



A new species of marine goby *Trimma* (Teleostei:Gobiidae) from Taiwan

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Abstract

A new species of marine goby, *Trimma tigrinum* sp. nov. is discovered and collected from the coastal waters off eastern and southern Taiwan. It can be well distinguished from other congeners by the following unique combination of features: (1) fin rays: D2 I/9, A I/9, P 17–19; second and third spines of D1 equal in length and not elongated; D2 rays branched; first ray of A not branched; fifth ray of V unbranched. (2) Squamation: LR 23–24 (modally 23), TR 6–7 (modally 7), PredS 7–8; no scales on the cheek and opercle. (3) Interorbital width narrow with deep trench and postorbital trench with slightly groove. (4) Specific colorations: cheek with two yellow vertical bands; anterior margin of pectoral-fin base with large yellow bar, two third of pupil diameter-sized; spine of second dorsal-fin with two small, dark reddish spots. dorsum from D1 to dorsal procurrent caudal-fin with seven yellow-orange bands like saddles; ventral from origin A to ventral procurrent caudal-fin with five diffuse yellowish or reddish orange bands. The molecular evidence from mtDNA COI sequence is also revealed that the new species is discrete species from others. A diagnostic key to nominal species of *Trimma* from Taiwanese waters would be also provided in this paper.

Key words: Gobiinae, coral reef fish, *Trimma*, new species, Taiwan

Introduction

The gobiid genus *Trimma* Jordan & Seale, 1906, is a colourful, small-sized (<30 mm SL) marine benthic fish that is found widely associated with coral and rocky reef at shallow and deep water in the Indo-Pacific Ocean (Winterbottom and Chen 2004; Winterbottom 2019, 2022; Winterbottom *et al.* 2023). The species members of the genus can be recognized by following combination of features: lack of any cephalic sensory canals and pores; a rather wide gill opening that extends to below the vertical limb of the preopercle or anterior to this; the lack of spicules (odontoids) on the outer gill rakers of the first gill arch; usually fewer than 12 rays each in the second dorsal and anal fins; and the 5th pelvic-fin ray length being equal or more than 40% of the length of 4th pelvic-fin ray (Winterbottom, 1984; Winterbottom & Hoese 2015).

Currently, with 111 described species recognized as valid species, and this number is expected to grow, genus *Trimma* known as second largest marine gobiid fish (Winterbottom 2019, 2022, 2023; Froese & Pauli 2023; Winterbottom *et al.* 2023). Of these, 9 nominal species of *Trimma* have been recorded from Taiwan so far including: *T. anaima* Winterbottom, 2000, *T. annosum* Winterbottom, 2003, *T. caesiura* Jordan & Seale, 1906, *T. grammistes* (Tomiya, 1936), *T. macrophthalmus* (Tomiya, 1936), *Trimma milta* Winterbottom, 2002, *T. naudei* Smith, 1957, *T. okinawae* (Aoyagi 1949), and *T. caudomaculatum* Yoshino & Araga, 1975 (Chen *et al.* 1997; Shao 2023)

Recent exploration of the coastal fishes in Taiwan employing SCUBA gear, we discovered an undescribed species of *Trimma*. Here we describe the new species while presenting both morphological and mito-genetic data concerning it.

Materials & Methods

Fish specimens were collected by hand-net while SCUBA diving. Freshly collected specimens were immediately recorded and photographed. Fish samples were preserved in 10% formalin then transferred to 70% ethanol for long term storage. Measurements were made from the specimens to the nearest 0.01 mm using a digital calliper with the aid of a stereo microscope. Body length was recorded as standard length (SL). All morphological counts follow Miller (1988) and meristic counts follow Chen & Shao (1996). The terminology of the cephalic sensory canals and free neuromast organs (sensory papillae) follow Wongrat & Miller (1991) based on Sanzo (1911). The fish length is given as percentage of standard length (SL). Meristic abbreviations used in this paper are as follows: A, anal-fin; C, caudal-fin; D1, first dorsal-fin; D2, second dorsal-fin; P, pectoral-fin; LR, lateral scale rows; TR: transverse scale rows; PreD, predorsal scales; SDP, scales between first dorsal-fin to upper marginal of pectoral fin base.; VC, vertebral count. Type specimens have been deposited in the Pisces collections of National Taiwan Ocean University, Keelung (NTOUP).

For DNA analysis, fin tissues of the collected *Trimma* specimens from coastal water off Taiwan were directly preserved in 95% ethanol. The fish genome was extracted using Tissue and Cell Genomic DNA Purification Kit (GenMark, Taichung, Taiwan) according to the manufacturer's protocols. A pair of primers, COI-TrF1 (5'-TCAACAAAYCATAAAGAYATYGGCAC-3') and COI-TrR1 (5'-AYACTTCBGGGTGSCCAAARAATCAG-3') were designed to amplify partial fragment of mitochondrial gene cytochrome c oxidase subunit 1 (COI). PCR was carried out using an Applied Biosystems 2720 thermal cycler with 50 µl reaction volume containing 20 µl of sterile distilled water, 25 µl of Taq 2x master mix Red (Amplicon, Denmark), 1 µl of each primer (10 µM) and 2 µl of genomic DNA. The thermal cycle started with an initial denaturation at 94°C for 5 m, followed by 40 cycles of denaturation (94°C for 25 s), annealing (55.5°C for 30 s), elongation (72°C for 40 s), and final elongation 72°C for 7 m. The PCR products were run in 1.5% agarose gel with DNA Ladder (PROTECH) and checked under ultraviolet trans-illumination. After confirmation. Sequencing was performed in an ABI 3730XL DNA analyzer using the same PCR primers. A Neighbor-joining (NJ) approach with 1000 bootstraps was performed in Molecular Evolutionary Genetics Analysis (MEGA) version X (Kumar *et al.* 2018). MtDNA COI sequences from 82 nominal species of *Trimma* were downloaded from Barcode of Life Data System (BOLD) (Ratnasingham & Hebert 2007) and GenBank database (Table 3). Of these, 17 sequences from 8 different species obtained in the current study have been deposited in GenBank. *Priolepis semidoliata* (Valenciennes, 1837) was assigned as the outgroup.

Systematics

Trimma Jordan & Seale, 1906

Trimma tigrinum Chen & Harefa, new species

(Figures 1–2)

New english name: Tiger pygmygoby.

Materials examined

Holotype: NTOUP-2008-07-294, female, 1 specimen (20.1 mm SL), Jihue, Chenggong Township, Taitung County, Taiwan, depth 6–7 m, coll. coll. IS. Chen, 16 July 2008.

Paratypes

Taitung county

NTOUP-2008-07-295, 2 specimens (18.7–18.9 mm SL), same data as holotype. NTOUP-2020-09-065, 4 specimens (19.5–24.2 mm SL), Jihue, Chenggong Township, depth 6–7 m, coll. T. Harefa, 29 September 2020.

NTOUP-2021-02-114, 1 specimen, female (22.4 mm SL), Jihue, Chenggong Township, depth 5–6 m, coll. T. Harefa & DY. Hong, 25 February 2021.

NTOUP-2021-09-220, Male, 1 specimen (27.1 mm SL), Jihue, Chenggong Township, Taitung County, Taiwan, depth 6–7 m, coll. T. Harefa & D.Y. Hong, 24 September 2021.
NTOUP-2021-09-221, 5 specimens (15.5–20.0 mm SL), Jihue, Chenggong Township, Taitung County, Taiwan, depth 6–7 m, coll. T. Harefa & D.Y. Hong, 24 September 2021.
NTOUP-2021-09-222, 6 specimens (21.8–24.6 mm SL), Jihue, Chenggong Township, Taitung County, Taiwan, depth 6–7 m, coll. T. Harefa & D.Y. Hong, 24 September 2021.
NTOUP-2021-12-182, 5 specimens (19.4–25.4mm SL), Jihue, Chenggong Townshi, depth 6–7 m, coll. T. Harefa & DY. Hong, 21 December 2021.
NTOUP-2023-01-102, 1 specimen (22.2 mm SL), Jihue, Chenggong Township, depth 5–6 m, coll. T. Harefa *et al.*, 12 January 2023.

Pingtung county

NTOUP-2020-11-093, 4 specimens (24.9–26.8 mm SL), Tiaoshi, Hengchun Township, depth 5–6 m, coll. T. Harefa, 16 November 2020.
NTOUP-2021-04-099, 3 specimens (21.4–23.8 mm SL), Nanren, Manzhou Township, depth 5–8 m, coll. T. Harefa & JZ. Ho, 02 April 2021.
NTOUP-2022-01-050, 4 specimens (23.0–25.5mm SL), Tiaoshi, Hengchun Township, depth 4–5 m, coll. T. Harefa & DY. Hong, 22 January 2022.
NTOUP-2022-01-051, 1 specimen (24.9 mm SL), Hongchaikeng, Hengchun Township, depth 8–12 m, coll. T. Harefa *et al.*, 23 January 2022.
NTOUP-2022-01-052, 4 specimens (23.2–25.6mm SL), Shanhai, Hengchun Township, depth 8–9 m, coll. T. Harefa *et al.*, 22 January 2022.

