Journal of the
Ocean Science Foundation

2015, Volume 14

Four new species of *Trimma* (Pisces: Gobiidae) from Papua New Guinea and Indonesia

GERALD R. ALLEN
Department of Aquatic Zoology, Western Australian Museum,
Locked Bag 49, Welshpool DC, Perth, Western Australia 6986

Abstract

Four new species belonging to the gobiid genus *Trimma* are described from the Indo-Australian Archipelago. *Trimma abyssum* is described from two specimens, 28.8–31.6 mm SL, collected in 107 m depth at Siladen Island, North Sulawesi, Indonesia. Diagnostic features include the combination of 7–8 segmented dorsal rays, the second and third spines longest with short filamentous tips reaching base of first two segmented rays of the second dorsal fin when adpressed; anal rays I,8; pectoral rays 16, all unbranched; unbranched fifth pelvic ray 48–55% length of fourth pelvic ray; bony interorbital 53–65% pupil diameter; fully scaled nape with 12–13 scales in midline of predorsal; scales covering cheek and opercle; ctenoid scales on breast (prepelvic); and prominent dark bar at caudal-fin base and scale pockets strongly outlined with melanophores. The remaining three species were collected at Milne Bay Province, Papua New Guinea. *Trimma chledophilum* is described from 19 specimens, 13.5–22.2 mm SL, collected in 17–18 m depth near the town of Alotau. Diagnostic features include the combination of 9 (rarely 10) segmented dorsal rays, second spine elongate and filamentous, reaching caudal-fin base when fully developed; segmented anal rays 8 (rarely 9); pectoral rays 16–18 (usually 17); fifth pelvic ray branched, 62–71% length of fourth pelvic ray; bony interorbital 46–62% pupil diameter; midline of predorsal broadly scaleless; cheek and opercle scaleless; and mainly bright orange red in life except white on breast belly, and lower half of head, also white stripe on midline of snout. *Trimma nauagium* is described from 3 specimens, 17.4–20.3 mm SL, collected in 24 m depth from a shipwreck off the village of Waga Waga. Diagnostic features include the combination of 8 segmented dorsal and anal rays, the second and third dorsal spines elongate, reaching to base of fifth or sixth segmented ray of second dorsal fin when adpressed; pectoral rays 16; fifth pelvic ray branched, 56–64% length of fourth pelvic ray; bony interorbital equal to pupil diameter; predorsal, cheek, and opercle fully scaled; predorsal scales 12; pattern of cephalic sensory papillae includes five transverse rows below eye; and brownish in life with pink zone along upper side and seven darker brown saddles on back interspersed with smaller golden saddles,

narrow white bar behind eye, and yellowish bar at base of pectoral fin. *Trimma multiclitellum* is described from a single specimen, 17.4 mm SL, collected in 17–18 m depth near the town of Alotau. Diagnostic features include the combination of 8 dorsal and anal segmented rays; pectoral rays 17; caudal fin emarginate with pointed upper lobe and rounded lower lobe; fifth pelvic ray branched, 74% length of fourth pelvic ray; basal membrane 41% length of fourth pelvic ray; bony interorbital about equal to pupil diameter; midline of predorsal mainly scaleless, but with patch of about 4 scales on middle portion; cheek scaleless; opercle with a few scales dorsally; and highly distinctive colour pattern consisting of seven, alternating brown and white bars on upper side, a nearly eye-sized black spot at base of caudal fin, and pair of yellow bars on head, one below eye and another on opercle.

Key words: taxonomy, new species, gobies, deep coral reefs, Indo-Australian Archipelago.

Introduction

Tiny gobiid fishes of the genera *Eviota* Jenkins 1903 and *Trimma* Jordan & Seale 1906 inhabiting Indo-Pacific coral reefs are the most dynamic groups in the family with regards to the rate of new discoveries and number of new taxa described over the past three decades (Allen & Erdmann 2012). The latter genus is particularly speciose with 78 valid described species and a predicted total of nearly 200 species (Winterbottom *et al*. 2014b). Prior to 1970, only 10 currently recognized species of *Trimma* were known (Eschmeyer 2015). It is easy to understand how they have escaped detection in the past, considering their small size (usually less than 25 mm SL) and the affinity of many species for relatively deep water, which was largely inaccessible prior to the advent of scuba diving. Indeed, the great proliferation of diving ichthyologists since the 1970s, and the parallel growth of underwater photography, have resulted in a much better understanding of these interesting fishes. The work of Richard Winterbottom (Canada) and Toshiyuki Suzuki (Japan) and their collaborators, who have described most of the recent new species, has been particularly instrumental in this regard.

The present paper describes four new species of *Trimma*. One of these was collected at a depth of 107 m, which represents the deepest record for the genus. It was among a collection of deep reef fishes obtained at North Sulawesi, Indonesia by Forest Young and colleagues during April 2005. Two specimens were collected during a series of deep reef rebreather scuba dives. Although the primary goal of the expedition, to locate and film the recently described Indonesian coelacanth (*Latimeria menadoensis* Pouyaud *et al*. 1999), was unsuccessful, a valuable collection of small reef fishes was obtained. The remaining three species were collected by the author in December 2014 during scuba dives in the vicinity of Alotau (10° 19’ S, 150° 27’ E) and nearby areas in Milne Bay Province of Papua New Guinea. Two of these were discovered during a series of 19 scuba dives, involving 38 hours underwater, which facilitated a detailed survey of a sloping, mud-bottom habitat, extending along 200 m of shoreline to a maximum depth of about 18 m. The gobiid fauna of this small area (approximately 8,000 m^2) was especially impressive and included new species of *Acentrogobius* Bleeker 1874, *Cryptocentrus* Valenciennes 1837, *Tomiyamichthys* Smith 1956, and *Trimma*. An additional new *Trimma* was collected on a remarkably intact World War II shipwreck (Muscoota) at Waga Waga, a small village about 10 km from Alotau on the southern side of Milne Bay.

Materials and Methods

The methods of counting and measuring and general format of the new species descriptions follow those of Winterbottom (2002, 2011). Specimens were stained with cyanine blue solution, which greatly facilitated examination of branching patterns of pectoral and pelvic rays, as well as patterns of cephalic sensory papillae rows. The row nomenclature (i.e. italicised abbreviations) for cephalic sensory papillae is based on the explanation and illustrations of Winterbottom (2011). Standard length, the measurement from the tip of the snout to the caudal-fin base, is abbreviated as SL. The range of counts and measurements for paratypes is indicted in parentheses if different from the holotype. Type specimens are deposited at the Western Australian Museum, Perth (WAM).

