*Zootaxa* 5738 (1): 048–061
https://www.mapress.com/zt/
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**Article**

ISSN 1175-5326 (print edition)
**ZOOTAXA**
ISSN 1175-5334 (online edition)

https://doi.org/10.11646/zootaxa.5738.1.10
http://zoobank.org/urn:lsid:zoobank.org:pub:AF3A9B59-D182-4F26-B1F3-5FDBCAF4B9D3

# Two new species of marine goby genus *Trimmatom* (Teleostei: Gobiidae) from Taiwan with comments on a newly recorded species

TONISMAN HAREFA[1] & I-SHIUNG CHEN[1,2*]
[1]*Institute of Marine Biology, National Taiwan Ocean University, Keelung, 202301 Taiwan, R.O.C.*
[2]*Center of Excellence for the Oceans, National Taiwan Ocean University, Keelung, 202301 Taiwan, R.O.C.*
*tonisharefa@gmail.com; https://orcid.org/0000-0003-2308-8669*
**Corresponding author: iscfish@gmail.com; https://orcid.org/0000-0002-4190-7720*

## Abstract

Two new species of marine goby of the genus *Trimmatom* Winterbottom & Emery, 1981 are described from coastal waters of Taiwan. *Trimmatom novempunctatus* **sp. nov.** is distinguished from all congeneric species by the following unique combination of features: second dorsal fin rays 8–10; anal fin rays 8–9; pectoral fin rays 13–14; longitudinal scale rows 23; transverse scale rows 5; and pelvic fins with the first to third rays each branched once, the fourth ray elongated posteriorly (reaching beyond the last ray of the anal fin) and the fifth ray 6–10% as long as the fourth; distinctive colorations: the dorsum has a medial row of 9 dark spots extending from the first dorsal fin to the upper procurrent caudal fin, and the ventral side of the body has a medial row of 5 dark spots between the anal fin origin and the end of the caudal peduncle. *Trimmatom tetramaculatus* **sp. nov.** is similarly distinguished by its unique combination of features: second dorsal fin rays 9; anal fin rays 9; pectoral fin rays 18; longitudinal scale rows 23; transverse scale rows 6; and pelvic fin with the first to fourth rays branched and the fourth ray short; distinctive colorations: a short, light-purplish blue band on both sides of the upper opercle (discontinuous across the nape); and four light-purplish blue saddles along the body's upper side. A new distributional record for Taiwan of another member of this genus, *Trimmatom pharus* Winterbottom, 2001, is also documented. A brief comparison of related congeneric species will also be addressed.

**Key words:** coral reef goby, Gobiinae, marine fish, pygmy gobies, taxonomy

## Introduction

The widespread marine gobiid genus *Trimmatom* Winterbottom & Emery, 1981, belonging to the subfamily Gobiinae, consists of seven valid species of small, colorful fish that are generally found associated with coral and rocky reefs (Winterbottom & Emery 1981; Winterbottom 1989, 1990, 2001). The species of this genus are found widely in the Indian Ocean and eastward into the central Pacific Ocean. One of its members, *T. nanus* Winterbottom & Emery, 1981, is one of the smallest fishes in the world (range of specimen size 6.7–11.7 mm SL) (Winterbottom & Emery 1981; Winterbottom 1990; Heemstra *et al*. 2022).

*Trimmatom* was erected for its type species *T. nanus,* as well as *T. offucius* Winterbottom & Emery, 1981, both having been collected from Salomon Atoll and Peros Banhos Atoll in the Chagos Archipelago. Winterbottom (1989) redescribed *T. nanus*, reported additional widespread localities for it in the Western Pacific (as far east as Fiji) and Indian Ocean, and redefined the diagnostic features of the genus. In the same work, he also described three additional species, viz., *T. macropodus* Winterbottom, 1989 from the Great Barrier Reef, Australia, *T. sagma* Winterbottom, 1989 from various parts of the Philippines, as well as Australia's Cocos-Keeling Island and Indonesia's Kepulauan Banda, and *T. zapotes* Winterbottom, 1989 from Australia's Great Barrier Reef, Abaiang Atoll in Kiribati, and Ponape in the Federated States of Micronesia. Winterbottom (1990) considered five of the then-known species to belong to *T. nanus* species complex while also reassigning *Trimma eviotops* Schultz, 1943 to *Trimmatom* as the putative sister group with six other undescribed species. Winterbottom (2001) subsequently described *T. pharus* Winterbottom, 2001, from Seychelles Island, within his newly proposed *T. eviotops* species complex. Gill & Jewett (2004) later relegated *Eviota cornelia* Fricke, 1998, from the Loyalty Islands, New Caledonia, as a synonym of *T. eviotops*.

