilliant white markings, beginning at pectoral-fin base, continuing to posterior caudal peduncle.

**Description.** Dorsal-fin rays VI–I, 9 (8–11); anal-fin rays I, 10 (9–11); most segmented dorsal- and anal-fin rays branched (last to base), except first unbranched in some paratypes; pectoral-fin rays 16 (one paratype with 15), most rays branched except 1 or 2 uppermost and lowermost; pelvic-fin rays I, 5, all segmented rays branched, most with 2 branch points, fifth rays completely joined medially with membrane; pelvic frenum absent; branched



**Figure 7.** *Grallenia dimorpha*, preserved holotype, WAM P.34659-001, male, 13.3 mm SL, White Island, Papua New Guinea (G.R. Allen).

caudal-fin rays 11; segmented caudal-fin rays 15; upper unsegmented caudal-fin rays 8 (7–8); lower unsegmented caudal-fin rays 7 (6–7); total longitudinal scales 24 (24–26), usually continuous from posterior pectoral-fin base to caudal-fin base, but with a slight gap after fifth scale in holotype; gill rakers 3+7 (2–3 + 7–8); pseudobranch filaments 4; vertebrae 27 (4 specimens).

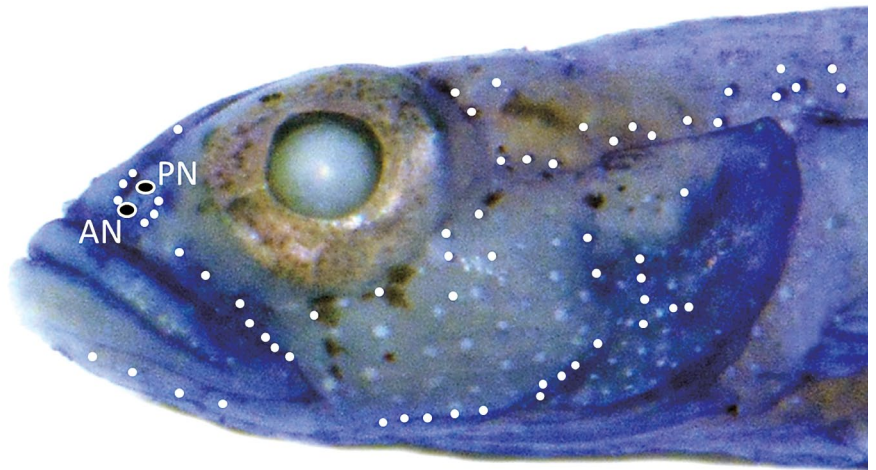
Body elongate and slender, depth at pelvic-fin origin 6.8 (5.8–7.5) in SL; depth at anal-fin origin 7.3 (7.0–9.0) in SL; body compressed, width at pectoral-fin origin 1.8 (1.9–2.5) in HL; head length 3.8 (3.2–4.0) in SL; head compressed, width 0.8 (0.8–1.1) in HL; snout short, much less than eye diameter, length 6.1 (4.7–6.9) in HL; eye diameter 2.7 (2.7–3.5) in HL; interorbital very narrow, eyes nearly in contact with each other; caudal-peduncle depth 2.7 (2.7–4.1) in HL; caudal-peduncle length 1.3 (1.1–1.5) in HL.

Mouth oblique, forming angle of about 48° to horizontal axis of body; lower jaw protruding; mouth relatively large, maxilla reaching beyond vertical at front of pupil, upper-jaw length 2.5 (2.1–3.1) in HL; teeth of jaws unicuspid, villiform, in 2–3 rows; row of 8–10 slender teeth in outer row on each side of upper jaw; lower jaw with three rows of teeth anteriorly, narrowing to single row posteriorly; pair of moderately enlarged, recurved teeth on anterolateral part of middle row; no teeth on vomer or palatine; edge of lips smooth; anterior margin of tongue concave; gill opening extending forward to level of middle of opercle.

Anterior nostril opening tubular, its distal tip not reaching to upper jaw when adpressed; posterior nostril opening with low rim, situated about midway between anterior nostril and eye; cephalic sensory-canal pores absent; pattern of head papillae as shown in Fig. 8.

Head and nape region scaleless; body scales ctenoid, scale pattern variable, with either a single scale row anteriorly (Fig. 4B) or with as many as 3–4 longitudinal scale rows anteriorly (Fig. 9); transverse scale rows between middle of second dorsal and anal fins 7 (5–7); circumpeduncular scales 8.

Origin of first dorsal fin about three-fourths eye diameter behind head, snout to first dorsal-fin origin 2.9 (2.7–3.3) in SL; dorsal-fin spines slender and flexible, fifth spine of male longest, 1.4 (1.2–1.4) in HL, first spine of female longest 0.8–1.2 in HL, usually forming prolonged



**Figure 8.** *Grallenia dimorpha*, preserved holotype, pattern of head papillae, AN= anterior nostril, PN=posterior nostril (G.R. Allen).



**Figure 9.** *Grallenia dimorpha*, preserved paratype, WAM P.34659-002, female, 15.1 mm SL, stained to show pattern of body scales, White Island, Papua New Guinea (G.R. Allen).

TABLE 2

Proportional measurements of selected type specimens of *Grallenia dimorpha*, n. sp.  
as percentages of the standard length

