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An illustrated key to the described valid species of *Trimma* (Teleostei: Gobiidae)

RICHARD WINTERBOTTOM

*Curator Emeritus, Department of Natural History, Royal Ontario Museum,
100 Queen's Park, Toronto, Ontario, M5S 2C6, Canada*
*Professor Emeritus, Department of Ecology & Evolutionary Biology, University of Toronto,
Toronto, Ontario, M5S 1A1, Canada*
E-mail: rickw@rom.on.ca

Abstract

An illustrated key to the 105 recognized valid species of the gobiid *Trimma* (pygmygobies), based on morphological and color-pattern characteristics is presented. Caution should be employed when using the key for specimens less than about 16 mm SL. A brief summary of what we know about the biology of the various species is given. Definitions and illustrations of the various characters used in the key are provided, along with the geographic range (where discernible) for each species. Details of the catalogue number and provenance of the holotype of each species (where known) are included. Comments on the variation of the mitochondrial genetic marker COI-5P, derived from an unpublished neighbor-joining network based on 844 tissue samples, are also included where available.

Key words: ichthyology, taxonomy, coral-reef fishes, pygmygobies, Indo-Pacific Ocean, mtDNA, barcoding.

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Introduction

In 1906, Jordan & Seale erected a new genus, *Trimma*, for a new species they described from Samoa, *T. caesiura*. The diagnosis of their new taxon is not especially enlightening. They merely stated that it was similar to *Eviota*, but differed in having the region before the dorsal fin fully scaled, and that the “texture” of “the species is firmer and less translucent” (op.cit., p. 391). No etymology for *Trimma* was given by the authors, but the word may be derived from the Greek “τρίμμα” for something “ground exceedingly fine”, “crushed” or “rubbed” (see e.g. <https://en.wiktionary.org/wiki/τρίμμα>). *Trimma* is neuter in gender. In 1983, there was a total of 17 valid

species in the genus (as it is currently defined). Twelve of these had been described in genera other than *Trimma*. Since 1983, 89 species have been added, all described as belonging to *Trimma*, with a total (as of May, 2019) of 105 recognized valid species. (One of the recently described species is here regarded as a junior synonym of a previously described species— see Discussion). The explosion in species descriptions would seem correlated with the increasing combination of scuba diving and chemical collection techniques (rotenone, quinaldine and, most recently, clove oil). Members of the genus are commonly known as “pygmygobies”, and are confined to coral reefs and adjacent habitats in the Indo-Pacific Ocean. They range from South Africa and the Red Sea in the west to Easter Island in the east. Much of the geographic range information for western Pacific species in the key below was taken from Allen & Erdmann (2012) and Winterbottom & Hoese (2015).

Trimma can be distinguished from other gobiid genera by their small size (generally <30 mm SL), fewer than 12 dorsal-fin and anal-fin rays, a fifth pelvic-fin ray that is $\geq 40\%$ the length of the fourth pelvic-fin ray, a much reduced cephalic sensory papillae (free neuromasts) pattern on the head, coupled with a lack of cephalic sensory canals and associated pores, a wide gill opening extending to below the vertical limb of the preopercle or, more usually, anterior to this, and the lack of spicules (odontoids) on the outer gill rakers of the first gill arch (definition adapted from Winterbottom & Hoese [2015]). Note that this definition is probably a mixed combination of plesiomorphic (ancestral) and apomorphic (derived) character states, riddled with rampant homoplasy. I would prefer to use a phylogenetic diagnosis, but this is not practical in the absence of a phylogenetic tree for all species of *Trimma* based on morphological characters (genetic diagnoses, even if potentially available, would not be very practical to most users of this key).

In broad ecological terms, *Trimma* appears to replace *Eviota* both in total numbers of individuals and in number of species with increasing water depth, particularly on the outer reefs (there are, of course several exceptions to this generalization). Members of these two genera are usually the dominant gobiids associated with hard substrates in tropical Indo-Pacific lagoons, reef tops, reef slopes, and drop-offs, and both appear to have their maximum species richness in the Coral Triangle (see e.g. Allen & Erdmann [2012]). Those authors list 45 species of *Trimma* from the “East Indies” (three as undescribed species, which have since been formally named) and 36 species of *Eviota* (currently 54; D. Greenfield, pers.comm., February 2019).

There is limited and scattered knowledge on different aspects of the biology of a few species in the genus, with one exception (see below under mating systems and sex change). Members of *Trimma* can be broadly divided into benthic forms, which sit on the substrate, often under overhangs or in caves, and schooling species, which form small (a few individuals) to huge (a thousand or more individuals) aggregations which hover, usually vertically with the head up, a meter or so away from the substrate, to which they retreat when threatened. Limited empirical evidence suggests that *Trimma* species are planktivores. Saeki et al. (2005) found that a schooling species, *T. caudomaculatum*, ate primarily calanoid and harpacticoid copepods, while the benthic *T. caesiura* made short forays into the water column to ingest individual copepods, primarily harpacticoids. Similar behaviour has been observed in the schooling *T. nasa* and the benthic *T. benjamini* in Palau (pers.obs.). The former occur in “heads-up” schools, and individuals would dart 6–10 cm towards the water surface, stop (presumably having engulfed a back-lit prey item), and then return to their original position in a series of short, jerky backwards (i.e. downward) movements. The *T. benjamini* perched at the tips of coral branches or on coral rock and would make rapid elliptical forays into the water column, returning (usually) to the same perch. In neither case was actual ingestion of food seen, and no specimens were examined for stomach contents.

Embryonic development has been described for *T. grammistes* (Shiobara & Tanaka 1994, Sunobe 1995) and *T. okinawae* (Sunobe 1995) using eggs and larvae derived from aquarium spawnings. Age and growth studies based on daily otolith increments are confined to two species in the genus, both based on specimens from Palau. *Trimma nasa* has a calculated maximum life span of 87 days, with a pelagic larval duration of nearly 39% of that value, and a daily mortality rate of 4.7% (Winterbottom & Southcott 2008). *Trimma benjamini* has values of 140 days, 34%, and 3–6% respectively for these parameters (Winterbottom et al. 2011). In comparison, *T. benjamini* has a longer life span, and the males have continuous growth, while *T. nasa* has a shorter life span and a faster overall growth rate, although this decreases with age in the males.

By far the most detailed biological knowledge currently available for species of *Trimma* involves the mating systems and sex change of, especially, *T. okinawae* (Sunobe & Nakazono 1990, 1993). Since then, Sunobe and his co-workers have added numerous additional details (involving, e.g. mating behaviours, inter-group movement, steroid pathways, and gonadal structure), culminating in the first relatively detailed phylogeny of the genus (31 included species), outgroup comparisons, and optimization of sex change and gonochorism (Sunobe et al. 2017). Their phylogenetic analysis involved the mitochondrial ND4/ND5 gene region. These authors reported that all 8 species of *Priolepis* they examined, and 29 of the 31 *Trimma* species were, or were inferred to be, bidirectional sex changers, and this would suggest that this condition also occurred in their common ancestor (these two genera were each found to be monophyletic, and to form each other's sister group in the phylogenetic analysis). The remaining two *Trimma* species (*T. nasa* and *T. marinae*) were sister species, and were found to be gonochoristic. The situation is somewhat complicated by the presence of gonochorism in the two species of *Trimmatom* examined, because that genus is the sister group of *Priolepis* + *Trimma*. However, since the two gonochoristic *Trimma* are deeply nested within the *Trimma* clade, the conclusion that gonochorism is independently derived in the two genera is the most parsimonious explanation (Sunobe et al. 2017).

The phylogeny cited above is the only reliable (if partial) one currently available. Jeon et al. (2012) included 5 species of *Trimma* in their generalized 'phylogeny' (strictly speaking, a 'gene tree' not a phylogeny) based only on 542 base pairs of the cytochrome c oxidase subunit 1 marker (COI). Two species (*T. caesiura* and *T. grammistes*) form part of a huge polytomy at the base, and I suspect both of these are contaminated or misidentified, since these species nest well within the *Trimma* clade in Sunobe et al.'s (2017) tree. The remaining three species form a clade in Jeon et al.'s (2012) analysis.

There are two aspects for future research on *Trimma* that would appear, potentially, to promise especially fruitful results. One involves a much deeper understanding of the COI marker and its variation that is frequently seen in morphologically defined species in the genus. These differences, often greater than 10% of the base pairs, have led to the description of several new species as a result of subsequent in-depth studies of morphological and/or color characteristics initiated by the mtDNA results (e.g. Winterbottom 2016). In other cases, no such differences were found despite intensive morphological study of several different haplogroups of COI (e.g. *T. xanthochrum*, unpublished data). Other species, such as *T. annosum*, appear to share COI sequences over wide geographic distances (Taiwan to the Great Barrier Reef, with less than 1% maximum intragroup distance among 26 specimens).

The second aspect involves the trophodynamics of Indo-Pacific coral reefs, where cryptobenthic fishes, such as the small planktivorous gobies, have been shown to be the main contributor to nutrient and energy import to reefs in tropical seas (Brandl et al. 2019). In that study, cryptobenthic fishes, with their abundant larvae, fast growth, and high mortality, were found to account for almost 60% of the reef fish biomass consumed on coral reefs. *Trimma* may account for the majority of cryptobenthic fishes on many Indo-Pacific coral reefs, and thus it would be especially interesting to examine the source of prey items ingested by *Trimma*. Although likely to vary between outer reef and lagoonal species/populations, a stable-isotope study of dietary items could pinpoint whether or how much of the prey is derived from offshore sources vs. locally produced. This, in turn, would allow us to better estimate the relative degree to which members of the genus are net energy importers (or exporters) and the role they play in the trophodynamics of the reef, a subject that is an important component in conservation and management decisions in the future.

Methods

Morphology: This key depends solely on morphology (including color and marking patterns). Unfortunately, some of the dichotomous characters used in its construction to separate species and to subdivide groups may display both states in a given species. In such cases, that species will appear in the key in two (or even up to 4) places in the key. These instances are identified by an "*" after the citation of the name, author(s) and date at the end of that half of the couplet. Most of the methods used in the key, where different from standard practice, are defined in Winterbottom (2002). Further details are given below.

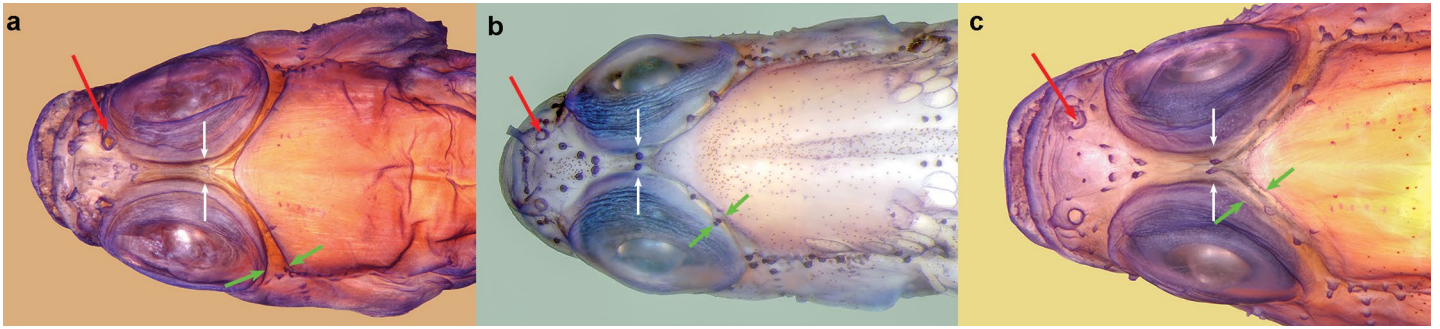


Figure 1. Dorsal views of the heads of a) *T. corallinum*, b) *T. hotsarihiensis* and c) *T. cana* to show the difference between trenches (a) and troughs (b & c). Posterior naris indicated by red arrow. Bony interorbital width measured between pairs of white arrows. Approximate position of posterolateral extent of posterior interorbital trench or trough indicated by pairs of green arrows. Specimens stained with cyanine blue (RW).

Trenches and troughs: The interorbital and posterodorsal orbital regions of *Trimma* exhibit considerable variation in form. They range from deep, narrow, vertically-sided trenches, through troughs, which are grooves with sloping sides, to broad flat expanses with or without a low, smoothly rounded, medial, soft tissue ridge. It is difficult to precisely quantify this variation, but examples are given in Figs. 1 and 2. Bony interorbital width is measured from the lateral rims of the frontal bones at the level of the posterior pair of papillae in row *p* in the interorbital space (see white arrows in Figs. 1 and 2).

Nasal apparatus: In *Trimma*, this structure usually consists of a slightly raised nasal sac confined to the anterior one-third of the snout, with a narrow tubular anterior naris extending out over the snout tip/upper jaw, and a posterior naris of a large pore with a slightly raised rim (Fig. 1 b & c; Fig. 2, a & b). In certain species, the nasal sac is elongated and the posterior rim of the posterior naris is joined (adnate) to the anterior fleshy margin of the orbit (Fig. 1a). In other species, the nasal sac is enlarged posteriorly, but not to the same extent. The raised rim to the posterior naris may be absent, and, in one species, the dorsal wall of the sac is absent, resulting in an open nasal pit (Fig. 2c).

Fins: The number of fin rays in the median fins is seldom used in the key, because there are nearly always overlapping ranges in these values between species. Note that the last dorsal-fin and anal-fin rays are split to the base (the anterior half branched, the posterior half unbranched), appearing as two rays, but since they both arise from the last (posteriormost) pterygiophore they are counted as a single ray. The degree of development of the second (and often third) spine of the first dorsal fin has considerable utility in separating various species of *Trimma*. Comparisons are made when the spine is adressed (lying recumbent along the dorsal profile of the dorsum) and are expressed as how far the tip of the spine reaches posteriorly relative to the base of the nearest element of the second dorsal fin or mid-dorsal scale along the caudal peduncle (in the couplet text, the “adressed” and “to the bases” are assumed and not included).



Figure 2. Dorsal views of the heads of a) *T. xanthum*, b) *T. corerefum* and c) *T. marinae* to show the soft tissue median interorbital ridge development (between orange arrows). Posterior naris indicated by red arrow (except c, where arrow points to nasal pit). Bony interorbital width measured between pairs of white arrows. Approximate position of posterolateral extent of posterior interorbital trough indicated by single green arrows. Specimens stained with cyanine blue (RW).



Figure 3. Ventral view of pelvic fins. a) *T. sostra*, 17.9 mm male, ROM 73600, red lines delimit point measurements for lengths of fourth and fifth pelvic-fin rays; b) *T. wangununi*, 20.8 mm SL female, ROM 108308, white arrows show branch points of pelvic-fin rays; c) *T. cf. mendelssohni*, 17.0 mm SL female, ROM 59791, Comoros, black arrows show the 5 sequential branch points in fourth pelvic-fin ray. Specimens stained with cyanine blue (RW).

The branching of the pectoral-fin and pelvic-fin rays is best deciphered from preserved material stained with a cyanine blue solution, as first outlined in Akihito et al. (1993; Akihito et al. [2002: 1270] provide an English translation of the method). This technique is also useful (and often essential) in highlighting the head papillae and scales. The number of branched pectoral-fin rays (when present) in species tends to increase with size, and small juveniles usually do not have such rays. Pelvic-fin-ray branching (Fig. 3b) is described as sequential, where the outer (more lateral) branch or branches are clearly shorter than the inner (more medial) one(s), or dichotomous, where the two branches are of equal length or almost so (in which case the medial branch is often a little shorter than the lateral one). The length of the fifth pelvic-fin ray relative to the fourth ray is measured from the anterior base of the fourth ray to the tips of the fourth and fifth rays, and is expressed as a percentage of the former relative to the latter (Fig. 3a). In a few species, the pelvic-fin rays have multiple branches (Fig. 3c).

Scales: Lateral and transverse scale counts are subject to the method used by a given author and vary widely amongst them. For that reason, I rarely use these counts in the key. However, the presence or absence of scales on the predorsal midline, cheek, and opercle seem to be very useful characters, although subject to variation associated with the relative size of the specimen (fewer or none in smaller specimens), and may be variable within a species.

Cephalic sensory papillae (free neuromasts): This complex had seldom been reported on (and then incompletely) prior to 2010. Winterbottom (2011) recorded these papillae in some detail for the 6 new species he described, and proposed a nomenclature for them based on the work of Sanzo (1911). A little later, that nomenclature was updated and refined in light of new information regarding their innervation (Winterbottom et al. 2015), and those definitions and usages are employed in this paper. This has the unfortunate consequence that certain of the papillae counts given by Winterbottom (2011) were rendered inaccurate. Especially useful for this key are the number of papillae in rows *c* and *p*. Most of the other rows exhibit too much overlap in number of papillae per row to be of much utility in a key. Some of the variation used as characters in the key is shown in Fig. 4 (row *c*) and Fig. 5 (row *p*). For the full nomenclature and positioning of the rows see Winterbottom et al. (2015; Fig. 2), and Winterbottom (2011; Fig. 2B) for those species with short vertical rows of papillae under the eye.



Figure 4. Sensory papillae in row *c*. a) *T. griffithsi*, with 5 papillae; b) *T. zurae*, with 6 papillae; c) *T. hoese*, with 7 papillae. The papillae in row *c* are linked by white lines, red arrows point to individual papillae within the row. Specimens stained with cyanine blue (RW).

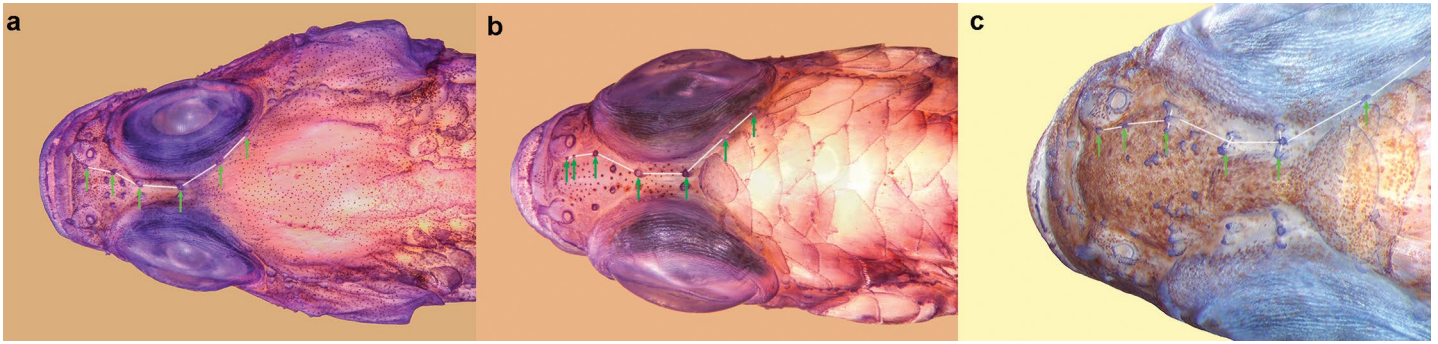


Figure 5. Sensory papillae in row *p*. a) *T. fangi* with 6 papillae; b) *T. rubromaculatum* with 7 papillae; c) *T. kitrinum* with 7 papillae, papillae at positions 3–5 each with 2 or 3 papillae in transverse rows. The papillae in row *p* are linked with white lines, green arrows point to individual papillae within the row. Specimens stained with cyanine blue (RW).

Photography: The method of taking portraits of freshly collected specimens in lateral view in the field used by the author followed Emery & Winterbottom (1980), with the distances of the background from the rear plate of the photo tank calculated as given in Holm (1989). Close-up images of various structures were produced from multiple digital images taken with a Canon EOS Rebel XS camera attached to a Zeiss SV-12 dissecting microscope using Zeiss AxioVision 4.8™ software and automatic increments. The image stack was then collated into a single image using Helicon Focus 5.1™ (HeliconSoft) and edited in Adobe LightRoom 4™ and Adobe PhotoShop CS6™.

Genetics: The methods and materials used to generate sequence data for the mtDNA COI marker for *Trimma* species follows those described in Winterbottom et al. (2014c: 82). Specimen information and barcode sequence data were compiled using BOLD, the Barcode of Life Data Systems (Ratnasingham & Hebert 2007, Ward et al. 2009). The sequence data for published genetic analyses are publicly accessible on GenBank. Sequence divergences were calculated using BOLD following the Kimura 2-parameter (K2P) model. Where appropriate, the results of a recent unpublished analysis (December 2018), based on 844 samples, are discussed. The analysis included 98 recognized species with 154 BIN entities present at the time of the analysis: BINs (Barcode Index Numbers) are artificial and usually impermanent clusters of related sequences generated by BOLD.

