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Trimma christianeae, a new species of goby (Teleostei: Gobiidae) from Milne Bay Province, Papua New Guinea

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Abstract

A new species of gobiid fish, *Trimma christianeae*, is described from 11 specimens, 9.8–18.9 mm SL, collected in 1–4 m depth near the town of Alotau in Milne Bay Province, Papua New Guinea. Diagnostic features include: dorsal-fin elements VI+I,9, second dorsal-fin spine usually with a short filament, extending to the base of the first to fourth segmented dorsal-fin ray when adpressed; anal-fin elements I,7; the fifth segmented pelvic-fin ray with sequential branching consisting of three branch points, its length about 75–90% (mean 83%) length of fourth ray; the basal membrane of the pelvic fin fully developed; well-developed interorbital and postorbital trenches; no scales present on the opercle; the posterior naris large and adnate to the orbital rim; the gill rakers on the first arch 3–4+12–13; color in life mainly orange to brownish red with diffuse brown scale margins forming a reticulated pattern; 6 indistinct narrow white or gray bars (sometimes branching) along the back and dorsalmost part of caudal peduncle; and the pectoral-fin base with a distinctive orange to reddish-brown medial area with large white spots dorsally and ventrally. The new species is most similar in appearance to *T. mendelssohni*, from the western Indian Ocean, which differs in having scales present on the upper opercle, a pair of small, fleshy lappets on the dorsal surface of the nape, and the absence of upper-limb gill rakers. The general color pattern and well-developed interorbital and postorbital trenches indicate a possible relationship to the *Trimma caesiura* complex.

Key words: taxonomy, systematics, ichthyology, coral-reef fishes, Indo-Pacific Ocean, *Trimma caesiura* complex

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Introduction

The gobiid genus *Trimma* Jordan & Seale, 1906 of the Indo-West Pacific region contains tiny (usually <3 cm SL) inconspicuous inhabitants of coral reefs. Diagnostic features of the genus include the lack of cephalic sensory-canal pores; a much reduced cephalic-sensory-papillae pattern; a wide gill opening extending anteriorly to below the vertical limb of the preopercle or, more usually, farther anterior; a lack of spicules (odontoids) on the outer gill rakers of the first gill arch; fewer than 12 dorsal- and anal-fin segmented rays; and a fifth pelvic-fin ray that is equal to or more than 40% the length of the fourth ray (Winterbottom 2011).

Prior to 1970, only 10 species were recognized, but, largely thanks to the widespread use of scuba-diving gear by ichthyologists in recent decades, there are now at least 100 valid species (Winterbottom 2018). Richard Winterbottom of the Royal Ontario Museum, Toronto, Canada, has played a major role in advancing our knowledge of this genus, including descriptions of the majority of the currently known species, and he expects the number of species in the genus could double with additional research underway (Winterbottom *et al*. 2014). Nevertheless, there is still much to learn about this intriguing group and there appears to be a steady stream of new discoveries, especially with collections beyond normal scuba-diving depths. Genetic research is also progressing and is especially useful for delineating and identifying species, although phylogenetic relationships within the genus remain largely unresolved (Winterbottom *et al*. 2014).

The present paper describes a new *Trimma* species collected recently at Milne Bay Province, Papua New Guinea that possesses well-developed interorbital and postorbital trenches, as well as a large posterior naris that is adnate to the orbital rim. The latter feature in particular indicates a possible relationship with *T. mendelssohni* (Goren, 1978) from the western Indian Ocean, which shares that unusual character: however, the new species does not share the scales on the upper opercle and differs in two other important characters, i.e. lacking a pair of small, fleshy lappets on the dorsal surface of the nape and having rakers on the upper (epibranchial portion) of the gill arch (absent in *T. mendelssohni*).

Materials and Methods

Type specimens are deposited at the Royal Ontario Museum, Toronto, Canada (ROM) and the Western Australian Museum, Perth, Australia (WAM).

The methods of counting and measuring and general format of the new species description follow those of Winterbottom (2016 and references cited therein). Naming of the cephalic sensory papillae rows follows Winterbottom (2011), as modified by Winterbottom *et al*. (2015). Cheek depth is the vertical measurement between the lower edge of the eye and anterior origin of papillae row *ip*. The relative length of the shorter fifth segmented pelvic-fin ray to the longer fourth ray, a useful diagnostic character among *Trimma* species, is rounded to the nearest 5%.