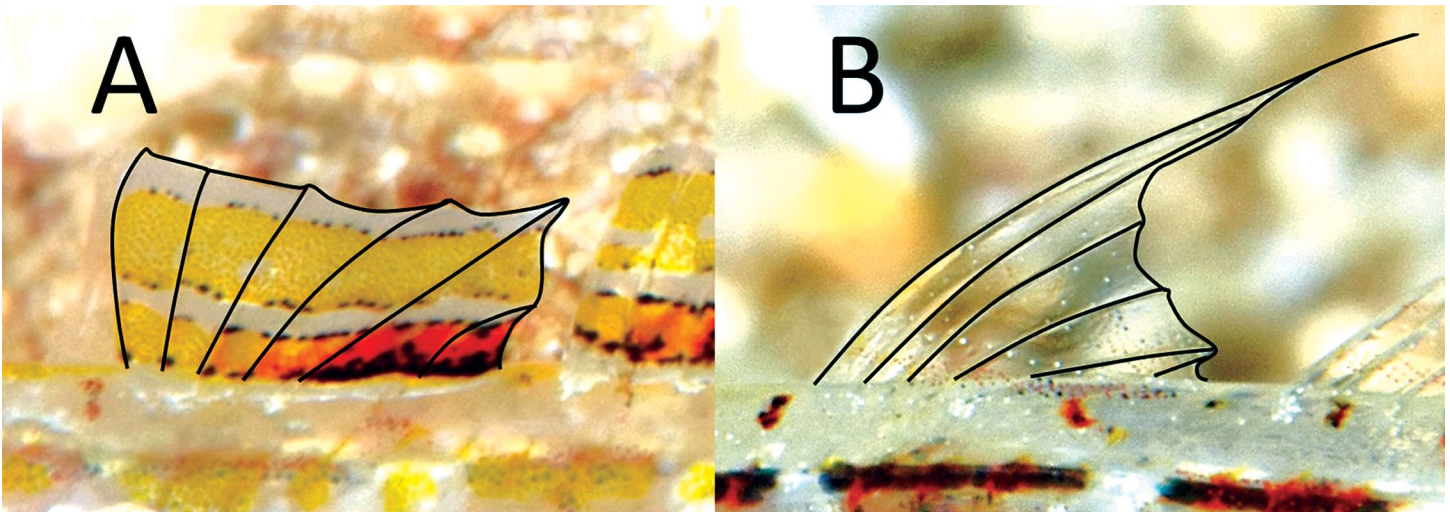
	holotype		paratypes							
	WAM P. 34659		WAM P. 34659							
Sex	male	female	male	female	female	male	male	male	female	female
Standard length (mm)	13.3	16.4	15.8	15.1	14.9	14.5	14.3	14.2	13.9	13.3
Head length	26.4	26.1	28.3	27.5	27.0	25.5	28.1	26.4	25.1	27.9
Head width	15.6	13.5	14.2	12.5	12.5	14.0	14.0	13.1	14.0	14.8
Head depth	12.8	14.1	13.9	13.9	12.5	12.2	15.0	13.0	13.4	13.3
Body depth (pelvic origin)	14.8	14.2	14.4	14.7	14.0	13.8	15.1	13.8	14.4	15.6
Body depth (anal origin)	13.6	11.9	13.3	12.5	12.7	12.7	14.2	13.3	11.9	13.0
Body width	15.0	12.2	13.2	12.9	12.1	12.4	13.3	13.7	12.4	13.5
Caudal-peduncle depth	9.7	7.7	8.1	8.0	8.3	9.5	9.1	9.7	8.2	8.9
Caudal-peduncle length	20.5	18.0	20.4	19.5	21.0	22.7	20.0	22.4	19.5	19.3
Snout length	4.4	4.3	4.5	4.5	4.7	4.1	5.3	5.2	4.5	4.3
Orbit diameter	9.8	8.6	8.0	9.4	8.6	8.9	9.1	9.3	9.3	9.1
Upper-jaw length	10.5	9.5	9.2	11.4	9.9	9.6	11.5	10.4	10.1	9.6
Snout to 1 <sup>st</sup> dorsal origin	34.8	31.5	33.1	33.0	33.5	32.3	32.5	33.2	33.6	34.1
Snout to 2 <sup>nd</sup> dorsal origin	54.3	51.4	52.1	54.4	53.5	55.3	51.8	49.8	56.3	52.5
Snout to anal-fin origin	49.9	49.4	51.2	54.0	54.1	52.0	52.1	53.3	56.1	52.1
Snout to pelvic-fin origin	32.3	30.8	28.3	30.1	29.0	31.1	32.2	32.3	26.5	31.3
First dorsal-fin spine length	10.2	29.1	12.8	36.0	31.1	12.5	14.3	12.3	29.4	22.8
First spine of 2nd dorsal	13.1	13.4	14.9	15.5	11.6	12.4	14.6	12.5	13.7	13.2
Longest soft dorsal-fin ray	18.7	13.3	21.3	15.2	13.8	19.4	29.4	30.3	15.4	12.4
Anal-spine length	8.6	8.1	9.0	7.4	6.2	8.3	10.1	7.3	7.9	8.5
Longest soft anal-fin ray	22.6	11.2	16.1	13.3	9.9	17.7	29.6	22.7	11.5	10.1
Pectoral-fin length	29.0	27.8	29.3	24.1	27.4	31.2	36.8	30.1	27.5	25.3
Pelvic-fin length	27.4	25.7	25.7	29.0	23.2	28.1	24.5	24.8	28.8	22.3
Caudal-fin length	25.1	21.7	24.5	21.2	22.3	23.8	24.7	24.6	23.0	22.4



**Figure 10.** *Grallenia dimorpha*, male (upper) and female (lower), approx. 15 mm SL, underwater photographs in 16 m, White Island, West New Britain Province, Papua New Guinea (G.R. Allen).

filament; snout to second dorsal-fin origin 1.8 (1.8–2.0) in SL; spine of second dorsal fin 2.0 (1.9–2.2) in HL; penultimate segmented dorsal-fin ray longest in male, 1.4 (0.9–1.5) in HL, first few anterior rays longest in female paratypes, 1.6–2.3 in HL; origin of anal fin slightly behind origin of second dorsal fin, snout to anal-fin origin 2.0 (1.8–2.0) in SL; anal-fin spine 3.1 (2.8–4.8) in HL; penultimate segmented anal-fin ray longest in male, 1.2 (1.0–2.0) in HL, first few anterior rays longest in female paratypes, 2.1–2.9 in HL; caudal fin shorter than head with rounded posterior margin, its length 4.0 (4.0–4.6) in SL; pectoral fins pointed, middle rays longest, reaching slightly posterior to origin of anal fin when adpressed, 0.9 (0.8–1.2) in HL; snout to pelvic-fin origin 3.1 (3.1–3.8) in SL; pelvic fins reaching slightly beyond anal-fin origin or about even with posterior extent of pectoral fins, 1.0 (0.9–1.4) in HL.

**Color in life.** (Fig. 10) Male translucent with mid-lateral row of five, progressively shorter posteriorly, horizontally ovate, yellowish blotches, each separated by a brilliant white marking and 1–2 smaller yellowish spots; lower side with corresponding row of less-distinct yellowish blotches; broad white band from lower rear corner of eye to lower edge of preopercle; small brown markings immediately behind eye and on middle of opercle; iris pinkish gray and 4–7 dark-brown spots on dorsal scleral surface of each eye; dorsal fins with pair of prominent stripes, outermost relatively broad and yellow-orange, inner stripe situated just above fin base, narrower and orange-red with black margin; anal fin yellowish with distinctive black margin; caudal fin yellowish with irregular translucent areas mainly on upper part of basal half; pectoral and pelvic fins translucent; bright white speckling scattered on head and body, especially concentrated on lips, cheek, post-interorbital nape, and translucent portion of fins. Female translucent with mid-lateral row of five, progressively shorter posteriorly, horizontal, brown lines, each separated by a brilliant white marking, anterior two greatly expanded ventrally



**Figure 11.** *Grallenia dimorpha*, comparison of first dorsal fin of male (A) and female (B) (G.R. Allen).

and forming white abdominal area; lower side with eight, progressively smaller posteriorly, red-brown blotches; about 10 small brown spots along dorsal body profile from base of first dorsal-fin spine to dorsal edge of caudal peduncle; tip of snout whitish and white band from lower rear corner of eye to edge of preopercle; several dark melanophores on dorsal snout and on post-ocular portion of nape; fins clear translucent without markings except oblique brown blotch at base of upper and lowermost caudal-fin rays.

**Color in alcohol.** (Fig. 7) Generally dull white; internal mid-lateral row of seven small black spots; several small black internal spots along base of dorsal fins, larger stellate melanophores near dorsal and ventral edges of caudal peduncle, and short, oblique bands on respective upper and lower base of caudal fin; usually a few small melanophores on dorsal surface of snout and post-interorbital nape; 4–7 black spots (2–3 dorsalmost largest) on dorsal scleral surface of each eye; scattered white speckles evident on head and body with concentrations on abdomen, pectoral-fin base, and cheek; dorsal fins translucent with black speckles on mainly basal third and white speckles on outer two-thirds; anal fin translucent whitish with broad black margin in male; pelvic and pectoral fins translucent.

**Sexual dimorphism.** There is a major difference in the shape or outline of the first dorsal fin related to sex. The male fin (Fig. 11A) is strongly rectangular with the first four spines approximately subequal in length and the fifth spine slightly longer, arising basally in the middle portion of the fin and extending to the extreme upper rear margin. In contrast, the female fin (Fig. 11B) has a triangular outline, characterized by a long, usually filamentous first spine (reaching past the base of the middle rays of the second dorsal fin when fully developed) and the remaining spines progressively shorter. Additionally, the posteriormost dorsal- and anal-fin rays of males are much longer than those of females, extending well beyond the middle of the caudal peduncle when adpressed (not reaching the midpoint in females). Typical of other members of the genus, the male urogenital papilla is pointed and that of the female is broad and flattened with a circular outline and its posterior margin fringed with several enlarged tubercles.

**Etymology.** The species is named *dimorpha* (Latin: two shapes) with reference to the sexual dimorphism in relation to dorsal-fin shape. It is treated as a feminine singular adjective.

**Distribution and habitat.** The new species is currently known only from Papua New Guinea (Fig. 6). The type series was collected off the southern coast of New Britain Island and the non-type specimens from the vicinity of Madang and near Port Moresby. The habitat consists of sandy substrate in about 8–18 m.