The results from the analyses of mtDNA COI sequences are presented in the “Genetic variation” section in the key couplets. If there are no data, the section is not presented. All sequences referred to are that of the COI marker generated by BOLD; the sample size is given in parentheses after mention of a haplotype or haplogroup; the separation distance between two haplogroups is presented as a percentage (the minimum inter-haplogroup distance of the combined set of sequences); and the variation within a haplogroup, the divergence within the group, is presented as a percentage (the maximum intra-haplogroup distance of the combined set of sequences). Percentages are rounded off.

There are numerous instances in the key given below where two or more haplogroups apparently differing significantly in their sequences are grouped under a single species name. These haplogroups may, or may not, ultimately be shown to represent separate species, but no congruent morphological differences have yet been found. However, in most of these cases, no-one has yet examined specimens to see whether such morphological characters are discernable.

Contributors: In the captions of the images accompanying the key, the initials of the photographer are listed in parentheses at the end of each image descriptor: the table of corresponding photographers’ names is presented at the end of the Acknowledgments.

Key to the Species of *Trimma* adults (usually >16 mm SL)

- 1a. Midline of predorsal with at least some scales, which may overlap midline from each side 2
- 1b. Midline of predorsal scaleless, no scales overlapping across midline 82 (p. 40)

- 2a. Fifth pelvic-fin ray with at least one branch point 3
- 2b. Fifth pelvic-fin ray a single element, without branches 49 (p. 26)

- 3a. At least some pectoral-fin rays branched 4
- 3b. Pectoral-fin rays all unbranched 30 (p. 18)

- 4a. Width of bony interorbital >80% pupil width 5
- 4b. Width of bony interorbital <80% pupil width 9

- 5a. Caudal fin distinctly forked; fifth pelvic-fin ray subequal to fourth
 Fork-tail Pygmygoby, *T. hoesei* Winterbottom, 1974: 704

Holotype: ROM 42428, 20.9 mm SL female; type locality: Salomon Atoll, Chagos Archipelago.

Range: Chagos Archipelago and the Maldives (photograph), Indonesia and the Philippines, to Palau in the north and south to the Great Barrier Reef, Solomon Islands, and Fiji.

Genetic variation: Two haplogroups, one from Misool (Indonesia) (1) and the other from other parts of Raja Ampat (Indonesia) plus Palau (6), separated by 2.3%. No samples available from the type locality.



Figure 6. *T. hoesei*, a) fresh, 24 mm SL female, ROM 83276, Helen Reef, Palau (RW); b) live, Uchelbelau Reef, Palau (PC); c) spawning, Milne Bay, PNG (GRA).

- 5b. Caudal fin not deeply forked, although may be asymmetrical; fifth pelvic-fin ray <75% length of fourth ..
 6

- 6a. Predorsal midline with 4–8 scales; upper lobe of caudal fin longer than lower lobe; upper-cheek papillae in two horizontal lines (*a* and *c*) 7
- 6b. Predorsal midline with more than 10 scales; upper lobe of caudal fin equal to lower lobe; upper-cheek papillae in short vertical rows 8

- 7a. Dorsal-fin and anal-fin rays 9 or more; 15 or fewer pectoral-fin rays; body uniform yellow (pale in preservative)..... Yellow Pygmygoby, *T. taylori* Lobel, 1979: 3

Holotype: BPBM 19919, 15.5 mm SL; type locality: Oahu, Hawai‘i, USA.

Range: Hawai‘i, other localities identity uncertain.

Genetic variation: Samples from Hawai‘i (4) form a single haplogroup with some from Palau (5) and Indonesia (Raja Ampat: Misool and Walo Islands) (3). Winterbottom et al. (2014c) reported three haplogroups, including the group above (their Group 3); the second (Group 2) also from Palau (4) and Raja Ampat (Fam Islands) (1), plus New Caledonia (1); and a third (Group 1) from Fiji (2). New material has added three additional haplogroups to this assemblage: one confined to the Red Sea (T. Alpermann & S.V. Bogorodsky, pers.comm.) (4); another in the western Indian Ocean (Seychelles) (1); and a third from the Marquesas Islands (3). All but one pair of these haplogroups are separated by more than 10% from all the other groups (the lone exception being samples from Fiji being separated from Group 2 members by 2.4%). Detailed morphological and color comparisons are needed.



Figure 7. *T. taylori*, a) fresh, 19.7 mm SL female, Helen Reef, Palau, ROM 83277 (RW); b) fresh, 23.8 mm SL male, New Caledonia, ROM 63928 (RW); c) live, Oahu, Hawaiian Islands (JER).

- 7b. Dorsal-fin and anal-fin rays 8; 17 pectoral-fin rays; body dark with white bars (pale in preservative) Multi-saddle Pygmygoby, *T. multicitellum* Allen, 2015: 43

Holotype: WAM P.34319-024, 17.4 mm SL male; type locality: Alotau, Papua New Guinea.

Range: Known only from the type locality.

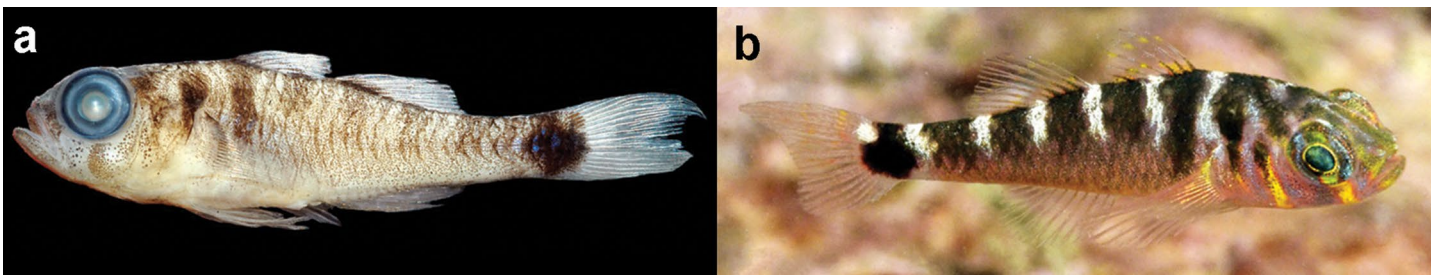


Figure 8. *T. multicitellum*, a) preserved holotype; b) live holotype, both Alotau, PNG (both GRA).

- 8a.(6) Caudal peduncle with a dark blotch; 12–14 predorsal scales; 18–21 total gill rakers on lateral face of first gill arch..... Step-spot Pygmygoby, *T. xanthochrum* Winterbottom, 2011: 115

Holotype: ROM 87483, 22.3 mm SL male; type locality: Raja Ampat, West Papua, Indonesia.

Range: Western Pacific, uncertain.

Genetic variation: At least 4 haplogroups can be distinguished from various western Pacific localities. Specimens from the type locality correspond to *T. xanthochrum* Group 2 of Winterbottom et al. (2014c).



Figure 9. *T. xanthochrum*, a) fresh, 21.4 mm SL male paratype, ROM 85082, Raja Ampat, Indonesia (RW); b) fresh, 23.2 mm SL male paratype, ROM 85319, Raja Ampat, Indonesia (RW); c) live, Raja Ampat, Indonesia (MVE).

- 8b. Caudal peduncle without a dark blotch; 15–18 predorsal scales; 21–24 total gill rakers on lateral face of first gill arch..... Giant Pygmygoby, *T. giganteum* Winterbottom & Zur, 2007: 14

Holotype: ROM 80353, 27.7 mm SL female; type locality: Uchebelau Reef, Palau.

Range: Western Pacific, uncertain.

Genetic variation: Winterbottom et al. (2014c) recorded two haplogroups under this name: from Palau (type locality, Group 8) and another from eastern Indonesia (Group 9). Recent data suggest there may be a third haplogroup from the Philippines.

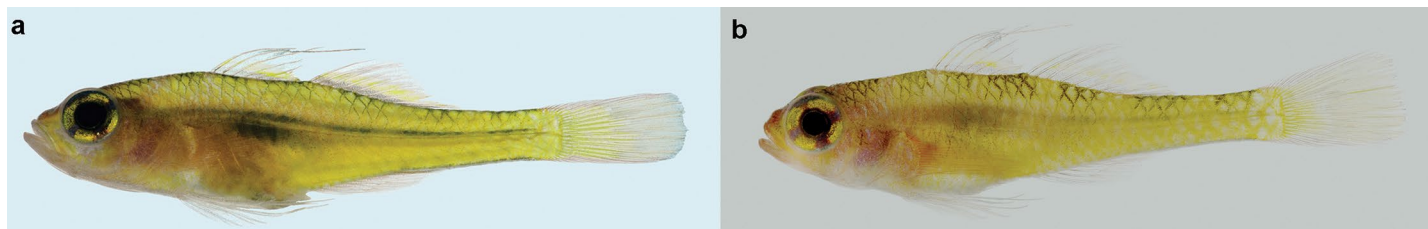


Figure 10. *T. giganteum*, a) fresh 27.7 mm SL female holotype, ROM 80353, Palau (RW); b) fresh 29.9 mm SL female paratype, ROM 80658, Palau (RW).

- 9a.(4) Deep, narrow, vertically-sided trenches between and posterodorsal to eyes, continuing to level of papilla row *x* at posteriormost edge of orbit 10

- 9b. Interorbital area not as above; trenches with sloping sides when present, posterior interorbital trench not extending to papilla row *x* 14

- 10a. No gill rakers on epibranchial 1; about 13 total gill rakers; a fleshy lappet on nape behind eye; posterior naris adnate to anterior margin of orbit ..Mendelssohn’s Pygmygoby, *T. mendelssohni* (Goren, 1978: 195)

Holotype: TAU 6208, 29.1 mm SL; type locality: Nuweiba, Egypt, Gulf of Eilat, Red Sea, .

Range: Red Sea, and perhaps elsewhere in the western Indian Ocean (Seychelles, Comoros).

Genetic variation: Two haplogroups, one in the Red Sea and the other from elsewhere in the western Indian Ocean, separated by 8.2%.



Figure 11. *T. mendelssohni*, a) fresh, 21.3 mm SL male, ROM 59791, Comoros (RW); b & c) live specimens, Egyptian Red Sea (GB).

- 10b. Gill rakers present on epibranchial; no fleshy lappet on nape behind eye; posterior naris separated from eye by a distance equal to or greater than diameter of nasal pore 11

- 11a. Second spine of first dorsal fin only marginally longer than third; cheek uniformly dusky or with two narrow, pale, vertical barsCaesiura Pygmygoby, *T. caesiura* Jordan & Seale, 1906: 391

Holotype: USNM 51772, 22.3 mm SL; type locality: Apia, Upolu Island, Samoa.

Range: Ryukyu Islands, Japan and the northern Marianas and Marshall Islands, south to Samoa and Niue, including Taiwan, Palau, Papua New Guinea, the Great Barrier Reef, New Caledonia, and Fiji.

Genetic variation: A single haplogroup from Palau south to Samoa (10). No apparent variation in morphology noted, although not examined in detail.



Figure 12. *T. caesiura*, a) fresh 21.5 mm SL male, ROM 74988, Urukthapel Island, Palau (RW); b) fresh, ROM 98992, Upolu, Samoa (MVE); c) live, Upolu, Samoa (MVE).

- 11b. Second spine of first dorsal fin elongated, reaching to or beyond origin of second dorsal fin; cheek with red, yellow, or brown blotches, bars, or stripes, but no pale bars 12
- 12a. Usually 9 dorsal-fin and anal-fin rays; head with a diagonal yellow stripe, margined with red, from posterior maxilla to middle of upper opercle. Cocos Pygmygoby, *T. insularum*, Winterbottom & Hoese, 2015: 36*

Holotype: ROM 82970, 23.9 mm SL male; type locality: Direction Island, Cocos (Keeling) Islands.
Range: Apparently confined to the Cocos (Keeling) Islands.



Figure 13. *T. insularum*, a) fresh, 18 mm SL, Cocos (Keeling) Islands (GRA); b) fresh, Cocos (Keeling) Islands (GRA); c) live, Cocos (Keeling) Islands (TU).

- 12b. Usually 8 or fewer dorsal-fin and anal-fin rays; head without a diagonal yellow stripe, although red or brown spots may be present on cheek..... 13
- 13a. Pectoral-fin base without a dark bar or oval spot; spots and/or bars present on cheek; caudal peduncle yellowLantana Pygmygoby, *T. lantana* Winterbottom & Villa, 2003: 16

Holotype: ROM 46039, 20.8 mm SL female; type locality: Honiara, Guadalcanal, Solomon Islands.
Range: Southwest Islands of Palau to eastern Indonesia, Papua New Guinea, Western Australia, the Great Barrier Reef, and Solomon Islands, .
Genetic variation: A single haplogroup from SW Palau south to the Great Barrier Reef (10). No apparent variation in morphology noted, although not examined in detail.

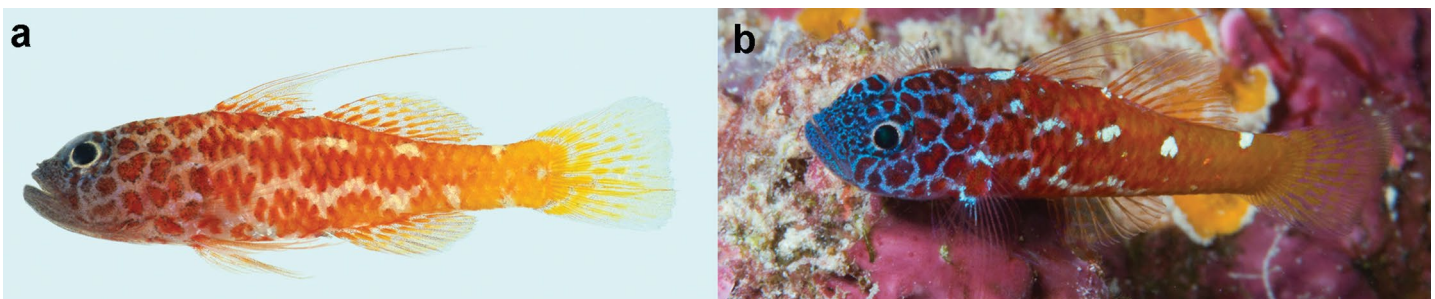


Figure 14. *T. lantana*, a) fresh, 22.6 mm SL male, ROM 83077, Helen Reef, Palau (RW); b) live, Milne Bay, PNG (MVE).

- 13b. Pectoral-fin base usually with a dark bar or oval spot; a single bar on cheek may be present below anterior margin of pupil; caudal peduncle not yellow Naude's Pygmygoby, *T. naudei* Smith, 1957: 828

Holotype: SAIAB [formerly RUSI] 213; type locality: Mahe, Seychelles.

Range: Comoros eastward to the Ryukyu Islands, Japan.

Genetic variation: Two haplogroups, one from the Indian Ocean (including the Maldives) and the other from Taiwan and Japan, separated by 2.9%. No specimens available from the Philippine region, although the species is recorded from there.



Figure 15. *T. naudei*, a) fresh, 26.7 mm SL male, ROM 59796, Comoros (RW); b) fresh, 21.5 mm SL male, ROM 73198, Nha Trang, Vietnam (RW); c) live, El Nino, Philippines (GRA).

- 14a.(9) Scales on opercle usually absent (except 1 or 2 scales present on 2 of 24 specimens of *T. erdmanni*)... 15

- 14b. Scales present on opercle 19

- 15a. Anal-fin rays 7; fifth pelvic-fin ray with two dichotomous branch points 16

- 15b. Anal-fin rays 8 or 9; fifth pelvic-fin ray with a single dichotomous branch point 17

- 16a. Pectoral-fin base with dark spots and two large and two small scales; cheek with dark bars; head and body brown with gray and white mottling
Four-spotted Pygmygoby, *T. quadrimaculatum* Hoese, Bogorodsky & Mal, 2015: 540

Holotype: SMF 35720, 16.7 mm SL female; type locality: Jeddah, Saudi Arabia.

Range: Northern to central Red Sea coast of Saudi Arabia, and Socotra, Yemen.

Genetic variation: A single specimen has been sequenced.

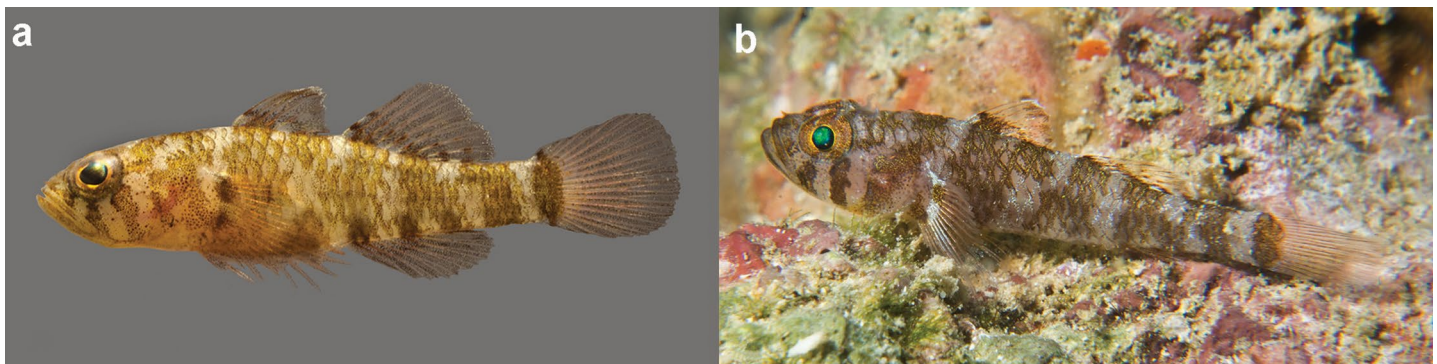


Figure 16. *T. quadrimaculatum*, a) fresh, 16.0 mm SL paratype, SMF 35530, S. of Duba (SVB); b) live 16.7 mm SL female holotype, SMF 35720 (SVB).

- 16b. Pectoral-fin base with two rows of about equal-sized cycloid scales (total 8) and without dark spots; cheek without dark bars; head and body reddish with white spots and bars
 Split-ray Pygmygoby, *T. meristum* Winterbottom & Hoese, 2015: 53

Holotype: AMS I.18353-037, 18.3 mm SL male; type locality: Viti Levu, Fiji.

Range: Great Barrier Reef, Milne Bay and the Bismarck Archipelago (Papua New Guinea), and Fiji.

Genetic variation: A single specimen has been sequenced (identified as *T. christianeae*).

Remarks: The recently described *T. christianeae* Allen, 2019 from Papua New Guinea is, according to morphology, a junior subjective synonym of *T. meristum* (see Discussion).



Figure 17. *T. meristum*, a) preserved, 18.9 mm SL male, Alotau, Milne Bay, PNG (GRA); b) live, Alotau, Milne Bay, PNG (CW); c) live, Alotau, Milne Bay, PNG (GRA).

- 17a.(15) Second spine of first dorsal fin more elongated, usually reaching beyond middle of second dorsal fin; cheek without a pale stripe; body without yellow stripes
 Barrall's Pygmygoby, *T. barralli* Winterbottom, 1995: 93*

Holotype: ROM 68980, 23.0 mm SL; type locality: Ras Abu Galum, Egypt, Red Sea.

Range: Port Sudan to Gulf of Aqaba, northern Red Sea.



Figure 18. *T. barralli*, a, b, c) live, northern Red Sea (GB).

- 17b. Second spine of first dorsal fin less elongated, usually not reaching middle of second dorsal fin; cheek with a pale stripe on cheek or body with three yellow stripes 18

- 18a. Scales in predorsal midline (when present) separated from first dorsal-fin spine by naked area; 19 or more total gill rakers; body with a broad red lateral stripe; iris with an oblique blue band
 Erdmann's Pygmygoby, *T. erdmanni* Winterbottom, 2011: 138*

Holotype: ROM 87482, 23.5 mm SL male; type locality: Kawe Island, Raja Ampat, West Papua, Indonesia.

Range: Specimens identified as *T. erdmanni* range from the Philippines to Sulawesi, Indonesia and New Britain, PNG, and the Solomon Islands.

Genetic variation: At least 7 haplogroups are documented under this name, as well as another three under the closely related *T. chledophilum* (see couplet 116). The haplogroup to which the types belong is currently known only from Misool, Kawe, and Jef Tsiep Islands in Raja Ampat, Indonesia.



Figure 19. *T. erdmanni*, a) fresh, 10.2 mm SL juvenile paratype, ROM 85033, Kawe Island, Raja Ampat, Indonesia (RW); fresh, 26.2 mm SL male paratype, ROM 85033, Kawe Island, Raja Ampat (RW); live, Kawe Island, Raja Ampat (MVE).