Specimens were stained with Cyanine Blue 5R solution, which greatly facilitated examination of branching patterns of the pectoral- and pelvic-fin rays, as well as highlighting cephalic sensory papillae rows. Standard length, the measurement from the tip of the snout to the caudal-fin base, is abbreviated as SL. Counts and measurements are given for the holotype followed in parentheses by the range for paratypes, if different, and the mean value for all specimens. The backslash (/) in the pectoral-fin ray count indicates different values for the left and right side respectively. All specimens were utilized for counts and measurements, except the smallest paratype (9.8 mm SL) was not used for measurements due to poor condition. Comparative data for the other members of the *Trimma caesiura* species complex was obtained from Winterbottom & Villa (2003). A single ROM paratype (T12977) was fixed in ETOH for future genetic analyses.

Trimma christianeae, n. sp.

Christiane's Pygmygoby

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Figures 1–4 & 6A.

Holotype. WAM P.34936-001, male, 18.9 mm SL, Papua New Guinea, Milne Bay Province, Alotau town, Nawae Construction Company dock, -10.3044°, 150.4131°, 1–4 m, clove oil & hand net, S. Tahing & R. Vanderloos, 28 October 2018.

Paratypes. ROM 104322, 2 specimens, 15.3–16.1 mm SL, collected with holotype; ROM T12977, 16.7 mm SL, collected with holotype; WAM P.34936-002, 7 specimens, 9.8–14.6 mm SL, collected with holotype.

Diagnosis. A species of *Trimma* with the following combination of characters: dorsal-fin elements VI+I,9, second dorsal-fin spine usually with short filament, extending to base of first to fourth segmented dorsal-fin

Figure 1. *Trimma christianeae*, approx. 20 mm SL, underwater photographs, Alotau, Milne Bay Province, Papua New Guinea (C. Waldrich, upper & G.R. Allen, lower).

Figure 2. *Trimma christianeae*, preserved male holotype, WAM P.34936-001, 18.9 mm SL, Alotau, Milne Bay Province, Papua New Guinea (G.R. Allen). The slight bluish hue on the head and abdomen is due to residual Cyanine Blue stain.

ray when adpressed; anal-fin elements I,8; fifth segmented pelvic-fin ray with sequential branching consisting of three branch points, its length 76.9–87.5% (mean 83.4%) length of fourth ray; basal membrane of pelvic fin fully developed; gill rakers on first arch 3–4+12–13; no scales on opercle; posterior naris large and adnate to orbital rim; indistinct narrow white or gray bars (sometimes branching) along back and dorsalmost part of caudal peduncle; pectoral-fin base with distinctive orange to reddish-brown medial area with large white spots dorsally and ventrally.

Description. Dorsal-fin elements VI+I,9, second dorsal-fin spine usually with short filament, extending to base of first to fourth segmented dorsal-fin ray when adpressed; anal-fin elements I,8; pectoral-fin rays 17/16 (16–18, 16.8), uppermost 4 or 5 and lowermost 6 or 7 unbranched (damaged in about half of paratypes); pelvic-fin rays I,5, no frenum, full basal membrane; first three segmented rays with a single branch point, fourth segmented ray with 1 or 2 branch points, and fifth segmented ray with sequential branching consisting of three branch points, fifth segmented pelvic-fin ray 90% (80–90%, 84%) length of fourth ray; scales on pectoral-fin base and prepelvic region cycloid, all other scales ctenoid; cheek and opercle scaleless; lateral scales 23 (22–24, 22.8); transverse scales 7; predorsal scale rows 9 (7–9, 7.9).

Teeth in both upper and lower jaws with large, curved, spaced canines in outer row, with smaller irregular inner rows of conical teeth, and innermost row of lower jaw with spaced canines about half size of outer-row canines. Gill opening to about level of rear margin of pupil; gill rakers on first arch 3+13 (3–4+12–13, 3.5+12.6). Anterior naris tubular and posterior naris forming a large pore with an elevated rim, adnate to anterior margin of orbital rim. Interorbital and postorbital trenches well-developed with a relatively gradual posterior frontal ridge slope (Fig. 3). Pattern of cephalic sensory papillae as shown in Fig. 4, with numbers in each row as follows: *a* 6 (5–6, 5.7), *b* 9 (5–7, 6.6), *c* 6 (5–6, 5.7), *cp* 1, *d* 6 (5–8, 6.2), *d'* 8 (6–9, 7.2), *ea* 15 (11–17, 14.2), *ep* 16 (15–19, 16.6), *ia* 7 (6–9, 7.0), *ip* 8 (6–8, 7.6), *p* 6, *r* 2 , *f* 4 (3–4, 3.6), *cs"* 3, *g* 1 (0–5, 1.5), *n* 1, *x* 7 (5–8, 6.2), *u* 5