**Comparisons.** The new species differs from all other members of the genus in having pronounced sexual dimorphism, particularly with regards to the shape of the first dorsal fin (Fig. 11), which is rectangular in males and triangular in females with a filamentous first spine. The species is further compared with congeners in the remarks section above for *G. compta* (and see Key below).

## *Grallenia lauensis*, n. sp.

### Lau Goby

urn:lsid:zoobank.org:act:1C488D43-2AEC-459A-BE30-2855DBE62543

Figures 3C, 12–15; Table 3.

**Holotype.** WAM P.34760-001, female, 11.4 mm SL, Fiji, Lau Archipelago, Cakau Motu, 18° 36.979' S, 179° 25.459' E, 35 m, hand net and clove oil, M.V. Erdmann, 12 May 2017.

**Paratype.** WAM P.34756-001, female, 11.1 mm SL, Fiji, Lau Archipelago, Totoya Island, 18° 57.760' S, 179° 54.215' E, 30 m, hand net and clove oil, M.V. Erdmann, 6 May 2017.

**Non-type specimens.** AMS I.24985-027, 3 specimens, 13.4–14.7 mm SL, Australia, Queensland, Great Barrier Reef, lagoon at One Tree Island, 23° 30.255' S, 152° 5.386' E; AMS I.25039-001, 12 specimens, 10.9–15.6 mm SL, Australia, Queensland, Great Barrier Reef, lagoon at One Tree Island; NTM S.11061-016, 2 specimens, 13.7–13.9 mm SL, Australia, Queensland, Great Barrier Reef, lagoon at One Tree Island; NTM S.13599-010, 13 specimens, 7.0–11.7 mm SL, Australia, Coral Sea, Ashmore Reef, 10° 26.219' S, 144° 25.705' E; NTM S.13618-028, 3 specimens, 9.6–10.4 mm SL, Australia, Coral Sea, Boot Reef, 9° 58.802' S, 144° 42.321' E.

**Diagnosis.** Dorsal-fin rays VI + I,7; anal-fin rays I,7; all segmented dorsal- and anal-fin rays unbranched; pectoral-fin rays 15, all rays unbranched except middle 2–4; posterior longitudinal scales 8–12, mainly restricted to caudal peduncle; anterior body scales absent; body depth at pelvic-fin origin 15.1–15.7% SL; depth at anal-fin origin 12.9–13.2% SL; cephalic sensory-canal pores present; live color of female mainly translucent with faint markings, including five, progressively shorter, orange-brown, dash-like marks overlying vertebral column, about 10–12 narrow orange bars on back between level of pectoral-fin base and caudal-fin base, and 5–6 widely-spaced, brown-to-orange spots on lower side between middle of abdomen and caudal-fin base; color of male unknown.

**Description.** (Non-type specimens excluded) Dorsal-fin rays VI–I,7; anal-fin rays I,7; all segmented dorsal- and anal-fin rays unbranched; pectoral-fin rays 15, all rays unbranched except middle 2–4; pelvic-fin rays I,5, all segmented rays with single branch point, fifth rays completely joined medially with membrane; pelvic frenum present, but weakly developed; branched caudal-fin rays 11; segmented caudal-fin rays 15; upper unsegmented caudal-fin rays 7; lower unsegmented caudal-fin rays 7; total longitudinal scales 8 (12), restricted to caudal peduncle or slightly anterior (to below base of sixth dorsal-fin ray); anterior scale series absent; gill rakers 0+5; vertebrae 27.



**Figure 12.** *Grallenia lauensis*, preserved holotype, WAM P.34760-001, female, 11.4 mm SL, Lau Archipelago, Fiji, (G.R. Allen).

Body elongate and slender, depth at pelvic-fin origin 6.4 (6.6) in SL; depth at anal-fin origin 7.6 (7.8) in SL; body compressed, width at pectoral-fin origin 2.3 in HL; head length 3.5 (3.4) in SL; head compressed, width 0.7 (0.9) in HL; snout short, much less than eye diameter, 4.7 (5.5) in HL; eye diameter 3.3 in HL; interorbital very narrow, eyes nearly in contact with each other; caudal-peduncle depth 3.7 (3.6) in HL; caudal-peduncle length 1.2 (1.3) in HL.

Mouth very oblique, forming angle of about 48° to horizontal axis of body; lower jaw protruding; mouth relatively large, the maxilla reaching beyond vertical at front of pupil, upper-jaw length 2.7 (3.0) in HL; teeth of jaws unicuspid, villiform, in 2–3 rows; row of 8–10 slender teeth in outer row on each side of upper jaw; lower jaw with three rows of teeth anteriorly, narrowing to single row posteriorly; pair of moderately enlarged, recurved teeth on anterolateral part of middle row; no teeth on vomer or palatine; edge of lips smooth; anterior margin of tongue concave; gill opening mainly restricted to pectoral-fin base, extending forward to about level of middle of opercle.

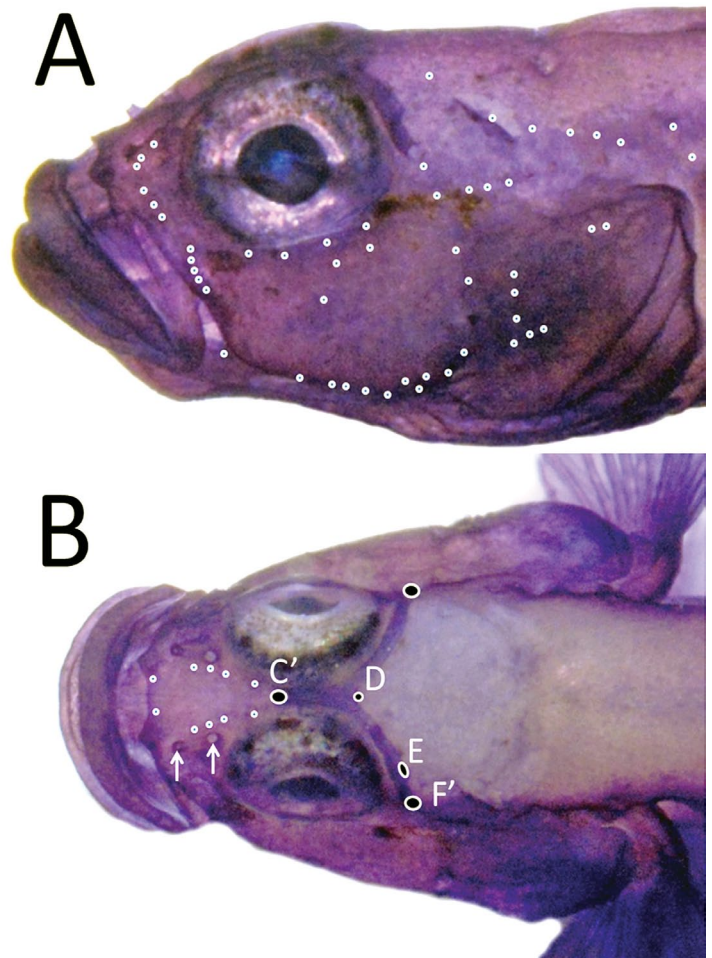
Anterior nostril opening tubular; posterior nostril opening with low rim, situated about midway between anterior nostril and eye; pattern of head papillae and sensory-canal pores as shown in Fig. 13; pores reduced with anterior oculoscapular canal containing pore C' (unpaired), D (unpaired), E (missing on right side of holotype), and F'.

Head and most of body without scales; scales ctenoid and mainly restricted to caudal peduncle region as shown in Fig. 3C (those of paratype extending forward to level of base of sixth segmented dorsal-fin ray).

Origin of first dorsal fin about one eye diameter behind head, snout to first dorsal fin 2.8 (2.7) in SL; dorsal-fin spines slender and flexible, second spine longest, 1.5 in HL; snout to second dorsal-fin origin 1.7 (1.8) in SL; spine of second dorsal fin 3.4 (3.2) in HL; first 3–4 segmented dorsal-fin rays longest, 1.9 in HL; origin of anal fin slightly behind origin of second dorsal fin, snout to anal-fin origin 1.7 in SL; anal-fin spine 4.3 (4.7) in HL; second segmented anal-fin ray longest, 2.2 (2.4) in HL; caudal fin shorter than head with slightly emarginate posterior margin, its length 4.8 (4.2) in SL; pectoral fins pointed, middle rays longest, reaching to level of posterior edge of pelvic fins, 1.2 in HL; snout to pelvic-fin origin 3.1 (3.0) in SL; pelvic fins reaching to genital papilla, 1.2 in HL.