18b. Predorsal midline fully scaled, no naked area in front of first dorsal-fin spine; 19 or fewer total gill rakers; body without a red lateral stripe; iris with purple to red diagonal stripe across middle, a band across top of eye, and a spot above middle of cheek ..Exquisite Pygmygoby, *T. preclarum* Winterbottom, 2006: 63

Holotype: ROM 77556, 20.3 mm SL male; type locality: Ulong Pass, Palau.

Range: Saipan to the Philippines and the northeastern coast of New Guinea.

Genetic variation: Three haplogroups separated by 7–10%: one in Palau (and probably Guam and Saipan), a second in the Philippines, and a third along the northeast coast of New Guinea.



Figure 20. *T. preclarum*, a) fresh, 19.2 mm SL male paratype, ROM 80020, Kayangel Atoll, Palau (RW); b) fresh, 19.2 mm SL male, ROM 83023, Pulo Anna Island, Palau (RW); c) live, Saipan, Northern Mariana Islands (HK).

19a.(14) Second spine of first dorsal fin less elongated, not reaching origin of second dorsal fin 20

19b. Second spine of first dorsal fin more elongated, reaching origin of second dorsal fin or beyond 23

20a. Vertically oriented scales present along margins of interorbital trench; dorsal fins with black margins
.....Blackmargin Pygmygoby, *T. unisquam* (Gosline, 1959: 70)

Holotype: USNM 175009, 18.2 mm SL; type locality: Oahu, Hawai‘i, USA.

Range: Comoros to Easter Island: primarily south of the equator, except for Hawai‘i and Ifaluk Atoll, Caroline Islands.

Genetic variation: A single haplogroup from Easter Island (7), Society Islands (Mauphelia Atoll) (1), Gambier (1), and the Austral Islands (1), with less than 0.4% divergence within the group. No samples are available from the type locality or from farther west in the Indo-Pacific.



Figure 21. *T. unisquam*, a) fresh, 13.5 mm SL female, ROM 45960, Great Astrolabe Reef, Fiji (RW); b) fresh, 14.6 mm SL male, ROM 59755, Moorea, Society Islands (RW); c) live, Tahiti, Society Islands (PB).

- 20b. No scales present along margins of interorbital trench or trough; dorsal fins without black margins..... 21
- 21a. Pelvic fin with full basal membrane and frenum; fifth pelvic-fin ray with two dichotomous branches (4 terminal tips)Bridle Pygmygoby, *T. fraena* Winterbottom, 1984: 699

Holotype: ROM 41475, 16.8 mm SL female; type locality: Salomon Atoll, Chagos Archipelago. Range: Chagos Archipelago and Comoros.

Remarks: Currently known from only three specimens: two from the Chagos Archipelago and one from Moheli Island, Comoros.



Figure 22. *T. fraena*, a) preserved holotype, 16.8 mm SL female, ROM 41475, Chagos Archipelago (CG); b) lateral view of head of holotype, stained (RW); c) dorsal view of head of holotype, stained (RW).

- 21b. Pelvic fin with no frenum and basal membrane less than 50% length of fifth ray; fifth pelvic-fin ray usually with a single dichotomous branch point (two terminal tips)..... 22
- 22a. Head and body whitish with large irregular red spots and blotches; cheek with 7 papillae in row *c*; no large black ocellus in first dorsal fin ...Red-spotted Pygmygoby, *T. rubromaculatum* Allen & Mundy, 1995: 102*

Holotype: WAM P.30889-001, 18.1 mm SL male; type locality: Kimbe Bay, New Britain, Papua New Guinea.

Range: Philippines to Bali, Papua New Guinea, and the Solomon Islands.

Genetic variation: A single haplogroup from throughout the range (10) with 0.7% divergence.



Figure 23. *T. rubromaculatum*, a) fresh, 20.9 mm SL male, ROM 85187, Yef Tsiep Island, Raja Ampat, Indonesia (RW); b) fresh, AMS I.21922, Anilao, Philippines (DFH); c) live, 21.8 mm SL male, ROM 84890, Penemu Island, Raja Ampat (MVE).

- 22b. Head and body orange-red with yellow spots on nape; black ocellus about eye diameter covering most of first dorsal fin; cheek with 6 papillae in row *c*
Marg's goby, *T. zurae* Winterbottom, Erdmann & Cahyani, 2014: 379

Holotype: ROM 94019, 22.6 mm SL female; type locality: Manado, North Sulawesi, Indonesia.

Range: Currently known only from the type location.

Genetic variation: A single specimen has been sequenced.



Figure 24. *T. zurae*, a) fresh, 18.3 mm SL female paratype, ROM 94886, Manado, Sulawesi, Indonesia (MVE); b) fresh, 22.6 mm SL female holotype, ROM 94019, Manado, Sulawesi, Indonesia (GRA); c) live, ROM 94886, Manado, Sulawesi, Indonesia (GRA).

23a.(19) Cheek scaled on posterodorsal region; dorsum crossed by 7 narrow bluish-white (live) or gray (fresh) saddles Brown Pygmygoby, *T. yanagitai* Suzuki & Senou, 2007: 176

Holotype: KPM-NI 3444, 33.0 mm SL male; type locality: Izu Oceanic Park, Shizuoka, Japan.

Range: Izu Peninsula, Shizuoka to Ryukyu Islands, Japan.



Figure 25. *T. yanagitai*, a) fresh, 33.0 mm SL male holotype, KPM-NI 3444, Izu Oceanic Park, Japan (HS); b) live, KPM-NR 70144, Shizuoka Prefecture, Japan (AM); c) live, KPM-NR 60-137 (SY).

23b. Cheek without scales; colors not as in 23a 24

24a. A black spot on body below first-dorsal-fin origin (half to one pupil width); fifth pelvic-fin ray with two dichotomous branch points (4 terminal tips) Lilac Pygmygoby, *T. nomurai* Suzuki & Senou, 2007: 180

Holotype: KPM-NI 4109, 19.2 mm SL male; type locality: Iejima, Okinawa, Japan.

Range: Japan to Western Australia, Palau, West Papua (Indonesia), and New Caledonia and a photographic record from Mayotte, Comoros, western Indian Ocean (PP).

Genetic variation: A single specimen from Raja Ampat, West Papua, Indonesia has been sequenced.



Figure 26. *T. nomurai*, a) preserved, 19.2 mm SL male, holotype, KPM-NI 4109, Iejima, Japan (HS); b) fresh, same specimen (HS); c) live, Milne Bay, PNG (MVE).

24b. No black spot below first-dorsal-fin origin; fifth pelvic-fin ray with a single dichotomous branch point (two terminal tips)..... 25

- 25a. First dorsal fin with two pupil-sized black spots basally on first 6 spines
Irina's Pygmygoby, *T. irinae* Winterbottom, 2014: 210

Holotype: ROM 94505, 19.7 mm SL female; type locality: Milne Bay Province, Papua New Guinea.

Range: Currently known only from the Lawadi region of Milne Bay Province.

Genetic variation: A single specimen has been sequenced.



Figure 27. *T. irinae*, a) fresh, 19.7 mm SL female holotype, ROM 94505, Lawadi, Milne Bay (GRA); b) live, Lawadi, Milne Bay, PNG (MVE); c) live, Lawadi, Milne Bay, PNG (MVE).

- 25b. First dorsal fin without dark spots, but if present, very small, smaller than space between two spine bases .26

- 26a. Dark basal stripe in dorsal fins, followed by a yellow/orange stripe and then another dark stripe 27

- 26b. Coloration at base of dorsal fins not as in 26a 28

- 27a. Second spine of first dorsal fin less elongated, not reaching beyond base of third ray of second dorsal fin; cheek with two red-to-orange bars (pale in preservative)
 Face-stripe Pygmygoby, *T. cheni* Winterbottom, 2011: 133

Holotype: ROM 87481, 20.0 mm SL male; type locality: Waigeo, Raja Ampat, West Papua, Indonesia.

Range: Sulawesi to Raja Ampat (Indonesia), New Britain (PNG), north to the Philippines and Palau.

Genetic variation: Two haplogroups, one from Rabaul, New Britain (PNG) (2) and the other from Indonesia at the Moluccas, Raja Ampat, and Cenderawasih Bay (4), separated by 3.9%.



Figure 28. *T. cheni*, a) close-up of dorsal fin coloration of fresh specimen, 20.1 mm SL, ROM 85161, Raja Ampat, Indonesia (RW); b) live, Banda, Indonesia (GRA); c) live, Palawan, Philippines (GRA).

- 27b. Second spine of first dorsal fin more elongated, usually reaching beyond middle of second dorsal fin; cheek uniform, without bars
Barrall's Pygmygoby, *T. barralli* Winterbottom, 1995: 93*

Holotype: ROM 68980, 23.0 mm SL; type locality: Ras Abu Galum, Egypt, Gulf of Aqaba, Red Sea.

Range: Gulf of Aqaba to Port Sudan, north/central Red Sea.



Figure 29. *T. barralli*, a, b, c) live, northern Red Sea (GB).

28a.(26) Cheek uniform pinkish red, without yellow-to-red bars; dorsal fin with a small dark spot ocellated with orange basally behind fourth dorsal-fin spine ..Pawpaw Pygmygoby, *T. papayum* Winterbottom, 2011: 151

Holotype: ROM 87485, 21.6 mm SL female; type locality: Kawe Island, Raja Ampat, West Papua, Indonesia.

Range: Sulawesi to Raja Ampat (Indonesia) and east to the Solomon Islands.

Genetic variation: Two haplogroups, from Indonesia (3) and Solomon Islands (1), separated by 1.6%.



Figure 30. *T. papayum*, a) fresh, 21.6 mm SL female holotype, ROM 85034, Kawe Island, Raja Ampat, Indonesia (RW); b) live, 20.2 mm SL male, ROM 94020, Manado, Sulawesi, Indonesia (GRA); c) live, 18.4 mm SL female, ROM 101545, North Lembata, Indonesia (MVE).

28b. Cheek with yellow-to-red bars (pale in preservative); no small dark spot on dorsal fin 29

29a. Reddish orange spots, always with distinct dark centers, scattered on nape and anterior body, as well as one on fin near base of sixth dorsal-fin spine and one prominent spot near anteroventral base of pectoral fins; cheek without prominent reddish orange bars

.....Pimple Pygmygoby, *T. halonevum* Winterbottom, 2000: 623

Holotype: ROM 72215, 20.9 mm SL female; type locality: Normanby Island, Papua New Guinea.

Range: Maldives to Japan, Philippines, and Solomon Islands; possibly to Society Islands (D.F. Hoese, pers. comm.).

Genetic variation: A single haplogroup from throughout much of the range (26), diverging by less than 1%.



Figure 31. *T. halonevum*, a) fresh, 18.2 mm SL male, ROM 85251, Walo Island, Raja Ampat, Indonesia (RW); b) fresh, 8.6 mm SL, ROM 87414, Ef Pian Island, Raja Ampat, Indonesia (RW); c) live, ROM 106269, Hithadhoo, Maldives (MVE).

- 29b. Reddish orange spots, without distinct dark centers, scattered on nape and body; cheek with reddish orange bars; no prominent black-centered spot near anteroventral base of pectoral fins
Putra's Pygmygoby, *T. putrai* Winterbottom, Erdmann & Mambrasar, 2019: 48

Holotype: MZB 24001, 20.4 mm SL male; type locality: Batanta, Raja Ampat, West Papua, Indonesia.
Range: Currently known only from deep reefs at Bali, Flores, Raja Ampat, and Timor Leste (Indonesia).
Genetic variation: A single haplogroup from Raja Ampat (Indonesia) (2).



Figure 32. *T. putrai*, a) fresh, 13.9 mm SL male paratype, ROM 101303, Flores, Indonesia (MVE); b) fresh, 10.5 mm SL paratype, WAM P.33825.001, Miosging, Raja Ampat, Indonesia (GRA); c) live, Flores, Indonesia (MVE).

- 30a.(3) Width of bony interorbital at posterior pair of interorbital papillae of row *p* greater than 50% pupil width ..31
 30b. Width of bony interorbital at posterior pair of interorbital papillae of row *p* less than 50% pupil width. 36

- 31a. Cheek with two or three rows of cycloid scales 32
 31b. Cheek without scales..... 33

- 32a. Pectoral-fin rays 16; 8 or 9 scale rows in predorsal midline; body scales without central yellowish spots (or pale spots in preservative) ...Blue-eyed Pygmygoby, *T. blematium* Winterbottom & Erdmann, 2018: 472

Holotype: ROM 102761, 22.0 mm SL male; type locality: Normanby Island, Papua New Guinea.
Range: Currently known only from Normanby Island, Papua New Guinea.
Genetic variation: A single specimen has been sequenced.



Figure 33. *T. blematium*, a) fresh, 22.8 mm SL female paratype, ROM 101301, Normanby Island, PNG (MVE); b) live, Normanby Island, PNG (MVE); c) live, Normanby Island, PNG (MVE).

- 32b. Pectoral-fin rays 14; 12–14 scale rows in predorsal midline; each body scale with a large yellowish spot at center (pale spot in preservative).....Porthole Pygmygoby, *T. finistrinum* Winterbottom, 2017: 564

Holotype: ROM 101380, 21.0 mm SL female; type locality: between Viti Levu and Vanua Levu, Fiji.
Range: Fiji Islands.
Genetic variation: Two haplogroups from Fiji, one from the type locality (3) and the other from the Lau Islands (3), separated by 8.6%.



Figure 34. *T. finistrinum*, a) fresh, 23.4 mm SL female paratype, BPBM 38965, Viti Levu, Fiji (JER); fresh, Lau Islands, Fiji (MVE); c) live, Lau Islands, Fiji (MVE).

33a.(31) Body with alternating reddish and pale stripes (dark and light in preservative); bony interorbital width less than 80% pupil width; cheek with 5 papillae in row *c* and a single papilla in row *p* medial to nasal capsulePajama Pygmygoby, *T. pajama* Winterbottom, Erdmann & Cahyani, 2014: 374

Holotype: ROM 94175, 14.0 mm SL female; type locality: Fakfak, Raja Ampat, West Papua, Indonesia.

Range: Raja Ampat, Indonesia. Similar looking specimens are known from photographs and/or formalin-fixed specimens from Kalimantan (Indonesia), Hermit Islands (Papua New Guinea), Solomon Islands, and Palau.

Genetic variation: Two haplogroups, one from Fakfak and Penemu Island (Indonesia) (3) and the other from the Solomon Islands (2), separated by 15.7%.



Figure 35. *T. pajama*, a) fresh, 12.5 mm SL paratype, ROM 95784, Penemu Lagoon, Raja Ampat, Indonesia (MVE); b) live, 14.0 female holotype, ROM 94175, Fakfak, Raja Ampat (MVE); c) live, Kawe Island, Raja Ampat (MVE).

33b. Body without stripes; bony interorbital width about pupil width; cheek with 6 papillae in row *c* and 2 papillae in row *p* medial to nasal capsule 34

34a. Nasal capsule an open pit without separate anterior and posterior nares; posterior margin of caudal peduncle with a red bar (few, if any, melanophores in preservative) Princess Pygmygoby, *T. marinae* Winterbottom, 2005: 30

Holotype: ROM 76678, 19.6 mm SL female; type locality: Kaibakku Island, Palau.

Range: Western Pacific, potentially Ryukyu Islands to the Great Barrier Reef, including Bali (Indonesia), Philippines, and Palau to the Solomon Islands.

Genetic variation: Three haplogroups, one from the type locality in Palau, Cenderawasih Bay (Indonesia), and Rabaul, New Britain (PNG) (Group 3 of Winterbottom et al. [2014c]), separated by 15% from Groups 1 and 2, both from Raja Ampat (Indonesia) and separated by 4.8%.



Figure 36. *T. marinae*, a) 17.3 mm SL male paratype, ROM 74798, Palau, dorsal view of anterior head (stained), red arrows show two papillae of row *p* medial to nasal capsule (RW); b) fresh, 20.0 mm SL female paratype, ROM 74798, Palau (RW); c) live, Cenderawasih Bay, Indonesia (MVE).

- 34b. Nasal capsule typical, with separate anterior and posterior nares; posterior margin of caudal peduncle with a dark spot made up of numerous melanophores 35
- 35a. Caudal peduncle with a small dark spot, about half or less height of caudal peduncle Griffiths' Pygmygoby, *T. griffithsi* Winterbottom, 1984: 701

Holotype: ROM 41228, 15.5 mm SL male; type locality: Peros Banhos Atoll, Chagos Archipelago.

Range: Currently known only from the Chagos Archipelago and Maldives. The record from the Andaman Islands (Allen & Erdmann 2012; 938) needs confirmation.

Genetic variation: One haplogroup from the Maldives (4) diverging by 0.4%.



Figure 37. *T. griffithsi*, a) left lateral view of caudal region (stained) to show caudal spot, 12.4 mm SL female, ROM 107898, Maldives (RW); 16.9 mm SL female paratype, ROM 41227, Chagos Archipelago (RW); c) live, ROM 107898, Laamu Atoll, Maldives (MVE).

- 35b. Caudal peduncle with a large dark spot, covering most of height of caudal peduncle Nasal-bar Pygmygoby, *T. nasa* Winterbottom, 2005: 34

Holotype: ROM 53043, 19.7 mm SL female; type locality: Siquijor Island, Visayas, Philippines.

Range: Western Pacific, from Palau, the Philippines, Bali (Indonesia), east to the Solomon Islands and Fiji.

Genetic variation: Winterbottom et al. (2014c) recognized 4 well-separated haplogroups under this species name, with pairwise divergences ranging from 5.5–16.8%. A fifth group is apparently present in Fiji. A single specimen from Batangas, Philippines (about 560 km NNW of the type locality) belongs to Group 4, along with specimens from northern Sulawesi (Indonesia) and Rabaul (Papua New Guinea). However, several collections contain more than one haplogroup, so it is difficult to pin down exactly which haplogroup the holotype belongs to without morphological or color pattern matching.



Figure 38. *T. nasa*, a) left lateral view of caudal region, 12.9 mm SL, ROM 94486, Lembak Strait, Sulawesi (RW); b) fresh, 17.5 mm SL, Batangas, Luzon (JTW); c) live, KPM-NR 92407, Mactan, Philippines (SG). All images are from specimens as near to the type locality as possible.

- 36a.(30) Cheek with at least two scales present (at posterodorsal corner of cheek) 37
- 36b. Cheek without scales 42

- 37a. Cheek with 5 papillae in row *c*; caudal peduncle without white markings; no red blotches on flanks . . . 38
- 37b. Cheek with 6 or 7 papillae in row *c*; caudal peduncle with white semicircles or irregular red blotches on flanks 41
- 38a. Bony interorbital width 18–26% pupil width; dorsal-fin spines not elongated; body with broad yellow bars (dark in preservative) Yellow-banded Pygmygoby, *T. fasciatum* Suzuki, Sakaue & Senou, 2012: 68*

Holotype: OMNH-P 35167, 21.9 mm SL male; type locality: Ngemlis Reef, Palau.

Range: Japan to Palau, and Christmas Island (Indian Ocean); possibly also Maluku Islands (Indonesia) (see Fig. 46c).



Figure 39. *T. fasciatum*, a) preserved holotype, 21.9 mm SL male, OMNH-P 35167, Palau (TS); b) fresh holotype (TS); c) live, KPM-NR 44892, Palau (JS).

- 38b. Bony interorbital width 25–44% pupil width; second spine of first dorsal fin elongated or not; head and body uniform yellow without bars, or with a dark caudal peduncle or caudal fin 39
- 39a. Body uniformly yellow; second spine of first dorsal fin elongated, reaching middle of second dorsal fin; 8 or 9 predorsal scales Winch’s Pygmygoby, *T. winchi* Winterbottom, 1984: 712*

Holotype: ROM 41477, 18.8 mm SL male; type locality: Salomon Atoll, Chagos Archipelago.

Range: Currently known only from Chagos Archipelago and St. Joseph Atoll, Seychelles.

Genetic variation: A single specimen from Seychelles has been sequenced.