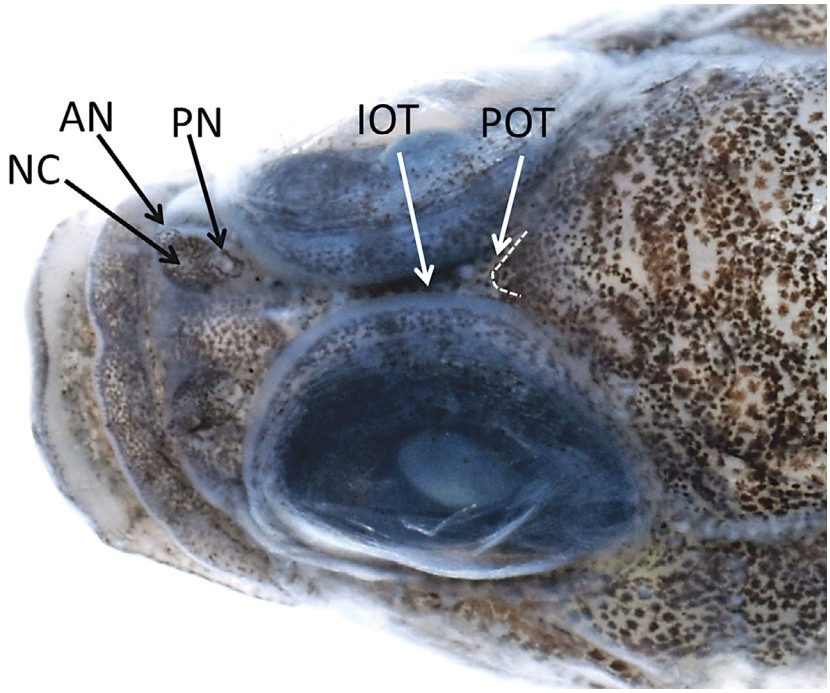

Figure 3. *Trimma christianeae*, holotype, 18.9 mm SL, dorsal view of head: IOT=interorbital trench; POT=postorbital trench; NC=nasal capsule; AN= anterior naris; PN=posterior naris. The dashed line indicates the apex of the frontal ridge that forms the posterior boundary of the trench system (G.R. Allen).