New Taipei City

NTOUP-2021-08-059, 1 specimen, female (22.1 mm SL), Maoao, Gongliao District, depth 8–12m, coll. T. Harefa & DY. Hong, 09 August 2021

Nontypes

NTOUP-2021-09-219, 5 specimens (14.8–17.8 mm SL), Jihue, Chenggong Township, depth 6–7 m, coll. T. Harefa, 29 September 2020.
NTOUP-2021-11-148, 12 specimens (17.8–21.4 mm SL), Jihue, Chenggong Townshi, depth 5 m, coll. T. Harefa & DY. Hong, 17 November 2021.
NTOUP-2021-12-189, 5 specimens (16.2–18.8 mm SL), Jihue, Chenggong Townshi, depth 6–7 m, coll. T. Harefa & DY. Hong, 21 December 2021.
NTOUP-2023-01-103, 2 specimens (17.3–19.8 mm SL), Jihue, Chenggong Township, depth 5–6 m, coll. T. Harefa *et al.*, 12 January 2023.

Diagnosis

The new species *Trimma tigrinum* **sp. nov.** is well distinguished from other congeners by the following unique combination of features: (1) fin rays: D2 I/9, A I/9, P 17–19; second and third spines of D1 equal in length and not elongated; D2 rays branched; first ray of A not branched; fifth ray of V unbranched. (2) Squamation: LR 23–24 (modally 23), TR 6–7 (modally 7), PreD 7–8; no scales on the cheek and opercle. (3) Interorbital width narrow with deep trench and postorbital trench with slightly groove. (4) Specific colorations: cheek with two yellow vertical bands; anterior margin of pectoral-fin base with large yellow bar, two third of pupil diameter-sized; spine of second dorsal-fin with two small, dark reddish spots. dorsum from D1 to dorsal procurrent caudal-fin with seven yellow-orange bands like saddles; ventral from origin A to ventral procurrent caudal-fin with five diffuse yellowish or reddish orange bands.

Description

Body proportion in Table 1. Body moderately elongated, slightly compressed posteriorly. Head slightly depressed anteriorly. Mouth oblique, maxilla extending posteriorly to slightly beyond vertical drawn through anterior margin of orbit. Lower jaw protruding slightly beyond tip upper jaw. Anterior nasal with a short tapering tube reaching anteriorly to above anterior margin of upper lip, posterior opening pore-like with low raised rim. Eyes large, dorsolateral. Interorbital narrow, with deep trench and postorbital trench with slightly groove. Cheek slightly fleshy. Gill opening on each side large, extending anteroventrally to vertical drawn through posterior edge of mid-pupil.



FIGURE 1. Preserved *Trimma tigrinum* sp. nov., holotype, male (upper one) NTOUP-2008-07-294, 20.1 mm SL, Jihue, Chenggong Township, Taitung County, Taiwan; freshly collected of paratype, male (middle one) NTOUP-2021-09-220 27.1 mm, Jihue, Chenggong Township, Taitung County; paratype, female (lower one), NTOUP-2022-01-050 25.5 mm SL, Tiaoshi, Hengchun Township, Pingtung County, Taiwan.

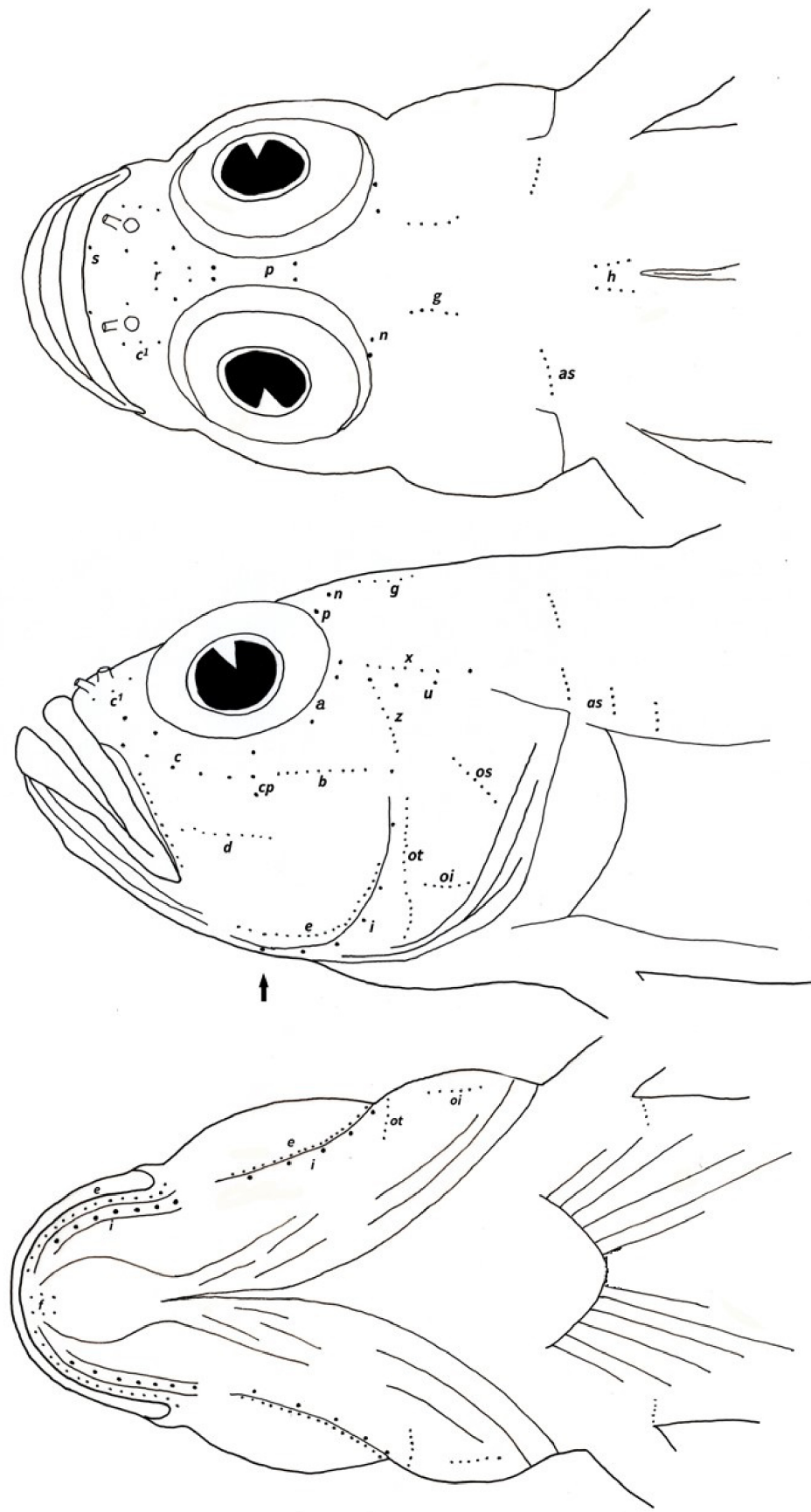


FIGURE 2. Head lateral-line system of *Trimma tigrinum* sp. nov. NTOUP-2021-09-220, 27.1 mm SL. Bar = 1 mm. The arrow denotes the position of the gill opening.

Fins.—D1 VI, D2 I/9, A I/9, P 16–19 (modally 18), V I/5+I/5 (distribution frequency in Table 2). Second to fourth spine of D1 equal in length, not elongate, and not reaching origin D2, when adpressed. D2 rays all branched and last ray always two rays with one branched. A origin located below first ray of D2; first ray usually unbranched remaining rays branched and last ray always two rays with one branched. Upper 2–4 (usually 2–3) and lower 2–8 (usually 2–7) of P rays unbranched, central 6–14 (usually 8–11) rays branched. V no fraenum, basal membrane vestigial (about 3–12% length of fifth ray); first to fourth ray branched once; fifth ray unbranched, 40–50% length of fourth ray; fourth segmented ray longest reaching between first to third segmented ray of A.

TABLE 1. Morphometric measurements of *Trimma tigrinum* sp. nov from Taiwan.

	Holotype	Paratypes					
	Female	Male			Female		
		(9 specimens)			(13 specimens)		
		Min	Max	Av	Min	Max	Av
Standard length (mm SL)	20.1	18.9	27.6		18.7	26.8	
% in SL							
Head length	29.1	27.5	30.9	29.5	27.8	30.2	28.7
Snout to 1st dorsal origin	37.2	35.3	38.5	37.1	34.9	38.0	36.6
Snout to 2nd dorsal origin	55.7	54.6	58.3	56.8	55.5	58.7	57.2
Snout to anus	54.9	52.1	56.0	53.8	50.2	54.4	53.1
Snout to anal fin origin	60.2	55.9	60.4	58.3	55.9	61.2	58.3
Prepelvic length	28.8	27.8	31.2	29.5	27.8	31.0	29.1
Caudal peduncle length	21.9	20.3	24.3	22.7	21.5	24.9	22.9
Caudal peduncle depth	12.9	11.1	13.4	12.0	11.1	13.0	11.8
First dorsal fin base	18.6	13.8	18.9	17.0	13.6	19.0	16.7
Second dorsal fin base	19.3	18.6	21.6	19.8	18.1	21.0	19.6
Anal fin base	18.1	16.8	19.6	18.2	16.5	19.8	17.8
Caudal fin length	22.6	19.7	22.7	21.9	18.4	24.3	21.9
Pectoral fin length	24.5	23.1	25.2	24.5	23.3	28.0	24.7
Pelvic fin length	37.6	31.4	38.7	35.8	33.3	38.7	36.0
Body depth of pelvic fin origin	23.9	21.3	24.1	22.8	21.7	24.6	22.8
Body depth of anal fin origin	21.3	19.9	22.1	20.8	19.5	21.9	20.4
Body width of anal fin origin	13.6	11.1	13.5	12.6	11.4	13.8	12.2
Pelvic fin origin to anus	28.2	24.7	28.8	26.0	24.8	27.4	26.0
% in HL							
Snout length	18.3	15.7	18.9	17.0	13.4	18.9	16.6
Eye diameter	40.6	37.6	42.7	39.7	36.9	43.2	39.3
Postorbital length	40.9	38.4	40.7	39.5	36.6	42.1	39.6
Cheek depth	24.3	24.2	28.2	26.1	23.5	30.8	25.7
Head width in upper gill opening	50.7	45.3	53.4	48.4	45.9	54.6	49.4
Head width in maximum	77.4	62.6	79.2	71.9	64.9	79.6	71.5
Fleshy interorbital width	17.3	9.4	18.9	15.8	8.6	18.0	14.8
Bony interorbital width	2.7	1.8	3.2	2.4	1.7	3.0	2.3
Lower jaw length	40.8	38.4	41.0	39.8	31.8	41.8	39.3

Scales.—LR 23–25 (modally 24), TR 6–7 (modally 7), PreD 7–8 (modally 7) SDP 4; cheek and opercle region naked; three rows of cycloid scales on pectoral-fin base; cycloid scales on breast, pelvic-fin base and belly.