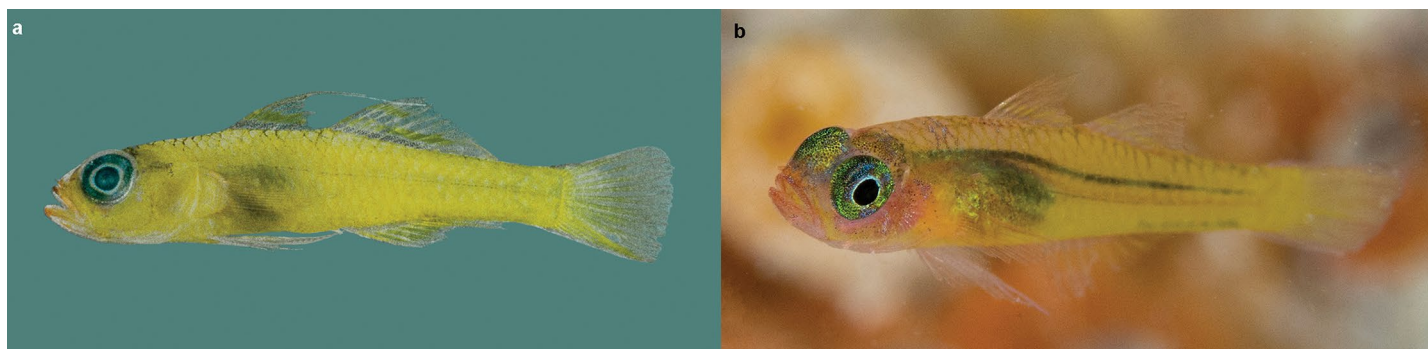


Figure 40. *T. winchi*, a) fresh, 18.8 mm SL male holotype, ROM 41477, Salomon Atoll, Chagos Archipelago (RW); b) live, St Joseph Atoll, Seychelles (RD).

- 39b. Body not uniformly colored; second spine of first dorsal fin elongated or not; 4–10 predorsal scales; dark area on posterior caudal peduncle or caudal fin dark 40

- 40a. Dorsal-fin spines not reaching to second-dorsal-fin origin; 4 or 5 predorsal scales; posterior caudal peduncle dark, caudal fin light yellow to white Wasp Pygmygoby, *T. flavatrum* Hagiwara & Winterbottom, 2007: 164*

Holotype: YCM-P42599, 23.0 mm SL male; type locality: Ryukyu Islands, Japan.

Range: Japan to Rowley Shoals (NW Australia) and the Great Barrier Reef, Marshall Islands, Fiji, and Samoa.

Genetic variation: A single haplogroup from Sulawesi (Indonesia), Palau, and the Philippines (5) diverging by 0.4% within the group.



Figure 41. *T. flavatrum*, a) fresh, 18.1 mm SL male paratype, Ryukyu Islands, Japan (TH); fresh, 15.5 mm SL female, ROM 83348, Helen Reef, Palau (RW); c) live, Balbulol Island, Raja Ampat, Indonesia (MVE).

- 40b. Second spine of first dorsal fin elongated, reaching past origin of second dorsal fin; 6–10 predorsal scales; caudal fin dark reddish brown to black..Randall’s Pygmygoby, *T. randalli* Winterbottom & Zur, 2007: 18*

Holotype: ROM 80040, 16.0 mm SL male; type locality: Garreru Island, Palau.

Range: Palau, Philippines, and Flores (Indonesia).

Genetic variation: A single specimen from Palau has been sequenced.



Figure 42. *T. randalli*, a) fresh, 16.0 mm SL male, ROM 80040, Garreru Island, Palau (RW); b) fresh, 18.7 mm SL male, ROM 80040, Garreru Island, Palau (RW); c) live, Palau (TU).

- 41a.(37) Cheek with 6 papillae in row *c*; posterior caudal peduncle black with a pair of white, pupil-width spots dorsally and ventrally at procurrent caudal fin rays; head and body yellowish to greenish Day-night Pygmygoby, *T. meranynx* Winterbottom, Erdmann & Cahyani, 2014: 368

Holotype: ROM 94170, 18.7 mm SL female; type locality: Sulawesi, Indonesia.

Range: Indonesia at Sulawesi, Raja Ampat, and the Fakfak Peninsula, as well as Milne Bay Province, Papua New Guinea. Photographs of what appears to be this species are known from the Philippines and Vanuatu.

Genetic variation: Two haplogroups, from Sulawesi, Indonesia (1) and the other from Milne Bay, Papua New Guinea (2), separated by 2%.



Figure 43. *T. meranynx*, a) left lateral view of caudal peduncle to show white spots, 17.8 mm SL female paratype, ROM 94721 (RW); b) fresh, Lembeh, Sulawesi, Indonesia (MVE); c) fresh, Vanuatu (RP).

- 41b. Cheek with 7 papillae in row *c*; head and body whitish with large irregular red spots and blotches
Red-spotted Pygmygoby, *T. rubromaculatum* Allen & Munday, 1995: 102*

Holotype: WAM P.30889-001, 18.1 mm SL male; type locality: Kimbe Bay, New Britain, Papua New Guinea.

Range: Philippines to Bali (Indonesia), Papua New Guinea, and the Solomon Islands.

Genetic variation: One haplogroup (9) from the Philippines, Raja Ampat (Indonesia) and Milne Bay (Papua New Guinea) diverging by 0.7% within the group.



Figure 44. *T. rubromaculatum*, a) fresh, 22.2 mm SL, ROM 84883, Penemu Island, Raja Ampat, Indonesia (RW); b) fresh, AMS I.21922, Anilao, Philippines (DFH); c) live, Kimbe Bay, New Britain (GRA).

- 42a.(36) Cheek with 5 papillae in row *c*; pectoral-fin base with a conspicuous dark bar
Mourning Pygmygoby, *T. pentherum* Winterbottom & Hoese, 2015: 70

Holotype: USNM 243051, 20.3 mm SL male; type locality: Lau Group, Fiji.

Range: Tonga to the Great Barrier Reef and north to Fiji and the Southwest Islands of Palau.



Figure 45. *T. pentherum*, a) fresh, 15.7 mm SL female, ROM 83330, Helen Reef, Palau (RW); b) fresh, 15.2 mm SL male, ROM 83253, Helen Reef, Palau (RW); c) fresh, 15.1 mm SL, Solomon Islands (JTW).

- 42b. Cheek with 6 papillae in row *c* (except 5 in *T. fasciatum* and *T. kadium*); pectoral-fin base without a conspicuous dark bar..... 43

- 43a. Cheek with 5 papillae in row *c*; body bars or plain yellow with a pair of red spots on branchiostegal membranes.. 44

- 43b. Cheek with 6 papillae in row *c*; color pattern not as in 43a..... 43

- 44a. Body with broad yellow-to-red bars (dark in preservative); 14–16 pectoral-fin rays; no spots on branchiostegal membranes Yellow-banded Pygmygoby, *T. fasciatum* Suzuki, Sakaue & Senou, 2012: 68*

Holotype: OMNH-P 35167, 21.9 mm SL male; type locality: Ngemlis Reef, Palau.

Range: Japan to Palau, and Christmas Island (Indian Ocean); possibly also Maluku Islands (Indonesia) (see Fig. 46c).



Figure 46. *T. fasciatum*, a) preserved, 21.9 mm SL male holotype, OMNH-P 35167, Palau (TS); b) fresh holotype (TS); c) fresh, WAM P.33822.007, Maluku, Indonesia (MVE).

- 44b. Body uniformly yellowish; 17 or 18 pectoral-fin rays; branchiostegal membranes with a pair of red pupil-width spots (dark in preservative)
Heart Pygmygoby, *T. kardium* Winterbottom, Erdmann & Cahyani, 2015: 210*

Holotype: ROM 98815, 16.7 mm SL male; type locality: Triton Bay, West Papua, Indonesia.

Range: Currently known only from West Papua Province, Indonesia (Raja Ampat, Triton Bay, and Cenderawasih Bay).

Genetic variation: A single specimen from Raja Ampat (Indonesia) has been sequenced.

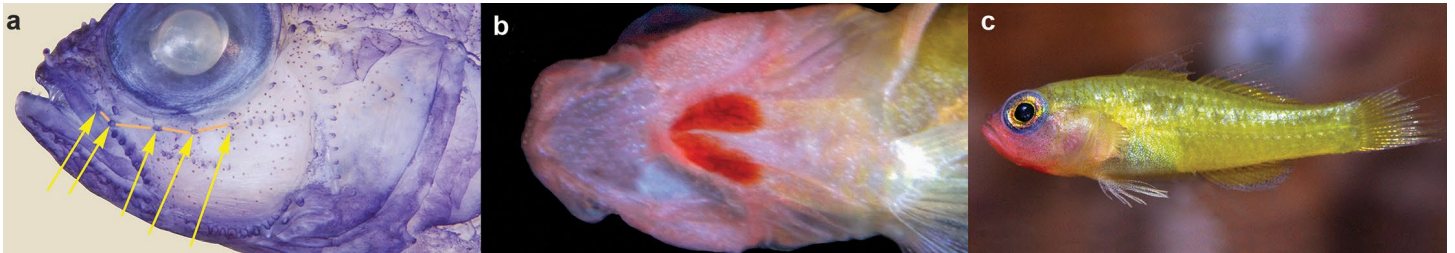


Figure 47. *T. kardium*, a) left lateral view of head showing the 5 papillae in row c, 15.8 mm SL male paratypes, ROM 87545 (yellow arrows, line joined in orange – RW); b) ventral view of head showing branchiostegal spots (MVE); c) fresh, 12.2 mm SL paratype, ROM T012726, Raja Ampat, Indonesia (GRA).

- 45a.(43) Second spine of first dorsal fin more elongated, reaching to second to eighth rays of soft dorsal fin; cheek with two yellow bars; yellowish spots at scale centers
Wangunu’s Pygmygoby, *T. wangunui* Winterbottom & Erdmann, 2019: 572

Holotype: ROM 108308, 20.8 mm SL female; type locality: near Nuakata Island, Milne Bay Province, Papua New Guinea.

Range: Currently known from three localities: Milne Bay Province (Papua New Guinea), Atauro Island (Timor-Leste), and Batangas Province (Philippines).

Genetic variation: A single haplogroup from Milne Bay Province (Papua New Guinea) (1), Atauro Island (Timor-Leste) (1), and Batangas Province (Philippines) (1), diverging by less than 1% within the haplogroup.



Figure 48. *T. wangunui*, a) fresh, 20.8 mm SL female holotype, ROM 108308 (MVE); b) fresh, 14.7 mm SL female paratype, ROM 101358, Atauro Island, Timor Leste, (MVE); c) fresh, 17.4 mm SL male paratype, ROM T20886, Nuakata, Milne Bay, PNG (MVE).

- 45b. Second spine of first dorsal fin less elongated, reaching to origin of second dorsal fin; cheek without yellow bars; no yellowish spots at scale centers..... 46

- 46a. Posterior interorbital trench deep, with vertical sides; cheek and nape with red spots and streaks
 Yellow-tailed Pygmygoby, *T. flavicaudatum* (Goren, 1982: 139)

Holotype: TAU 7743, 19.8 mm SL; type locality: Marsa Bareika, Ras Mohamed, Sinai, Egypt, Red Sea.
Range: Red Sea, south to Gulf of Tadjoura in Gulf of Aden.
Genetic variation: A single specimen has been sequenced.
Remarks: Two integrating forms exist in the Red Sea: one extreme with a yellow caudal peduncle and other with only the caudal fin yellow.



Figure 49. *T. flavicaudatum*, a) fresh, 24 mm SL, BPBM 18326, Gulf of Aqaba (JER); b) live, yellow-tailed form, Egyptian Red Sea (GB); c) live, plain form, El Quseir, Red Sea (SVB).

- 46b. Posterior interorbital trough shallow, with sloping sides; cheek and nape without red markings 47

- 47a. Scale pockets and edges strongly outlined with melanophores; opercle without a red-orange bar
 Emery's Pygmygoby, *T. emeryi* Winterbottom, 1985: 752

Holotype: ROM 44481, 16.7 mm SL male; type locality: Salomon Atoll, Chagos Archipelago.
Range: Western Indian Ocean, but details of additional localities uncertain.
Genetic variation: Winterbottom et al. (2014c) recognized 5 haplogroups based on specimens from the western Pacific that had been identified as this species. No specimens are available from the Indian Ocean. Recent collections have added a sixth haplogroup, from Cenderawasih (Indonesia) and Milne Bay (Papua New Guinea).

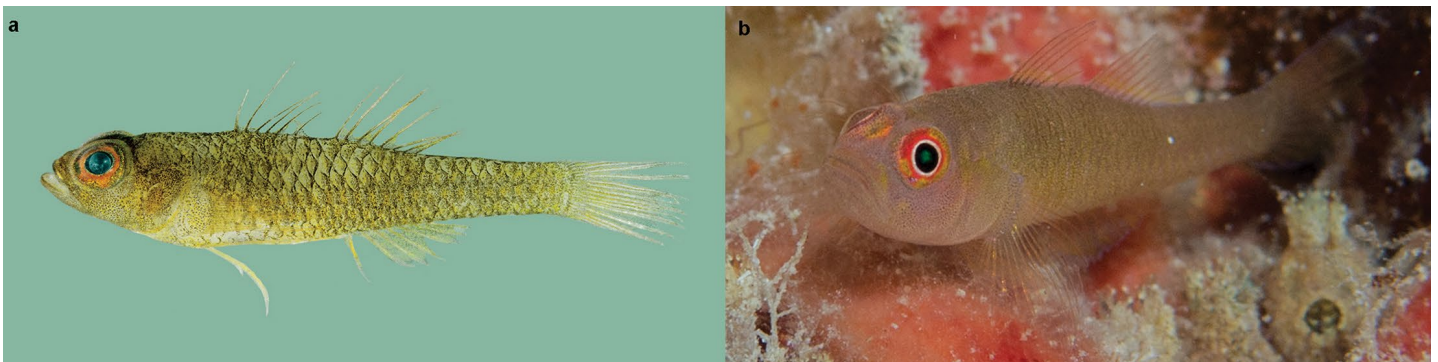


Figure 50. *T. emeryi*, a) fresh, 17.9 mm SL female paratype, ROM 40317, Chagos Archipelago (RW); b) live, D'Arros Island, Seychelles (RD).

- 47b. Scale pockets and edges not strongly outlined with melanophores; opercle with a red-orange bar behind vertical limb of preopercle 48

48a. A single red or yellow bar along posterior margin of preopercle (pale in preservative), continuing dorsally and posteriorly beyond posterior margin of eye
 Harlot Pygmygoby, *T. fucatum* Winterbottom & Southcott, 2007: 70

Holotype: ROM 81759, 19.8 mm SL male; type locality: Phuket, Thailand.

Range: Maldives to Bali, Indonesia.

Genetic variation: One haplogroup from the Maldives (1) and Phuket, Thailand (3), diverging by 0.7% within the group.



Figure 51. *T. fucatum*, a) fresh, 21.0 mm SL male paratype, ROM 68098, Phuket, Thailand (RW); b) fresh, 22.8 mm SL male paratype, ROM 68097, Phuket, Thailand (RW); c) fresh, 16.4 mm SL female, ROM T26070, Laamu Atoll, Maldives (MVE).

48b. Four large spots on posterior head and pectoral-fin base (pale in preservative), spot along posterior margin of preopercle somewhat vertically elongate (but not bar-like)
 Gray-bearded Pygmygoby, *T. annosum*, Winterbottom, 2003: 22

Holotype: ROM 73126, 15.5 mm SL male; type locality: Bau Island, Fiji.

Range: Western Pacific from Bali to Fiji, north to Vietnam and Japan, east to Kiribati and perhaps the Phoenix Islands. Records from the Indian Ocean (Maldives, Sri Lanka, and Christmas Island) may be misidentified *T. fucatum* (above).

Genetic variation: A single haplogroup from Taiwan to Indonesia and Palau (total 26), with 0.71% divergence.



Figure 52. *T. annosum*, a) fresh, 19.0 mm SL male, ROM 45965, Great Astrolabe Reef, Fiji (RW); b) fresh, Balbulol, Raja Ampat, Indonesia (MVE); c) live, Rote, West Timor, Indonesia (MVE).

49a.(2) Scales present on cheek, often in several rows 50

49b. No scales on cheek 67 (p. 34)

50a. At least some pectoral-fin rays branched 51

50b. All pectoral-fin rays unbranched 56

51a. Papillae under eye in short vertical rows (see Fig. 54a) 52

51b. Papillae under eye not in vertical rows, except for those at positions 1 and 5 of papillae row *c* 53

- 52a. Pectoral-fin rays 13 or 14; a dark blotch on posterior caudal peduncle
Yoshino's Pygmygoby, *T. yoshinoi* Suzuki, Yano & Senou, 2015: 68

Holotype: OMNH-P 40816, 20.8 mm SL male; type locality: Ryukyu Islands, Japan.
Range: Ryukyu Islands, Japan, and possibly Palau.



Figure 53. *T. yoshinoi*, a) preserved, 20.8 mm SL male holotype, OMNH-P 40816, Ryukyu Islands, Japan (TS); b) fresh, 20.8 mm SL male holotype, OMNH-P 40816, Ryukyu Islands, Japan (TS); c) live, Ryukyu Islands, Japan (KS).

- 52b. Pectoral-fin rays 16; caudal peduncle without a dark blotch
Shipwreck Pygmygoby, *T. nauagium* Allen, 2015: 38

Holotype: WAM P.34320-002, 20.3 mm SL male; type locality: Waga Waga, Papua New Guinea.
Range: Currently known only from type locality.
Genetic variation: A single specimen has been sequenced.



Figure 54. *T. nauagium*, a) head showing vertical papillae rows below eye (GRA); b) preserved holotype (GRA); c) live, Waga Waga, Papua New Guinea (GRA).

- 53a.(51) Branched pectoral-fin rays 4-6; no dark blotch over end of caudal peduncle
Fishelson's Pygmygoby, *T. fishelsoni* Goren, 1985: 64

Holotype: TAU 6569, 25.8 mm SL; type locality: Sinai, Egypt, Gulf of Aqaba, Red Sea.
Range: Northern half of the Red Sea.



Figure 55. *T. fishelsoni*, a) fresh, 21 mm SL, Saudi Arabia (SVB); b) live, Egyptian Red Sea (GB); c) live, Dahab, Red Sea (SVB).

- 53b. Pectoral-fin rays usually unbranched, or fewer than 3 branched; caudal peduncle with dark blotch54

- 54a. Second spine of first dorsal fin elongated, usually reaching beyond end of second dorsal fin; head with bluish spots in front of eye and on opercle and a bluish stripe edged dorsally with red from tip of maxilla to preopercle (all dark in preservative) Blotch-tailed Pygmygoby, *T. caudomaculatum* Yoshino & Araga in Masuda et al., 1975: 272*

Holotype: SMBL-F 75057, 28.6 mm SL male; type locality: Okinawa, Japan.

Range: Maldives to the Western Pacific.

Genetic variation: A single haplogroup from Maldives to Papua New Guinea with 1.7% divergence within the group, made up of 4 subgroups: one from Maldives (7), a second from Japan (11), a third from Timor Leste (2), and a fourth from Papua New Guinea at Milne Bay (1), Port Moresby (2), and Rabaul (3), plus the Solomon Islands (2).



Figure 56. *T. caudomaculatum*, a) fresh, ROM 106267, Hithadhoo, Maldives (MVE); b) fresh, Solomon Islands (MVE); c) live, Port Moresby, PNG (MVE).

- 54b. Second spine of first dorsal fin variable length, usually not reaching to end of second dorsal fin; head markings not as in 54a 55

- 55a. Second spine of first dorsal fin less elongated, not reaching beyond base of third ray of second dorsal fin; usually 5 papillae in row *r* on top of snout; dark stripe on midline of snout usually made up of large melanophores (in preservative); no broad internal dark stripe over abdominal cavity Holleman's Pygmygoby, *T. hollemani* Winterbottom, 2016: 42*

Holotype: ROM 84878, 25.5 mm SL female; type locality: Fam Islands, Raja Ampat, Indonesia.

Range: Great Barrier Reef to the Philippines as well as northeastern Kalimantan, Indonesia.

Genetic variation: One haplogroup (12) from eastern New Britain (Papua New Guinea), Philippines, and eastern Indonesia with 0.8% divergence.



Figure 57. *T. hollemani*, a) fresh, 25.5 mm SL female holotype, ROM 84878, Penemu Island, Raja Ampat, Indonesia (RW); b) fresh, 22.0 mm SL female, ROM 92129, New Britain, PNG (RW); c) live, Milne Bay, PNG (MVE).

- 55b. Second spine of first dorsal fin more elongated, reaching to or beyond end of second dorsal fin; usually 4 papillae in row *r* on top of snout; dark stripe on midline of snout (in preservative) usually made up of tiny black melanophores; a broad internal dark stripe over abdominal cavity, narrowing and continuing posteriorly along vertebral column Mary's Pygmygoby, *T. burridgeae* Winterbottom, 2016: 28*

Holotype: ROM 100153, 21.1 mm SL male; type locality: Helen Reef, Southwest Islands, Palau.