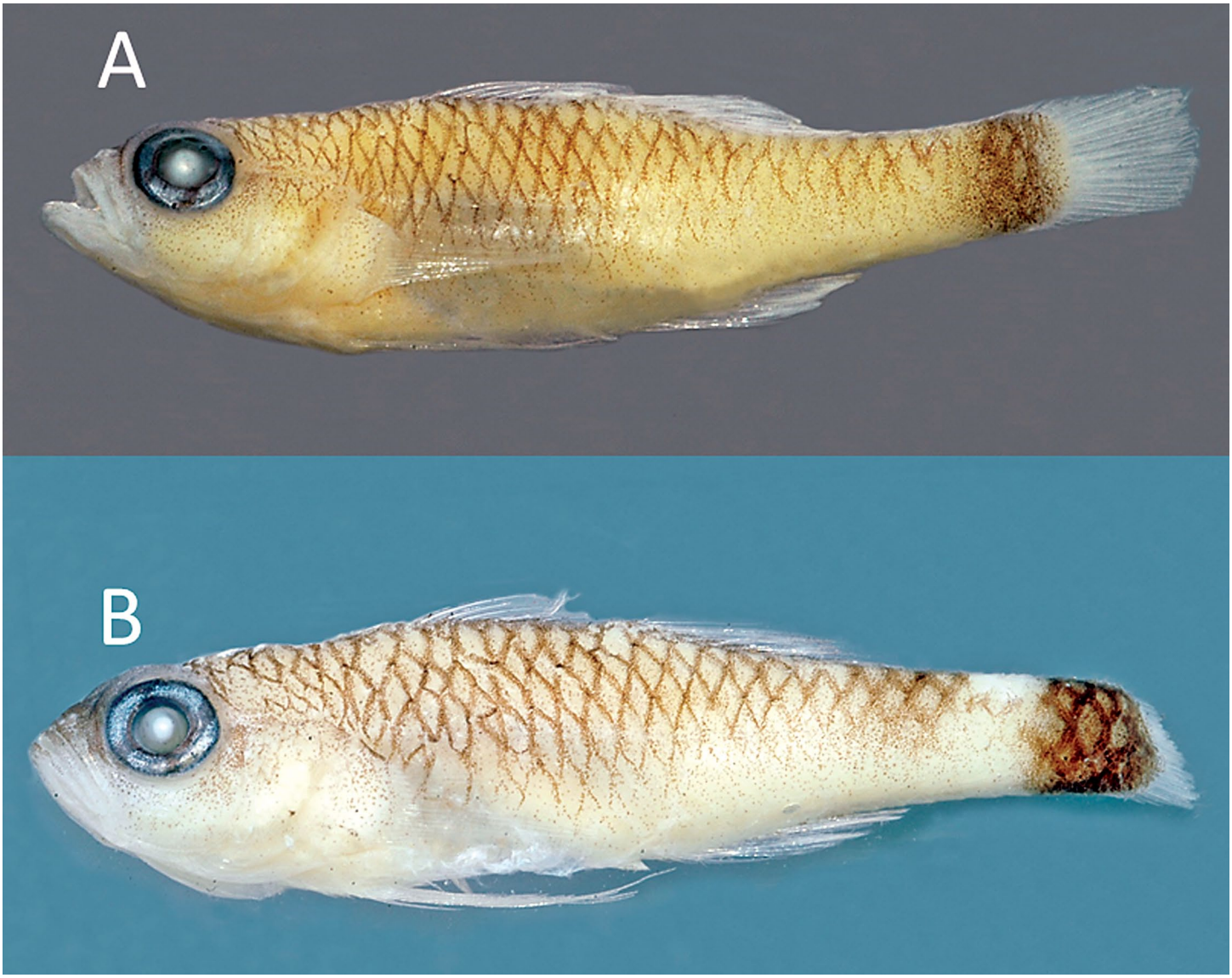

Figure 1. *Trimma abyssum*: A. male holotype, WAM P.34327-001, 31.6 mm SL; B. female paratype, WAM P.34327-002 28.8 mm SL, Siladen Island, North Sulawesi, Indonesia. Photographs by G.R. Allen.

Trimma abyssum Allen, n. sp.

Deepreef Pygmy Goby

Figures 1–2.

Holotype. WAM P.34327-001, male, 31.6 mm SL, off Pulau Siladen, approximately 01° 38' N, 124° 47' E, North Sulawesi, Indonesia, 107 m, quinaldine and hand net, F. Young, 24 April 2005.

Paratype. WAM P.34327-002, female, 28.8 mm SL, collected with holotype.

Diagnosis. A species of *Trimma* with the following combination of characters: dorsal-fin rays VI + I,7 or 8, second and third spines longest, with short filamentous tips reaching to between bases of first two segmented rays of second dorsal fin when adpressed; anal rays I,8; pectoral rays 16, all unbranched; fifth pelvic ray unbranched, 48–55% length of fourth pelvic ray; bony interorbital 53–65% pupil diameter; fully scaled nape with 12–13 scales

on midline of predorsal; scales covering cheek and opercle; ctenoid scales on breast (prepelvic); colour pattern includes prominent dark bar at caudal-fin base and scale pockets strongly outlined with melanophores.

Description. Dorsal-fin rays VI + I,8 (7), second and third spines longest with short filaments, reaching to base of first or second segmented ray of second dorsal fin when adpressed, all segmented rays of second dorsal fin branched; anal rays I,8, all segmented rays branched; pectoral rays 16, all rays unbranched; pelvic-fin rays I, 5, first four rays with a single sequential branching pattern, fifth ray unbranched and about 55% (48%) length of fourth ray, no frenum and no basal membrane.

Lateral scales 26; predorsal scales 13 (12); anterior transverse scales 8 (7); posterior transverse scales 7; pectoral-fin base with cycloid scales; breast and midline of belly with ctenoid scales, ctenoid scales also covering remainder of body, including nape and predorsal-midline; opercle entirely covered with approximately 12–13 scales (counted from scale pockets); cheek with two main rows of scales (counted from scale pockets).

Teeth of the outer row of the upper jaw, and of outer and inner rows of the lower jaw, consisting of enlarged, curved, widely separated canines, with several irregular rows of small conical teeth behind the outer rows. Tongue broadly rounded, about half pupil diameter in width. Gill opening extending ventrally to below midpoint of pupil; outer gill rakers of first gill arch 4 + 15. Anterior nasal opening a short tube, posterior nasal opening pore-like with an elevated rim, nasal sac slightly raised, with nasal apparatus confined to the anterior half of the snout. A relatively deep interorbital trench, none posterodorsal to the eye; bony interorbital width 65% (53%) pupil diameter; epaxial musculature reaching anteriorly to above posterior margin of pupil.

Pattern of cephalic sensory papillae as shown in Fig. 2 with number in each row (in parentheses) as follows: *a* (5), *c* (6), *cp* (1), *d* (6–8), *d'* (8–9), *ea* (14–17), *ep* (18–21), *ia* (6–7), *ip* (6–7), *r* (2), *f* (3–4), *cs"* (2), *x* (7), *ot* (10, incomplete), *oi* (4), *p* (7), and *sm* (1); row *g* is apparently absent and rows *b*, *z*, and *os* appear to be abraded.

Color of holotype in alcohol. (Fig. 1) Generally pale yellowish tan with brown melanophores concentrated on margins of scale pockets on dorsal two-thirds of the body and also on nape; dark brown bar, its width about equal to eye diameter, at base of caudal fin; lips whitish; all fins translucent whitish. The female paratype is similar, except the dark markings, including the scale outlines and brown bar at the caudal-fin base are more vivid and the latter is preceded by a white bar of nearly equal width with an intensely white saddle across the upper edge of the caudal peduncle, this marking in turn is preceded by a brownish saddle, formed by the expansion of dark brown melanophores on the margins of the scale pockets. The live colouration is unknown.

Distribution and habitat. The new species is currently known only from the type locality, but further collecting/observations in similar depth and habitat conditions across the East Indian region will likely extend the range. The habitat consists of caves and ledges in 107 m depth at the base of a steep outer reef slope.

Etymology. The new species is named *abyssum* (from the Latin '*abyssus*': the deep sea) with reference to the unusually deep habitat in comparison with most gobiid fishes.

Comparisons. *Trimma abyssum* belongs to a small group of species, which share a narrow bony interorbital (< 80% of pupil width), lack an elongate spine in the first dorsal fin, and have a scaled predorsal midline, scaled cheek and opercle, and no branched rays in the pectoral fin. The group was discussed by Winterbottom *et al*. (2014b, p. 373) and contains the following described taxa (general distribution indicated in parentheses): *T. emeryi* Winterbottom 1985 (Indo-west Pacific), *T. fasciatum* Suzuki *et al*. 2012 (western Pacific), *T. flavatrum* Hagiwara & Winterbottom (western Pacific), and *T. meranyx* Winterbottom *et al*. 2014a (Sulawesi to Papua New Guinea). The first two species lack a dark marking on the posterior caudal peduncle, a feature that is shared by the other three. The dark peduncular marking of *T. meranyx* is interrupted posteriorly by two intense white spots that form dorsal and ventral saddles. In addition, it has 23–24 (versus 26) lateral scales, a branched (versus unbranched) fifth pelvic ray, and a well developed (versus absent) basal membrane on the pelvic fins. The dark mark of *T. flavatrum* occupies almost the entire caudal peduncle (versus posterior part), although it is diffuse anteriorly and increasingly darker posteriorly. It also differs from *T. abyssum* in having 13–15, usually 14 (versus 16) pectoral rays and 7–8 predorsal scales (versus 12–13). Additionally, most of these species, and the majority of *Trimma*, are found in shallower depths, usually in less than about 30–40 m, although *T. meranyx* and a few other species range to at least 70 m. Importantly, the new species differs from the above mentioned species and all other *Trimma* in having only ctenoid scales on the breast (prepelvic area).