**Color in life.** (Fig. 14) Male color pattern unknown. Female translucent with silvery-white abdomen and mid-lateral row of five, progressively shorter posteriorly, horizontal, orange-brown, dash-like marks, each enclosing 4–8 stellate melanophores; upper side with about 10–12 narrow orange bars between level of pectoral-fin base and caudal-fin base; lower side with 5–6 progressively smaller brown spots between middle of abdomen and caudal-fin base; head generally lacking dark pigment except a pair of small brown spots immediately below eye and dorsal scleral surface of each eye with 2–4 small black spots; cheek and opercle with silvery-white patches; fins clear translucent except a row of small brown spots across middle of both dorsal fins, numerous brown spots on pelvic fins, and a white pectoral-fin base and adjacent white patch on basal portion of middle pectoral-fin rays.

**Color in alcohol.** (Fig. 12) Uniform whitish with a small amount of blackish or brownish pigmentation limited to a row of small spots across middle of both dorsal fins, spotting on pelvic fins, a faint bar across anterior



**Figure 13.** *Grallenia lauensis*, preserved holotype, stained to show pattern of head papillae (white dots) and sensory pores (larger black spots): A) lateral; B) dorsal. Nostrils indicated with arrows (G.R. Allen).



**Figure 14.** *Grallenia lauensis*, females, approx. 11 mm SL, underwater photographs in 30–35 m, Lau Archipelago, Fiji (M.V. Erdmann).

cheek, and 2–4 small black spots on dorsal scleral surface of each eye.

**Sexual dimorphism.** One of the two non-type specimens (NTM S.11061-016, Fig. 15A) from One Tree Island on the southern Great Barrier Reef is a male, which has a typical pointed urogenital papilla and also possesses a filamentous first dorsal-fin spine that extends nearly to the base of the last segmented dorsal-fin ray when adpressed. The female urogenital papilla is broad and flattened with a circular outline, its posterior margin fringed with several enlarged tubercles.

**Etymology.** The species is named *lauensis* with reference to the Lau Archipelago type locality.

**Distribution and habitat.** The new species is currently known from the southern Lau Archipelago of southeastern Fiji and 33 non-type specimens from the Great Barrier Reef and northwestern Coral Sea. The Lau habitat consists of extensive gradual slopes of clean white sand in 30–35m depth. Both Lau sites were located in channel passes from the outer reef to extensive inner lagoons, and were hence subject to frequent strong currents and high rates of water exchange.



**Great Barrier Reef and Coral Sea specimens.** (Fig. 15) The status of the 33 non-type specimens from the southern Great Barrier Reef and northwestern Coral Sea remains problematic. The specimens are in poor condition with extensive fin damage, but otherwise exhibit important diagnostic features, including a lack of anterior scales, reduced scalation on the posterior body, usually 7 (rarely 6 or 8) segmented dorsal- and anal-fin rays, and the presence of cephalic sensory-canal pores. Posterior longitudinal scale counts range from 5–8, except a male specimen (Fig. 15A) from One Tree Island on the Great Barrier Reef has 5 additional mid-lateral scales extending forward from the main scale mass, resulting in a total of 13 longitudinal scales. Although the distal portion of the dorsal, anal, and pectoral fins are damaged in most specimens, at least 2 specimens from One Tree Island possess a few branched dorsal-fin rays, unlike the type specimens. They also differ from the types in having pelvic-fin rays with more than a single branch point in at least a few specimens. Another question involves the elongate and filamentous first dorsal-fin spine of some non-type males, compared to the female types which have the second spine longest, although not filamentous. Future morphological and genetic studies should help to resolve the status of the Australian population.

**Comparisons.** The new species belongs to a complex that also includes *G. arenicola* and *G. solomonensis*, which is characterized by the presence of cephalic sensory-canal pores and usually 7 segmented dorsal- and anal-fin rays. The new species is most similar to *G. solomonensis* in having greatly reduced scalation, which is mainly restricted to the caudal peduncle. However, it differs from *G. solomonensis* and all other congeners in completely lacking anterior body scales, in having all segmented dorsal-fin rays unbranched (except some non-type specimens from Australia), and most pectoral-fin rays unbranched. In most other species, the main scale mass extends well forward to the anterior half of the body or there is at least a row containing several scales immediately behind the pectoral-fin base (Fig. 3). It further differs from *G. solomonensis* in usually having 15 (vs, 16) pectoral-fin rays, pelvic-fin rays with a single branch point (vs. 2 or 3 branch points), the second dorsal-fin spine longest (vs. the first spine), and a slightly emarginate (vs. truncate) caudal fin. Additionally, preserved specimens of *G. solomonensis* have much more pigmentation, including two large spots at the caudal-fin base (compare Figs. 12 and 20) (and see Key below).



**Figure 15.** *Grallenia lauensis*, non-type specimens from Australia: A) male, 13.9 mm SL (NTM S.11061–016), One Tree Island, Great Barrier Reef; and B) female, 9.9 mm SL (NTM S.13599–010), Ashmore Reef, Coral Sea (G.R. Allen). Specimens stained with cyanine blue to show scale patterns.

TABLE 3

Proportional measurements of selected type specimens of *Grallenia lauensis*, n. sp. and *Grallenia solomonensis*, n. sp. as percentages of the standard length

	<i>G. lauensis</i>					<i>G. solomonensis</i>		
	holotype		paratypes		non-types	holotype	paratypes	
	WAM P. 34760	WAM P. 34756	AMS I.25039	AMS I.25039	NTM S.11061		WAM P. 34617	
Sex	female	female	male	male	male	female	female	female
Standard length (mm)	11.4	11.1	15.6	13.9	13.9	12.5	12.5	12.4
Head length	28.7	29.1	28.8	28.7	29.4	28.5	26.7	29.0
Head width	17.5	15.8	14.6	12.7	16.1	15.9	17.1	16.1
Head depth	13.0	14.6	12.8	13.9	13.2	14.6	14.9	15.4
Body depth (pelvic origin)	15.7	15.1	15.2	14.7	14.0	16.9	17.9	16.6
Body depth (anal origin)	13.2	12.9	11.1	11.4	12.3	13.6	13.3	13.5
Body width	12.7	12.6	11.9	12.4	12.4	12.7	12.8	12.9
Caudal-peduncle depth	7.7	8.1	6.8	8.6	8.8	7.8	8.8	8.7
Caudal-peduncle length	23.1	22.8	25.1	27.0	26.9	25.4	26.2	25.6
Snout length	6.1	5.3	5.4	6.4	5.9	5.4	6.0	5.6
Orbit diameter	8.7	8.9	10.0	9.7	9.4	9.0	9.5	9.4
Upper-jaw length	10.7	9.7	10.1	10.3	11.2	11.3	11.8	11.4
Snout to 1 <sup>st</sup> dorsal origin	35.8	37.1	35.8	35.5	36.1	37.3	38.1	39.2
Snout to 2 <sup>nd</sup> dorsal origin	57.2	56.5	57.5	56.3	53.7	55.9	56.6	58.0
Snout to anal-fin origin	58.4	58.1	58.1	56.4	54.4	56.4	56.4	58.0
Snout to pelvic-fin origin	32.5	33.3	31.7	31.7	32.0	32.2	32.7	34.4
First dorsal-fin spine length	11.7	11.7	21.3	30.2	30.4	13.9	16.3	15.3
First spine of 2nd dorsal	8.4	9.0	9.2	11.2	11.1	7.7	8.7	8.6
Longest soft dorsal-fin ray	14.9	15.0	14.1	14.3	15.7	12.9	15.3	13.7
Anal-spine length	6.7	6.2	6.2	6.7	5.8	6.7	5.5	7.2
Longest soft anal-fin ray	12.6	12.1	12.1	13.1	11.9	11.2	12.0	13.1
Pectoral-fin length	25.4	26.9	23.0	26.7	22.4	21.3	22.7	24.1
Pelvic-fin length	24.0	23.9	22.8	22.8	20.9	25.0	23.6	25.0
Caudal-fin length	21.1	24.0	18.6	24.9	23.1	20.1	20.8	19.1

## *Grallenia rubrilineata*, n. sp.

### Redstripe Goby

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Figures 3D, 5C, 16–19; Table 4.