Range: Confirmed only from throughout the Palauan Islands (including the Southwest Islands), but may occur in the Mariana Islands as well.

Genetic variation: One haplogroup from Palau (8) with 0.8% divergence.



Figure 58. *T. burridgeae*, a) fresh, 17.2 mm SL male paratype, ROM 83350 and b) fresh, 17.2 mm SL female paratype, ROM 83255, both Helen Reef, Palau (RW); c) fresh, 26.6 mm SL male paratype, ROM 83066, Tobi Island, Palau (RW).

- 56a.(50)Caudal peduncle with a distinct large dark spot over caudal peduncle and caudal-fin-ray bases 57
 56b. Caudal peduncle without a distinct dark spot (entire caudal fin or posterior half of caudal peduncle may be dark)..62
 57a. Bony interorbital width <65% pupil width; 16 pectoral-fin rays
Abyssal Pygmygoby, *T. abyssum* Allen, 2015: 30

Holotype: WAM P.34327-001, 31.6 mm SL male; type locality: North Sulawesi, Indonesia.
Range: Currently known only from type locality.

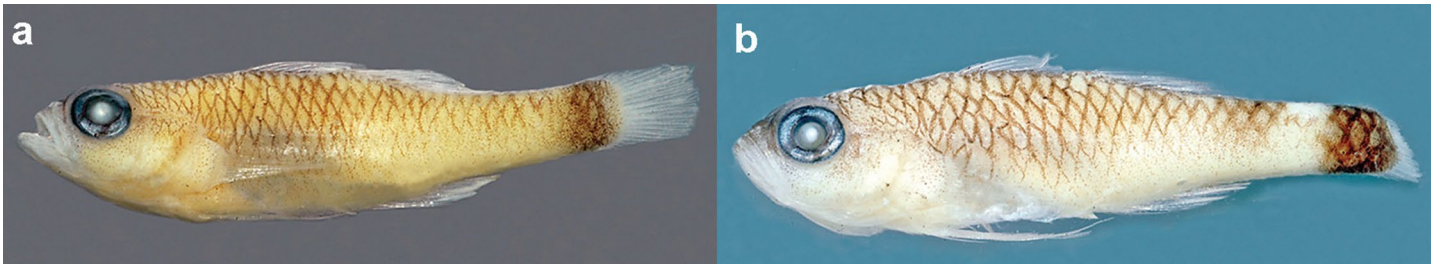


Figure 59. *T. abyssum*, a) preserved, 31.6 mm SL male holotype, WAM P.34327-001 (GRA); and b) preserved, 28.8 mm SL female paratype, WAM P.34327-002, both North Sulawesi, Indonesia (GRA).

- 57b. Bony interorbital width >65% pupil width; fewer than 16 pectoral-fin rays 58
 58a. Second spine of first dorsal fin elongated, usually reaching to middle of second dorsal fin; anterior rows of midline predorsal scales cycloid; no third (ventralmost) row of cheek scales; 2 papillae in row *f* on chin, 2 in row *r* on snout, usually 4 in row *d'* behind maxilla; no blue stripe (black in preservative) from anterior tip of snout towards origin of first dorsal fin; lateral stripe segment over pupil constricted into two spots connected by a thin line; 4 distinct groupings of melanophores around lower orbital rim
Colin's Pygmygoby, *T. corerefum* Winterbottom, 2016: 36

Holotype: ROM 100151, 15.2 mm SL female; type locality: Uchelbeluu Reef, Palau.
Range: Palau to the Philippines and Sulawesi (Indonesia).
Genetic variation: One haplogroup including specimens (3) from Bunaken (Sulawesi, Indonesia) nested among those from Palau (38), with 0.62% divergence within the group.



Figure 60. *T. corerefum*, a) lateral head showing melanophore groupings (red ovals), preserved, 15.2 mm SL female paratype, ROM 99084, Palau (RW); b) fresh, 14.4 mm SL female paratype, ROM 80390, Palau (RW), note: right eye displaced into buccal cavity, and extruded gut between pelvic-fin and anal-fin bases; c) live, Bunaken, Sulawesi, Indonesia (MVE).

- 58b. Second spine of first dorsal fin variable length; anterior rows of midline predorsal scales cycloid or ctenoid; third (ventralmost) row of cheek scales usually present; usually 4 or more papillae in row *f* on chin, 4 or more in row *r* on snout, 6 or more in row *d'* behind maxilla; with or without blue stripe (black in preservative) from anterior tip of snout towards origin of first dorsal fin; lateral stripe segment over pupil (if present) not constricted; no distinct groupings of melanophores around lower orbital rim 59
- 59a. Second spine of first dorsal fin less elongated, not reaching beyond base of third ray of second dorsal fin; anterior midline of head without a blue stripe (dark in preservative); a diffuse dark spot behind symphysis of lower jaw; top and sides of snout densely pigmented with small, dark, rounded melanophores mixed with slightly larger, amorphous, lighter brown melanophores and a sprinkling of much larger, darker, rounded melanophores Tevegae Pygmygoby, *T. tevegae* Cohen & Davis, 1969: 321

Holotype: USNM 203436, 19.8 mm SL female; type locality: Rabaul, New Britain, Papua New Guinea.
Range: Philippines and northeast Kalimantan (Indonesia) to Solomon Islands.
Genetic variation: One haplogroup (31) from Palawan (Philippines), Rabaul (Papua New Guinea), Raja Ampat and Moluccas (Indonesia), with 0.4% divergence within the group.

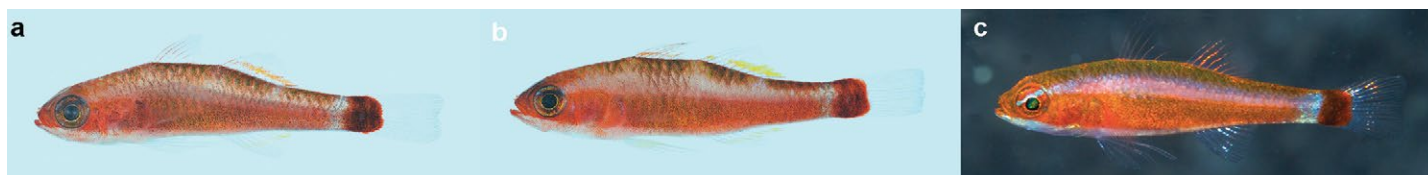


Figure 61. *T. tevegae*, a) fresh, 16.0 mm SL female, ROM T013180, Rabaul, PNG (RW); fresh, 19.8 mm SL male, ROM T013172, Rabaul, PNG (RW); c) live, Cenderawasih Bay, West Papua, Indonesia (MVE).

- 59b. Second spine of first dorsal fin more elongated, usually reaching well beyond base of third ray of second dorsal fin (except *T. hollemani*); anterior midline of head with a blue stripe (dark in preservative); dark spot behind symphysis of lower jaw usually absent; snout markings not as in 59a 60
- 60a. Second spine of first dorsal fin more elongated, usually reaching beyond end of second dorsal fin; head with bluish spots in front of eye and on opercle and a bluish stripe edged dorsally with red from tip of maxilla to preopercle (all dark in preservative) Blotch-tailed Pygmygoby, *T. caudomaculatum* Yoshino & Araga in Masuda et al., 1975: 272*

Holotype: SMBL-F 75057, 28.6 mm SL male; type locality: Okinawa, Japan.
Range: Maldives to the Western Pacific.
Genetic variation: A single haplogroup from Maldives to Papua New Guinea with 1.7% divergence within the group, made up of 4 subgroups: one from Maldives (7), a second from Japan (11), a third from Timor Leste (2), and a fourth from Papua New Guinea at Milne Bay (1), Port Moresby (2), and Rabaul (3), plus the Solomon Islands (2).



Figure 62. *T. caudomaculatum*, a) fresh, ROM 106267, Hithadhoo, Maldives (MVE); b) fresh, Solomon Islands (MVE); c) live, Port Moresby, PNG (MVE).

60b. Second spine of first dorsal fin less elongated, usually not reaching end of second dorsal fin; head without blue spots or stripes (or dark spots or stripes in preservative)..... 61

61a. Second spine of first dorsal fin less elongated, not reaching beyond base of third ray of second dorsal fin; usually 5 papillae in row *r* on top of snout; dark stripe on midline of snout usually made up of large melanophores (in preservative); no broad internal dark stripe over abdominal cavity
Holleman’s Pygmygoby, *T. hollemani* Winterbottom, 2016: 42*

Holotype: ROM 84878, 25.5 mm SL female; type locality: Fam Islands, Raja Ampat, Indonesia.

Range: Great Barrier Reef to the Philippines as well as northeastern Kalimantan, Indonesia.

Genetic variation: One haplogroup (12) from eastern New Britain (Papua New Guinea), Philippines, and eastern Indonesia with 0.8% divergence.



Figure 63. *T. hollemani*, a) fresh, 25.5 mm SL female holotype, ROM 84878, Penemu Island, Raja Ampat, Indonesia (RW); b) fresh, 22.0 mm SL female, ROM 92129, New Britain, PNG (RW); c) live, Milne Bay, PNG (MVE).

61b. Second spine of first dorsal fin more elongated, reaching to or beyond end of second dorsal fin; usually 4 papillae in row *r* on top of snout; dark stripe on midline of snout (in preservative) usually made up of tiny black melanophores; a diffuse, broad, internal dark stripe over abdominal cavity, narrowing and continuing posteriorly along vertebral columnMary’s Pygmygoby, *T. burridgeae* Winterbottom, 2016: 28*

Holotype: ROM 100153, 21.1 mm SL male; type locality: Helen Reef, Southwest Islands, Palau.

Range: Confirmed only from throughout the Palauan Islands (including the Southwest Islands), but may occur in the Mariana Islands as well.

Genetic variation: One haplogroup (8) from Palau with 0.8% divergence.



Figure 64. *T. burridgeae*, a) fresh, 17.2 mm SL male paratype, ROM 83350, Helen Reef, Palau (RW); b) fresh, 17.2 mm SL female paratype, ROM 83255, Helen Reef, Palau (RW); c) fresh, 26.6 mm SL male paratype, ROM 83066, Tobi Island, Palau (RW).

62a.(56) Bony interorbital width <35% pupil width; a single papilla in row *p* just medial to nasal capsule; posterior caudal peduncle or caudal fin dark reddish brown to black 63

62b. Bony interorbital width >55% pupil width; two or more papillae in row *p* just medial to nasal capsule; neither posterior caudal peduncle nor caudal fin dark reddish brown to black 64

- 63a.(62) Dorsal-fin spines not reaching origin of second dorsal fin; 17 or fewer total gill rakers; 4 or 5 predorsal scales; posterior caudal peduncle dark; caudal fin light yellow to white
Wasp Pygmygoby, *T. flavatrum* Hagiwara & Winterbottom, 2007: 164*

Holotype: YCM-P42599, 23.0 mm SL male; type locality: Ryukyu Islands, Japan.

Range: Japan to Rowley Shoals (NW Australia) and the Great Barrier Reef, Marshall Islands, Fiji, and Samoa.

Genetic variation: single haplogroup from Sulawesi (Indonesia), Palau, and the Philippines (5) diverging by 0.4% within the group.



Figure 65. *T. flavatrum*, a) preserved, 23.0 mm SL male holotype, YCM-P42599 (KH); b) fresh, 15.5F, Helen Reef, Palau, ROM 83348 (RW); c) live, Cenderawasih Bay, West Papua, Indonesia (MVE).

- 63b. Second spine of first dorsal fin elongated, reaching past origin of second dorsal fin; 19 or more total gill rakers; 6–10 predorsal scales; caudal fin dark reddish-brown to black
Randall's Pygmygoby, *T. randalli* Winterbottom & Zur, 2007: 18*

Holotype: ROM 80040, 16.0 mm SL male; type locality: Garreru Island, Palau.

Range: Palau, Philippines, and Flores (Indonesia).

Genetic variation: A single specimen from Palau has been sequenced.



Figure 66. *T. randalli*, a) fresh, 16.0 mm SL male, ROM 80040, Garreru Island, Palau (RW); b) fresh, 18.7 mm SL male, ROM 80040, Garreru Island, Palau (RW); c) live, Palau (TU).

- 64a.(62) Total gill rakers on lateral surface of first gill arch 17 or fewer 65
 64b. Total gill rakers on lateral surface of first gill arch 20 or more 66

- 65a. Nasal sac slightly elevated above snout profile and posterior naris in a short tube; 7–10 cheek scales in one or two rows; reddish ventrum and translucent dorsum
*T. habrum* Winterbottom, 2011: 143

Holotype: ROM 87486, 16.8 mm SL male; type locality: Raja Ampat, Indonesia.

Range: Raja Ampat and northern Sulawesi, Indonesia.

Genetic variation: One haplogroup (8) from Raja Ampat, Indonesia with 0.5% divergence.



Figure 67. *T. habrum*, a) dorsal view of left side of snout, red arrow = rim on posterior naris, 16.8 mm SL male holotype, ROM 87486 (RW); b) fresh, 16.8 mm SL holotype, Penemu Island, Raja Ampat, Indonesia, ROM 87486 (RW); c) fresh, ROM 94888, 32 Bunaken, Sulawesi, Indonesia (MVE).

- 65b. Nasal sac flush with snout profile and no tube for posterior naris; three cheek scales in a single short row; anterior half of body yellow and posterior half reddish
Helen's Pygmygoby, *T. helenae* Winterbottom, Erdmann & Cahyani, 2014: 421

Holotype: ROM 95780, 20.2 mm SL female; type locality: Raja Ampat, Indonesia.

Range: Penemu Island, Raja Ampat and Bunaken, Sulawesi, Indonesia.

Genetic variation: One haplogroup (4) from Raja Ampat, Indonesia with 0.5% divergence.



Figure 68. *T. helenae*, a) left lateral view of snout, red arrow = no rim on posterior naris, 18.1 mm SL female paratype, ROM 94172 (RW); b) fresh, 20.2 mm SL female holotype, ROM 95780, Penemu, Raja Ampat, Indonesia (MVE); c) live, 18.2 mm SL female, ROM 94172, Penemu, Raja Ampat, Indonesia (GRA).

- 66a.(64) Pectoral-fin rays 13 or 14; up to 5 papillae per position in rows *p* and *r* on top of head
Citron Pygmygoby, *T. kitrinum* Winterbottom & Hoese, 2015: 40

Holotype: ROM 45285, 25.2 mm SL female; type locality: Great Astrolabe Reef, Fiji.

Range: Ambon, Indonesia to Fiji, Tonga, Samoa, Enewetok Atoll, and Guam.

Genetic variation: A single specimen from the Lau Islands of Fiji has been sequenced.



Figure 69. *T. kitrinum*, a) fresh, 26.4 mm SL female paratype, ROM 45284, Great Astrolabe Reef, Fiji (RW); b) fresh, 24.3 mm SL female, ROM T03400, Lau Islands, Fiji (MVE); c) live, Lau Islands, Fiji (MVE).

- 66b. Pectoral-fin rays 17 or 18; a single papilla per position in rows *p* and *r* on top of head
Meity's Pygmygoby, *T. meityae* Winterbottom & Erdmann, 2018: 476

Holotype: ROM 106350, 18.6 mm SL male; type locality: Cenderawasih Bay, Indonesia.

Range: Currently known only from Cenderawasih Bay (Pulau Purup), West Papua, Indonesia.

Genetic variation: Three specimens from the type locality share a single haplotype.



Figure 70. *T. meityae*, a) fresh, Cenderawasih Bay, West Papua, Indonesia (GRA); b) live, Cenderawasih Bay, West Papua, Indonesia (MVE); c) live, Cenderawasih Bay, West Papua, Indonesia (MVE).

67a.(49) Pectoral-fin rays all unbranched.....	68
67b. At least some pectoral-fin rays branched.....	72
68a. Upper opercle with scales.....	69
68b. Opercle without scales.....	70
69a. Cheek with 5 papillae in row <i>c</i> ; branchiostegal membranes with a pair of red pupil-width spots (dark in preservative); caudal fin without lavender spots	
.....Heart Pygmygoby, <i>T. kardium</i> Winterbottom, Erdmann & Cahyani, 2015: 210*	

Holotype: ROM 98815, 16.7 mm SL male; type locality: Triton Bay, West Papua, Indonesia.

Range: Currently known only from West Papua Province, Indonesia (Raja Ampat, Triton Bay, and Cenderawasih Bay).

Genetic variation: A single specimen from Raja Ampat (Indonesia) has been sequenced.

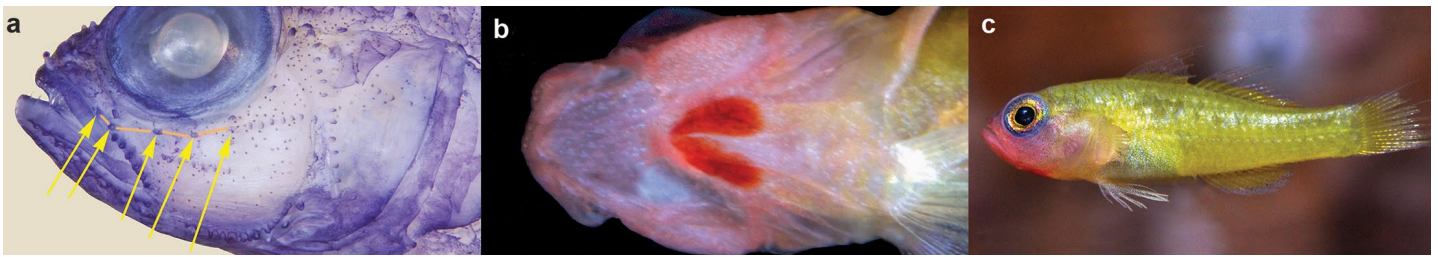


Figure 71. *T. kardium*, a) left lateral view of head showing the 5 papillae in row *c*, 15.8 mm SL male paratype, ROM 87545 (yellow arrows, line joined in orange) (RW); b) ventral view of head showing branchiostegal spots, Raja Ampat, West Papua, Indonesia (MVE); c) fresh, 12.2 mm SL paratype, ROM T012726, Raja Ampat, West Papua, Indonesia (GRA).

69b. Cheek with 6 papillae in row <i>c</i> ; caudal fin with lavender spots; branchiostegal membranes without red spots	
.....Spot-tailed Pygmygoby, <i>T. caudipunctatum</i> Suzuki & Senou, 2009: 109	

Holotype: KPM-NI 13301, 20.9 mm SL male; type locality: Okinawa, Japan.

Range: Japan, Palau, Flores, Papua New Guinea, and New Caledonia (photograph).

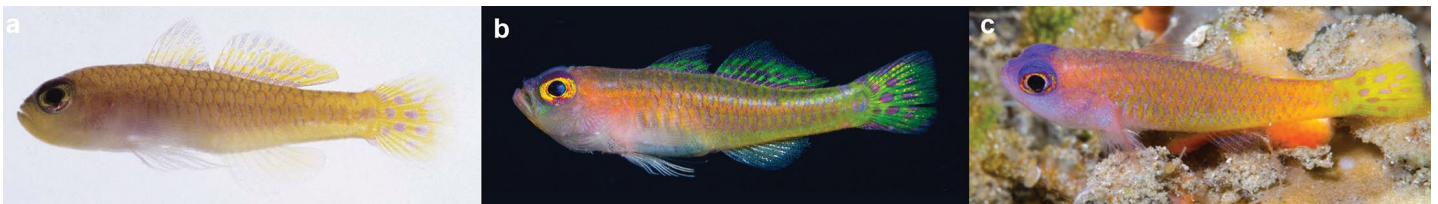


Figure 72. *T. caudipunctatum*, a) fresh, 20.9 mm SL holotype, Okinawa, Japan (HS); b) fresh, 16.9 mm SL, ROM 101370, Flores, Indonesia (MVE); c) live, Milne Bay, Papua New Guinea (MVE).

70a.(68) Body with gray and yellow bars	Slanted Pygmygoby, <i>T. erwani</i> Viviani, Williams & Planes, 2016: 3
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Holotype: USNM 409436, 13.9 mm SL female; type locality: Fatu Hiva, Marquesas Islands, French Polynesia.

Range: Currently known only from two specimens from the type locality.

Genetic variation: Two specimens from the type locality share single haplotype.