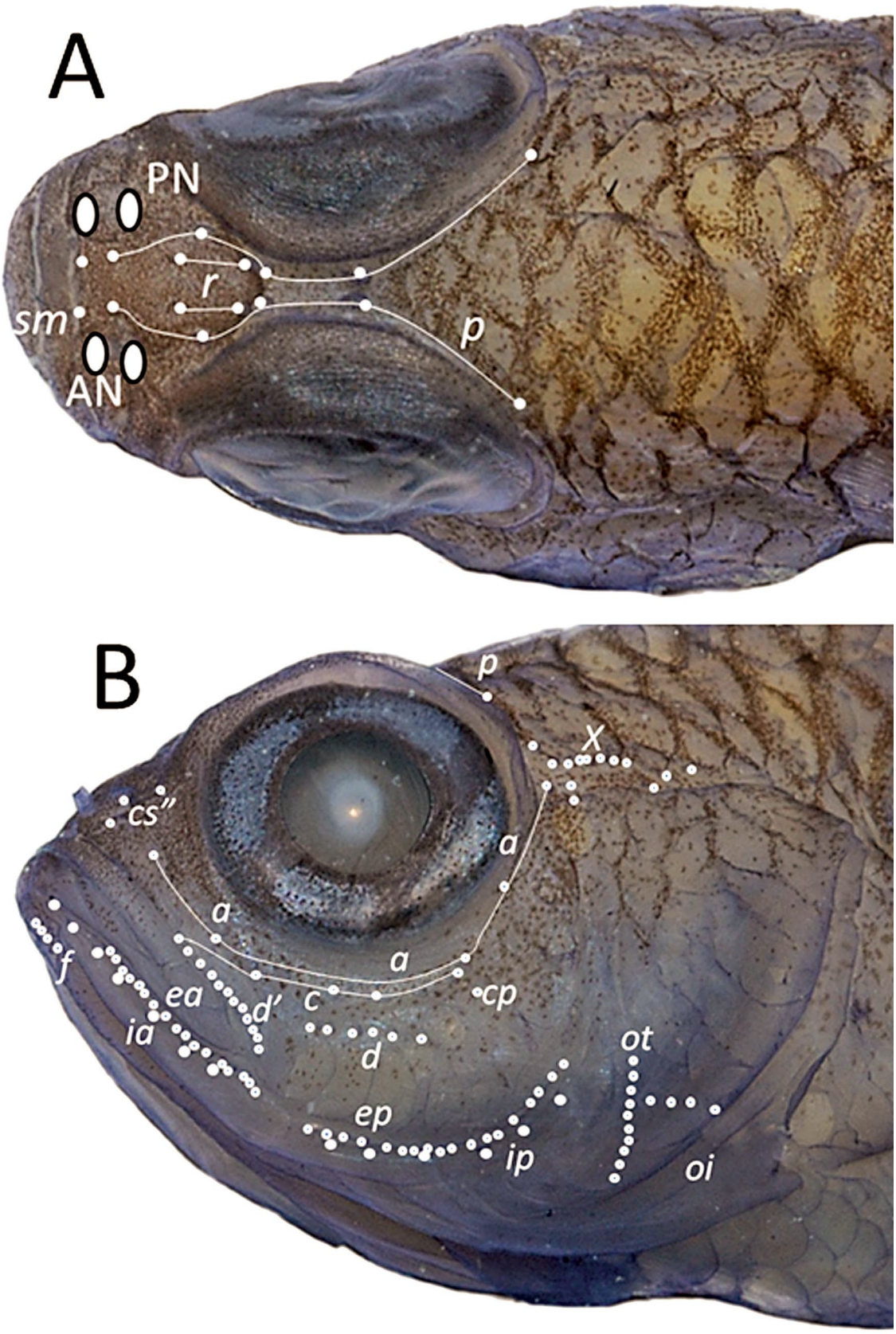

Figure 2. *Trimma abyssum*, head of holotype, WAM P.34327-001, 31.6 mm SL, showing sensory papillae (white dots) in dorsal (A) and left lateral (B) view. Specimen stained with cyanine blue. Photographs by G.R. Allen.

Figure 3. *Trimma chledophilum*, preserved male holotype, WAM P.34319-007, 22.2 mm SL. Photograph by G.R. Allen.

Trimma chledophilum Allen, n. sp.

Mud Pygmy Goby

Figures 3–6.

Holotype. WAM P.34319-007, male, 22.2 mm SL, Alotau, Papua New Guinea, 4.8 km east of main wharf, 10º 18.256'S, 150º 24.768'E, 17.5 m, clove oil and hand net, G. R. Allen, 11 December 2014.

Paratypes. WAM P.34319-007, 18 specimens, 13.5–21.0 mm SL, collected with holotype.

Diagnosis. A species of *Trimma* with the following combination of characters: dorsal-fin rays VI + I,9 (rarely 10), second spine elongate and filamentous, reaching caudal-fin base when fully developed; anal rays I,8 (rarely 9); fifth pelvic ray branched, 62–71% length of fourth pelvic ray; bony interorbital 46–62% pupil diameter; midline of predorsal broadly scaleless; cheek and opercle scaleless; mainly bright orange-red in life except white on breast and belly, and lower half of head, also white stripe on midline of snout in life.

Description. Dorsal-fin rays VI + I,9 (one paratype with 10), second spine elongate and filamentous, reaching caudal-fin base when adpressed, segmented rays of second dorsal fin branched except first ray unbranched in 75% of paratypes; anal rays I,8 (9 in one paratype), segmented rays branched except first ray unbranched in holotype and 83% of paratypes; pectoral rays 17 (two paratypes with 16 and one with 18), the middle 8–9 rays branched; pelvic-fin rays I,5, first four rays with one or two sequential branch points, fifth ray branched once and 68% (62–71%) length of fourth ray, frenum absent, basal membrane poorly developed, 8% (5–10%) length of fourth pelvic ray.

Lateral scales 24 (24–26); anterior transverse scales 9; posterior transverse scales 8 (4 paratypes with 7); midline of predorsal broadly scaleless; pectoral-fin base with cycloid scales; midline of prepelvic with 4–5 cycloid scales, body scales ctenoid except for cycloid scales on anterior belly midline, beneath and immediately posterior to pectoral-fin base, anterior scales on sides of nape, and along base of first dorsal fin; body scales extend anteriorly on sides of nape almost to rear margin of eye.

Teeth of upper jaw consisting of outer row of curved, widely separated, enlarged canines (about 8–9 on each side), decreasing in size posteriorly, and inner band of several irregular rows of smaller conical teeth, widest at symphysis, the number of rows decreasing posteriorly; lower jaw with outer row of curved, widely separated, enlarged canines (5–6 on each side), ending at bend of dentary and several rows of small, curved conical teeth, widest at symphysis and narrowing to a single row posteriorly; innermost row of teeth at bend of dentary notably larger than those of intermediate rows. Gill opening extending ventrally to below midpoint of pupil; outer gill

rakers of first gill arch 5 + 16 (4–5 + 14–16, n = 6). Anterior nasal opening a short tube, posterior nasal opening pore-like with an elevated rim, nasal sac slightly raised, with nasal apparatus confined to the anterior half of the snout. A relatively deep, U-shaped interorbital trench, none posterodorsal to the eye; bony interorbital width 62% (46–62%) pupil diameter; epaxial musculature reaching anteriorly to above posterior margin of pupil.

Pattern of cephalic sensory papillae as shown in Fig. 4 with number in each row (in parentheses) as follows: *a* (5), *b* (6), *c* (5–6), *cp* (1), *d* (9–10), *d'* (7–10), *ea* (14), *ep* (17–18), *ia* (7–8), *ip* (7–8), *r* (2), *f* (3–4), *cs"* (3), *g* (10), *x* (6–8), *z* (7–9), *ot* (16–18), *os* (6–7), *oi* (4–6), *p* (7), and *sm* (1).