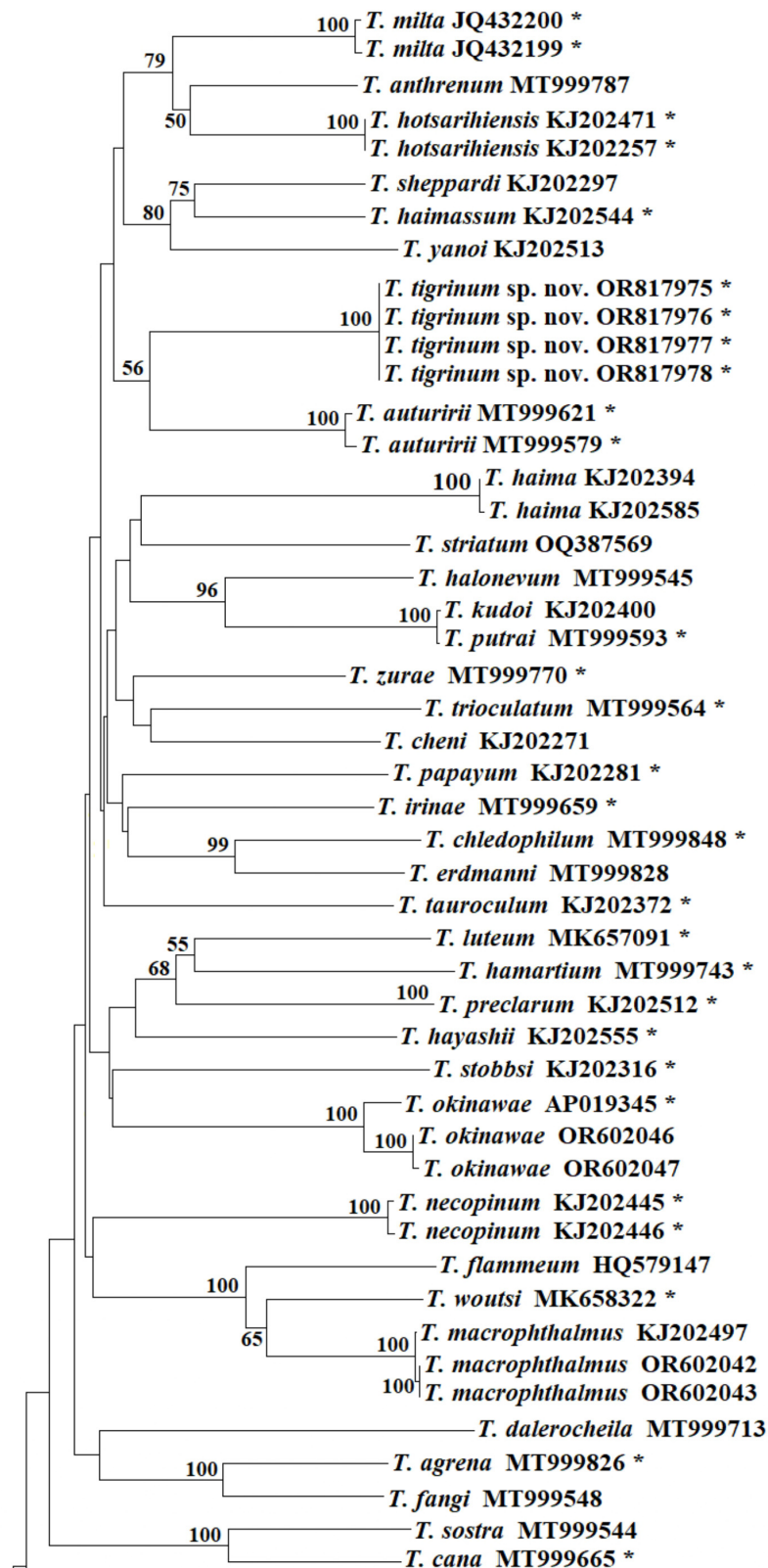


FIGURE 3. Neighbor-joining (NJ) tree of nominal *Trimma* species inferred from mtDNA COI sequence. The outgroup is *Priolepis semidoliata*. NJ bootstrap values greater than 50% are shown at the nodes. Species names are followed by GenBank accession numbers. Sequences from sampling localities close or similar to the type species locality are marked with an asterisk (*).

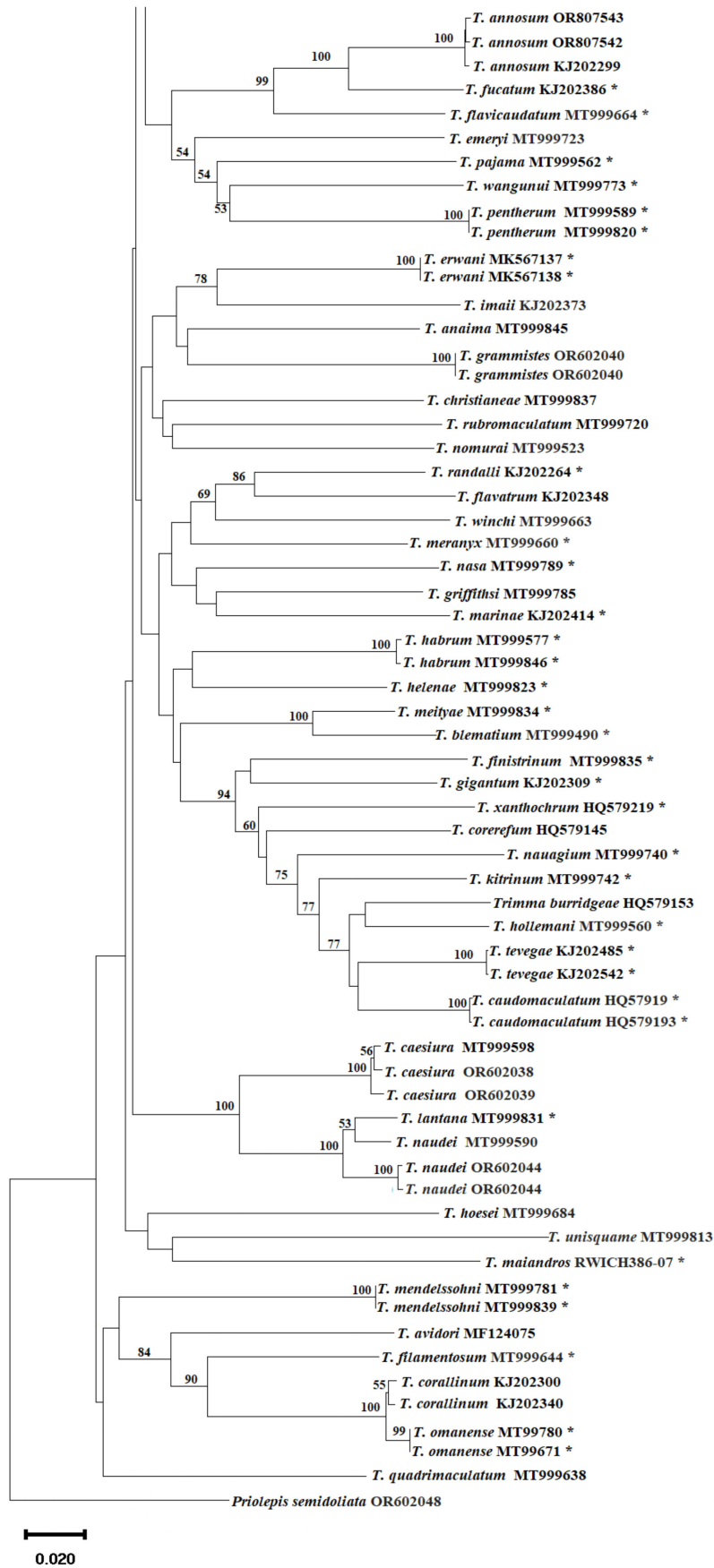


FIGURE 3. Continued.

Head lateral-line system.—(Figure 2)

Canals: No canal pore on head.

Sensory papillae: Distributed as follows, with counts and ranges shown in parentheses: row *a* (6) long, extending from posterior to anterior of orbit; rows *b* and *d* (8–9 and 8–9 respectively); row *c* (6) present longitudinally below infraorbital; single *cp* papilla (1); rows *e* and *i* (34–35 and 14–15, respectively) on preoperculo-mandibular; row *f* (3 paired papillae) on rostral mandibular; rows *n* and *g* (1 and 5 respectively) anteriodorsal; rows *ot*, *oi* and *os* (18–19, 5–6 and 6–7, respectively) on opercular; *p* papillae (6, paired) longitudinally on interorbital; rows *r* and *s* (2 and 1, respectively, all paired) flanking midline in preorbital area; rows *u*, *x* and *z* (4–5, 5–6 and 8–9, respectively) on oculoscapular.