**Holotype.** WAM P.34264-001, male, 15.2 mm SL, Philippines, Batangas Province, vicinity of Anilao, Ligo Island, 13° 49.490' N, 120° 54.604' E, 12–15 m, hand net, P. Paleracio & R. Vanderloos, 4 June 2014.

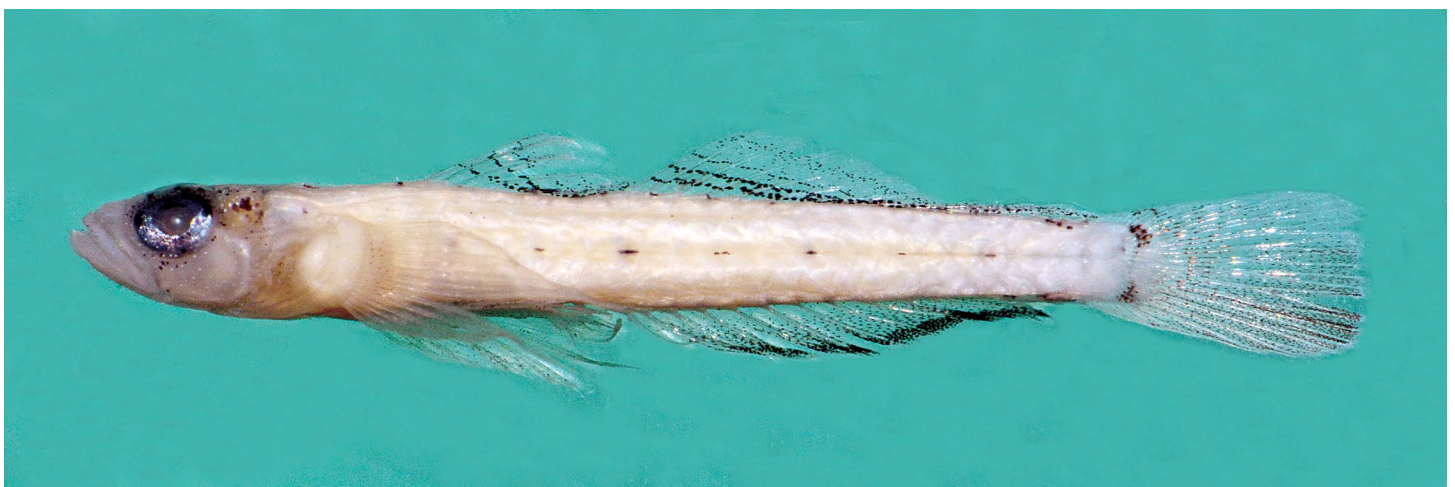
**Paratypes.** (collected with holotype) USNM 432520, 20 specimens, 9.6–15.1 mm SL; WAM P.34264-003, 55 specimens, 8.9–15.8 mm SL.

**Diagnosis.** Dorsal-fin rays VI + I, 9–11 (usually 10); anal-fin rays I, 9–11 (usually 10); first dorsal-fin spine not produced into filament in either sex; pelvic frenum absent; head pores absent; posterior longitudinal scales 17–22, usually extending forward to at least level of second-dorsal-fin origin, body anterior to level of middle of second dorsal fin with numerous scales; body depth at pelvic-fin origin 12.8–16.4% in SL; color in life translucent with reddish-brown markings consisting of 8–12 widely separated small spots or short irregular bars along dorsal profile of body, an interrupted stripe from upper rear edge of opercle to upper caudal peduncle (each segment progressively shorter with increasingly wider space between, proceeding posteriorly) and a longitudinal row of about 9 irregular brown blotches along ventral portion of side; both dorsal fins of adult male with distinctive basal red or red-edged black stripe and anal fin with bold black outer margin.

**Description.** Dorsal-fin rays VI–I, 10 (9–11); anal-fin rays I, 10 (9–11); all segmented dorsal-fin rays branched (last to base) except first 1–2 in some paratypes; all segmented anal-fin rays branched (last to base) except first 1–2; pectoral-fin rays 16 (14–16), all rays branched except uppermost and 1–2 lowermost; pelvic-fin rays I, 5, first 4 segmented rays with 2 branch points, the fifth rays with single branch point and completely joined medially with membrane; pelvic frenum absent; branched caudal-fin rays 11; segmented caudal-fin rays 15; upper unsegmented caudal-fin rays 8 (7–8); lower unsegmented caudal-fin rays 7 (6–8); total longitudinal scales 24 (20–26), consisting of 4 (2–5) anterior scales and 20 (17–22) posterior scales; gill rakers 2+7 (1–2 + 7–8); vertebrae 27 (8 specimens) or 28 (4 specimens).

Body elongate and slender, depth at pelvic-fin origin 8.0 (6.4–8.1) in SL; depth at anal-fin origin 8.2 (7.6–10.3) in SL; body compressed, width at pectoral-fin origin 2.0 (1.9–2.6) in HL; head length 3.9 (3.6–4.1) in SL; head compressed, width 0.9 (0.8–1.1) in HL; snout short, much less than eye diameter, length 5.4 (4.5–5.5) in HL; eye diameter 2.8 (2.6–3.2) in HL; interorbital very narrow, eyes nearly in contact with each other; caudal-peduncle depth 3.2 (2.9–3.7) in HL; caudal-peduncle length 1.2 (1.1–1.8) in HL.

Mouth oblique, forming angle of about 48–50° to horizontal axis of body; lower jaw protruding; mouth



**Figure 16.** *Grallenia rubrilineata*, preserved holotype, P34264-001, male, 15.2 mm SL, near Anilao, Batangas Province, Philippines (G.R. Allen).

relatively large, the maxilla reaching beyond vertical at front of pupil, upper-jaw length 2.7 (2.4–2.9) in HL; teeth of jaws unicuspid, villiform, in 2–3 rows; row of 8–10 slender teeth in outer row on each side of upper jaw; lower jaw with three rows of teeth anteriorly, narrowing to single row posteriorly; pair of moderately enlarged, recurved teeth on anterolateral part of middle row; no teeth on vomer or palatine; edge of lips smooth; anterior margin of tongue concave; gill opening extending forward to level of middle of opercle.

Anterior nostril opening tubular, its distal tip not reaching to upper jaw when

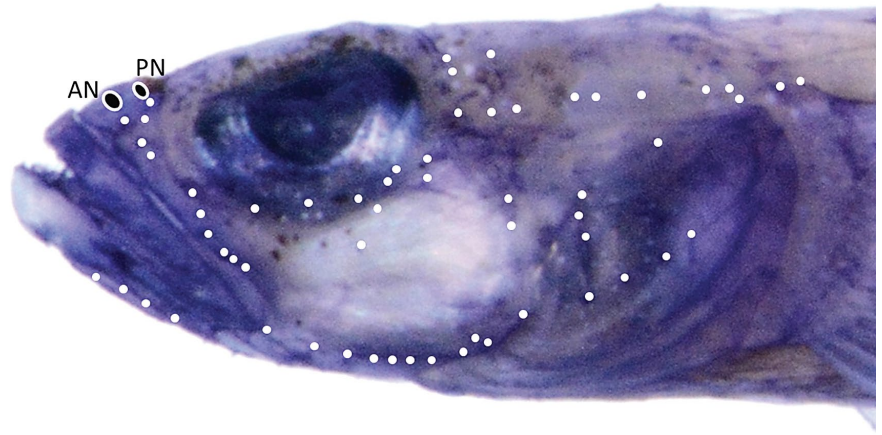
addressed; posterior nostril opening with low rim, situated about midway between anterior nostril and eye; cephalic sensory-canal pores absent; pattern of head papillae as shown in Fig. 17 (composite of several specimens).