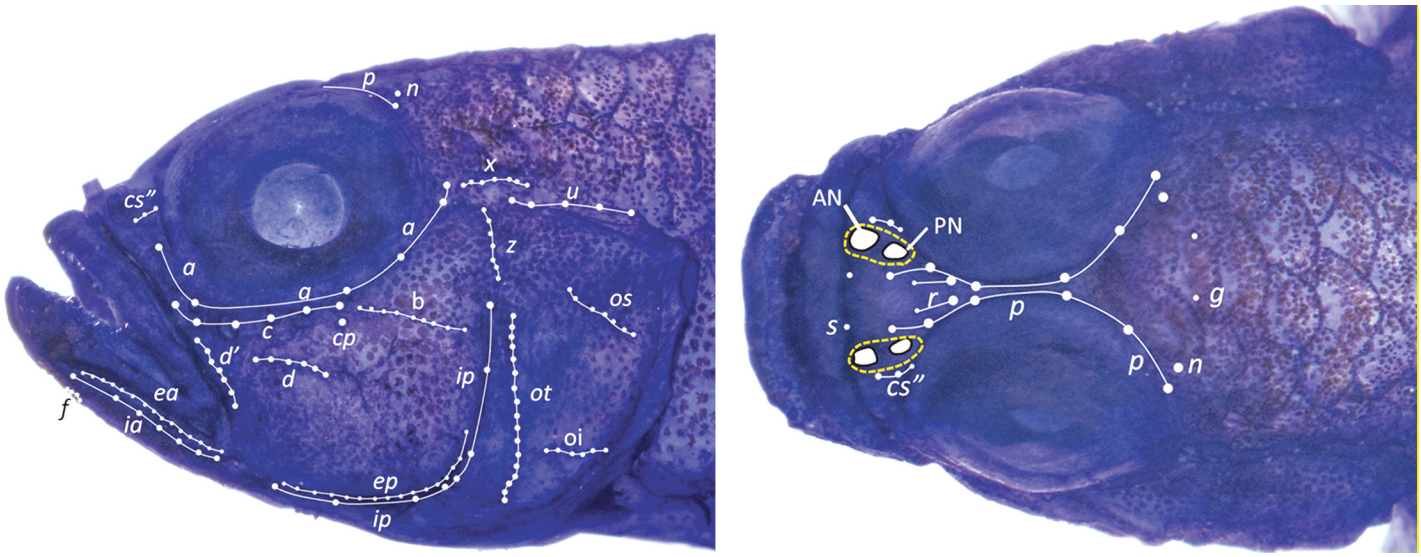

Figure 4. *Trimma christianeae*, holotype, 18.9 mm SL, showing papillae pattern of lateral and dorsal head. Individual papillae shown as white dots and labelled rows as thin lines. The outer margin of the nasal capsule is indicated by a yellow-dashed line. Specimen stained with Cyanine Blue (G.R. Allen).

(4–5, 4.8), *z* 7 (5–7, 6.0), *ot* 17 (12–15, 14.5), *os* 7 (5–7, 6.0), *oi* 6 (4–6, 5.0), and *s* 1 (note: rows *a* and *u* usually have 6 and 5 papillae respectively, and lower counts usually reflect loss due to abrasion).

Measurements: head length as percentage of SL 27.5 (27.7–33.0, 30.2); eye diameter as percentage of head length 42.9 (40.5–46.3, 43.3); snout length as percentage of head length 15.6 (16.1–20.7, 17.4); cheek depth as percentage of SL 27.7 (24.7–29.5, 27.2); bony interorbital as percentage of pupil diameter 28.6 (27.8–40.6, 34.8); and caudal peduncle depth as percentage of caudal peduncle length 46.6 (37.0–44.0, 41.6).

Color in life. (Figs. 1 & 6A) Overall orange to brownish red with diffuse brown scale margins forming a reticulated pattern; 6 indistict narrow white or gray bars (sometimes branching) along back and dorsalmost part of caudal peducle, first below dorsal-fin origin, second below base of last spine of first dorsal fin, third below base of second segmented dorsal-fin ray, fourth below base of last segmented dorsal-fin ray, fifth dorsally on middle of caudal peduncle, and sixth just anterior to uppermost portion of caudal fin; sometimes a similar white or grayish marking across middle of forehead (Fig. 1, lower); often several widely scattered, short, thin, white or grayish streaks or spots on middle part of side; cheek and lateral portion of lips pinkish to pale orange speckled with numerous melanophores, anterior part of lips brownish; postorbital head with large orange-to-reddish blotches or irregular bands; eye with orange ring around pupil and brownish-orange iris with a pair of white spots each on the anterior and posterior margins; fins mainly translucent with orange rays, caudal fin with diffuse orange transverse bands; pectoral-fin base with a distinctive orange-to-reddish-brown medial area with large white spots dorsally and ventrally (Fig. 1, lower).

Color in alcohol. (Fig. 2) Overall pale gray with concentration of melanophores on scale margins, pectoral-fin base, cheek, opercle, snout and interorbital regions; holotype and some paratypes with faint indication of 6 indistinct narrow white bars along back and dorsalmost part of caudal peduncle as described above; fins translucent whitish with faint gray transverse bands on caudal fin.

Etymology. The new species is named in honor of Christiane Waldrich, who photographed this fish while scuba diving and brought it to my attention. The specific epithet is treated as a noun in the genitive case.

Distribution and habitat. Currently known only from near the town of Alotau in Milne Bay Province, Papua New Guinea. The type specimens were collected from jetty pilings, log debris, and concrete stairs at the water's edge, at depths of about 1–4 m. The species seems to have an affinity for sponge-encrusted surfaces, but the general area is characterized by extensive silty mud substrata inhabited by a large number of burrowing gobies. It is noteworthy that this species was not previously observed despite nearly 100 hours of scuba-diving by the author in the immediate vicinity. However, they were likely missed because the collection site is immediately adjacent to shore at a busy shipyard where diving is usually banned during daylight hours. Also most of the specimens were found on the inner side of a single pillar of the jetty, which was situated in total shade.