TABLE 2. Distribution frequency of meristic counts of *Trimma tigrinum* sp. nov. with other congeners from Taiwan.

	D2 I/					A I/					P									
	7	8	9	10	X	7	8	9	10	11	X	14	15	16	17	18	19	20	X	
<i>Trimma tigrinum</i> sp. nov.	-	-	43	-	-	9	-	-	43	-	-	9	-	-	2	4	34	3	-	18
<i>Trimma anaima</i>	-	3	-	-	-	8	-	3	-	-	8	-	-	3	-	-	-	-	-	16
<i>Trimma annosum</i>	5	47	1	-	-	8	3	49	1	-	8	-	-	-	7	42	4	-	-	18
<i>Trimma caesiura</i>	-	40	-	-	-	8	-	40	-	-	8	-	-	11	25	4	-	-	-	17
<i>Trimma caudomaculatum</i>	-	1	-	-	-	8	-	1	-	-	8	1	-	-	-	-	-	-	-	14
<i>Trimma grammistes</i>	-	-	-	15	2	10	-	-	2	14	1	10	-	-	-	10	6	1	-	18
<i>Trimma macrophthalmus</i>	-	2	17	-	-	9	-	5	14	-	-	9	-	-	6	10	3	-	-	18
<i>Trimma milta</i>	-	-	1	-	-	9	-	1	-	-	8	-	-	-	1	-	-	-	-	17
<i>Trimma naudei</i>	1	9	-	-	-	8	1	9	-	-	8	-	-	3	6	1	-	-	-	17
<i>Trimma okinawae</i>	-	-	64	2	-	9	3	57	3	-	8	-	-	-	9	50	7	-	-	18

	LR								TR					SDP								
	22	23	24	25	26	27	28	29	Av	6	7	8	9	10	Av	0	1	2	3	4	5	Av
<i>Trimma tigrinum</i> sp. nov.	-	17	24	2	-	-	-	-	24	6	37	-	-	-	7	-	-	-	-	43	-	4
<i>Trimma anaima</i>	-	3	-	-	-	-	-	-	23	-	3	-	-	-	7	-	-	-	3	-	-	3
<i>Trimma annosum</i>	1	10	25	17	-	-	-	-	24	16	37	-	-	-	7	-	-	-	6	47	-	4
<i>Trimma caesiura</i>	-	29	9	1	1	-	-	-	23	4	28	5	-	-	7	-	-	-	1	34	5	4
<i>Trimma caudomaculatum</i>	-	1	-	-	-	-	-	-	23	-	1	-	-	-	7	-	-	-	1	-	-	3
<i>Trimma grammistes</i>	-	-	-	7	3	4	3	26	-	1	5	10	1	9	17	-	-	-	-	-	-	0
<i>Trimma macrophthalmus</i>	1	6	12	-	-	-	-	24	-	-	13	6	-	8	19	-	-	-	-	-	-	0
<i>Trimma milta</i>	-	1	-	-	-	-	-	23	1	-	-	-	-	6	-	-	-	-	1	-	-	4
<i>Trimma naudei</i>	1	6	3	-	-	-	-	23	3	6	1	-	-	7	-	-	-	-	8	2	4	
<i>Trimma okinawae</i>	1	40	25	2	-	-	-	23	-	23	43	2	-	8	-	-	-	30	38	-	4	

	PreD											AV	
	0	1	2	3	4	5	6	7	8	9	10		11
<i>Trimma tigrinum</i> sp. nov.	-	-	-	-	-	-	-	26	16	-	-	-	7
<i>Trimma anaima</i>	3	-	-	-	-	-	-	-	-	-	-	-	0
<i>Trimma annosum</i>	-	-	-	-	-	30	19	4	-	-	-	-	5
<i>Trimma caesiura</i>	-	-	-	-	-	-	9	19	12	-	-	-	8
<i>Trimma caudomaculatum</i>	-	-	-	-	-	-	-	-	-	-	1	11	-
<i>Trimma grammistes</i>	12	-	-	-	-	-	-	-	-	-	-	-	0
<i>Trimma macrophthalmus</i>	19	-	-	-	-	-	-	-	-	-	-	-	0
<i>Trimma milta</i>	-	-	-	-	-	-	1	-	-	-	-	-	7
<i>Trimma naudei</i>	-	-	-	-	-	2	2	6	-	-	-	-	7
<i>Trimma okinawae</i>	6	-	7	28	6	14	3	-	-	-	-	-	3

TABLE 3. List species and GenBank/BOLD accession number used in the phylogenetic tree.

Species	GenBank Acc. No	DNA sample locality	Type locality	Sources
<i>Trimma tigrinum</i> sp. nov.	OR817975, OR817976, OR817977, OR817978	Taiwan	Taiwan	Current study
<i>T. agrena</i> Winterbottom & Chen, 2004	MT999826	Philippines	Philippines	Winterbottom <i>et al.</i> 2020
<i>T. anaima</i> Winterbottom, 2000	MT999845	Seychelles islands	Comoros island	Winterbottom <i>et al.</i> 2020

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TABLE 3. (Continued)

Species	GenBank Acc. No	DNA sample locality	Type locality	Sources
<i>T. annosum</i> Winterbottom, 2003	KJ202299	Queensland, Australia	Bau Waters, Fiji	Winterbottom <i>et al.</i> 2014
<i>T. annosum</i> Winterbottom, 2003	OR807542, OR807543	Taiwan	Bau Waters, Fiji	Current study
<i>T. anthrenum</i> Winterbottom, 2006	MT999787	Lau Island, Fiji	Tonga	Winterbottom <i>et al.</i> 2020
<i>T. aturirii</i> Winterbottom, Erdmann & Cahyani, 2015	MT999621, MT999579	Raja ampat, Indonesia	Pulau Pagun, West Papua Indonesia	Winterbottom <i>et al.</i> 2020
<i>T. avidori</i> Goren, 1978	MF124075	Eilat, IUI reef, Israel	Gulf of Aqaba, Red Sea	Kimmerling <i>et al.</i> 2017
<i>T. blematium</i> Winterbottom & Erdmann, 2018	MT999490	Papua New Guinea	Papua New Guinea	Winterbottom <i>et al.</i> 2020
<i>T. caesiura</i> Jordan & Seale, 1906	OR602038, OR602039	Taiwan	Samoa	Current study
<i>T. burridgeae</i> Winterbottom, 2016	HQ579153	Palau	Palau	Winterbottom <i>et al.</i> 2020
<i>T. caesiura</i> Jordan & Seale, 1906	MT999598	Samoa	Apia, Upolu Island, Samoa	Winterbottom <i>et al.</i> 2020
<i>T. cana</i> Winterbottom, 2004	MT999665	Philippines	Philippines	Winterbottom <i>et al.</i> 2020
<i>T. caudomaculatum</i> Yoshino & Araga, 1975	HQ57919, HQ579193	Japan	Ryukyu Islands, Japan	Winterbottom <i>et al.</i> 2014
<i>T. cheni</i> Winterbottom, 2011	KJ202271	Raja ampat, Indonesia	Milne Bay, Papua New Guinea	Winterbottom <i>et al.</i> 2014
<i>T. chledophilum</i> Allen, 2015	MT999848	Papua New Guinea	Milne Bay, Papua New Guinea	Winterbottom <i>et al.</i> 2020
<i>T. christianeae</i> Allen, 2019	MT999837	Milne Bay, Papua New Guinea	Baixo Pinda, Mozambique	Winterbottom <i>et al.</i> 2020
<i>T. corallinum</i> (Smith, 1959)	KJ202300, KJ202340	KwaZulu-Natal South Africa	Koror Island, Palau	Winterbottom <i>et al.</i> 2014
<i>T. dalerocheila</i> Winterbottom 1984	MT999713	Seychelles	Chagos Archipelago	Winterbottom <i>et al.</i> 2020
<i>T. emeryi</i> Winterbottom 1985	MT999723	Cendrawasih Bay, Indonesia	Chagos Archipelago	Winterbottom <i>et al.</i> 2020
<i>T. erdmanni</i> Winterbottom, 2011	MT999828	Raja Ampat, Indonesia	Kawe Island, southwest bay	Winterbottom <i>et al.</i> 2020
<i>T. erwani</i> Viviani, Williams & Planes, 2016	MK567137, MK567138	French Polynesia	French Polynesia	Delrieu-Trottin <i>et al.</i> 2019
<i>T. fangi</i> Winterbottom & Chen 2004	MT999548	Bintan, Indonesia	Anambas, South China Sea	Winterbottom <i>et al.</i> 2020
<i>T. filamentosum</i> Winterbottom, 1995	MT999644	Red Sea	Gulf of Aqaba, Red Sea	Winterbottom <i>et al.</i> 2020
<i>T. finistrinum</i> Winterbottom, 2017	MT999835	Fiji	Fiji	Winterbottom <i>et al.</i> 2020
<i>T. flammeum</i> (Smith, 1959)	HQ579147	KwaZulu-Natal, South Africa	Mozambique	Winterbottom <i>et al.</i> 2020

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TABLE 3. (Continued)