Head and most of anterior body without scales; body scales ctenoid, scale pattern as shown in Fig. 3D; anterior longitudinal scales 4 (2–5), usually consisting of two pairs of scales separated by a gap behind pectoral-fin base (occasionally single pair or rarely 3–5 scales in continuous row); posterior longitudinal scales 20 (17–22), usually extending forward to at least level of second-dorsal-fin origin, body anterior to level of middle of second dorsal fin with numerous scales; transverse scales 5 (5–7); circumpeduncular scales 8 (7–8).

Origin of first dorsal fin about one eye diameter behind head, snout to first dorsal-fin origin 3.1 (2.9–3.3) in SL; dorsal-fin spines slender and flexible, first to fifth dorsal-fin spines more or less subequal, 1.8 (1.5–2.1) in HL; snout to second-dorsal-fin origin 1.9 (1.8–2.0) in SL; spine of second dorsal fin 2.1 (1.8–2.4) in HL; longest segmented dorsal-fin ray (penultimate in male, first 3 or 4 in female) 1.7 (1.6–2.3) in HL; origin of anal fin slightly behind origin of second dorsal fin, snout to anal-fin origin 1.9 (1.8–2.0) in SL; anal-fin spine 3.1 (2.9–4.3) in HL; third or fourth segmented anal-fin ray longest, 2.2 (2.0–2.8) in HL; caudal fin shorter than head with truncate to slightly emarginate posterior margin, its length 4.7 (4.4–5.0) in SL; pectoral fins pointed, middle rays longest, reaching to level of base of first or second segmented anal-fin ray, 1.0 (0.9–1.2) in HL; snout to pelvic-fin origin 3.7 (3.1–3.7) in SL; pelvic fins reaching to about anal-fin origin or slightly posterior, 1.1 (1.0–1.2) in HL.

**Color in life.** (Figs. 5C, 18 & 19) Translucent with reddish-brown to blackish markings consisting of 8–12 widely separated small spots or short irregular bars along dorsal profile of body, an interrupted stripe from upper rear edge of opercle to upper caudal peduncle (each segment progressively shorter with increasingly wider white space between, proceeding posteriorly) and a longitudinal row of about 9 irregular brown blotches along ventral portion of side, blotches variable, sometimes blackish with red margins or partially or completely absent; a pair of curved blackish marks at base of caudal fin (on posterior edge of hypural plate); abdomen white to pale gray, frequently with 1–2 diffuse, relatively large, red-brown spots; short white band usually evident under lower rear corner of eye; dorsal surface of snout with several blackish or dark brown spots; postorbital nape with several longitudinal reddish-brown streaks; iris pale grayish with relatively wide white ring around pupil, and about 6–7 variable-sized, dark-brown spots on dorsal scleral surface of each eye; fins of juvenile and female mainly translucent without conspicuous markings (Fig. 18); first and second dorsal fins of adult male generally translucent with broad, basal, black-edged, red stripe (Fig. 6C), or occasionally with white-edged brown stripe (Fig. 19), and second pale, brownish-orange, submarginal stripe of similar width on outer half of fin; anal fin of adult male pale yellowish-brown with bold black outer margin; caudal and pelvic fins translucent to slightly yellowish brown; pectoral fins translucent; lower half of head and body (including abdomen), and pale portions of median fins and pelvic fins frequently covered with bright white speckling.

**Color in alcohol.** (Fig. 16) Generally dull white with 7 widely scattered small spots in a mid-lateral row on side of body; about 10 subdermal black spots along dorsal profile of body and 7 similar spots along base of anal



**Figure 17.** *Grallenia rubrilineata*, stained to show pattern of head papillae (white dots), based on several specimens, AN= anterior nostril, PN=posterior nostril (G.R. Allen).



**Figure 18.** *Grallenia rubrilineata*, male (right), female (center), and juvenile (left) approx. 8–15 mm SL, underwater photograph in 15 m, Ligpo Island near Anilao, Batangas Province, Philippines (G.R. Allen).



**Figure 19.** *Grallenia rubrilineata*, male, approx. 15 mm SL, underwater photograph in 15 m near Anilao, Batangas Province, Philippines (G.R. Allen).

TABLE 4

Proportional measurements of selected type specimens of *Grallenia rubrilineata*, n. sp.  
as percentages of the standard length

	holotype		paratypes							
	WAM P. 34264		WAM P. 34264							
Sex	male	female	female	female	female	female	female	male	male	male
Standard length (mm)	15.2	15.4	15.4	15.3	15.3	15.2	14.9	14.6	14.5	13.7
Head length	25.3	27.2	26.7	24.4	27.6	25.1	26.7	24.4	26.9	24.6
Head width	14.8	12.8	14.3	15.3	12.9	16.1	13.3	16.0	12.4	14.4
Head depth	13.0	12.9	12.6	12.6	13.7	12.6	14.2	14.0	12.1	11.9
Body depth (pelvic origin)	12.5	13.7	13.8	13.1	14.3	15.4	15.5	13.3	12.4	13.8
Body depth (anal origin)	12.2	9.8	11.9	11.6	10.5	12.7	11.4	11.6	10.8	12.7
Body width	12.9	11.2	11.5	12.4	10.8	12.9	11.6	12.6	13.0	11.9
Caudal-peduncle depth	7.8	7.8	7.2	7.1	7.5	8.1	6.9	7.7	7.6	8.6
Caudal-peduncle length	20.9	23.9	19.5	18.2	18.3	19.4	15.2	21.8	20.7	18.8
Snout length	4.7	5.9	5.8	4.6	6.0	4.6	5.4	4.8	5.5	5.1
Orbit diameter	9.1	9.1	8.4	8.3	9.8	7.9	9.7	9.0	10.4	8.6
Upper-jaw length	9.4	10.1	9.7	9.5	10.7	9.5	11.1	9.8	9.3	8.6
Snout to 1 <sup>st</sup> dorsal origin	32.0	31.1	33.5	32.1	34.8	34.0	33.2	34.2	33.1	32.7
Snout to 2 <sup>nd</sup> dorsal origin	51.5	51.0	53.5	50.6	53.1	52.9	55.6	55.1	55.5	53.7
Snout to anal-fin origin	53.4	52.5	52.9	54.7	53.0	54.2	55.6	54.2	53.3	54.0
Snout to pelvic-fin origin	27.0	29.8	29.4	28.7	28.4	28.6	28.8	31.7	31.8	28.1
First dorsal-fin spine length	14.3	16.3	15.6	16.0	16.2	15.0	16.1	15.0	15.0	15.2
First spine of 2nd dorsal	11.9	11.5	13.0	11.2	12.2	12.1	13.9	12.2	11.5	12.6
Longest soft dorsal-fin ray	15.2	14.3	14.3	14.2	13.5	13.7	14.1	14.8	14.9	14.7
Anal-spine length	8.2	8.2	8.1	7.1	6.9	6.8	8.1	8.5	8.0	8.4
Longest soft anal-fin ray	11.7	11.8	10.7	11.5	10.9	11.2	10.7	11.7	12.8	12.5
Pectoral-fin length	25.7	28.2	23.9	25.8	27.3	24.0	26.0	28.1	26.2	25.9
Pelvic-fin length	23.2	24.1	23.0	23.3	25.0	22.7	25.3	24.9	23.3	23.4
Caudal-fin length	21.2	20.7	21.0	21.0	21.6	20.7	22.6	22.9	22.2	22.5

fin and ventral edge of caudal peduncle; dense concentration of pepper-like melanophores on cheek and dorsal surface of head and numerous tiny white spots on abdomen; fins translucent whitish.