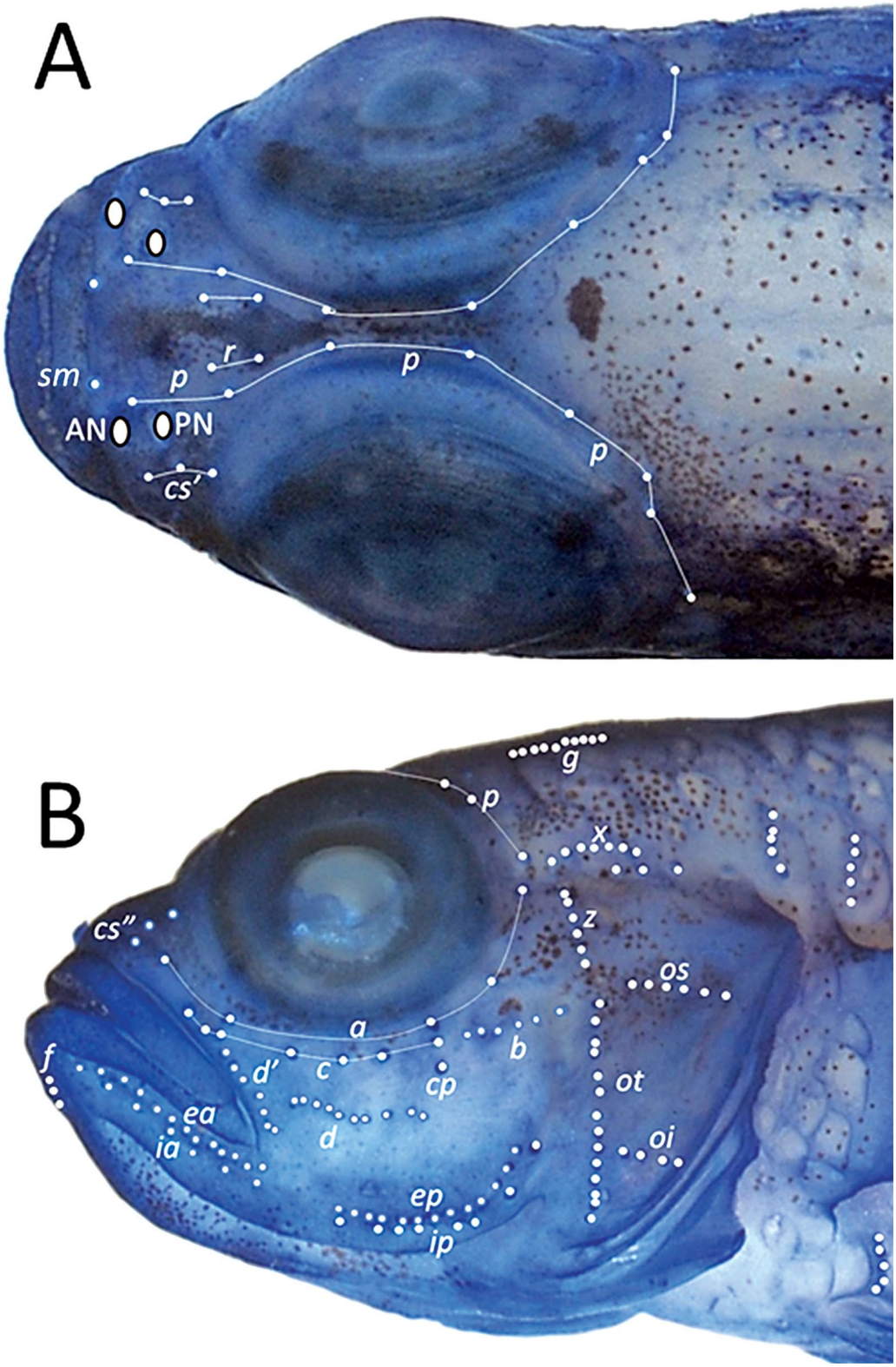

Figure 4. *Trimma chledophilum*, head of holotype, WAM P.34319-007, 22.2 mm SL, showing sensory papillae (white dots) in dorsal (A) and left lateral (B) view. Specimen stained with cyanine blue. Photographs by G.R. Allen.

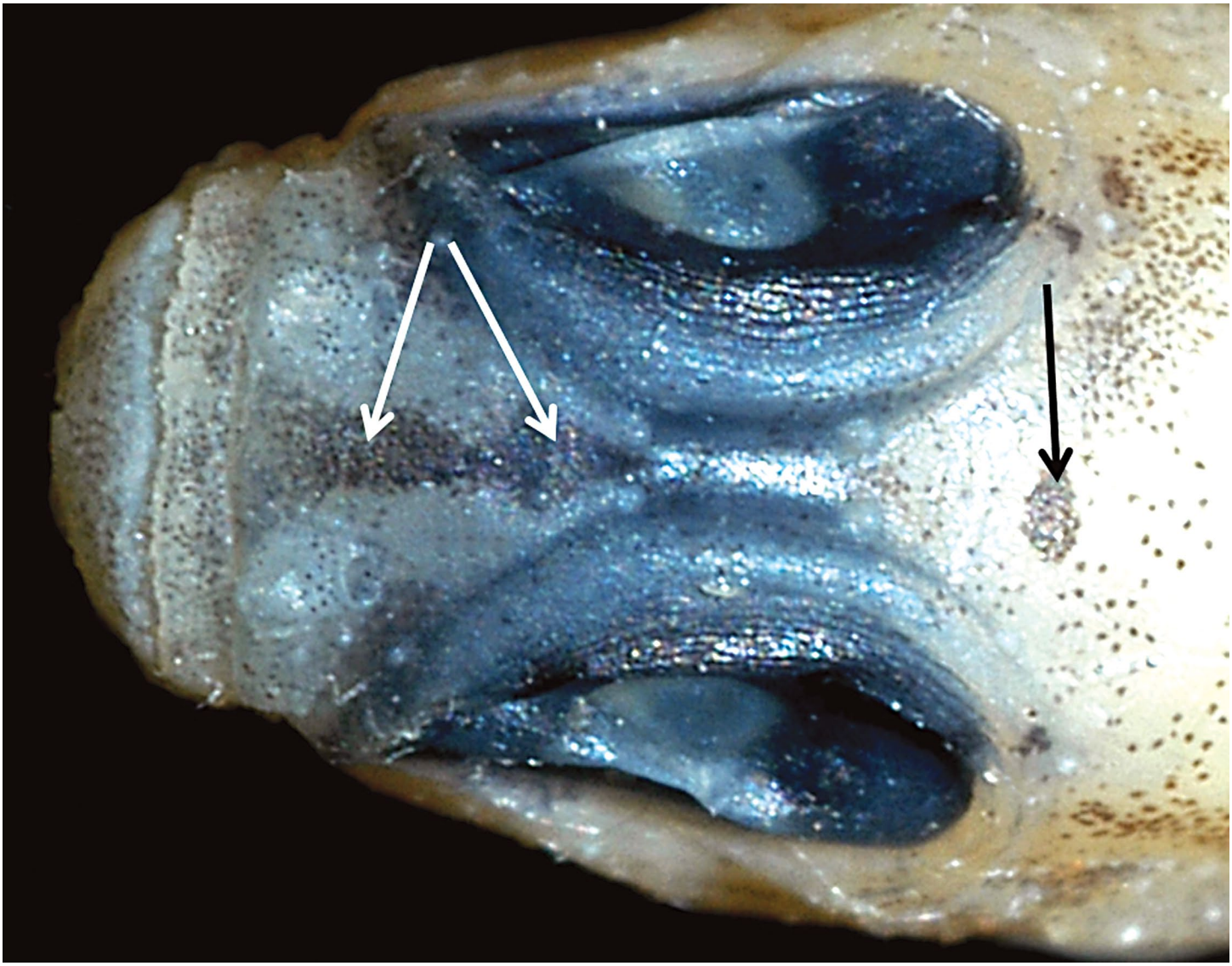

Figure 5. *Trimma chledophilum*, dorsal view of head of holotype, WAM P.34319-007, 22.2 mm SL, with arrows showing diagnostic dark markings. Photographs by G.R. Allen.

Color of holotype in alcohol. (Figs. 3–5) Generally pale yellowish white with numerous brown melanophores on head and sides except midlateral zone of relatively few melanophores as shown in Fig. 3; brown melanophores of head concentrated on upper two-thirds of opercle, behind upper rear margin of eye, and on nape region; scattering of brown melanophores just below lower margin of eye; distinctive blackish "hour-glass" marking (Fig. 5) on midline of snout with broadly flared anterior edge above upper lip and posterior pointed section extending to middle portion of interorbital; small blackish spot on dorsal midline of nape at level of rear margin of eyes (Fig. 5); fins translucent whitish, concentration of melanophores forming spot at upper edge of pectoral-fin base.