Species	GenBank Acc. No	DNA sample locality	Type locality	Sources
<i>T. flavatrum</i> Hagiwara & Winterbottom, 2007	KJ202348	Palau	Amami-Oshima Island, Japan	Winterbottom <i>et al.</i> 2014
<i>T. flavicaudatum</i> (Goren, 1982)	MT999664	Red Sea	Red Sea	Winterbottom <i>et al.</i> 2020
<i>T. fucatum</i> Winterbottom & Southcott, 2007	KJ202386	Thailand	Thailand	Winterbottom <i>et al.</i> 2014
<i>T. gigantum</i> Winterbottom & Zur, 2007	KJ202309	Palau	Augulpelu reef, Palau	Winterbottom <i>et al.</i> 2014
<i>T. grammistes</i> (Tomiyama 1936)	OR602040, OR602041	Taiwan	Hayama, Japan	Current study
<i>T. griffithsi</i> Winterbottom, 1984	MT999785	Maldives	Chagos Archipelago	Winterbottom <i>et al.</i> 2020
<i>T. habrum</i> Winterbottom, 2011	MT999577, MT999846	Raja Ampat, Indonesia	Raja Ampat, Indonesia	Winterbottom <i>et al.</i> 2020
<i>T. haima</i> Winterbottom, 1984	KJ202394, KJ202585	Seychelles	Chagos Archipelago	Winterbottom <i>et al.</i> 2014
<i>T. haimassum</i> Winterbottom, 2011	KJ202544	Raja Ampat, Indonesia	Raja Ampat, Indonesia	Winterbottom <i>et al.</i> 2014
<i>T. halonevum</i> Winterbottom, 2000	MT999545	Salomon Island	Papua New Guinea	Winterbottom <i>et al.</i> 2020
<i>T. hamartium</i> Winterbottom, 2018	MT999743	Palau	Palau	Winterbottom <i>et al.</i> 2020
<i>T. hayashii</i> Hagiwara & Winterbottom, 2007	KJ202555	Iriomote-Jima, Japan	Kakeroma Island, Japan	Winterbottom <i>et al.</i> 2014
<i>T. helenae</i> Winterbottom, Erdmann & Cahyani, 2014	MT999823	Raja Ampat, Indonesia	Raja Ampat, Indonesia	Winterbottom <i>et al.</i> 2020
<i>T. hoesei</i> Winterbottom 1984	MT999684	Raja Ampat, Indonesia	Chagos Archipelago	Winterbottom <i>et al.</i> 2020
<i>T. hollemani</i> Winterbottom, 2016	MT999560	Maluku, Indonesia	West Papua, Indonesia	Winterbottom <i>et al.</i> 2020
<i>T. hotsarihiensis</i> Winterbottom, 2009	KJ202471, KJ202257	Palau	Palau	Winterbottom <i>et al.</i> 2014
<i>T. imaii</i> Suzuki & Senou, 2009	KJ202373	Bali, Indonesia	Izu Islands, Japan	Winterbottom <i>et al.</i> 2014
<i>T. irinae</i> Winterbottom, 2014	MT999659	Papua New Guinea	Papua New Guinea	Winterbottom <i>et al.</i> 2020
<i>T. kitrinum</i> Winterbottom & Hoese, 2015	MT999742	Fiji	Fiji Islands	Winterbottom <i>et al.</i> 2020
<i>T. kudoi</i> Suzuki & Senou, 2008	KJ202400	Raja Ampat, Indonesia	Izu Islands, Japan	Winterbottom <i>et al.</i> 2014
<i>T. lantana</i> Winterbottom & Villa, 2003	MT999831	Solomon Islands	Solomon Islands, western Pacific	Winterbottom <i>et al.</i> 2020
<i>T. luteum</i> Viviani, Williams & Planes 2016	MK657091	French Polynesia	Austral Islands, French Polynesia	Delrieu-Trottin <i>et al.</i> 2019
<i>T. macrophthalmus</i> (Tomiyama 1936)	KJ202497	Taiwan	Japan	Winterbottom <i>et al.</i> 2014
<i>T. macrophthalmus</i> (Tomiyama 1936)	OR602042, OR602043	Taiwan	Hatizyo-zima, Idu-sitito, Japan	Current study

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TABLE 3. (Continued)

Species	GenBank Acc. No	DNA sample locality	Type locality	Sources
<i>T. maiandros</i> Hoese, Winterbottom & Reader, 2011	RWICH386-07	Australia	Queensland, Australia	Hoese <i>et al.</i> , 2011
<i>T. marinae</i> Winterbottom, 2005	KJ202414	Palau	Palau	Winterbottom <i>et al.</i> 2014
<i>T. meityae</i> Winterbottom & Erdmann, 2018	MT999834	Indonesia	Cendrawasih Bay, Indonesia	Winterbottom <i>et al.</i> 2020
<i>T. mendelssohni</i> (Goren 1978)	MT999781, MT999839	Red Sea	Gulf of Aqaba, Red Sea	Winterbottom <i>et al.</i> 2020
<i>T. meranyx</i> Winterbottom, Erdmann & Cahyani, 2014	MT999660	Sulawesi, Indonesia	Lembah strait, Sulawesi, Indonesia	Winterbottom <i>et al.</i> 2020
<i>T. milta</i> Winterbottom, 2002	JQ432199, JQ432200	French Polynesia	Society Islands, French Polynesia	Hubert <i>et al.</i> 2012
<i>T. nasa</i> Winterbottom, 2005	MT999789	Philippines	Philippines	Winterbottom <i>et al.</i> 2020
<i>T. nauagium</i> Allen, 2015	MT999740	Papua New Guinea	Milne Bay, Papua New Guinea	Winterbottom <i>et al.</i> 2020
<i>T. naudei</i> Smith, 1959	MT999590	Maldives	Seychelles	Winterbottom <i>et al.</i> 2020
<i>T. naudei</i> Smith, 1959	OR602044, OR602045	Taiwan	Seychelles	Current study
<i>T. necopinum</i> (Whitley 1959)	KJ202445, KJ202546	Queensland, Australia	Queensland, Australia	Winterbottom <i>et al.</i> 2014
<i>T. nomurai</i> Suzuki & Senou 2007	MT999523	Raja Ampat, Indonesia	Ryuku Islands, Japan	Winterbottom <i>et al.</i> 2020
<i>T. okinawae</i> (Aoyagi 1949)	OR602046, OR602047	Taiwan	Okinawa Island, Japan	Current study
<i>T. okinawae</i> Aoyagi, 1949	AP019345	Okinawa Island, Japan	Okinawa Island, Japan	Hanahara <i>et al.</i> , 2019
<i>T. omanense</i> Winterbottom, 2000	MT999671, MT999780	Oman	Gulf of Oman, Arabian Sea	Winterbottom <i>et al.</i> 2020
<i>T. pajama</i> Winterbottom, Erdmann & Dita Cahyani, 2014	MT999562	Fakfak, Indonesia	Fakfak Peninsula, Indonesia	Winterbottom <i>et al.</i> 2020
<i>T. papayum</i> Winterbottom 2011	KJ202281	Raja Ampat, Indonesia	Raja Ampat, Indonesia	Winterbottom <i>et al.</i> 2014
<i>T. penterum</i> Winterbottom & Hoese, 2015	MT999589, MT999820	Fiji	Fiji	Winterbottom <i>et al.</i> 2020
<i>T. preclarum</i> Winterbottom, 2006.	KJ202512	Palau	Palau	Winterbottom <i>et al.</i> 2014
<i>T. putrai</i> Winterbottom, Erdmann & Mambrasar, 2019	MT999593	Raja Ampat, Indonesia	Raja Ampat, Indonesia	Winterbottom <i>et al.</i> 2020
<i>T. quadrimaculatum</i> Hoese, Bogorodsky & Mal 2015	MT999638	Red Sea	Saudi Arabia, Red Sea	Winterbottom <i>et al.</i> 2020
<i>T. rubromaculatum</i> Allen & Munday, 1995	MT999720	Palau	Papua New Guinea	Winterbottom <i>et al.</i> 2020
<i>T. randalli</i> Winterbottom & Zur, 2007	KJ202264	Palau	Palau	Winterbottom <i>et al.</i> 2014

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TABLE 3. (Continued)

Species	GenBank Acc. No	DNA sample locality	Type locality	Sources
<i>T. sheppardi</i> Winterbottom, 2020	KJ202297	Raja ampat, Indonesia	Chagos Archipelago	Winterbottom <i>et al.</i> 2020
<i>T. sostra</i> Winterbottom, 2004	MT999544	Fiji	Canton Atoll, Kiribati	Winterbottom <i>et al.</i> 2020
<i>T. stobbsi</i> Winterbottom, 2001	KJ202316	New Caledonia	New Caledonia	Winterbottom <i>et al.</i> 2014
<i>T. striatum</i> Herre, 1945	OQ387569	Philippines	Busuanga Island, Philippines	Bemist <i>et al.</i> 2023
<i>T. tauroculum</i> Winterbottom & Zur, 2007	KJ202372	Palau	Palau	Winterbottom <i>et al.</i> 2014
<i>T. taylori</i> Lobel, 1969	KJ202345	Hawaii	Oahu Island, Hawaiian Islands	Winterbottom <i>et al.</i> 2014
<i>T. tevegae</i> Cohen & Davis, 1969	KJ202485, KJ202542	Papua New Guinea	Papua New Guinea	Winterbottom <i>et al.</i> 2014
<i>T. trioculatum</i> Winterbottom, Erdmann & Cahyani, 2015	MT999564	Raja Ampat, Indonesia	Raja Ampat, Indonesia	Winterbottom <i>et al.</i> 2020
<i>T. unisquame</i> (Gosline 1959)	MT999813	Easter Island, Chile	Oahu Island, Hawaiian Islands	Winterbottom <i>et al.</i> 2020
<i>T. wangunui</i> Winterbottom & Erdmann, 2019	MT999773	Papua New Guinea	Papua New Guinea	Winterbottom <i>et al.</i> 2020
<i>T. winchi</i> Winterbottom, 1984	MT999663	Seychelles islands	Salomon Atoll, Chagos Archipelago	Winterbottom <i>et al.</i> 2020
<i>T. woutsi</i> Winterbottom, 2002	MK658322	Marquesas Islands	Marquesas Islands	Delrieu-trotter, 2019
<i>T. xanthochrum</i> Winterbottom, 2011	HQ579219	Indonesia	Raja Ampat, Indonesia	Winterbottom <i>et al.</i> 2014
<i>T. yanoi</i> Suzuki & Senou, 2008	KJ202513	Palau	Ryukyu Islands, Japan	Winterbottom <i>et al.</i> 2014
<i>T. zurae</i> Winterbottom, Erdmann & Dita Cahyani, 2014	MT999770	North Sulawesi, Indonesia	Sulawesi, Indonesia	Winterbottom <i>et al.</i> 2020
<i>Priolepis semidoliata</i> (Valenciennes 1837)	OR602048	Taiwan	Santa Cruz Islands, Solomon Island	Current study