**Sexual dimorphism.** Last two dorsal-fin rays of male longer (when adpressed) than those of female, usually extending beyond middle of caudal peduncle (not reaching midpoint in female). Male urogenital papilla pointed, that of female broad and flattened with circular outline, its posterior margin fringed with several enlarged tubercles

**Etymology.** The species is named *rubrilineata* (Latin: “red-lined” or “red-striped”), with reference to the characteristic marking on the dorsal fin of adult males. It is treated as a feminine compound adjective.

**Distribution and habitat.** The new species is currently known from the Philippines, including the type locality near Anilao in Batangas Province, Luzon, and on the basis of a photograph from Dauin, Negros in the Central Visayas Group. A female specimen examined at WAM (P.30410-015), 18 mm SL, from Bohaydulung Island, Sabah State, Malaysia is probably *G. rubrilineata*, judging from fin-ray counts, scale pattern, and lack of head pores; however, additional specimens, including males, would be required to verify this identification. The habitat at Anilao consists of extensive areas of sand/silt substrate in about 12–15 m. The new species was very abundant in some areas, including the type locality, with an estimated abundance of 10–15 individuals per square meter. It was typically seen in small groups.

**Comparisons.** (see comparisons for *G. compta* and see Key below).

TABLE 5

Frequency distribution of counts for fin rays and total longitudinal scales for *Grallenia*

Data for *G. arenicola* and *G. lipi* from Shibukawa & Iwata (2007)

*G. lauensis* (Australia) refers to non-type specimens from the GBR and Coral Sea of Australia

<i>Grallenia</i> species	Dorsal-fin segmented rays						Anal-fin segmented rays					
	6	7	8	9	10	11	6	7	8	9	10	11
<i>G. arenicola</i>		11	2					11	1			
<i>G. baliensis</i>					20				1	19		
<i>G. compta</i>			5	6					6	5		
<i>G. dimorpha</i>			1	3	22	1				2	24	1
<i>G. lauensis</i>		2						2				
<i>G. lauensis</i> (Australia)	2	10	1				1	12				
<i>G. lipi</i>				3	6					9		
<i>G. rubrilineata</i>				9	51	2				12	48	2
<i>G. solomonensis</i>		3						3				

<i>Grallenia</i> species	Pectoral-fin rays				Longitudinal scales				
	14	15	16	17	<10	10–15	16–19	20–25	>25
<i>G. arenicola</i>		5	19	2				1	25
<i>G. baliensis</i>	1	18	1		21				
<i>G. compta</i>		2	9					11	
<i>G. dimorpha</i>		2	25					8	18
<i>G. lauensis</i>		3			1	1			
<i>G. lauensis</i> (Australia)		7	2		10	1			
<i>G. lipi</i>	1	1	13	3		8	7	3	
<i>G. rubrilineata</i>	1	20	39				5	53	3
<i>G. solomonensis</i>			3		1	2			

## *Grallenia solomonensis*, n. sp.

### Solomons Goby

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Figures 3E, 20–21; Table 3.

**Holotype.** WAM P.34617-001, female, 12.5 mm SL, Solomon Islands, Guadalcanal, Aruhilo, 09° 17.222' S, 159° 46.078' E, 14–15 m, hand net and clove oil, M.V. Erdmann & C.S. Erdmann, 12 October 2016.

**Paratypes.** (collected with holotype) WAM P.34617-002, females, 12.4–12.5 mm SL.

**Diagnosis.** Dorsal-fin rays VI + I,7; anal-fin rays I,7; posterior longitudinal scales 5–8, restricted to caudal peduncle; body depth at pelvic-fin origin 16.6–17.9% SL; depth at anal-fin origin 13.3–13.6% SL; cephalic sensory-canal pores present; live color unknown, but alcohol-preserved specimens with conspicuous dark bands below eye and across opercle, a pair of relatively large black spots at caudal-fin base, and dorsal surface of snout and nape with numerous black spots, streaks, and stellate markings.

**Description.** Dorsal-fin rays VI–I,7, all segmented rays branched except first; anal-fin rays I,7, all segmented rays unbranched; pectoral-fin rays 16, all rays branched except uppermost and 5–6 lowermost; pelvic-fin rays I,5, all segmented rays with 2 branch points (except fifth ray with 3), fifth rays completely joined medially with membrane; pelvic frenum present, but weakly developed; branched caudal-fin rays 11; segmented caudal-fin rays 15; upper unsegmented caudal-fin rays 7; lower unsegmented caudal-fin rays 7 (one paratype with 8); total longitudinal scales 8 (10–12), consisting of 3 (4–5) anterior scales and 5 (6–7) posterior scales; gill rakers 2+7; vertebrae 27 (27–28).

Body elongate and slender, but relatively deep for genus; depth at pelvic-fin origin 5.9 (5.6–6.0) in SL; depth at anal-fin origin 7.4 (7.4–7.5) in SL; body compressed, width at pectoral-fin origin 2.2 (2.1–2.3) in HL; head length 3.5 (3.4–3.7) in SL; head compressed, width 0.9 (0.9–1.0) in HL; snout short, much less than eye diameter, 5.3 (4.5–5.1) in HL; eye diameter 3.2 (2.8–3.1) in HL; interorbital very narrow, eyes nearly in contact with each other; caudal-peduncle depth 3.6 (3.0–3.3) in HL; caudal-peduncle length 1.1 (1.0–1.1) in HL.

Mouth very oblique, forming angle of about 44° to horizontal axis of body; lower jaw protruding; mouth relatively large, maxilla reaching beyond vertical at front of pupil, upper-jaw length 2.5 (2.3–2.6) in HL; teeth of jaws unicuspid, villiform, in 2–3 rows; row of 8–10 slender teeth in outer row on each side of upper jaw; lower jaw with three rows of teeth anteriorly, narrowing to single row posteriorly; pair of moderately enlarged, recurved teeth on anterolateral part of middle row; no teeth on vomer or palatine; edge of lips smooth; anterior margin



**Figure 20.** *Grallenia solomonensis*, preserved holotype, WAM P.34617-001, female, 12.5 mm SL, Guadalcanal, Solomon Islands (G.R. Allen).

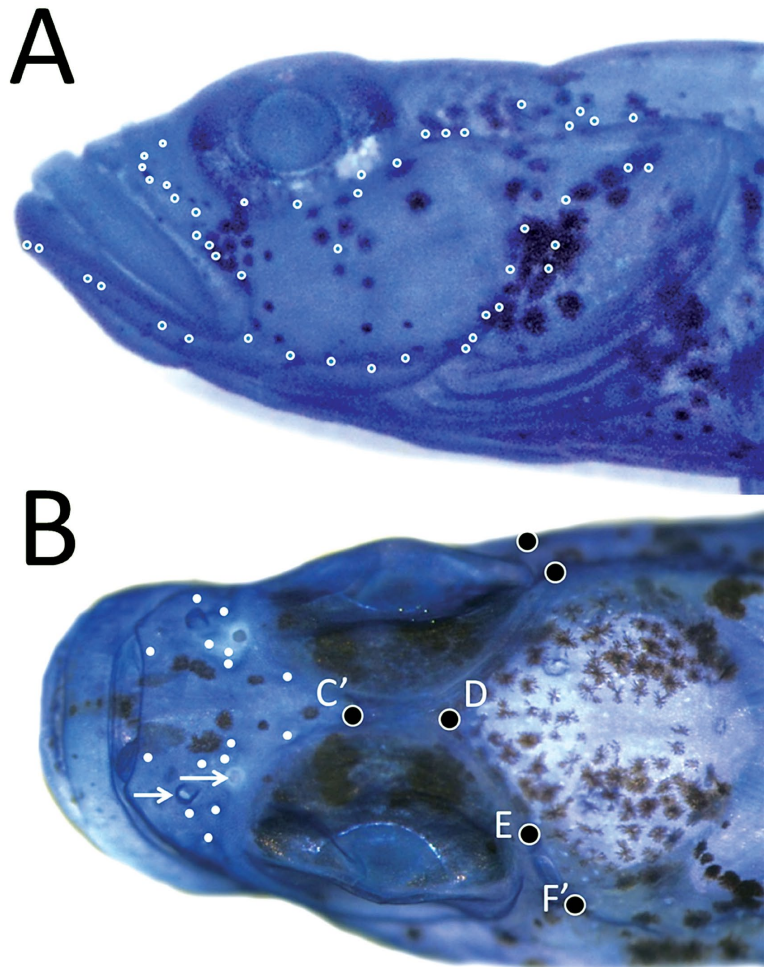


of tongue concave; gill opening mainly restricted to pectoral-fin base, extending forward to about level of middle of opercle.