Color in life. (Fig. 6) Generally bright orange-red on most of body and upper half of head, although portion above vertebral column semi-translucent and duller red; lower half of head, breast, belly, and area immediately posterior to pectoral fin white; broad dark red stripe on side of snout, passing through eye and continued behind eye to rear margin of opercle, interrupted ventrally just behind eye by small white spot; diagnostic white marks on head consisting of diffuse, poorly-formed stripe immediately below eye, intense stripe on dorsal midline of snout, small spot behind upper rear margin of eye, and two (occasionally three) round to squarish spots on upper iris; fins generally translucent with blue outer margins on second dorsal, anal, and caudal fins, also elongate filament of second dorsal spine and tips of pelvic-fin rays bluish; both dorsal fins with basal orange-red stripe and scattered small spots of same colour, more or less arranged in horizontal rows (one on first dorsal and 2–3 on second dorsal); caudal fin with scattered, small orange-red spots, base of fin usually with diffuse brownish-red spot just

below lateral midline of caudal peduncle; anal fin with slight reddish hue; dorsal edge of pectoral-fin base with small brown spot.

Distribution and habitat. The new species is currently known only from two sites in Milne Bay, Papua New Guinea. In addition to the type locality near Alotau, it was observed on a World War II shipwreck (Muscoota) at Waga Waga (10° 24.429'S, 150° 24.650'E). The habitat at the type locality consisted of pieces of metal wreckage and discarded tyres on mud bottom. The fishes either rested on the bottom or hovered in midwater in the shady recesses of the wreckage or tyres.

Figure 6. *Trimma chledophilum*, underwater photographs, approximately 20 mm SL, Alotau, Milne Bay Province, Papua New Guinea. Photographs by G.R. Allen.

Figure 7. *Trimma erdmanni*, underwater photograph, approximately 20 mm SL, near Fakfak, West Papua, Indonesia. Photograph by G.R. Allen.

Etymology. The new species is named *chledophilum* (from the Greek: '*chledos*', mud and '*phileo*', loving) with reference to the predilection of this species for mud bottom habitats, which is unusual for members of this genus, which are more commonly found on coral reefs.

Comparisons. *Trimma chledophilum* is most similar to *T. erdmanni* Winterbottom 2011 (Fig. 7) from Indonesia, Philippines, Papua New Guinea, and the Solomon Islands. However, Winterbottom *et al*. (2014b) showed that the populations of *T. erdmanni* from four different locations (Palawan, Raja Ampat Islands, Cenderawasih Bay, and New Britain) belonged to four separate CO1 haplogroups, differing from each other by values ranging from 4.5–10.6% of the CO1 gene. Both species share the following features: usually 9 soft dorsal and 8 soft anal-fin rays, branched fifth pelvic ray that is 52–71% length of fourth pelvic ray, broadly U-shaped interorbital trench and no postorbital trench, usual absence of scales on the predorsal midline (a few scales sometimes present on *T. erdmanni*), more than 19 total gill rakers on the first arch, no scales on the cheek and opercle, and a largely red colour pattern with a white stripe below the eye and another on the midline of the snout. The two species differ mainly with regard to finer details of the colour pattern and the length of the second dorsal spine, which is generally longer in *T. chledophilum* (maximally reaching caudal-fin base versus base of second to eighth dorsal rays). However, this feature is not completely reliable as the spine length shows a wide range of variability in the type series and underwater photographs. Although both species are primarily red in life, *T. erdmanni* has a darker red to orange midlateral stripe, which is bifurcated immediately behind the head. The midlateral stripe is essentially absent in *T. chledophilum*, but there is a broad stripe between the eye and rear margin of the opercle, usually punctuated just behind the eye by a whitish to pinkish spot, producing an overall effect that is reminiscent of the bifurcate stripe on the head of *T. erdmanni*. The new species is further distinguished by the presence of 2–3 (usually 2) large white spots on the upper iris, an intensely red spot on the middle of the caudal-fin base (appears blackish underwater when viewed with ambient light), and red to orange spotting on the dorsal and caudal fins.

Figure 8. *Trimma nauagium*, preserved male holotype, WAM P.34320-002, 20.3 mm SL, Waga Waga, Milne Bay Province, Papua New Guinea. Photograph by G.R. Allen.

Trimma nauagium Allen, n. sp.

Shipwreck Pygmy Goby

Figures 8–11.

Holotype. WAM P.34320-002, male, 20.3 mm SL, Waga Waga, Papua New Guinea, outer hull of Muscoota, a World War II shipwreck, 10° 24.429'S, 150° 24.650'E, 24 m, clove oil and hand net, G. R. Allen, 14 December 2014.

Paratypes. WAM P.34320-003, 2 specimens, 17.4–19.6 mm SL, collected with holotype.

Diagnosis. A species of *Trimma* with the following combination of characters: dorsal-fin rays VI + I, 8, second and third spines elongate, reaching to base of fifth or sixth segmented ray of second dorsal fin when adpressed; anal rays I,8; pectoral rays 16; fifth pelvic ray branched, 56–64% length of fourth pelvic ray; bony interorbital about equal to pupil diameter; predorsal, cheek, and opercle fully scaled; pattern of cephalic sensory papillae includes five transverse rows below eye; brownish in life with pink zone along upper side and seven darker brown saddles on back interspersed with smaller golden saddles, narrow white bar behind eye, and yellowish bar at base of pectoral fin.

Description. Dorsal-fin rays VI + I,8, second and third spines elongate, reaching to base of fifth or sixth segmented ray of second dorsal fin when adpressed; segmented rays of second dorsal fin branched except first ray unbranched in both paratypes; anal rays I,8, segmented rays branched except first ray unbranched in holotype; pectoral rays 16, the middle 5–6 rays branched; pelvic-fin rays I, 5, first four rays with a single sequential branching pattern, fifth ray unbranched and about 64% (55%) length of fourth ray, no frenum and no basal membrane.

Lateral scales 25; anterior transverse scales 8; posterior transverse scales 7; nape region fully scaled, predorsal scales 12, scales extending forward to about middle of interorbital; cheek and opercle covered with cycloid scales (Fig. 10), body scales ctenoid except for cycloid scales on prepelvic area, midline of prepelvic with 5–6 scales.

Teeth of upper jaw consisting of outer row of curved, widely separated, enlarged canines, decreasing in size posteriorly, and 2–3 rows of smaller conical teeth (inner row largest), narrowing to a single row posteriorly; lower jaw with outer row of curved, widely separated, enlarged canines (5–6 on each side), ending at bend of dentary and 3–4 rows of small, curved conical teeth, widest at symphysis and narrowing to a single row posteriorly. Gill

opening extending ventrally to below midpoint of pupil; outer gill rakers of first gill arch 5 + 14. Anterior nasal opening a short tube, posterior nasal opening pore-like with an elevated rim, nasal sac slightly raised, with nasal apparatus confined to the anterior half of the snout. Interorbital shallowly concave with broad rounded median fleshy ridge and no postorbital trough or trench; bony interorbital width 100% (81–100%) pupil diameter; epaxial musculature reaching anteriorly to above posterior margin of pupil.