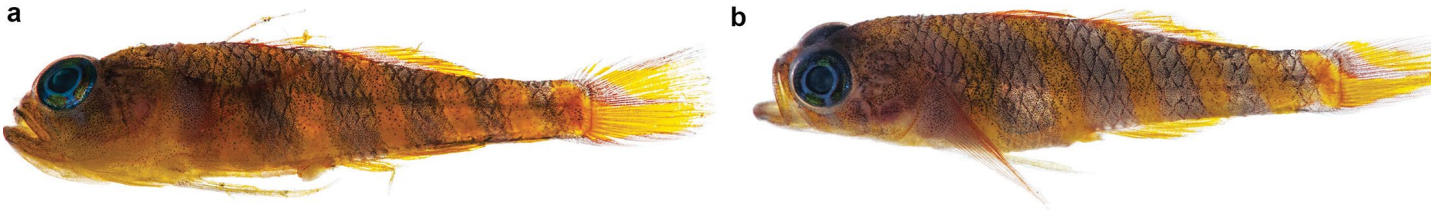


Figure 73. *T. erwani*, a) fresh holotype, 13.9 mm SL female, USNM 409436, Fatu Hiva, Marquesas Islands, French Polynesia (JTW); b) fresh paratype, USNM 409435, 13.4 mm SL female, Fatu Hiva, Marquesas Islands, French Polynesia (JTW).

- 70b. Body without gray and yellow bars 71
- 71a. Dorsal-fin rays 9; bony interorbital width about 40% pupil width; body uniform yellowish gray
 Imai’s pygmygoby, *T. imaii* Suzuki & Senou, 2009: 108

Holotype: KPM-NI 4252, 17.6 mm SL female; type locality: Izu Islands, Honshu, Japan.
Range: Currently known only from the Izu Islands. Allen & Erdmann’s (2012: 940) Bali record probably represents an undescribed species, as it has opercular scales which are absent in the single known specimen.



Figure 74. *T. imaii*, a) fresh holotype, KPM-NI 4252, 17.6 mm S, female, Izu Islands, Japan (HS); b) live, KPM-NR 89368, Izu Islands, Japan (HO); c) live, KPM-NR 97414, Izu Islands, Japan (HO).

- 71b. Dorsal-fin rays 8; bony interorbital width about 75% or more pupil width; body yellowish to red
 Matsuno’s Pygmygoby, *T. matsunoi* Suzuki, Sakaue & Senou, 2012: 72*

Holotype: NSMT 106483, 26.4 mm SL female; type locality: near Kashiwajima, Kochi, Japan.
Range: Currently known only from the type locality.



Figure 75. *T. matsunoi*, a) preserved holotype, NSMT-P 106483, Kashiwajima, Kochi, Japan (TS); b) fresh holotype (JS); c) live, KPM-NR 44894 Kashiwajima, Kochi, Japan (JS).

- 72a.(67) Cheek with 5 papillae in row *c* (see Fig. 77a) 73
- 72b. Cheek with 6 papillae in row *c* 75

- 73a. A dark line through middle of eye (wider at pupil than at edges); no colored spots
Honeybee Pygmygoby, *T. anthrenum* Winterbottom, 2006: 56

Holotype: ROM 60677, 18.7 SL male; type locality: Vava'u, Tonga.

Range: Tonga and Fiji.

Genetic variation: Specimens from Viti Levu (2) and Lau Islands, Fiji (4) share a single haplotype.



Figure 76. *T. anthrenum*, a) 19.7 mm SL female paratype, Fiji, ROM 79529 (RW); b) fresh, Lau Islands, Fiji (MVE); c) live, Lau Islands, Fiji (MVE).

- 73b. No dark line through eye; head and body with red to yellow spots 74

- 74a. Second spine of first dorsal fin less elongated, reaching second ray of second dorsal fin; cheek below rear pupil with reddish orange vertical bar (pale in preservative)
Orange-red Pygmygoby, *T. okinawae* (Aoyagi, 1949: 173)

Holotype: No catalogue number given, holotype apparently lost; type locality: Itoman, Okinawa, Japan.

Range: Winterbottom & Hoese (2015) reported a range from Thailand to Japan, south to western Australia and eastern Australia to Tonga and the Phoenix and Marshall Islands (op. cit., Fig. 38), but this probably encompasses multiple haplogroups.

Genetic variation: A single haplogroup of the COI-marker sequence from Japanese waters (4) with 0.5% divergence. However, Winterbottom et al. (2014c) reported 8 haplogroups under this name, and Winterbottom & Hoese (2015) subsequently described one of those as *T. readerae* (well separated from the Japanese haplogroup). The status of the remaining 6 haplogroups has yet to be determined.



Figure 77. *T. okinawae*, a) left lateral view of head, red arrows point to papillae in row c, 25.7 mm SL male, KPM-NI 19021, Kerama Island, Okinawa, Japan (RW); b) fresh, 23.3 mm SL, KPM-NI 30730, Amami Island, Ryukyu Islands, Japan (HS); c) fresh, Amami Island, Ryukyu Islands, Japan (HS).

- 74b. Second spine of first dorsal fin more elongated, reaching beyond base of second dorsal-fin ray in males and many females; cheek below rear pupil with two vertically aligned, reddish orange spots (pale in preservative)
Red-spotted Pygmygoby, *T. readerae* Winterbottom & Hoese, 2015: 75

Holotype: AMS I.20784-020, 22.5 mm SL female; type locality: Yonge Reef, Queensland, Australia.

Range: Winterbottom & Hoese (2015: fig. 43) reported this species from western Australia across the Pacific Ocean to Kiribati, but cautioned that this included several different haplogroups, and thus restricted type specimens to those from the Great Barrier Reef.

Genetic variation: One haplogroup (2) from Queensland, Australia, highly divergent from *T. okinawae* of Japan (above).

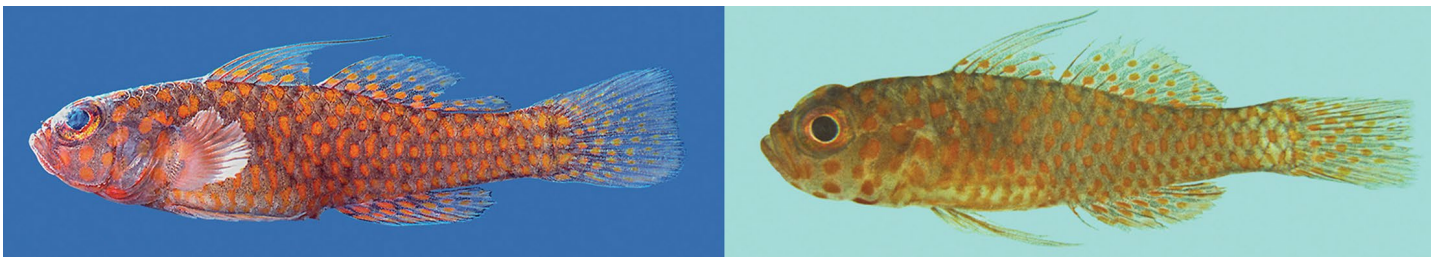


Figure 78. *T. readerae*, a) fresh, 22.5 mm SL holotype, AMS I.20784-02, Yonge Reef, Queensland, Australia (DFH); b) fresh, 18.7 mm SL paratype, ROM 39329, Lizard Island, Great Barrier Reef, Australia (RW).

75a.(72) Bony interorbital width >75% pupil width; 13 total gill rakers
Matsuno’s Pygmygoby, *T. matsunoi* Suzuki, Sakaue & Senou, 2012: 72*

Holotype: NSMT 106483, 26.4 mm SL female; type locality: near Kashiwajima, Kochi, Japan.

Range: Currently known only from the type locality.



Figure 79. *T. matsunoi*, a) preserved holotype, NSMT-P 106483, Kashiwajima, Kochi, Japan (TS); b) fresh holotype (JS); c) live, KPM-NR 44894 Kashiwajima, Kochi, Japan (JS).

75b. Bony interorbital width <55% pupil width; 15 or more total gill rakers 76

76a. Opercle with two or more scales in one or two horizontal rows on upper surface..... 77

76b. Opercle usually scaleless (rarely with one scale) 78

77a. First dorsal fin mostly covered by a large, round, ocellated black spot; 15 or 16 pectoral-fin rays
Three-eyed Pygmygoby, *T. trioculatum* Winterbottom, Erdmann & Cahyani, 2015: 217

Holotype: ROM 98816, 16.5 mm SL female; type locality: Cenderawasih Bay, West Papua, Indonesia.

Range: Western Pacific, but this encompasses multiple haplogroups.

Genetic variation: Three haplogroups, more than 7% divergent from each other: one from Cenderawasih Bay, Indonesia (2); a second from Rabaul, Papua New Guinea (1); and the third from Palau (1) and Bali, Indonesia (1).



Figure 80. *T. trioculatum*, a) preserved, 16.5 mm SL female paratype, ROM 95249, Cenderawasih Bay (RW); b) fresh, 16.5 mm SL female paratype, ROM 95249, Cenderawasih Bay (MVE); c) live, Cenderawasih Bay, Indonesia (GRA).

- 77b. First dorsal fin without a black spot; 17 or 18 pectoral-fin rays
Red-earth Pygmygoby, *T. milta* Winterbottom, 2002: 46

Holotype: ROM 59750, 22.7 mm SL male; type locality: Moorea, Society Islands, French Polynesia.

Range: At least the Society Islands, but specimens identified as this species range from Taiwan to north-western Australia, Hawai'i, the Marshall Islands, and several other western Pacific localities.

Genetic variation: Winterbottom et al. (2014c) recognized 4 well-separated haplogroups, each separated by at least 6.7%: Moorea (4); Fiji (1); Palau (10); and Raja Ampat, Flores (both Indonesia), and Palau (4). Two haplogroups are sympatric at Sonsorol Island, Palau.



Figure 81. *T. milta*, a) fresh, 22.1 mm SL male paratype, ROM 79751, Moorea, Society Islands (RW); b) fresh, 17.7 mm SL paratype, Moorea, Society Islands (JTW); c) live, Tahiti, Society Islands (PB).

- 78a.(76) Posterior interorbital trough extending posteroventrally to dorsalmost papilla of row *a* 79
- 78b. Posterior interorbital trough extending posteroventrally to last papilla of row *p*, not reaching dorsalmost papilla of row *a* 80

- 79a. Second spine of first dorsal fin more elongated, reaching to between second ray of second dorsal fin and caudal peduncle; 0–3 predorsal scales; head with a diagonal yellow stripe, margined with red, from posterior maxilla to middle of upper opercleCocos Pygmygoby, *T. insularum* Winterbottom & Hoese, 2015: 36*

Holotype: ROM 82970, 23.9 mm SL male; type locality: Direction Island, Cocos (Keeling) Islands.

Range: Apparently confined to the Cocos (Keeling) Islands.



Figure 82. *T. insularum*, a) fresh, 18 mm SL, Cocos (Keeling) Islands (GRA); b) fresh, Cocos (Keeling) Islands (GRA); c) live, Cocos (Keeling) Islands (TU).

- 79b. Second spine of first dorsal fin reaching at most to base of spine of second dorsal fin; 4–7 predorsal scales; no diagonal yellow line across cheek
Yellow-barred Pygmygoby, *T. lutea* Viviani, Williams & Planes, 2016: 6

Holotype: USNM 422899, 23.4 mm SL; type locality: Rimatara Island, Austral Islands, French Polynesia.

Range: Austral and southern Cook Islands.

Genetic variation: A single specimen has been sequenced.

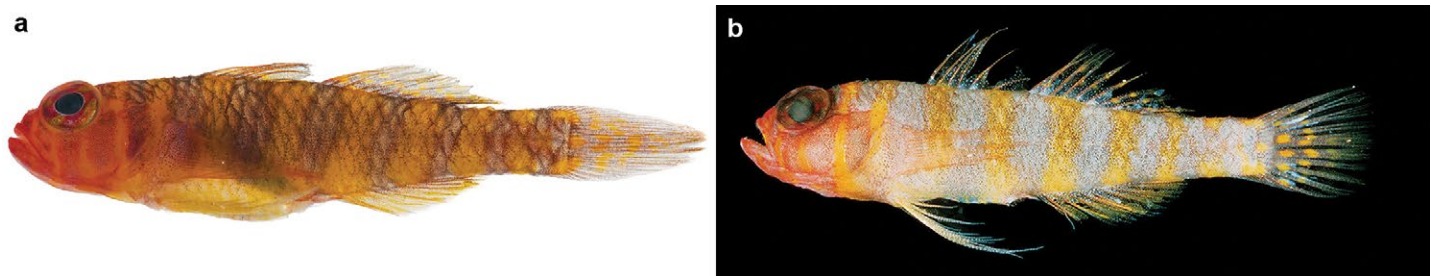


Figure 83. *T. lutea*, a) fresh, 23.4 mm SL holotype, USNM 422899, Austral Islands, French Polynesia (JTW); b) fresh, 22 mm SL paratype, BPBM 13699, Rarotonga, Cook Islands (JER).

80a.(78) Cheek with a dark wedge-shaped bar from ventral eye across to horizontal limb of preopercle; body with yellow bars or ovals separated by a zigzag pattern of gray lines about a half-pupil width wide
Zigzag Pygmygoby, *T. maiandros* Hoese, Winterbottom & Reader, 2011: 146*

Holotype: AMS I.20784-050, 20.7 mm SL, male; type locality: Yonge Reef, Queensland, Australia.
Range: Cocos (Keeling) Islands, Indian Ocean to Samoa and the Marshall and Mariana Islands, north to Japan, south to the Great Barrier Reef, Australia.
Genetic variation: Two haplogroups, one from Samoa (2) and a second from Palau (3), separated by 5.4%.



Figure 84. *T. maiandros*, a) fresh, 20.7 mm SL holotype, AMS I.20784-050, Yonge Reef, Queensland, Australia (DFH); b) fresh, 18.5 mm SL male, ROM 74975, Palau (RW); c) live, Grotto, Saipan, Northern Mariana Islands (HK).

80b. Cheek without a dark wedge-shaped bar; body without yellow bars or ovals or a zigzag pattern of gray lines 81

81a. Body translucent with 6 red ventral blotches (whitish without blotches in preservative); scale margins not outlined with melanophores; no black stripe along base of dorsal fins
Red-blotch Pygmygoby, *T. squamicana* Winterbottom, 2004: 14

Holotype: ROM 73761, 20.8 mm SL female; type locality: Kanton Island, Kiribati.
Range: Currently known only from the type locality.



Figure 85. *T. squamicana*, a) preserved, 18.3 mm SL paratype, ROM 73594, Kanton Island, Kiribati (RW); b) fresh, juvenile, Kanton Island, Kiribati (GRA); c) fresh, Kanton Island, Kiribati (GRA).

- 81b. Scale margins thinly outlined with melanophores; a black stripe along base of dorsal fins; body uniform yellowish, without red markings (straw-yellow in preservative)
Mistaken Pygmygoby, *T. hamartium* Winterbottom, 2018: 124

Holotype: ROM 83314, 19.2 mm SL male; type locality: Helen Reef, Southwest Islands, Palau.

Range: Palau and perhaps related populations from the Great Barrier Reef, Fiji, Niue, and Kiribati.

Genetic variation: Three sequences from Palau show anomalously high variation of 5% (may represent an artifact due to DNA quality). Another haplogroup from Fiji (5) is separated by 5.7% (vs. 1.4% within group).



Figure 86. *T. hamartium*, a) dorsal view of head (stained) to show postorbital groove, 18.4 mm SL female paratype, ROM 102747, Helen Reef, Palau (RW); b) lateral view of anterior body (preserved) to show pigmentation, 19.2 mm SL male holotype, ROM 83314, Helen Reef, Palau (RW); c) fresh, 21.3 mm SL male, ROM 101394, Merir Island, Palau (RW).

- 82a.(1) Fifth pelvic-fin ray unbranched..... 83
- 82b. Fifth pelvic-fin ray with at least one dichotomous branch..... 96
- 83a. Cheek with 5 papillae in row *c* (see Fig. 91a)..... 84
- 83b. Cheek with 6 or more papillae in row *c*..... 90
- 84a. Pectoral fin with at least some middle rays branched..... 85
- 84b. Pectoral-fin rays all unbranched..... 88
- 85a. Opercle with a small, black, vertically oval spot on posterodorsal surface
Stobbs's Pygmygoby, *T. stobbsi* Winterbottom, 2001: 20

Holotype: ROM 72488, 19.1 mm SL male; type locality: Port de Goro, New Caledonia.

Range: New Caledonia, but specimens identified as this species range from Maldives to New Caledonia, including Vietnam, Philippines, and Ashmore Reef, off Western Australia (Winterbottom & Hoese 2015; fig. 45). There is also a photographic record from mainland Japan (Sukumo Bay, Kochi; KPM).

Genetic variation: Winterbottom et al. (2014c) reported three haplogroups among 11 specimens identified morphologically as this species (with a specimen from the type locality in Group 3). A recent analysis of 20 additional specimens returned these same three haplogroups, plus an additional haplogroup from the Maldives.



Figure 87. *T. stobbsi*, a) fresh, 20.3 mm SL paratype, ROM 63938, New Caledonia (RW); b) fresh, ROM 102764, Cenderawasih Bay, Indonesia (MVE); c) live, Cenderawasih Bay, Indonesia (MVE).

- 85b. Opercle without a black spot on posterodorsal surface 86
- 86a. Branchiostegal membranes with a red or black spot (about pupil width) below vertical limb of preopercle Foureye Pygmygoby, *T. hayashii* Hagiwara & Winterbottom, 2007: 100*

Holotype: ROM 79838, 22.2 mm SL male; type locality: Kakeromajima, Kagoshima, Japan.

Range: Japan, but populations reported from Palau to Indonesia, Papua New Guinea, and Solomon Islands.

Genetic variation: Winterbottom et al. (2014c) reported multiple haplogroups including one from Japan, northern Palau, and Raja Ampat, Indonesia (Group 1) and a second, separated by 4.7%, from the Southwestern Islands of Palau. Additional collections add a sequence from Sulawesi, Indonesia to Group 1, a third group from Solomon Islands and, possibly, a fourth group from Milne Bay (PNG).



Figure 88. *T. hayashii*, a) ventral view of preserved 20.1 mm SL female paratype, ROM 76086, Palau, dark branchiostegal spots (RW); b) fresh, 20.1 mm SL female paratype, ROM 76085, Palau (RW); c) live, Cenderawasih Bay, Indonesia (MVE).

- 86b. Branchiostegal membranes without red or black spots..... 87
- 87a. Usually 9 dorsal-fin rays and 8 anal-fin rays; 6 or more branched pectoral-fin rays; head with a dark stripe behind eye just above opercle..... Helen Reef Pygmygoby, *T. hotsarihiensis* Winterbottom, 2009: 110*

Holotype: ROM 83365, 15.2 mm SL female; type locality: Helen Reef, Southwest Islands, Palau.

Range: Southwest Islands, Palau to eastern Indonesia.

Genetic variation: Two haplogroups, one from Palau (2) and Indonesia (4) and the second a single sequence from Maluku, Indonesia, separated by 2.1%.



Figure 89. *T. hotsarihiensis*, a) fresh, 14.0 mm SL male paratype, ROM 83268, Helen Reef, Palau (RW); b) fresh, 14.8 mm SL female paratype, ROM 83300, Helen Reef, Palau (RW); c) fresh, 14.4 mm SL female, ROM 94177, SE Ceram (MVE).

- 87b. Usually 10 dorsal-fin rays and 9 anal-fin rays; pectoral-fin rays usually unbranched (2 of 7 specimens with branched); head without a dark stripe behind eyeKudo's Pygmygoby, *T. kudoi* Suzuki & Senou, 2008: 98*

Holotype: KPM-NI 4255, 19.0 mm SL male; type locality: Izu Islands, Honshu, Japan.
Range: Apparently restricted to Japanese waters.



Figure 90. *T. kudoi*, a) fresh, 19.0 mm SL male holotype, KPM-NI 4255, Izu Islands, Japan (HS); b) fresh, 25.1 mm SL male paratype, BLIH 19960276, Kagoshima, Japan (YI); c) live, KPM-NR 80759, Kashiwajima Island, Japan (TUE).

- 88a.(84) Second spine of first dorsal fin more elongated, reaching rays 2-4 of second dorsal fin; usually 16 total gill rakers; head and body uniform dark orangish red (straw yellow in preservative)Sanguinello Pygmygoby, *T. sanguinellus* Winterbottom & Southcott, 2007: 74

Holotype: ROM 81760, 16.6 mm SL female; type locality: Similan Island, Thailand, Andaman Sea.
Range: Andaman Sea to western Sumatra, Indonesia.