Anterior nostril opening tubular; posterior nostril opening with low rim, situated about midway between anterior nostril and eye; pattern of head papillae and sensory pores as shown in Fig. 21; pores reduced with anterior oculoscapular canal containing pore C' (unpaired), D (unpaired), E, and F'. Head and most of body without scales; scales ctenoid and mainly restricted to caudal peduncle as shown in Fig. 3E.

Origin of first dorsal fin about one eye diameter behind head, snout to first dorsal-fin origin 2.7 (2.5–2.6) in SL; dorsal-fin spines slender and flexible, first spine longest, 2.1 (1.6–1.9) in HL; snout to second-dorsal-fin origin 1.8 (1.7–1.8) in SL; spine of second dorsal fin 3.7 (3.1–3.4) in HL; first 3–4 segmented dorsal-fin rays longest, 2.2 (1.7–2.1) in HL; origin of anal fin slightly behind origin of second dorsal fin, snout to anal-fin origin 1.8 (1.7–1.8) in SL; anal-fin spine 4.3 (4.0–4.8) in HL; second segmented anal-fin ray longest, 2.6 (2.2) in HL; caudal fin shorter than head with truncate posterior margin, its length 5.0 (4.8–5.2) in SL; pectoral fins pointed, middle rays longest, reaching to level of posterior edge of pelvic fins, 1.3 (1.2) in HL; snout to pelvic-fin origin 3.1 (2.9–3.1) in SL; pelvic fins reaching to urogenital papilla, 1.1 (1.1–1.2) in HL.

**Color in life.** Unknown, but judging from similarities with preserved specimens of *G. baliensis*, the live color pattern probably resembles that of *G. baliensis* (Fig. 22).



**Figure 21.** *Grallenia solomonensis*, preserved holotype, stained to show pattern of head papillae (white dots) and sensory pores (larger black spots): A) lateral; B) dorsal. Nostrils indicated with arrows (G.R. Allen).



**Figure 22.** *Grallenia baliensis*, underwater photograph, female, approx. 14 mm SL, Bali, Indonesia (G.R. Allen).

**Color in alcohol.** (Fig. 20) Generally whitish with dark pigmentation, especially prominent markings include a pair of backward slanting bands below eye, forward slanting band across anterior opercle, and a pair of dark spots at base of caudal fin; dorsal surface of snout and nape with numerous black spots, streaks, and stellate markings (Fig. 21B), and dorsal scleral surface of each eye with a pair of broad black bands; dorsal fins generally translucent except blackish stripe at base of first dorsal fin and diffuse blackish stripe on lower third of second dorsal fin; anal and pelvic fins translucent with relatively dense covering of melanophores on membranes; melanophores also concentrated on breast and pectoral-fin base; caudal fin translucent.

**Sexual dimorphism.** Male characteristics unknown; female urogenital papilla is broad and flattened with a circular outline and its posterior margin fringed with several enlarged tubercles.

**Etymology.** The species is named *solomonensis* with reference to the Solomon Islands type locality.

**Comparisons.** Although apparently related to *G. lauensis* (see comparisons for that species), which has similar patterns of head pores and caudal-peduncle scalation, *G. solomonensis* is similar in general appearance to *G. baliensis* (Fig. 22), from Bali and North Sulawesi, Indonesia. Both species are characterized by greatly reduced scalation, which is mainly restricted to the caudal peduncle except for a single longitudinal row immediately behind the pectoral-fin base with only 3–5 scales. However, the two species differ notably in counts of segmented rays in the dorsal and anal fins: the type specimens of *G. solomonensis* contain 7 rays in both fins compared to 10 dorsal-fin rays and 8–9 anal-fin rays in *G. baliensis*. Furthermore, *G. baliensis* lacks head pores vs. 4 pores in the anterior oculoscapular sensory canal in *G. solomonensis* (Fig. 21B). The new species further differs from *G. baliensis* and all other members of the genus in having a slightly deeper body (16.6–17.9% of SL at the pelvic-fin origin vs. less than 15.7%, but usually less than 15%).

### Key to the species of *Grallenia*

- 1a. Cephalic sensory-canal pores present; dorsal- and anal-fin rays I,6–I,8 (usually I,7) .....2
- 1b. Cephalic sensory-canal pores absent; dorsal- and anal-fin rays I,8–I,11 .....4
- 2a. Body scales extending forward to just behind pectoral-fin base, similar to Fig. 9 (S. Japan) ... ***G. arenicola***
- 2b. Body scales mostly restricted to caudal peduncle (Fig. 3C & E) .....3
- 3a. Anterior body behind pectoral-fin base with longitudinal row of 3–5 scales; pectoral-fin rays mostly branched (Solomon Islands) ..... ***G. solomonensis*, n. sp.**
- 3b. Anterior body behind pectoral-fin base without scales; pectoral-fin rays mostly unbranched (Lau Islands of Fiji, Great Barrier Reef & northwestern Coral Sea) ..... ***G. lauensis*, n. sp.**
- 4a. Most body scales restricted to caudal peduncle; male with filamentous first dorsal-fin spine .....5
- 4b. Most body scales extending well forward of caudal peduncle; male without filamentous first dorsal-fin spine .....6
- 5a. Longitudinal scales on posterior body 5–8; pectoral-fin rays usually 15 (rarely 14 or 16) (Bali to North Sulawesi, Indonesia) ..... ***G. baliensis***
- 5b. Longitudinal scales on posterior body 10–14; pectoral-fin rays usually 16 (rarely 14 or 15, occasionally 17) (eastern Indonesia) ..... ***G. lipi***

- 6a. Mid-lateral longitudinal scale row continuous from just behind pectoral-fin base to caudal-fin base (Fig. 3B); male with black anal-fin margin; female with filamentous first dorsal-fin spine (Papua New Guinea) ..... *G. dimorpha*, n. sp.
- 6b. Mid-lateral longitudinal scale row consisting of 1–5 scales behind pectoral-fin base, separated from remaining posterior body scales by a gap (Fig. 3A & D); male with or without black anal-fin margin; both sexes without a filamentous first dorsal-fin spine ..... 7
- 7a. Body anterior to level of middle of second dorsal fin mainly scaleless (Fig. 3A); dorsal- and anal-fin rays 8–9; male without black anal-fin margin (Milne Bay Province, Papua New Guinea) ..... *G. compta*, n. sp.
- 7b. Body anterior to level of middle of second dorsal fin with many scales (Fig. 3D); dorsal- and anal-fin rays 9–11 (usually 10); male with broad black anal-fin margin (Philippines & Sabah) ..... *G. rubrilineata*, n. sp.

### Australian records of *Grallenia arenicola*

*Grallenia arenicola*, the type species for the genus, was described by Shibukawa & Iwata (2007) on the basis of 17 specimens (including 4 non-types) from Kashiwa-jima Island, Kochi Prefecture, Japan. The first Australian record of this species was reported from the Northern Territory by Larson *et al.* (2013) on the basis of 7 lots at NTM. Eight additional lots from Australia have been identified at NTM and WAM and are presently being studied by the first author. Preliminary investigations reveal that specimens previously identified as *G. arenicola* from the Northern Territory and northern Western Australia (“?” locations in Fig. 6) most likely represent an undescribed species that will be treated in a separate publication.

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