Pattern of cephalic sensory papillae as shown in Fig. 9, papillae immediately below eye on cheek in five transverse rows, each row with 2–3 papillae except fifth row with 3–5, vertical rows incorporating elements of rows *a*, *c*, and *cp*, the range of numbers (in parentheses) in each of remaining rows as follows: *b* (3), *d* (8), *d'* (8–9), *ea* (14–15), *ep* (16–17), *ia* (6), *ip* (7–8), *r* (3), *f* (4–5), *cs"* (3–4), *x* (5–9), *z* (7), *ot* (16–18), *oi* (4–5), *p* (7),

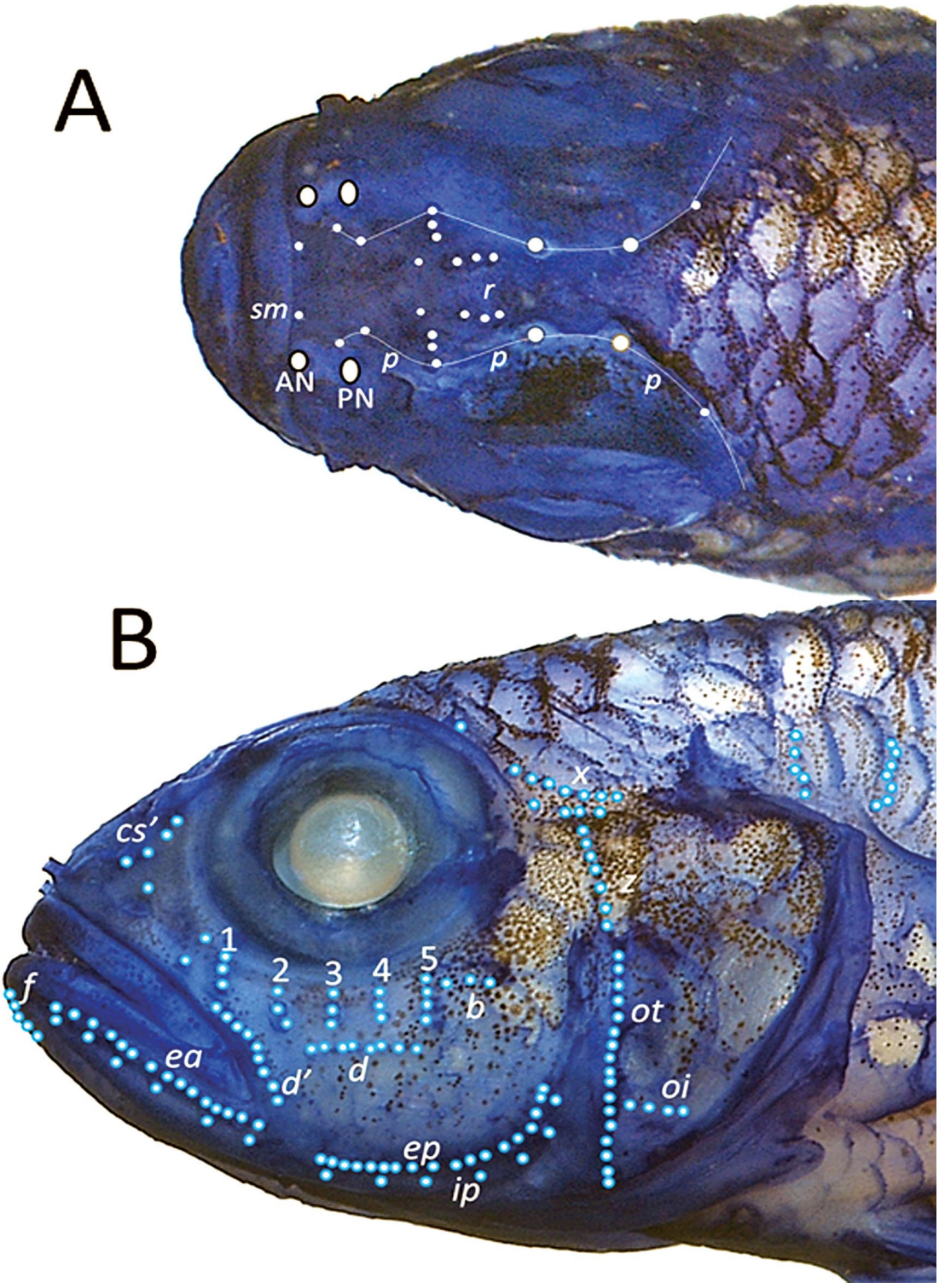

Figure 9. *Trimma nauagium*, head of holotype, WAM P.34320-002, 20.3 mm SL, showing sensory papillae (white dots) in dorsal (A) and left lateral (B) view. Specimen stained with cyanine blue. Photographs by G.R. Allen.

and *sm* (1). The papillae rows are highly susceptible to abrasion, especially those on the cheek and opercle as mentioned by Winterbottom (2011); row *g* (laterally on nape) appears to be genuinely absent, but row *os* was not detected and apparently abraded; similarly row *b* was evident only on one side of one individual and the count of 3 is probably incomplete.

Color of holotype in alcohol. (Fig. 8) Generally pale yellowish white or tan with numerous pepper-like, brown melanophores on head and body, concentrated on margins of scales to form narrow, brown network; some of scales on upper back with expanded brown margins, forming series of seven brownish saddles along back from nape to caudal-fin base, that below second dorsal fin largest; dorsal rim of opercle dark brown, also irregular concentrations of brown melanophores on operculum and portion of cheek adjacent to rear corner of eye; broad, blackish band on side of snout from anterior margin of eye to upper lip, also dorsal midline of snout broadly blackish; fins uniformly translucent whitish, caudal with narrow, diffuse blackish bar at base.

Color in life. (Fig. 11) Generally brown with narrow, darker-brown scale margins, grading to yellowish or white on ventral surfaces; an irregular pink zone on upper half of body from dorsal edge of operculum and side of nape to level of anterior half of second dorsal fin, this zone and area immediately below parallel to vertebral column semi-translucent; some of scales on upper back with expanded brown margins, forming series of seven brownish saddles along back from nape to caudal-fin base, these alternating with smaller saddles of golden yellow; ctenii on posterior margins of body scales appear white (on side of body) to golden (dorsally on back) when illuminated with artificial light (strobe or underwater torch); head, breast, and belly generally pinkish; yellowish-brown to green markings on head as follows: band on side of snout from anterior edge of eye to upper lip, stripe on midline of snout from interorbital to middle of upper lip, diffuse, yellow-brown stripe from middle of eye to upper rear corner of opercle, often extending ventrally (and more yellowish) along both anterior and posterior margins of opercle, and large diffuse spot on cheek below rear corner of eye; yellow band adjacent to posterior edge of

Figure 10. *Trimma nauagium*, head of paratype, WAM P.34320-003, 17.4 mm SL, showing scalation pattern. Specimen stained with cyanine blue. Photograph by G.R. Allen.

Figure 11. *Trimma nauagium*, underwater photographs, approximately 20 mm SL, Waga Waga, Milne Bay Province, Papua New Guinea. Photographs by G.R. Allen.

upper jaw; diffuse, often fragmented white bar along posterior margin of preopercle, sometimes a second diffuse white bar on middle of opercle; iris dark brown with golden reflections along outer margin, a narrow, white inner margin, and three narrow, white spoke-like markings; fins generally translucent with pink membranes and darker pink rays, both dorsal fins with broad yellow stripe (often faint) near base, and caudal fin often with several, more or less horizontal yellow stripes; narrow yellow bar on pectoral-fin base, sometimes fragmented to form pair of diffuse spots at upper and lower portion of fin base. The colour of this species is highly variable depending on the background (midwater versus hard substratum) and angle of the light source.

Distribution and habitat. The new species is currently known only from the outer hull of the Muscoota, a World War II shipwreck at Waga Waga (10° 24.429'S, 150° 24.650'E) in Milne Bay, Papua New Guinea. Numerous individuals were found along the vertical, stern section of the outer hull of the vessel in about 23–28 m depth. The iron hull was completely encrusted with marine growth, especially algae, gorgonians, tunicates, and sponges. The fishes either rested on the bottom or hovered in midwater usually in small groups.

Etymology. The new species is named *nauagium* (from the Greek '*nauagia*': shipwreck) with reference to the type locality and only known habitat.

Comparisons. *Trimma nauagium* apparently belongs to the *T. tevegae* species group, discussed by Winterbottom (2011, p. 160). The group is characterised by an interorbital width of greater than 75% of the pupil width and a Type A abdominal/caudal vertebral transition. Although the latter feature was not investigated, this

species appears to share a number of features with another member of this group, *T. xanthochrum* Winterbottom 2011 (Fig. 12) from West Papua, Indonesia. Both species share similar dorsal, anal, and pectoral-ray counts, elongate second and third dorsal spines, similar pattern of cephalic sensory pores (featuring transverse rows on the cheek), and similar scalation, including a fully scaled, predorsal, cheek, and opercle. The two species also possess vaguely similar colours, but the patterns are very different. The new species lacks a dark spot at the caudal fin base (not clearly evident in Fig. 12) and generally has a more complex overall colour pattern. The pattern of the iris, which seems distinctive for individual *Trimma* species, also differs between the two species with *T. xanthochrum* possessing an oblique white band across the iris, over the top of the pupil, compared to the three, spoke-like white marks on the iris of *T. nauagium*.