Colouration while fresh

Head and body with whitish-pale yellow or pink background. Scale pockets outlined with brown melanophores. Head with 4 yellowish vertical bars, scattered with brown melanophores: first bar extending vertically from anteroventral margin of eye to posterior end of maxilla; second bar extending from posteroventral margin of eye to posteroventral of cheek; third bar behind the eye, connecting to band on anterior nape and extending vertically along to middle preopercular, larger dorsally and grading to thin bar ventrally; fourth bar extending from upper posterior opercle to middle of opercle. Mid-anterior of pectoral-fin base with yellowish-orange blotch, two third of diameter-pupil size, and a small blotch, same colour, on upper posteriormost near rays. Snout yellow, lighter anteriorly and darker posteriorly. Iris dark gold with thin yellow margin around pupil. Body with irregular yellow-darker blotches, somewhat larger dorsally, grading to lighter ventrally. Dorsum from first dorsal fin to dorsal procurrent caudal fin with seven yellow-orange bands like saddles, scattered with brown melanophores. Ventral from origin of anal fin to

ventral procurrent caudal fin with five diffuse yellowish or reddish-orange bands, lighter anteriorly to strong colored posteriorly. Both dorsal fins with two yellowish orange or reddish-orange stripes; upper stripe broader; outer margin whitish; first, fifth and sixth spine of first dorsal-fin with small dark reddish spot; spine of second dorsal fin with two small dark reddish spot. Anal fin with broad yellowish-orange or reddish-orange stripe, outer margin whitish. Pectoral and pelvic fins hyaline with yellowish or pinkish rays. Caudal fin with 4 yellowish or reddish-orange stripes, extending posteriorly; sometimes with some small dark reddish spot, dorsal and ventral margin whitish, posterior margin scattered with brown melanophores.

Colouration in preserved (based on holotype). Head and body creamy yellow, marking bars on cheek, nape, pectoral-fin base with brown melanophores. Brown blotches on dorsum strongly colored with brown melanophores anteriorly and fading posteriorly. Ventral body without blotches. Dorsal-fin translucent with black spots on spines; upper posterior margin of second-dorsal fin scattered with brown melanophores. Anal-fin translucent with brown melanophores scattered basally. Pectoral-fin and pelvic-fin translucent. Caudal-fin translucent with brown melanophores scattered on posterior margin of segmented rays.

Distribution

Currently known from the coastal regions of northern to southeastern Taiwan.

Etymology

The specific name, *tigrinum* derived from the latin “*tigris*” meaning tiger, in allusion to the bars and spots on head and body.

Phylogenetic insights.—molecular evidence of the new discrete species by mtDNA

(Figure 3)

Current analysis of partial COI sequences (530 bp) from 81 nominal species of *Trimma* using a Neighbor-Joining method demonstrated that the new species *T. tigrinum* (Genbank accession number: OR817975–OR817978) exhibits the closest genetic similarity to *T. aturiri*, a species from west papua, Indonesia, with the value of genetic distance is 11.9%. Nevertheless, the new species *T. tigrinum* and *T. aturiri* exhibit distinct morphological differences, such as yellowish vertical bars and blotches on the head body of *T. tigrinum*, in contrast to two bluish elongated stripes on the upper and lower margins of the pupil and a bicolored body with a dark red dorsal surface and a white ventral surface. Further different characters are discussed below. In the tree topology, current new species were found not grouped with the species it resembled most morphologically (see Remarks). In addition, given high genetic distance between the new species *T. tigrinum* and the currently available partial COI sequences for *Trimma* species (10.6–24.1%), indicates that an unsequenced, possibly an undescribed one, could be more closely related to the new species. Moreover, all other 6 recognized species of *Trimma* from Taiwan that have been sequenced, including *T. annosum*, *T. caesiura*, *T. grammistes*, *T. macrophthalmus*, *T. naudei* and *T. okinawae* (Genbank accession number: OR807542–OR807543, OR602038–OR602047) were found well separated and each species grouped with other individuals from different localities.

Remarks

The new species *Trimma tigrinum* **sp. nov.** shares similar features with 11 other species of *Trimma* by possessing scales on the predorsal midline, absent cheek scales, an unbranched fifth pelvic-fin ray, and some branched pectoral-fin rays. These species include: *T. anthrenum* Winterbottom, 2006, *T. insularum* Winterbottom & Hoese, 2015, *T. hamartium* Winterbottom, 2018, *T. luteum* Viviani *et al.* 2016, *T. maiandros* Hoese *et al.* 2011, *T. milta*, *T. okinawae*, *T. readereae* Winterbottom & Hoese, 2015, *T. squamicana* Winterbottom, 2004, *T. trioculatum* Winterbottom *et*

al. 2015 and *T. ukkriti* Winterbottom, 2021 (note that in *T. insularum* and *T. maiandros* most specimens predorsal midline scales absent). The new species *T. tigrinum* differs from all them, except for *T. trioculatum*, by possessing darker spots on dorsal fins. In *T. tigrinum*, darker spots smaller size (one third pupil-diameter), surrounded by reddish-orange margin, situated on some spines and segmented rays. The new species also differs from *T. milta* and *T. trioculatum* by having a naked operculum (vs scaled operculum), and higher count of anal-fin rays (9 vs 8). Moreover, four species *T. anthrenum*, *T. insularum*, *T. maiandros* and *T. squamicana* differs by not having two yellowish or reddish vertical bars or spots below the eye. The new species *T. tigrinum* differ further from *T. anthrenum* by having more papillae in row *c* (6 vs 5) and no dark line through the eye (vs a dark line through middle of eye). It also differs from *T. maiandros* by having higher count of anal-fin (9 vs 8), first segmented ray of second dorsal-fin branched (vs unbranched). The new species can be distinguished from *T. insularum*, *T. readereae*, and *T. squamicana* by having no elongated spine of the first dorsal fin (vs slightly elongated reaching from at least the 2nd to end ray of the second dorsal-fin). It also differs further from *T. okinawae*, and *T. readereae* by having more papillae in row *c* (6 vs 5) and higher count of predorsal midline scales (7–8 vs 2–6). *T. hamartium* from current new species *T. tigrinum* in having a higher count of transverse scales row (8–9 vs 6–7), fifth ray of pelvic-fin 51–64% length of fourth (40–50% length of fourth ray). *T. tigrinum* also differs from *T. luteum* by having a lower number of rays in the second dorsal-fin (9 vs 10).

Trimma tigrinum has most similar color patterns with *T. ukkriti*, species from Thailand, when fresh. The two species also share similar characters in having same count elements of both dorsal-fin and anal-fin, longitudinal scale rows, predorsal midline scales, no scales on operculum and papillae number in row *c*. In coloration, *T. tigrinum* can be distinguished from *T. ukkriti* by possessing two yellowish vertical bars below the eye (vs possessing spots in the same position); mid-anterior of pectoral-fin base with yellowish-orange blotch, two third of diameter-pupil size (vs two small spots); two yellowish elongated stripes in both dorsal-fins with spine of second dorsal spine has two small dark spots surrounded red margin (vs no such stripe in both dorsal-fins, second dorsal-fin with 1–2 rows of orange/red elongate spots along spine and rays, vague distally); dorsally, from first dorsal-fin to dorsal procurrent caudal-fin with 7 large yellow-orange blotches across the dorsum, and ventrally, from anal-fin origin to ventral procurrent caudal-fin with 5 diffuse yellowish-orange or reddish-orange blotches (vs dorsum across by 8 smaller yellowish blotches, and ventral with 6 diffuse yellowish blotches or sometimes faded forming a stripe or smaller spots). It further differs from *T. ukkriti* by having lower pectoral-fin rays and transverse scale rows (16–19, modally 18 vs 19–20, modally 19 and 6–7 vs 8–9, respectively).

Moreover, the new species is also similar to *T. quadrimaculatum* Hoese *et al.* 2015, in patterns of bars and blotches on head and body. However, *T. quadrimaculatum*, species from Red Sea, has darker brown bars and blotches on head body whereas *T. tigrinum* has yellowish orange bars and blotches. That species also differs relatively in body size, largest specimen reaching only 16.8 mm SL whereas *T. tigrinum* largest reaching 27.6 mm SL. Further characters differences in *T. tigrinum* and *T. quadrimaculatum* include number rays of first dorsal-fin and second dorsal-fin (9 and 9 vs 8 and 7, respectively), having some branched pectoral-fin rays (vs unbranched pectoral-fin rays), having fifth ray of pelvic-fin unbranched and shorter (vs fifth ray of pelvic-fin with two branches dichotomous, and 40–50% length of fourth ray vs 70–90%, respectively).