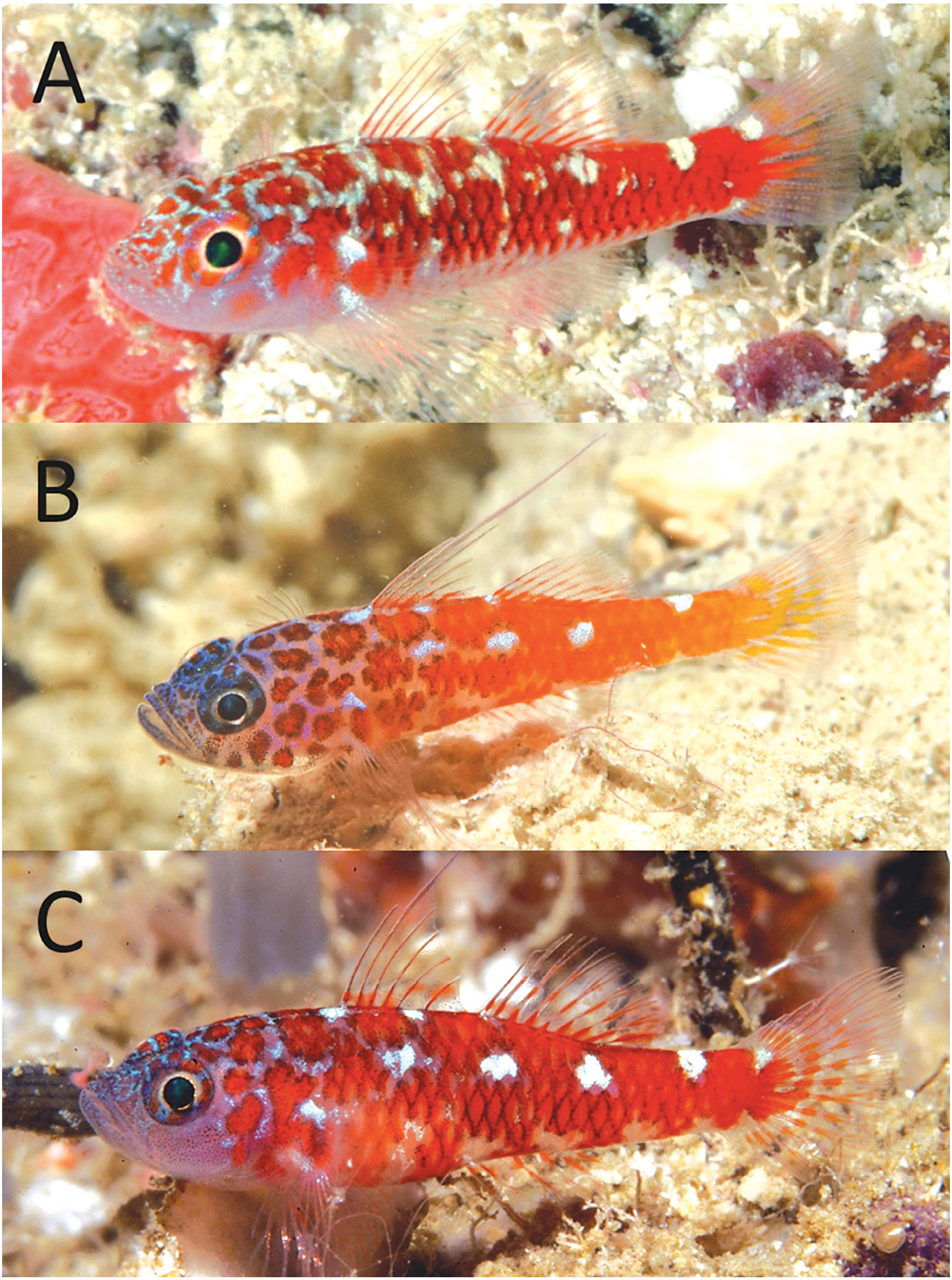

Figure 5. *Trimma caesiura* species complex in the western Pacific Ocean, adults approx. 20 mm SL: A) *T. caesiura*, Palau; B) *T. lantana*, Milne Bay Province, Papua New Guinea; and C) *T. naudei*, Palawan, Philippines (G.R. Allen).