Figure 12. *Trimma xanthochrum*, underwater photograph, approximately 22 mm SL, Triton Bay, West Papua, Indonesia. Photograph by G.R. Allen.

Figure 13. *Trimma multiclitellum*, preserved male holotype, WAM P.34319-024, 17.4 mm SL, Alotau, Milne Bay Province, Papua New Guinea. Photograph by G.R. Allen.

Trimma multiclitellum Allen, n. sp.

Multisaddle Pygmy Goby

Figures 13–16.

Holotype. WAM P.34319-024, male, 17.4 mm SL, Alotau, Papua New Guinea, 4.8 km east of main wharf, 10º 18.256'S, 150º 24.768'E, 17.5 m, clove oil and hand net, G. R. Allen, 11 December 2014.

Diagnosis. A species of *Trimma* with dorsal-fin rays VI + I, 8, no elongate or filamentous spines; anal rays I,8; pectoral rays 17; caudal fin emarginate with pointed upper lobe and rounded lower lobe; fifth pelvic ray branched, 74% length of fourth pelvic ray; basal membrane relatively well-developed, 41% length of fourth pelvic ray; bony interorbital about equal to pupil diameter; midline of predorsal mainly scaleless, but with patch of about 4 scales on middle portion; cheek scaleless; opercle with a few scales dorsally; highly distinctive colour pattern consisting of seven, alternating brown and white bars on upper side, a nearly eye-sized black spot at base of caudal fin, and pair of yellow bars on head, one below eye and another on opercle; habitat consists of wreckage on mud bottoms in 17–18 m depth.

Description. Dorsal-fin rays VI + I,8, no elongate or filamentous spines; segmented rays of second dorsal fin branched except first ray unbranched; anal rays I,8, segmented rays branched except first ray unbranched; pectoral rays 17, the middle 6 branched; pelvic-fin rays I, 5, most rays with a single sequential branching pattern except first ray on right side and first two rays on left side with secondary branching of inner branch near tip, fifth ray branched and 74% length of fourth ray, no frenum and well-developed basal membrane, 41% length of fourth pelvic ray.

The scales are strongly deciduous and mostly missing from the holotype, but scale pockets are clearly evident and form the basis of the present description. Only a few ctenoid scales remain at the base of the caudal fin, but presumably most of the body scales are ctenoid as in other *Trimma* species. Lateral scales 25; anterior transverse scales 8; posterior transverse scales 7; scales narrowly absent on predorsal midline except cluster of about 4 scales on middle portion, otherwise nape fully scaled almost to posterior edge of eye; upper third of opercle scaled; cheek apparently scaleless; midline of prepelvic with 5 scales.

Teeth of upper jaw consisting of outer row of curved, widely separated, enlarged canines, decreasing in size posteriorly, and 2 rows of smaller conical teeth (inner row largest), narrowing to a single row posteriorly; lower jaw with outer row of curved, widely separated, enlarged canines (5 on each side), ending at bend of dentary and

3 rows of small, curved conical teeth, widest at symphysis and narrowing to a single row posteriorly. Gill opening extending ventrally to below midpoint of pupil; outer gill rakers of first gill arch 4 + 18. Anterior nasal opening a short tube, posterior nasal opening pore-like with an elevated rim, nasal sac slightly raised, with nasal apparatus confined to the anterior half of the snout. Interorbital shallowly concave with broad, rounded median fleshy ridge and no postorbital trough or trench; bony interorbital width 100% pupil diameter; epaxial musculature reaching anteriorly to above posterior margin of pupil.

Pattern of cephalic sensory papillae as shown in Fig. 14; some of the papillae rows are apparently abraded and could not be detected including row b on the cheek and most rows on the opercle (except for remnant of row ot). The following papillae counts (in parentheses) were recorded for the various rows: *a* (5), *c* (6), *cp* (1), *d* (8), *d'* (12), *ea* (15), *ep* (16), *ia* (8), *ip* (7), *p* (5, incomplete?), *sm* (1), *r* (2), *f* (5), *cs"* (3), *x* (3, incomplete?), and *ot* (4, incomplete?).

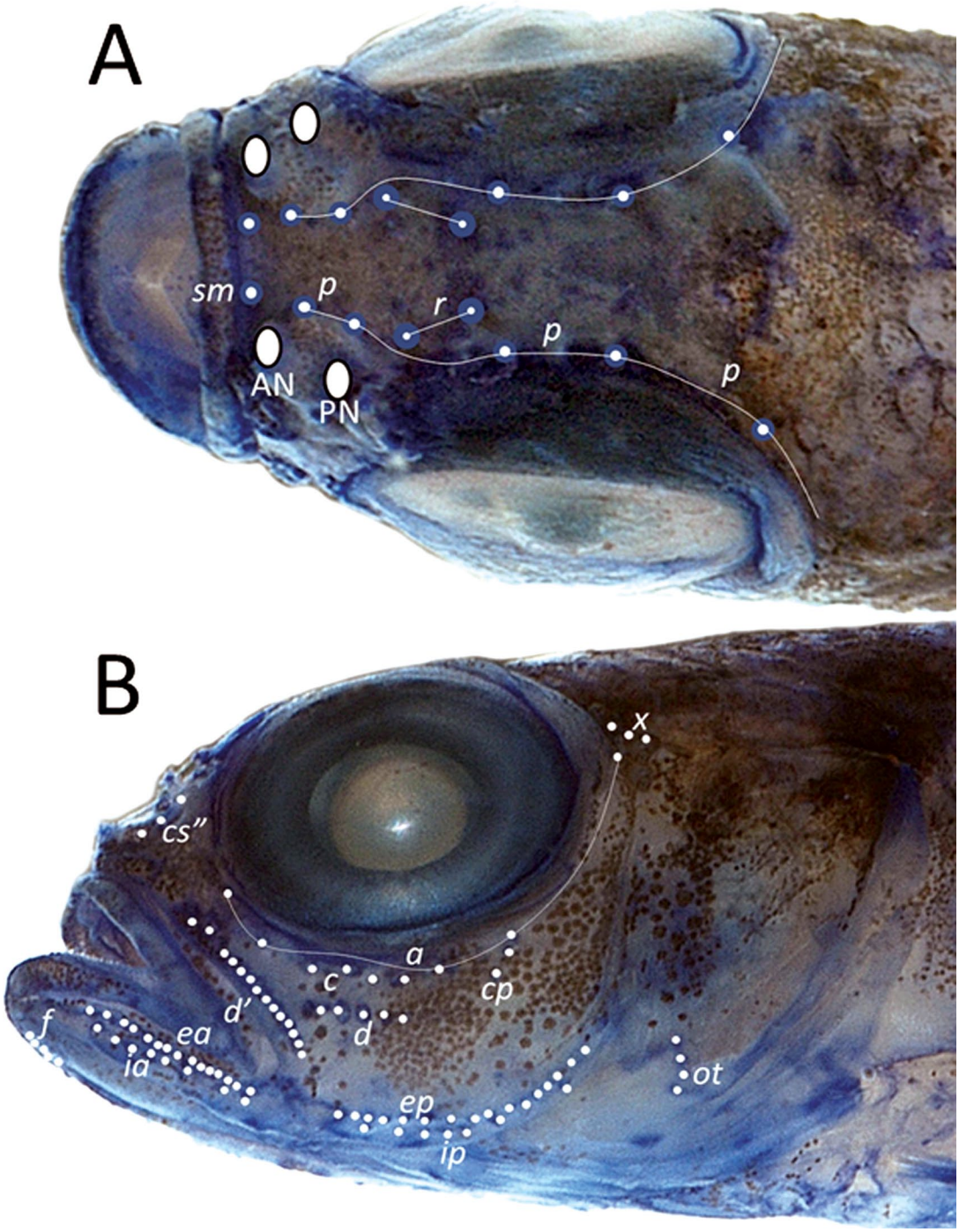

Figure 14. *Trimma multiclitellum*, head of holotype, WAM P.34319-024, 17.4 mm SL, showing sensory papillae (white dots) in dorsal (A) and left lateral (B) view. Specimen stained with cyanine blue. Photographs by G.R. Allen.

Figure 15. *Trimma multiclitellum*, male holotype, 17.4 mm SL, Alotau, Milne Bay Province, Papua New Guinea. Photograph by G.R. Allen.