Diagnostic key to all nominal species of *Trimma* from Taiwan

1a.	Predorsal midline scaleless.	2
1b.	Predorsal midline with some scales or fully scaled	4
2a.	Lateral side of body with dark stripe	<i>T. grammistes</i>
2b.	Lateral side of body without dark stripe.	3
3a.	P 17–19; TR 8–9; P base with three dark spots	<i>T. macrophthalmus</i>
3b.	P 16; TR 7; P base without dark spot	<i>T. anaima</i>
4a.	P rays some branched	5
4b.	P rays unbranched.	9
5a.	Interorbital with trench between and posterodorsal to the eyes	6
5b.	No trench or groove between and posterodorsal to the eyes	<i>T. milta</i>
6a.	Opercle with 1–3 cycloid scales	7
6b.	Scale on upper opercle absent	8
7a.	Second spine of D1 elongated; P base with dark bar	<i>T. naudei</i>
7b.	Second spine of D1 not elongated; P base without dark bar	<i>T. caesiura</i>

- 8a. PreD 7–9; 5, 8–9 and 8–9 papillae in row *c*, *b* and *d*, respectively; spines of dorsal-fin with black spots surrounded reddish margin. *T. tigrinum* sp. nov.
- 8b. PreD 2–6; 5, 5–6 and 5–6 papillae in row *c*, *b* and *d*, respectively; spines and rays with yellowish-orange spots . . . *T. okinawae*
- 9a. Cheek with scale rows, P 14–15; large black-reddish blotch on C base *T. caudomaculatum*
- 9b. Cheek without scale; P 17–19; no such blotch on C base *T. annosum*

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APPENDIX I

Other comparative materials examined of nominal species *Trimma* from Taiwan.

Trimma anaima Winterbottom, 2000

NTOUP-2010-09-453, 1 (12.8 mm SL), Houbihu, Hengchun township, Pingtung county, Taiwan. coll. M. K. Chiang. 27 May 2010; NTOUP-2010-09-458, 1 (12.6 mm SL), Houbihu, Hengchun township, Pingtung county, Taiwan. coll. M. K. Chiang. 27 May 2010; NTOUP-2010-09-459, 1 (12.3 mm SL), Houbihu, Hengchun township, Pingtung county, Taiwan. coll. M. K. Chiang. 27 May 2010.

Trimma annosum Winterbottom, 2003

NTOUP-2020-07-162, 6 (16.7–22.5 mm SL), Longdong, Gongliao District, New Taipei City, Taiwan, depth 14–18 m, coll. T. Harefa and LH. Chen, 01 July 2020; NTOUP-2020-09-056, 2 (21.4–21.6 mm SL), Xiji Island, WangAn Township, Penghu County, Taiwan, depth 10–15 m. coll. T. Harefa and LH. Chen, 12 September 2020; NTOUP-2020-09-057, 1 (17.7 mm SL), JiangJunAo Island, WangAn Township, Penghu County, Taiwan, depth 5–7 m, coll. T. Harefa and YY. Shia, 15 September 2020; NTOUP-2020-09-064, 3 (17.7–20.1 mm SL), Jihue, Chenggong Township, Taitung County, Taiwan, depth 6–8 m, coll. T. Harefa, 29 September 2020; NTOUP-2020-12-017, 2 (17.2–18.1 mm SL), Tiaoshi, Nanwan Rd, Hengchun Township, Pingtung County, Taiwan, depth 5–7 m, coll. T. Harefa *et al.*, 14 December 2020; NTOUP-2020-12-018, 2 (17.9–19.0 mm SL), Wanlintong, Hengchun Township, Pingtung County, Taiwan, depth 5–8 m, coll. T. Harefa *et al.*, 14 December 2020; NTOUP-2021-01-064, 1 (18.3 mm SL), Jihue, Chenggong Township, Taitung County, Taiwan, depth 6–7 m, coll. T. Harefa *et al.*, 08 January 2021; NTOUP-2021-04-100, 2 (19.2–20.8 mm SL), Dongyupin Island, WangAn Township, Penghu County, Taiwan, depth 8–12 m, coll. T. Harefa *et al.*, 12 April 2021; NTOUP-2021-07-337, 1 (18.1 mm SL), DongAo, Suao Township, Yilan County, Taiwan, depth 5–8m, coll. T. Harefa and DY. Hong, 30 July 2021; NTOUP-2021-08-066, 7 (20.2–24.5 mm SL), Fongguei, Magong City, Penghu County, Taiwan, depth 8–10 m, coll. T. Harefa and DY. Hong, 14 August 2021; NTOUP-2021-08-071, 3 (21.5–23.5 mm SL), Magong City, Penghu County, Taiwan, depth 8–10 m, coll. T. Harefa and DY. Hong, 17 August 2020; NTOUP-2021-09-230, 10 (18.4–21.2 mm SL), Jihue, Chenggong Township, Taitung County, Taiwan, depth 6–7 m, coll. T. Harefa *et al.*, 24 September 2021; NTOUP-2022-01-056, 1 (17.6 mm SL), Tiaoshi, Hengchun Township, Pingtung County, Taiwan, depth 5–6 m, coll. T. Harefa, *et al.*, 21 January 2022; NTOUP-2022-11-161, 8 (18.3–21.3mm SL), Jihue, Chenggong Township, Taitung County, Taiwan, depth 6–7 m, coll. T. Harefa and DY. Hong., 17 November 2022; NTOUP-2023-01-100, 4 (17.3–20.6 mm SL), Jihue, Chenggong Township, Taitung County, Taiwan, depth 5–6 m, coll. T. Harefa *et al.*, 12 January 2023.

Trimma caesiura Jordan and Seale, 1906

NTOUP-2019-11-081, 1 (21.7 mm SL), Jihue, Chenggong Township, Taitung County, Taiwan, depth 5–6 m, coll. T. Harefa and IS. Chen, 13 November 2019; NTOUP-2020-09-061, 1 (24.1 mm SL), Jihue, Chenggong Township, Taitung County, Taiwan, depth 6–7 m, coll. T. Harefa and IS. Chen, 29 September 2020; NTOUP-2020-09-062, 2 (20.2–22.2 mm SL), Jihue Chenggong Township, Taitung County, Taiwan, depth 6–7 m, coll. T. Harefa and IS. Chen, 29 September 2020; NTOUP-2020-11-095, 1 (28.0 mm SL), Longdong, Gongliao District, New Taipei City, Taiwan, depth 16–18 m, coll. T. Harefa and LH. Chen, 09 November 2020; NTOUP-2021-02-112, 2 (20.6–22.4 mm SL), Jihue, Chenggong Township, Taitung County, Taiwan, depth 6–7 m, coll. T. Harefa, 24 February 2021; NTOUP-2021-08-060, 2 (16.8–19.7mm SL), Maoao, Gongliao District, New Taipei City, Taiwan, depth 10–12 m, coll. T. Harefa and DY. Hong, 09 August 2021; NTOUP-2021-09-223, 4 (15.2–22.4 mm SL), Jihue, Chenggong Township, Taitung County, Taiwan, depth 6–7 m, coll. T. Harefa *et al.*, 24 September 2021; NTOUP-2021-11-145, 1 (26.5 mm SL), Jihue, Chenggong Township, Taitung County, Taiwan, depth 6–7 m, coll. T. Harefa *et al.*, 04 November 2021; NTOUP-2021-11-146, 5 (21.8–24.7 mm SL), Jihue, Chenggong Township, Taitung County, Taiwan, depth 6–7 m, coll. T. Harefa *et al.*, 04 November 2021; NTOUP-2021-12-189, 6 (18.3–25.3 mm SL), Jihue, Chenggong Township, Taitung County, Taiwan, depth 6–8 m, coll. T. Harefa *et al.*, 21 December 2021; NTOUP-2022-01-038, 1 (20.9 mm SL), Hongchaikeng, Hengchun Township, Pingtung County, Taiwan, depth 8–9 m, coll. T. Harefa, *et al.*, 21 January 2022; NTOUP-2022-01-039, 1 (25.2 mm SL), Shanhai, Hengchun Township, Pingtung County, Taiwan, depth 8–9 m, coll. T. Harefa *et al.*, 23 January 2022; NTOUP-2022-11-159, 4 (21.4–25.7 mm SL), Jihue, Chenggong Township, Taitung County, Taiwan, depth 6–8 m, coll. T. Harefa and DY. Hong, 17 November

2022; NTOUP-2022-11-160, 3 (20.1–23.6 mm SL), Jihue, Chenggong Township, Taitung County, Taiwan, depth 5–6 m, coll. T. Harefa and DY. Hong, 17 November 2022; NTOUP-2023-01-097, 6 (19.8–28.4 mm SL), Jihue, Chenggong Township, Taitung County, Taiwan, depth 6–7 m, coll. T. Harefa and DY. Hong, 21 January 2023.

Trimma caudomaculatum Yoshino and Araga, 1975

NMMSTP00165, 1 (21.3 mm SL), Tantzuan, Pingtung, Taiwan, depth 10–20 m, coll. J.P. Chen, 14 April 1986.