Comparisons. The general color pattern and well-developed interorbital and postorbital trenches indicate a possible relationship to the species group that Winterbottom & Villa (2003) referred to as the *Trimma caesiura* complex. They provisionally included the following species: *T. caesiura* Jordan & Seale, 1906 (W. Pacific to Samoa), *T. lantana* Winterbottom & Villa, 2003 (Australia, New Guinea, and Solomon Islands), *T. mendelssohni* (Goren, 1978) (W. Indian Ocean), *T. naudei* Smith, 1957 (widespread Indo-W. Pacific), and *T. winterbottomi* Randall & Downing, 1994 (Persian Gulf to W. Thailand). More recently, R.W. Winterbottom (pers. comm, 2019) provided genetic data utilizing COI mtDNA sequences indicating that there are actually two discrete groups within the complex: one containing *T. caesiura*, *T. lantana*, and *T. naudei*, and another from the Indian Ocean/Red Sea containing *T. mendelssohni* and *T. winterbottomi*, with the addition of *T. avidori* (Goren, 1978) (Red Sea and Gulf of Aden); *T. corallinum* (Smith, 1959) (W. Indian Ocean); *T. filamentosus* Winterbottom, 1995 (Red Sea); and *T. omanensis* Winterbottom, 2000 (Gulf of Oman).

The new taxon differs markedly from the three members of the *T. caesiura* species group that occur in the western Pacific (Fig. 5; *T. caesiura*, *T. lantana*, and *T. naudei*), although it shares the general reddish or orange coloration with widely scattered white or gray markings. Important differences exhibited by *T. christianeae* include sequential branching with three branch points in the fifth pelvic-fin ray (vs. a single dichotomous branching), fully developed basal pelvic-fin membrane (vs. vestigial membrane), no scales on the opercle (vs. at least one scale, often several, on the uppermost opercle), and 12 or 13 gill rakers on the lower limb of the first arch (vs. 14–17), 7 segmented anal-fin rays (vs. usual counts of 8 or 9), and a large posterior naris adnate to the anterior margin of the orbital rim (vs. small naris, well separated from the eye). It further differs from *T. caesiura* in usually having

Figure 6. *Trimma* spp., approx. 20 mm SL: A) *T. christianeae*, Milne Bay Province, Papua New Guinea (C. Waldrich); B) *T. mendelssohni*, Egyptian Red Sea (G. Barrall, from Winterbottom & Villa [2003]).

a short elongation of the second dorsal-fin spine (vs. no elongation of any dorsal-fin spine), from *T. lantana* and *T. naudei* in having a second dorsal-fin spine that maximally extends to the base of the third or fourth segmented dorsal-fin ray when adpressed (vs. maximally to caudal peduncle or beyond). Additionally, *T. naudei* usually has 7 (average 7.4) segmented dorsal-fin rays compared to 8 rays in *T. christianeae*.

The overall appearance of *T. christianeae* is very similar to that of *T. mendelssohni* (Fig. 6B) from the western Indian Ocean. The latter exhibits several important features that are shared by *T. christianeae*, including multiple sequential branching of the fifth segmented pelvic-fin ray, a fully developed basal pelvic-fin membrane, and the posterior naris adnate to the anterior margin of the orbital rim. However, it differs from *T. christianeae* in having scales present on the upper opercle and a pair of small, fleshy lappets on the dorsal surface of the nape. It also lacks upper limb gill rakers. The other species in the Indian Ocean group mentioned above that have moderate to well-developed interorbital and postorbital trenches are clearly separable from *T. christianeae* in lacking predorsal scales and usually possess 10 or 11 segmented dorsal-fin rays vs. 9 (except 9 or 10 in *T. corallinum*).

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Rob Vanderloos, owner of Milne Bay Charters, and his staff generously provided an opportunity for the author to collect and photograph fishes, including the new *Trimma*, while aboard M/V *Chertan* during October-November 2018. Crew member, Sebastian Tahing was particularly helpful with collecting specimens. Christiane Waldrich's underwater observation skills were instrumental in the discovery of the new species. Thanks are also due Glenn Moore and Mark Allen (WAM) and Erling Holm and Margaret Zur (ROM) for curatorial assistance. Richard Winterbottom, Mark Erdmann, and David Greenfield critically reviewed the manuscript. I am especially grateful to the Paine Family Trust for their continued support of my taxonomic research.

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