Color of holotype in alcohol. (Fig. 13) Generally pale yellowish white or tan with numerous pepper-like, brown melanophores on head and body, with concentration of pigment on edge of scale pockets, forming network indicative of original scalation pattern; brown bars on upper half of body as described for live colouration faintly evident, except first two bars, on side of nape and below first four dorsal spines much darker and clearly evident; large diffuse brown patch also evident immediately behind upper rear corner of eye and another less distinct patch on upper anterior portion of opercle; narrow white rim parallel to lower edge of eye; cheek with numerous brown melanophores, with the main concentration forming a bar below middle of eye; melanophores strongly concentrated on side of snout in front of eye, on lips, and lower jaw; fins generally translucent whitish with large dark brown spot at base of caudal fin and upper edge of pectoral-fin base brownish.

Color in life. (Figs. 15–16) A series of seven alternating dark-brown and chalk-white bars on upper half of body, dark bars about twice width of white ones, first dark bar on nape, second dark bar from base of first four dorsal spines, third dark bar from posterior part of first dorsal fin, fourth dark bar from base of first four segmented dorsal rays, fifth dark bar from posterior part of second dorsal fin, sixth dark bar on caudal peduncle, and last dark bar (much abbreviated), forming dorsal saddle at base of caudal fin and confluent with prominent, eye-sized black spot just below, dark bars terminating on middle of side, except first and second, the first tapering to a point along rear edge of opercle and the second reaching area behind lower pectoral-fin base; lower half of body peach colour with dusky brown scale edges forming reticulum; dorsum of head with dark brown band from upper rear corner of eye, connecting with first dark saddle on nape, just behind eyes, confluent with second dark brown band, arching dorsally across head; cheek and opercle rosy pink, yellow bar below eye (confluent with yellow marking on iris), extending to chin and another on lower portion of opercle, confluent with short brown bar on upper half of opercle; diffuse bluish-grey bar below eye, separated from aforementioned yellow bar by narrow pink bar; interorbital region with greenish-yellow band adjacent to rim of eye then widening to incorporate nasal apparatus; narrow, inverted V-shaped white marking on interorbital (Fig. 16) and smaller V-shaped yellow marking below mouth (Fig. 16); lips yellow laterally and posteriorly; iris dark brown with "dusting" of silver-bluish chromatophores anteriorly and posteriorly, and broad yellow bar dorsally and ventrally, a prominent yellow ring around pupil; fins

generally translucent with pink rays; dorsal fins with diffuse yellow band at base and outer row of yellow spots; caudal fin with pair of faint yellow cross bands; pectoral fin with yellow patch on basal portion of rays.

Distribution and habitat. The new species is currently known only from the type locality near the town of Alotau, Milne Bay Province, Papua New Guinea. The single individual was found together with *T. chledophilum* at the base of a sloping mud bottom in 17–18 m depth, among pieces of metal wreckage. It was invariably seen sheltering in a small enclosed "grotto", either resting on the bottom or hovering a short distance above it. The collected holotype was the only individual encountered in the area despite 38 hours of diving in the immediate vicinity of this site. Possibly the main population inhabits deeper waters farther from shore.

Etymology. The new species is named *multiclitellum* (from the Latin: '*multi*', many and '*clitella*', saddle) with reference to the distinctive markings of this fish.

Comparisons. The highly distinctive colour pattern of this species serves to distinguish it from all other species of *Trimma*, most of which lack highly contrasted patterns and are frequently shades of red, orange, pink, or yellow. The only other species from the region that have contrasting bars are *T. cana* Winterbottom 2004 and *T. fasciatum* Suzuki *et al*. 2012, both of which have alternating yellow or red and white bars (Fig. 17). *Ego zebra* Randall 1994 from Oman is another *Trimma*-like gobiid that has a pattern consisting of seven dark brown bars. However, most of the bars extend to the ventralmost portion of the side and are narrower than the intervening white areas. There is conjecture concerning the generic status of this fish, which may actually be assignable to either *Trimma* or *Priolepis* Valenciennes 1837 (Winterbottom, pers. comm.). The emarginate caudal fin with a pointed upper lobe and rounded lower lobe is also diagnostic of the new species. For example, of the 46 species from the East Indian region treated by Allen & Erdmann (2012) or the 27 species illustrated by Senou *et al*. (2004) from Japanese seas, none possess this fin shape. Most have either a rounded or truncate caudal fin. However, *T. hoesei* Winterbottom 1984, has a distinctly forked caudal with pointed lobes and *T. taylori* Lobel 1979 has a wedge-shaped caudal fin with the upper lobe longer than the lower lobe.

Figure 16. *Trimma multiclitellum*, male holotype, 17.4 mm SL, Alotau, Milne Bay Province, Papua New Guinea. Photograph by G.R. Allen.

Figure 17. A: *Trimma cana*, underwater photograph, Milne Bay Province, Papua New Guinea; B: *Trimma fasciatum*, underwater photograph, Cenderawasih Bay, West Papua, Indonesia, both approximately 20 mm SL. Photographs by G.R. Allen.

Acknowledgments

Rob Vanderloos, owner of Milne Bay Charters, and his staff provided an excellent opportunity for the author to collect and photograph fishes, including three of the new *Trimma*, while aboard MV *Chertan* during December 2014. This work was capably assisted by Roger Steene. Thanks are also due Glenn Moore and Sue Morrison (WAM) for curatorial assistance. I am also grateful to Forest Young, who collected the type specimens of *T. abyssum*. He was assisted by Ben Daughtry, who was responsible for technical aspects of the deep-diving program. Billy Deans managed surface operations and various aspects of diving safety. Heath Laetari, Kenichi Fuji, Kotaro Yoshimura, and Larry Wright provided backup safety for the deep-diving team. The North Sulawesi deep-diving expedition was organized by Masa Iwata and Fukushima Aquamarine, who also provided financial support. The manuscript was reviewed by Rick Winterbottom and Mark Erdmann.

References

Allen, G.R. & Erdmann, M.V. (2012) *Reef fishes of the East Indies. Vol. III*. Tropical Reef Research, Perth, Australia, pp. 857–1292.

Eschmeyer, W.N. (Ed.) (2014) Catalog of Fishes: Genera, Species, References. (31 October 2014). California Academy of Sciences, San Francisco, CA. Available from http://researcharchive.calacademy.org/research/ichthyology/catalog/fishcatmain.asp (accessed 7 February 2015).

Senou, H., Suzuki, T., Shibukawa, K. & Yano, K. (2004) *A photographic guide to the gobioid fishes of Japan.* Heibonsha Co., Japan, 536 pp.

Suzuki, T., Sakaue, J. and Senou, H. (2012) Two new species of the gobioid fish genus *Trimma* (Actinopterygii: Perciformes: Gobiidae) from Japan and Palau. *Bulletin of the National Museum of Nature and Science (Series A)*, Supplement 6, 67–77.

Suzuki, T. & Senou, H. (2007) Two new species of the gobiid fish genus *Trimma* (Perciformes: Gobioidei) from southern Japan. *Bulletin of the National Museum of Nature and Science (Series A),* Supplement 1, 175–184.

Winterbottom, R. (2002) Two new species of *Trimma* (Gobiidae) from the central, western, and south Pacific. *Aqua, Journal of Ichthyology and Aquatic Biology*, 5(2), 45–52.

Winterbottom, R. (2011) Six new species of the genus *Trimma* (Percomorpha: Gobiidae) from the Raja Ampat Islands, Indonesia, with notes on cephalic sensory papillae nomenclature. *Aqua, International Journal of Ichthyology*, 17(3), 127–162.

Winterbottom, R. (2014) *Trimma irinae*, (Pisces; Gobioidei) a new species of gobiid fish from Milne Bay Province, Papua New Guinea. *Zootaxa*, 3802(2), 209–226.

Winterbottom, R., Erdmann, M.V. & Cahyani, N.K.D. (2014a) *Trimma helenae* (Pisces: Gobioidei), a new species of gobiid fish from Indonesia. *Zootaxa*, 3760(3), 420–428.

Winterbottom, R., Hanner, R.H., Burridge, M. & Zur, M. (2014b) A cornucopia of cryptic species – a DNA barcode analysis of the gobiid genus *Trimma* (Percomorpha, Gobiiformes). *ZooKeys*, 381, 79–111.