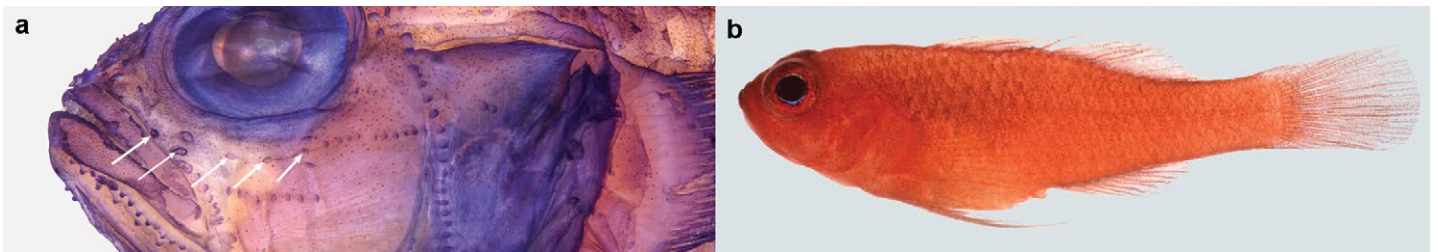


Figure 91. *T. sanguinellus*, a) lateral view of cheek showing 5 papillae in row c, 20.9 mm SL male, ROM 68252 (RW); b) fresh, 16.7 mm SL female paratype, ROM 68114, Phuket, Thailand, Andaman Sea (RW).

- 88b. Second spine of first dorsal fin less elongated, not reaching origin of second dorsal fin; usually 17 or 18 total gill rakers; head and body yellowish to pink 89

- 89a. Posterior interorbital trench extending posteroventrally to dorsalmost papilla of row a; usually 19 pectoral-fin rays; 8 or 9 posterior transverse scalesDeep-reef Pygmygoby, *T. bathum* Winterbottom, 2017: 560

Holotype: ROM 101384 (ex-BPBM 40009), 16.4 mm SL male; type locality: Suva, Viti Levu, Fiji.
Range: Currently only known from outer reefs off Suva Harbour in 53–91 m.
Genetic variation: Three specimens from the type locality share a single haplotype.

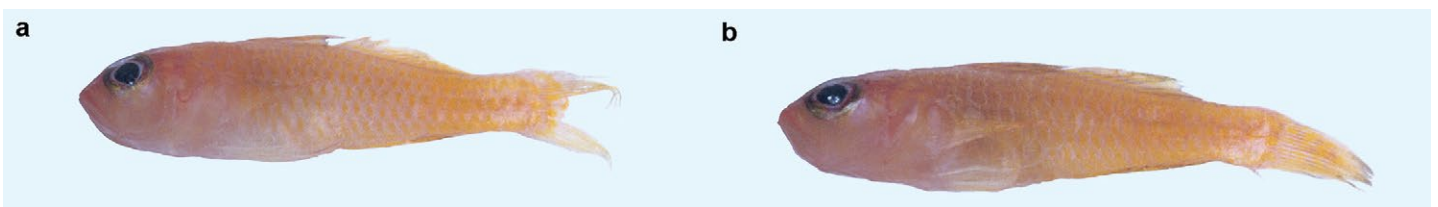


Figure 92. *T. bathum*, a) fresh, 16.4 mm SL, ROM T02301, Viti Levu, Fiji (RP); b) fresh, 17.6 mm SL, UK T4454, Viti Levu, Fiji (RP).

89b. No posterior interorbital trench or trough; mean of 17 pectoral-fin rays; 7 or 7.5 posterior transverse scales
Kudo's Pygmygoby, *T. kudoi* Suzuki & Senou, 2008: 98*

Holotype: KPM-NI 4255, 19.0 mm SL male; type locality: Izu Islands, Honshu, Japan.
Range: Apparently restricted to Japanese waters.



Figure 93. *T. kudoi*, a) fresh, 19.0 mm SL male holotype, KPM-NI 4255, Izu Islands, Japan (HS); b) fresh, 25.1 mm SL male paratype, BLIH 19960276, Kagoshima, Japan (YI); c) live, KPM-NR 80759, Kashiwajima Island, Japan (TUE).

90a.⁽⁸³⁾ Pectoral-fin rays all unbranched 91
 90b. At least some pectoral-fin rays branched 92

91a.⁽⁸⁶⁾ Bony interorbital width about two-thirds pupil width; 8 dorsal-fin and anal-fin rays; no black stripe along body Pallid Pygmygoby, *T. anaima* Winterbottom, 2000: 57

Holotype: ROM 59805, 13.0 mm SL male; type locality: Anjouan, Comoros.
Range: Winterbottom & Hoese (2015: fig. 3) report this species from the Comoros eastwards to Fiji and Japan, including the Great Barrier Reef. It apparently does not occur on the Pacific Plate.
Genetic variation: A single haplogroup (10) from the Seychelles, Philippines, and Indonesia, with 1.0% divergence.



Figure 94. *T. anaima*, a) fresh, 13.0 mm SL male holotype, ROM 59805, Anjouan, Comoros (RW); b) fresh, 14.6 mm SL male, ROM 80351, Uchelbelu Reef, Palau (RW); c) live, 12.2 mm SL, tissue, Mapia Atoll, Indonesia (MVE).

91b. Bony interorbital width about half or less pupil width; 9-11 dorsal-fin and anal-fin rays; a black stripe along body Black-striped Pygmygoby, *T. grammistes* (Tomiyama, 1936: 47)

Holotype: NSMT [ex-LICPP] 1571, 30 mm SL; type locality: Hayama, Kanagawa, Japan.
Range: Apparently confined to Japan, Taiwan, and South Korea.
Genetic variation: A single specimen has been sequenced.



Figure 95. *T. grammistes*, a) fresh, unattributed from Ehime University; b) live, Osezaki, Shizuoka, Japan, (Vin/ Izuzuki [CC -by-2.1-jp] www.izuzuki.com/Zukan/Fish/haze/ichimonjiHZ.html); c) live, KPM-NR 14752, Sugami Bay, Japan (HT).

- 92a.(90) Body with 6 wide red bars or half-bars (uniform straw-yellow in preservative) 93
 92b. Body without red bars or half-bars (patterned melanophores in preservative)..... 94

93a. Red bars on body full width; no pigment over anteriormost part of braincase; pectoral-fin base and lower caudal peduncle without dark spotsCandy-cane Pygmygoby, *T. cana* Winterbottom, 2004: 8

Holotype: ROM 73776, 22.3 mm SL male; type locality: Siquijor Island, Visayas, Philippines.

Range: Philippines, Indonesia, Fiji, Palau, and Marshall Islands.

Genetic variation: Two haplogroups, one from Palau (3) and Maluku, Indonesia (1), the other from Philippines (2), separated by 3.6%.

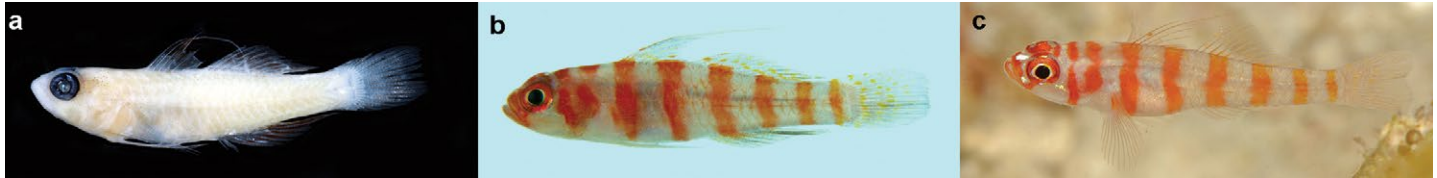


Figure 96. *T. cana*, a) preserved, 23.3 mm SL holotype, ROM 73776, Siquijor Island, Visayas, Philippines (RW); b) fresh, 18.1 mm SL male, ROM 49215, Mactan, Cebu, Philippines (RW); c) live, Widi, Halmahera, Maluku, Indonesia (MVE).

93b. Red bars on body only below lateral septum; melanophores cover anteriormost part of braincase; pectoral-fin base and lower caudal peduncle each with a dark spot in preservative
Sostra's Pygmygoby, *T. sostra* Winterbottom, 2004: 12

Holotype: ROM 74046, 18.1 mm SL male; type locality: Kanton Island, Kiribati.

Range: Solomon Islands to Fiji and Wallis Island, north to the Marshall and Caroline Islands and to Kiribati.

Genetic variation: A single specimen has been sequenced.



Figure 97. *T. sostra*, a) preserved, 14.4 mm SL paratype, ROM 73599, Kanton Island, Kiribati (RW); b) fresh, 20.1 mm SL, USNM 365598, Stewart Island, Solomon Islands (JTW); c) fresh, Wallis Island (JTW).

94a.(92) Posterior interorbital trench well developed, extending posteroventrally to dorsalmost papilla of row *a*; head with a diagonal yellow stripe, margined with red, from posterior maxilla to middle of upper opercle
Cocos Pygmygoby, *T. insularum* Winterbottom & Hoese, 2015: 36*

Holotype: ROM 82970, 23.9 mm SL male; type locality: Direction Island, Cocos (Keeling) Islands.

Range: Apparently confined to the Cocos (Keeling) Islands.



Figure 98. *T. insularum*, a) fresh, 18 mm SL, Cocos (Keeling) Islands (GRA); b) fresh, Cocos (Keeling) Islands (GRA); c) live, Cocos (Keeling) Islands (TU).

- 94b. Posterior interorbital trough poorly developed, ending before last papilla of row *p*; head without a yellow stripe..... 95
- 95a. Second spine of first dorsal fin more elongated, reaching to middle or beyond second dorsal fin; caudal peduncle with a dorsal white saddle (about pupil-width) and a much smaller ventral saddle
Two-saddle Pygmygoby, *T. bisella* Winterbottom, 2000: 60

Holotype: ROM 72014, 22.7 mm SL male; type locality: Baie de la Petite Rivière, Mauritius.
Range: Apparently endemic to Mauritius.



Figure 99. *T. bisella*, 23.0 mm SL male paratype, BPBM 16345, Mauritius (JER).

- 95b. Second spine of first dorsal fin less elongated, reaching at most to first ray of second dorsal fin; caudal peduncle without saddles ...Zigzag Pygmygoby, *T. maiandros* Hoese, Winterbottom & Reader, 2011: 146*

Holotype: AMS I.20784-050, 20.7 mm SL, male; type locality: Yonge Reef, Queensland, Australia.
Range: Cocos (Keeling) Islands, Indian Ocean to Samoa and the Marshall and Mariana Islands, north to Japan, south to the Great Barrier Reef, Australia.
Genetic variation: Two haplogroups, one from Samoa (2) and a second from Palau (3), separated by 5.4%.



Figure 100. *T. maiandros*, a) fresh, 20.7 mm SL holotype, AMS I.20784-050, Yonge Reef, Queensland, Australia (DFH); b) fresh, 18.5 mm SL male, ROM 74975, Palau (RW); c) live, Grotto, Saipan, Northern Mariana Islands (HK).

- 96a.(82) Posterior naris attached (adnate) to rim of orbit; interorbital and posterior interorbital trenches well developed with vertical walls, posterior trench extending to posterodorsal papilla of row *a* 97
- 96b. Posterior naris separated from rim of orbit by at least diameter of the narial opening; interorbital and posterior interorbital trenches variously developed, but posterior trench not extending laterally to posterodorsal papilla of row *a* 102

- 97a. Usually 17 or 18 pectoral-fin rays; body brownish to reddish with orange-red, half-pupil-width spots at center of most body scales and on nape (pale in preservative); about 4 small dark saddles across dorsum98
- 97b. Usually 19–21 pectoral-fin rays; body not colored as in 97a; if spots present on body scales and nape, larger, almost pupil-width size; no dark saddles across dorsum..... 99
- 98a. Second spine of first dorsal fin less elongated, reaching to third ray of second dorsal fin; cheek without a pale stripe below eyeAvidor's Pygmygoby, *T. avidori* (Goren, 1978: 198)

Holotype: TAU 6203, 20.1 mm SL; type locality: Eilat, Israel, Gulf of Aqaba, Red Sea.

Range: Red Sea and the Gulf of Tadjoura (Djibouti).

Genetic variation: A single haplogroup from the Gulf of Aqaba (2).



Figure 101. *T. avidori*, a) preserved, Gulf of Aqaba (JH); b) fresh, Gulf of Aqaba (JH); c) live, Sudan (SVB).

- 98b. Second spine of first dorsal fin more elongated, reaching to middle or beyond second dorsal fin; cheek with a pale stripe below eye.....Long-spine Pygmygoby, *T. filamentosus* Winterbottom, 1995: 94

Holotype: ROM 54842, 19.5 mm SL; type locality: Egypt, Gulf of Aqaba, Red Sea.

Range: Sudan to Gulf of Aqaba, Red Sea.

Genetic variation: A single specimen has been sequenced.



Figure 102. *T. filamentosus*, a) fresh, KAU14-861, Saudi Arabia, (SVB); b) live, Egyptian Red Sea (GB); c) live, Sudan (SVB).

- 99a.(97) Opercle with a small, dark, triangular marking at posterodorsal margin; pectoral-fin base without a dark crescent or half-crescent-like bar or light spots
.....Trench-head Pygmygoby, *T. winterbottomi* Randall & Downing, 1994: 250

Holotype: BMNH 1897.9.22.4-9, syntypes, 20.8–25.7 mm SL; type locality: Mekran (=Makran) coast, Iran.

Range: Socotra to Oman and Persian Gulf, east to western Thailand (Andaman Sea).



Figure 103. *T. winterbottomi*, a) fresh, 20.5 mm SL male, ROM 68103, Phuket, Thailand (RW); b) fresh, 20.9 mm SL female, ROM 68091, Phuket, Thailand (RW); c) live, Musandam Peninsula, Oman (RF).

- 99b. Opercle without a small, dark, triangular marking at posterodorsal margin; pectoral-fin base with either two orange spots (pale in preservative) or a dark crescent or half-crescent-like bar..... 100

100a. Pectoral-fin base with two orange spots and no dark bar; body with irregular, pupil-width, diffuse orange spots (pale in preservative).....Volcano Pygmygoby, *T. volcana* Winterbottom, 2003: 10

Holotype: ROM 73474, 17.1 mm SL female; type locality: Mayotte, Comoros.

Range: Tanzania, Mozambique, and Comoros.



Figure 104. *T. volcana*, a) preserved, 17 mm SL female, Comoros (RW); b) fresh, 13.6 mm SL female paratype, ROM 59762, Mayotte Island, Comoros (RW); c) fresh, 17.4 mm SL female paratype, ROM 59759, Mayotte Island, Comoros (RW).

100b. Pectoral-fin base with a dark crescent or half-crescent-like bar 101

101a. Gular region dark Polka-dot Pygmygoby, *T. corallinum* Smith, 1959: 209

Holotype: SAIAB [formerly RUSI] 179, 24 mm SL; type locality: Baixo Pinda, Mozambique.

Range: KwaZulu-Natal, South Africa to Seychelles, and possibly Maldives.

Genetic variation: One haplogroup from South Africa (3), which also includes three sequences of “*T. omanense*” from the Persian Gulf (note that the sequence of another *T. omanense* also from the Persian Gulf is separated by 8.9% and may represent the type lineage, see below).



Figure 105. *T. corallinum*, a) ventral view of head of preserved 19.1 mm SL female, ROM 72843, KwaZulu, South Africa, to show dark gular region (RW); b) fresh, Sodwana Bay, KwaZulu, South Africa (RW); c) fresh, 19.2 mm SL female, ROM 72843, Sodwana Bay, KwaZulu, South Africa (RW).

101b. Gular region not darker than surrounding area
.....Crescent-wing Pygmygoby, *T. omanense* Winterbottom, 2000: 65

Holotype: ROM 39897, 19.1 mm SL female; type locality: Sur, Oman.

Range: Socotra, Yemen, Oman, to the Persian Gulf.

Genetic variation: Three sequences of *T. omanense* from the Persian Gulf group with *T. corallinum* from South Africa, but the sequence of another *T. omanense* also from the Persian Gulf is separated by 8.9% and may represent the type lineage,

Remarks: This species may prove to be a junior synonym of *T. corallinum*.



Figure 106. *T. omanense*, a) preserved, 19.2 mm SL female holotype, ROM 39897, Sur, Oman; b) fresh, Gulf of Oman, UAE (JC); c) fresh, Gulf of Oman, UAE (JC).

- 102a.⁽⁹⁶⁾ Papilla row *p* with 7 or 8 papillae (additional papillae medial and posterior to nasal capsule); interorbital trench with a soft, fleshy, rounded medial ridge; 11 or more scales in anterior transverse series 103
- 102b. Papilla row *p* with 6 papillae (a single papilla medial to nasal capsule); interorbital trench without a medial ridge; 10 or fewer scales in anterior transverse series 106
- 103a. Fifth pelvic-fin ray with a single dichotomous branch point 104
- 103b. Fifth pelvic-fin ray with two dichotomous branch points 105
- 104a. Second dorsal-fin soft rays 8 or 9; 7 papillae in line *p*; head with a pair of dark spots or a dashed dark line above opercle Sheppard's Pygmygoby, *T. sheppardi* Winterbottom, 1984: 709

Holotype: ROM 41225, 15.5 mm SL female; type locality: Salomon Atoll, Chagos Archipelago.

Range: Red Sea and Seychelles to Indonesia, Solomon Islands, Palau, and Japan.

Genetic variation: A single specimen from Indonesia has been sequenced.



Figure 107. *T. sheppardi*, a) fresh, 17.0 mm SL male, ROM 80355, Uchelbelu Reef, Palau (RW); b) fresh, 17.6 mm SL female paratype, ROM 41222, Chagos Archipelago (RW); c) live, Egyptian Red Sea, (GB).

- 104b. Second dorsal-fin soft rays 10 or 11; 8 papillae in line *p*; head without dark spots or line above opercle Yellow-red Pygmygoby, *T. xanthum* Winterbottom & Hoese, 2015: 92

Holotype: ROM 46003, 17.8 mm SL male; type locality: Great Astrolabe Reef, Fiji.

Range: Great Barrier Reef to Fiji, Palau, and the Marshall Islands.

Genetic variation: Three specimens from Palau share a single haplotype.



Figure 108. *T. xanthum*, a) fresh, 17.8 mm SL male holotype, ROM 46003, Great Astrolabe Reef, Fiji (RW); b) fresh, 19.3 mm SL female, ROM 83072, Tobi Island, Palau (RW); c) live, Fiji (KM).

- 105a.⁽¹⁰³⁾ Second spine of first dorsal fin more elongated, reaching beyond origin of second dorsal fin; top of snout with reticulated pattern of melanophores; no dark blotches along spine; stripe over opercle continues anteriorly across base of eye to maxilla ... Blood-spot Pygmygoby, *T. haimassum* Winterbottom, 2011: 146

Holotype: ROM 87484, 27.3 mm SL female; type locality: Raja Ampat, Indonesia.

Range: Indonesia to the Philippines, Papua New Guinea, and the Solomon Islands.

Genetic variation: A single haplogroup from New Britain (PNG) (5) and Raja Ampat (Indonesia) (1).



Figure 109. *T. haimassum*, a) fresh, 25.9 mm SL female paratype, ROM 85347, Wayil Island, Raja Ampat, Indonesia; b) fresh, 29.2 mm SL, Busuanga, Philippines (JTW); c) live, Anilao, Philippines (BH).

105b. Second spine of first dorsal fin less elongated, reaching to origin of second dorsal fin; top of snout without reticulated pattern of melanophores; dark blotches along spine; stripe over opercle not continuing anteriorly across base of eyePudgy Pygmygoby, *T. yanoi* Suzuki & Senou, 2008: 102

Holotype: KPM-NI 5649, 21.8 mm SL male; type locality: Iriomotejima, Ryukyu Islands, Japan.

Range: Malaysia to Japan and Palau, Indonesia (Raja Ampat), and the Solomon Islands.

Genetic variation: A single haplogroup from Palau, the Philippines, and Indonesia (13 total).



Figure 110. *T. yanoi*, a) fresh, 23.3 mm SL female, ROM 82992, Sonsorol Island, Palau (RW); b) fresh, 19.6 mm SL female, ROM 85621, Walo Island, Raja Ampat, Indonesia (RW); c) live, Iriomotejima, Japan (KY).

106a.(102) Cheek with 5 papillae in row *c* 107

106b. Cheek with 6 papillae in row *c* 111

107a. Side of body below first dorsal fin or branchiostegal membranes with a large, black, ocellated spot..... 108

107b. No spot as in 107a..... 109

108a.(107) Branchiostegal membranes with a red or black spot (about pupil width) below vertical limb of preopercle; usually 16 pectoral-fin rays .Foureye Pygmygoby, *T. hayashii* Hagiwara & Winterbottom, 2007: 100*

Holotype: ROM 79838, 22.2 mm SL male; type locality: Kakeromajima, Ryukyu Islands, Japan.