Trimma grammistes (Tomiyama, 1936)

NTOUP-2020-08-180, 1 (15.6 mm SL), GongXueYuen, Zhongzheng District, Keelung City, Taiwan, depth 17–18 m, coll. T. Harefa and LH. Chen, 12 August 2020; NTOUP-2020-11-097, 1 (18.4 mm SL), Longdong, Gongliao District, New Taipei City, Taiwan, depth 16–18 m, coll. T. Harefa and LH. Chen, 09 November 2020; NTOUP-2021-05-168, 1 (18.5 mm SL), Longdong, Gongliao District, New Taipei City, Taiwan, depth 14–18 m, coll. T. Harefa and DY. Hong, 17 May 2021; NTOUP-2021-05-057, 1 (14.3 mm SL), Longdong, Gongliao District, New Taipei City, Taiwan, depth 18–20 m, coll. T. Harefa and DY. Hong, 21 May 2021; NTOUP-2021-05-174, 1 (22.3 mm SL), 82.5KM, Ruifang District, New Taipei City, Taiwan, depth 18–20 m, coll. T. Harefa and DY. Hong, 17 May 2021; NTOUP-2021-05-175, 1 (21.4 mm SL), 82.5KM, Ruifang District, New Taipei City, Taiwan, depth 18–20 m, coll. T. Harefa and DY. Hong, 17 May 2021; NTOUP-2021-07-334, 3 (16.2–16.9 mm SL), Maoao, Gongliao District, New Taipei City, Taiwan, depth 10–12 m, coll. T. Harefa and DY. Hong, 16 July 2021; NTOUP-2021-07-339, 1 (16.8 mm SL), Maoao, Gongliao District, New Taipei City, Taiwan, depth 12–16 m, coll. T. Harefa and DY. Hong, 15 July 2021; NTOUP-2021-08-057, 1 (14.3 mm SL), Longdong, Gongliao District, New Taipei City, Taiwan, depth 18–20 m, coll. T. Harefa and DY. Hong, 05 August 2021; NTOUP-2021-05-175, 2 (16.8–17.2 mm SL), 82.5 KM, Ruifang District, New Taipei City, Taiwan, depth 16–18 m, coll. T. Harefa *et al.*, 12 April 2022; NTOUP-2022-06-074, 4 (14.8–17.1 mm SL), Longdong, Gongliao District, New Taipei City, Taiwan, depth 20–22 m, coll. DY. Hong and YC. Yan, 28 June 2022.

Trimma macrophthalmus (Tomiyama, 1936)

NTOUP-2020-08-184, 1 (19.5 mm SL), GongXueYuen, Zhongzheng District, Keelung City, Taiwan, depth 17–18 m, coll. T. Harefa and LH. Chen, 12 August 2020; NTOUP-2020-09-066, 2 (14.4–14.5 mm SL), Xiji Island, WangAn Township, Penghu County, Taiwan, depth 12–15 m, coll. T. Harefa and LH. Chen, 12 September 2020; NTOUP-2020-11-098, 1 (17.2 mm SL), Pingtung County, Taiwan, coll. IS. Chen, 16 July 2008; NTOUP-2022-01-042, 7 (18.2 mm SL), Hongchaikeng, Hengchun Township, Pingtung County, Taiwan, depth 17–18 m, coll. T. Harefa *et al.*, 23 January 2022; NTOUP-2022-01-042, 1 (18.2 mm SL), HeJie, Hengchun Township, Pingtung County, Taiwan, depth 17–18 m, coll. T. Harefa *et al.*, 23 January 2022; NTOUP-2022-01-043, 7 (13.6–18.0 mm SL), HeJie, Hengchun Township, Pingtung County, Taiwan, depth 17–18 m, coll. T. Harefa *et al.*, 23 January 2022.

Trimma milta Winterbottom, 2002

NMMB-P026921, 1 (17.6 mm SL), Lanyu, Taitung, Taiwan. coll. K. Koeda. 10 September 2017.

Trimma naudei Smith, 1957

NTOUP-2020-12-019, 1 (20.5 mm SL), Tiaoshi, Nanwan Rd, Hengchun Township, Pingtung County, Taiwan, depth 5–6 m, coll. T. Harefa *et al.*, 04 December 2020; NTOUP-2021-02-113, 1 (24.9 mm SL), Jihue, Chenggong Township, Taitung County, Taiwan, depth 6–7 m, coll. T. Harefa, 24 February 2021; NTOUP-2021-07-332, 1 (22.5 mm SL), Longdong, Gongliao District, New Taipei City, Taiwan, depth 8–12 m, coll. T. Harefa and DY. Hong, 14 July 2021; NTOUP-2021-08-064, 2 (18.5–19.8 mm SL), Maoao, Gongliao District, New Taipei City, Taiwan, depth 10–12 m. coll. T. Harefa and DY. Hong, 09 August 2021; NTOUP-2022-01-041, 1 (21.8 mm SL), HeJie, Hengchun Township, Pingtung County, Taiwan, depth 17–18 m. coll. T. Harefa *et al.*, 21 January 2022; NTOUP-2022-01-044, 1 (22.8 mm SL), Tiaoshi, Nanwan Rd, Hengchun Township, Pingtung County, Taiwan, depth 5–6 m. coll. T. Harefa *et al.*, 21 January 2022; NTOUP-2022-01-045, 1 (23.6 mm SL), Hongchaikeng, Hengchun Township, Pingtung County, Taiwan, depth 8–12 m. coll. T. Harefa *et al.*, 22 January 2022. NTOUP-2022-02-165, 2 (21.4–23.2 mm SL), Longdong, Gongliao District, New Taipei City, Taiwan. coll. T. Harefa *et al.*, 12 February 2022.

Trimma okinawae (Aoyagi, 1949)

NTOUP-2020-06-133, 3 (20.2–24.3 mm SL), Longdong Bay, Gongliao District, New Taipei City, Taiwan, depth 14–18 m coll. T. Harefa and LH. Chen, 11 June 2020;

NTOUP-2020-06-136, 1 (24.8 mm SL), GongXueYuen, Zhongzheng District, Keelung City, Taiwan, depth 15–17

m, coll. T. Harefa and LH. Chen, 27 June 2020 NTOUP-2020-07-161, 5 (18.8–22.6 mm SL), Longdong, Gongliao

District, New Taipei City, Taiwan, depth 16–18 m, coll. T. Harefa and LH. Chen, 01 July 2020; NTOUP-2020-07-

164, 10 (19.8–24.4 mm SL), GongXueYuen, Zhongzheng District, Keelung City, Taiwan, depth 14–16 m, coll. T.

Harefa and LH. Chen, 02 July 2020; NTOUP-2020-08-176, 1 (25.8 mm SL), GongXueYuen, Zhongzheng District,

Keelung City, Taiwan, depth 15–18 m, coll. T. Harefa and LH. Chen, 12 August 2020; NTOUP-2020-08-179, 1

(21.8 mm SL), GongXueYuen, Zhongzheng District, Keelung City, Taiwan, depth 15–18m, coll. T. Harefa and LH.

Chen, 14 August 2020; NTOUP-2020-08-185, 7 (21.8–24.8 mm SL) GongXueYuen, Zhongzheng District, Keelung

City, Taiwan, depth 15–18m, coll. T. Harefa and LH. Chen, 21 August 2020; NTOUP-2020-09-058, 4 (19.8–23.1

mm SL), Longdong, Gongliao District, New Taipei City, Taiwan, depth 16–18 m, coll. T. Harefa and LH. Chen,

18 September 2020; NTOUP-2020-09-063, 2 (18.5–19.2 mm SL), Jihue , Chenggong Township, Taitung County,

Taiwan, depth: 6–7 m, coll. T. Harefa, 29 September 2020; NTOUP-2021-04-101, 5 (18.8–21.9 mm SL), Maoao,

Gongliao District, New Taipei City, Taiwan, depth 10–12m, coll. T. Harefa and DY. Hong, 30 April 2021; NTOUP-

2021-05-169, 2 (22.5–23.3 mm SL), DongAo, Suao Township, Yilan County, Taiwan, depth 5–8 m, coll. T. Harefa

and DY. Hong, 17 May 2021; NTOUP-2021-05-172, 14 (19.5–23.1 mm SL), 82.5 KM, Ruifang District, New

Taipei City, Taiwan, depth 18–20m, coll. T. Harefa and DY. Hong, 17 May 2021; NTOUP-2021-06-278, 6 (20.4–

24.2 mm SL), Xianglan, Gongliao District, New Taipei City, Taiwan, depth 10–12m, coll. T. Harefa and DY. Hong,

10 June 2021; NTOUP-2021-06-281, 6 (21.1–24.3 mm SL), Maoao, Gongliao District, New Taipei City, Taiwan,

depth 12–16m, coll. T. Harefa and DY. Hong, 24 June 2021; NTOUP-2021-07-335, 1 (22.8 mm SL), DongAo, Suao

Township, Yilan County, Taiwan, depth 5–8m, coll. T. Harefa and DY. Hong, 30 July 2020; NTOUP-2021-09-229,

1 (21.3 mm SL), Jihue, Chenggong Township, Taitung County, Taiwan, depth: 5–6 m, coll. T. Harefa and DY. Hong,

25 September 2021; NTOUP-2022-11-156, 1 (22.6 mm SL), Jihue, Chenggong Township, Taitung County, Taiwan,

depth 6–7 m, coll. T. Harefa and DY. Hung., 17 November 2023; NTOUP-2023-01-101, 1 (20.6 mm SL), Jihue,

Chenggong Township, Taitung County, Taiwan, depth 6–7 m, coll. T. Harefa *et al.*, 12 January 2023.