Range: Western Pacific region.

Genetic variation: Winterbottom et al. (2014c) reported two haplogroups separated by 4.7%, one from Japan (type locality, Group 1), northern Palau, and Raja Ampat (Indonesia), and the second from the Southwest Islands of Palau. Additional sequences add Sulawesi (Indonesia) to Group 1 and a third group in the Solomon Islands, and possibly a fourth one at Milne Bay (PNG).



Figure 111. *T. hayashii*, a) ventral view of preserved 20.1 mm SL female paratype, ROM 76086, Palau (RW); b) fresh, 20.1 mm SL female paratype, ROM 76085, Palau (RW); c) live, Cenderawasih Bay, Indonesia (GRA).

108b. Side of body below first dorsal fin with a large black ocellated spot, about eye diameter; usually 18 pectoral-fin rays Bullseye Pygmygoby, *T. tauroculum* Winterbottom & Zur, 2007: 20

Holotype: ROM 80302, 15.7 mm SL female; type locality: Peleliu Island, Palau.

Range: Palau, and probably Yap Island (photograph), Micronesia.

Genetic variation: A single haplogroup from Palau (6) with about 1% divergence.



Figure 112. *T. tauroculum*, a) fresh, 18.3 mm SL male paratype, ROM 74806, Uchelbelu Reef, Palau (RW); b) fresh, 18.6 mm SL female paratype, ROM 80027, Palau; c) live, Palau (HN).

109a.⁽¹⁰⁷⁾ Head with a thin blue stripe from maxilla through lower margin of eye to dorsal margin of opercle (dark in preservative); bipartite color pattern (red or orange above, white or pale pink below) Aturiri's Pygmygoby, *T. aturirii* Winterbottom, Erdmann & Cahyani, 2015: 203

Holotype: ROM 94889, 18.4 mm SL female; type locality: Mapia Atoll, Papua, Indonesia.

Range: Northern atolls of Papua Province, Indonesia. May occur at the Line Islands.

Genetic variation: A single haplogroup from Mapia Atoll (5) with about 1% divergence.



Figure 113. *T. aturirii*, a) preserved, lateral head, 14.0 mm SL female, ROM 87934 (RW); b) fresh, ROM 87934, Raja Ampat, Waigeo, Indonesia (MVE); c) live, ROM 98809, Ayau, Indonesia (MVE).

109b. Head without a stripe; color pattern not bipartite 110

110a. Second spine of first dorsal fin more elongated, reaching up to eighth ray of second dorsal fin; 19–22 total gill rakers Erdmann's Pygmygoby, *T. erdmanni* Winterbottom, 2011: 138*

Holotype: ROM 87482, 23.5 mm SL male; type locality: Kawe Island, Raja Ampat, West Papua, Indonesia.
Range: Specimens identified as *T. erdmanni* range from the Philippines to Sulawesi, Indonesia and New Britain, PNG, and the Solomon Islands.

Genetic variation: At least 7 haplogroups are documented under this name, as well as another three under the closely related *T. chledophilum* (see couplet 116). The haplogroup to which the types belong is currently known only from Misool, Kawe, and Jef Tsiep Islands in Raja Ampat, Indonesia.



Figure 114. *T. erdmanni*, a) fresh, 10.2 mm SL juvenile paratype, ROM 85033, Kawe Island, Raja Ampat, Indonesia (RW); b) fresh, 26.2 mm SL male paratype, ROM 85033, Kawe Island, Raja Ampat (RW); c) live, Kawe Island, Raja Ampat (MVE).

110b. Second spine of first dorsal fin less elongated, reaching to origin of second dorsal fin; 16–18 total gill rakers
Helen Reef Pygmygoby, *T. hotsarihiensis* Winterbottom, 2009: 110*

Holotype: ROM 83365, 15.2 mm SL female; type locality: Helen Reef, Southwest Islands, Palau.

Range: Southwest Islands, Palau to eastern Indonesia.

Genetic variation: Two haplogroups, one from Palau (2) and Indonesia (4) and the second a single sequence from Maluku, Indonesia, separated by 2.1%.



Figure 115. *T. hotsarihiensis*, a) fresh, 14.0 mm SL male paratype, ROM 83268, Helen Reef, Palau (RW); b) fresh, 14.8 mm SL female paratype, ROM 83300, Helen Reef, Palau (RW); c) fresh, 14.4 mm SL female, ROM 94177, SE Ceram (MVE).

111a.⁽¹⁰⁶⁾ Fifth pelvic-fin ray with a single dichotomous branch point..... 112

111b. Fifth pelvic-fin ray with two or more dichotomous branch points..... 117

112a. Anterior extent of body scales to a line between origin of first dorsal fin and base of pectoral fin..... 113

112b. Anterior extent of body scales onto head, up to about posterior rim of orbit 114

113a. Dorsal midline of snout with a white stripe from tip to mid-interorbital area (dark in preservative); cheek without colored bars Hotlips Pygmygoby, *T. dalerocheila* Winterbottom, 1984: 697

Holotype: ROM 40522, 16.1 mm SL female; type locality: Salomon Atoll, Chagos Archipelago.

Range: Currently known from Mauritius, Seychelles, and Chagos Archipelago.

Genetic variation: A single specimen from Seychelles has been sequenced.



Figure 116. *T. dalerocheila*, a) fresh, 16.6 mm SL male paratype, ROM 40519, Chagos Archipelago (RW); b) fresh, 21.0 mm SL, Mahe, Seychelles (PCH); c) live, Alphonse Island, Seychelles (JER).

113b. Snout without a midline stripe; cheek with two reddish orange bars
Cut-face Pygmygoby, *T. haima* Winterbottom, 1984: 702

Holotype: ROM 40297, 14.0 mm SL male; type locality: Salomon Atoll, Chagos Archipelago.

Range: Rodrigues to Comoros, Seychelles and Chagos Archipelago.

Genetic variation: A single haplogroup from Seychelles (3).



Figure 117. *T. haima*, a) fresh, 15.9 mm SL male paratype, ROM 40278, Chagos Archipelago (RW); b) fresh, St. Joseph Atoll, Seychelles (RD); c) live, St. Joseph Atoll, Seychelles (RD).

- 114a.(112) Dorsal-fin rays usually 10 and anal-fin rays usually 9..... 115
- 114b. Dorsal-fin rays usually 9 and anal-fin rays usually 8 116
- 115a. Head with a thin line of melanophores circling eye and two short bars onto upper cheek, no diagonal yellow stripe; head and body uniformly reddish Ringeye Pygmygoby, *T. benjamini* Winterbottom, 1996: 57

Holotype: ROM 53038, 21.2 mm SL male; type locality: Siquijor Island, Visayas, Philippines.

Range: Western Pacific: Vietnam to the Marshall Islands, Samoa, and the Great Barrier Reef and North West shelf of Australia.

Genetic variation: Winterbottom et al. (2014c: 99) reported three haplogroups under this name, but lacked material from the type locality. Specimens from farther north in the Philippines (10) and Raja Ampat (Indonesia) (4) compose Group 2 with 1.8% intragroup divergence. An additional haplogroup from Samoa, is separated by 6% from the nearest of the three haplogroups.



Figure 118. *T. benjamini*, a) fresh, 21.2 mm SL male holotype, ROM 53038, Siquijor Island, Philippines (RW); b) fresh, 20.5 mm SL female, ROM 85065, Quoy Island, Raja Ampat (RW); c) live, ROM 101367, Sumbawa, Teluk Saleh (MVE).

- 115b. Head with no thin line of melanophores around eye and onto cheek; with a diagonal yellow stripe, margined with red, from posterior maxilla to middle of upper opercle; body with reddish and pale bars.....
Cocos Pygmygoby, *T. insularum* Winterbottom & Hoese, 2015: 36*

Holotype: ROM 82970, 23.9 mm SL male; type locality: Direction Island, Cocos (Keeling) Islands.

Range: Apparently confined to the Cocos (Keeling) Islands.



Figure 119. *T. insularum*, a) fresh, 18 mm SL, Cocos (Keeling) Islands (GRA); b) fresh, Cocos (Keeling) Islands (GRA); c) live, Cocos (Keeling) Islands (TU).

- 116a.(114) Second spine of first dorsal fin less elongated, reaching up to eighth ray of second dorsal fin; a white band across top of iris and a diffuse triangular white spot just behind eye; a distinct red mid-lateral stripe; base of caudal fin without a dark spot Erdmann's Pygmygoby, *T. erdmanni* Winterbottom, 2011: 138*

Holotype: ROM 87482, 23.5 mm SL male; type locality: Kawe Island, Raja Ampat, West Papua, Indonesia.

Range: Specimens identified as *T. erdmanni* range from the Philippines to Sulawesi, Indonesia and New Britain, PNG, and the Solomon Islands.

Genetic variation: At least 7 haplogroups are documented under this name, as well as another three under the closely related *T. chledophilum* (below). The haplogroup to which the types belong is currently known only from Misool, Kawe, and Jef Tsiepi Islands in Raja Ampat, Indonesia.



Figure 120. *T. erdmanni*, a) fresh, 10.2 mm SL juvenile paratype, ROM 85033, Kawe Island, Raja Ampat, Indonesia (RW); b) fresh, 26.2 mm SL male paratype, ROM 85033, Kawe Island, Raja Ampat (RW); live, Kawe Island, Raja Ampat (MVE).

116b. Second spine of first dorsal fin more elongated, reaching up to base of caudal fin; two large white spots at top of iris, and a rounded white spot or short stripe just behind eye; absent or indistinct red mid-lateral strip; base of caudal fin with a diffuse dark spot.....Mud Pygmygoby, *T. chledophilum* Allen, 2015: 33

Holotype: WAM P.34319-007, 22.2 mm SL male; type locality: Alotau, Milne Bay, Papua New Guinea.

Range: May be confined to Milne Bay, PNG.

Genetic variation: Three haplogroups are documented under this name, two from Milne Bay (PNG) and one from Rabaul (New Britain, PNG). The status of these haplogroups is uncertain due to overlap in morphology and color with nominal *T. erdmanni*.



Figure 121. *T. chledophilum*, a) preserved, 22.2 mm SL male holotype, WAM P.34319-007, Milne Bay, Papua New Guinea (GRE); b) live, Alotau, Milne Bay, Papua New Guinea (GER); c) live, Sideia, Milne Bay, , Papua New Guinea (MVE).

117a.(111) Head and anterior body with 4 red lateral stripes (pale in preservative)..... 118

117b. No stripes on head and anterior body..... 119

118a. Dark midline area of lower lip separated by a red band (pale in preservative) from dark area of gular region; usually 17 pectoral-fin rays Red-lined Pygmygoby, *T. striatum* (Herre, 1945: 81)

Holotype: CAS-SU 39854, 21 mm SL; type locality: Busuanga Island, Palawan, Philippines.

Range: Maldives to Japan, Palau, Papua New Guinea (Madang) and offshore reefs of Western Australia (Ashmore, Hibernia).

Genetic variation: Two haplogroups, one from Palau main islands (3) and Raja Ampat (Indonesia) (5) with 0.9% intragroup divergence, and the second from Maldives (2), separated by 3.6%.

Remarks: Specimens identified as this species from the Great Barrier Reef (Allen & Erdmann 2012: 947) represent *T. capostriatum* (see below), while those from Fiji are of unknown affiliation (but likely *T. capostriatum*).



Figure 122. *T. striatum*, a) ventral view of head (red arrow points to clear area), 20.0 mm SL male, ROM 83138, Palau (RW); b) fresh, 21.3 mm SL male, ROM 85089, Raja Ampat, Indonesia (RW); c) live, Laamu, Maldives (MVE).

118b. Dark midline area of lower lip continuous with dark area of gular region; usually 18 pectoral-fin rays
Spotted red-lined Pygmygoby, *T. capostriatum* (Goren, 1981: 94)

Holotype: MNHN 1980-1072, 19.6 mm SL; type locality: Canala Bay, New Caledonia.

Range: Great Barrier Reef (Australia), New Caledonia, Vanuatu, Solomon Islands, Bismark Archipelago (PNG), northern and southern New Guinea, and Helen Reef, Palau.

Genetic variation: A single haplogroup from the Great Barrier Reef (9) and Rabaul (New Britain, PNG) (2) with 0.8% intragroup divergence.



Figure 123. *T. capostriatum*, a) ventral view of head, preserved (note chin pigmentation), 19.2 mm SL male, ROM 84493, Helen Reef, Palau (RW); b) fresh, AMS I.20982, Lizard Island, Great Barrier Reef (DFH); c) live, 21.3 mm SL female, Lizard Island, Great Barrier Reef (AGC).

119a.⁽¹¹⁷⁾ Shoulder with a dark spot above where opercular membrane joins body 120
 119b. Shoulder without a dark spot 121

120a. Anterior extent of scales up to nape at dark shoulder spot; cheek with larger orange spots (pale in preservative), each about half to two-thirds pupil width; chin crossed by an orange band
Fang's Pygmygoby, *T. fangi* Winterbottom & Chen, 2004: 105

Holotype: MZB 12621, 20.5 mm SL; type locality: Pulau Bajau, Anambas, Riau Archipelago, Indonesia.
Range: Northwestern Indonesia and Western Australia to Palawan, Philippines, south to the Great Barrier Reef.

Genetic variation: Four haplogroups with minimal variation within groups, but none specifically from the type location: one group from nearby Bintan (Indonesia) (2); another from Raja Ampat (Indonesia) (8) separated by 2.2%; a third from Milne Bay, PNG (2); and a fourth from Rabaul (PNG) and the Great Barrier Reef (5), the latter two separated by 3.6%.



Figure 124. *T. fangi*, a fresh, 20.4 mm SL male, ROM 85083, Mutus Island, Raja Ampat, Indonesia (RW); b) live, ROM 101085, Waga Waga, Milne Bay, PNG (MVE); c) live, Fakfak Peninsula, West Papua, Indonesia (MVE).

120b. Anterior extent of scales up to nape halfway between orbit and dark shoulder spot; cheek with smaller orange spots (pale in preservative), each about a third or less pupil width; chin without an orange band Fishnet Pygmygoby, *T. agrena* Winterbottom & Chen, 2004: 103

Holotype: ROM 53126, 20.8 mm SL female; type locality: Sumilon Island, Cebu, Philippines.

Range: Malaysia to the Philippines and Cenderawasih Bay, Indonesia.

Genetic variation: A single haplotype, from Batangas, Philippines (2) and Raja Ampat (Indonesia) (1).



Figure 125. *T. agrena*, a) fresh, 23.2 mm SL holotype, ROM 53126, Sumilan Island, Philippines (RW); b) fresh, 26.2 mm S male, ROM 84919, between Kawe & Balabalak Islands, Raja Ampat, Indonesia (RW); c) fresh, 20.9 mm SL, ROM 104105, Cenderawasih Bay, Indonesia (MVE).

121a.(119) Head and body with few, if any, orange spots: if present, about size of pupil width and with a diffuse outline Wouter's Pygmygoby, *T. woutsi* Winterbottom, 2002: 49

Holotype: ROM 72562, 23.6 mm SL male; type locality: Hiva Oa, Marquesas Islands, French Polynesia.

Range: Apparently restricted to the Marquesas Islands.

Genetic variation: A single haplogroup from the type locality (4).



Figure 126. *T. woutsi*, a) fresh, 23.6 mm SL female holotype, ROM 76562, Marquesas Islands, French Polynesia (JER); b) fresh, 18.4 mm SL, Marquesas Islands, French Polynesia (JTW); c) live, Marquesas Islands, French Polynesia (PB).

121b. Cheek, nape, and body with numerous small, well-outlined, orange-to-red spots, most less than pupil width (pale in preservative) 122

- 122a. Origin of first dorsal-fin spine in a dark area; pectoral-fin base with a crescentic red bar and without spots Australian Pygmygoby, *T. necopinum* (Whitley, 1959: 316)

Holotype: AMS IB.3991, 19 mm SL; type locality: Heron Island, Great Barrier Reef, Australia.

Range: Restricted to between Cape York and Sydney on Australia's eastern coastline.

Genetic variation: A single haplogroup from the type locality (4), highly divergent from sequences of similar-looking species, i.e. *T. woutsi*, *T. macrophthalmus*, and *T. flammeum*.



Figure 127. *T. necopinum*, a) fresh, 20.0 mm SL male, AMS I.20784-053, Yonge Reef, Great Barrier Reef, Australia (DFH); b) fresh, 20.1 mm SL female, ROM 68825, Lizard Island, GBR (RW); c) live, Amity, Queensland, Australia (RK).

- 122b. Origin of first dorsal-fin spine in a pale area; pectoral-fin base with two vertically aligned spots and without a crescentic red bar 123

- 123a. Pectoral-fin base spots dusky to dark brown (dark gray to brown in preservative); spots on body smaller than interspaces, head spots mostly about equal to or slightly smaller than interspaces Large-eyed Pygmygoby, *T. macrophthalmus* (Tomiya, 1936: 47)

Holotype: ZUMT 30331, “12 mm”; type locality: Hachijojima, Izu Islands, Japan (specimen apparently lost).

Range: Cocos (Keeling) to Vietnam and Japan, south and east to the Great Barrier Reef, Fiji, and Samoa (records from elsewhere in the Indian Ocean in Allen & Erdmann (2012; 941) refer to *T. flammeum* [q.v.]).

Genetic variation: One haplogroup from Taiwan, Palau, and eastern Indonesia (24) with 1.3% divergence.



Figure 128. *T. macrophthalmus*, a) fresh, 14.8 mm SL female, ROM 82983, Sonsorol Island, Palau (RW); b) fresh, 17.3 mm SL female, ROM 46024, Fiji (RW); c) live, Anilao, Batangas, Philippines (BH).

- 123b. Pectoral-fin base spots dark red (pale in preservative); spots on body equal or larger than interspaces, head spots much larger than interspaces Flame Pygmygoby, *T. flammeum* (Smith, 1959: 209)

Holotype: SAIAB [formerly RUSI] 180, 25 mm (TL?); type locality: Pinda, Mozambique.

Range: : Western Indian Ocean to the Andaman Islands.

Genetic variation: A single haplogroup from South Africa to Seychelles, Maldives, and the Andaman Islands (28) with 1.6% divergence.



Figure 129. *T. flammeum*, a) fresh, 16.2 mm SL male, ROM 59778, Comoros (RW); b) fresh, 17.4 mm SL male, ROM 72839, Sodwana Bay, KwaZulu, South Africa (RW); c) live, St. Joseph Atoll, Seychelles (RD).

Discussion

The recently described *T. christianeae* Allen, 2019 from Milne Bay, Papua New Guinea appears to be conspecific with *T. meristum* Winterbottom & Hoese, 2015 (type location is Fiji). Examination of three paratypes of the former reveals that they have 8 dorsal-fin and 7 anal-fin soft rays (vs. 9 and 8 respectively in Allen's description), the fifth pelvic fin ray is branched dichotomously twice, for a total of four tips (vs. branched twice sequentially for a total of three tips), the posterior naris is separated from the front of the orbit by a distance equal to its transverse width (vs. adnate to the orbit), there are 14 lower gill rakers on the first gill arch (vs. 12 or 13), and the overall preserved coloration is similar (the live/freshly collected coloration is unknown for *T. meristum*), although more intense in *T. christianeae* than in *T. meristum* owing to the very faded nature of the type specimens of the latter. Two morphological characters overlap between the two nominal species. *Trimma meristum* was reported to have 15 lower gill rakers on the first gill arch in the original description. A paratype of *T. meristum* previously unexamined for this character (AMS I.18354-104) has 14 lower gill rakers (D.F. Hoese, in litt., April 2019), thus giving a range for the species of 14 or 15 vs. 14 in the paratypes of *T. christianeae* I examined (reported as 12 or 13 by Allen [2019]). The second spine of the first dorsal fin was reported as reaching posteriorly to between the bases of the spine and first ray of the second dorsal fin when addressed in *T. meristum*, vs. to between the spine and the fourth ray in *T. christianeae*. These two overlapping values do not, to me, seem to warrant diagnostic status. However, given the propensity of many (but by no means all) species of *Trimma* to have two or more haplogroups of the COI marker in different geographic localities, it remains possible that *T. christianeae* may prove to be a valid species separate from *T. meristum*. That source of evidence is not currently available for specimens from the type locality of *T. meristum* (Fiji), and, based solely on morphology (including pigmentation of preserved specimens), I conclude that *T. christianeae* is a junior subjective synonym of *T. meristum*.

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