 *Accepted by M.-F. Yeh: 25 Nov. 2025; published: 30 Dec. 2025*

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*Trimmatom* is distinguished from other gobiid genera by having the first element of the anal-fin ray as a segmented or unsegmented, bilaterally paired element (as opposed to a spine), a fifth pelvic-fin ray that is unbranched and no more than 20% as long as the fourth ray, and no scales on the head, breast or pectoral fin base (Winterbottom & Emery 1981; Winterbottom 1989, 1990, 2001). *Trimma* Jordan and Seale, 1906, most closely resembles the genus but differs in having an anal-fin spine, a scaled breast and a fifth pelvic-fin ray that is branched or unbranched with >40% as long as the fourth ray (Winterbottom and Emery 1981; Winterbottom 1984; Winterbottom & Hoese 2015).

The earliest record of any species of *Trimmatom* in Taiwan was that of Winterbottom (1989), who designated a specimen from Kenting, near the southern tip of the island, as a paratype of *T. macropodus*. Besides that, Hsu *et al*. (2013) recorded *T. nanus* from Dongsha Island (Pratas Island) in the South China Sea.

More specimens of *Trimmatom* collected during recent SCUBA-based fish surveys in coastal waters of Taiwan have proven under detailed morphological and mitogenomic examination to belong to two undescribed species, which are described herein, and to one additional species that represents a new record for Taiwan.

## Materials & Methods

Fish were collected by hand-net while SCUBA diving. Freshly collected specimens were immersed in ice-cold water for methodology of euthanasia followed Blessing *et al*. (2010) and immediately recorded and photographed.

Fish samples were preserved in 10% seawater-based formalin and later transferred to 70% ethanol for long-term storage. Measurements were taken using digital calipers to the nearest 0.01 mm with the aid of a stereo microscope, following Miller (1988) and are expressed as percentage of standard length (SL) or head length (HL). Meristic counts follow Chen & Shao (1996).

The terminology of the cephalic sensory canals and free neuromast organs (sensory papillae) follows Wongrat & Miller (1991), based on Sanzo (1911). Voucher specimens are deposited in the Pisces collections of National Taiwan Ocean University, Keelung (NTOUP) and at the Biodiversity Research Center Academia Sinica, Taipei (ASIZP). The following abbreviations are used herein: A = anal fin; C= caudal fin; D1 = first dorsal fin; D2 = second dorsal fin; P = pectoral fin; V = pelvic fin; LR= number of longitudinal scale rows; TR = number of transverse scale rows; SDP = number of scales between origin of first dorsal fin and upper margin of pectoral fin base.

## Systematics

### *Trimmatom novempunctatus* Chen & Harefa, sp. nov.

(九斑小磨鰕虎)
(Figs. 1–2)

*Trimmatom macropodus* (not of Winterbottom 1989): 2404 (Taiwan).

#### *Material examined*

**Holotype.** NTOUP-2022-01-136, 1 male (13.6 mm SL), Wanlintong, Hengchun Township, Pingtung County, Taiwan, depth 5–6 m, coll. T. Harefa, H.-E. Li and D.-Y. Hong, 21 January 2022.

#### Paratypes

NTOUP-2020-11-093, 1 (12.1), Tiaoshi, Hengchun Township, Pingtung County, Taiwan, depth 5–7 m, coll. T. Harefa *et al.*, 16 November 2020; NTOUP-2020-11-094, 1 (11.5 mm SL), Wanlintong, Hengchun Township, Pingtung County, Taiwan, depth 5–7 m, coll. T. Harefa *et al.*, 16 November 2020.

NTOUP-2021-12-187, 1 (11.8 mm SL), Jihue, Chenggong Township, Taitung County, Taiwan, depth 6–8 m, coll. T. Harefa *et al*., 21 December 2021.

NTOUP-2022-01-137, 3 (11.2–12.1 mm SL), same locality and date as holotype. NTOUP-2022-01-139, 3 (10.7–12.2 mm SL), Shanhai, Hengchun Township, Pingtung County, Taiwan, depth 8–9 m, coll. T. Harefa *et al*., 23 January 2022.

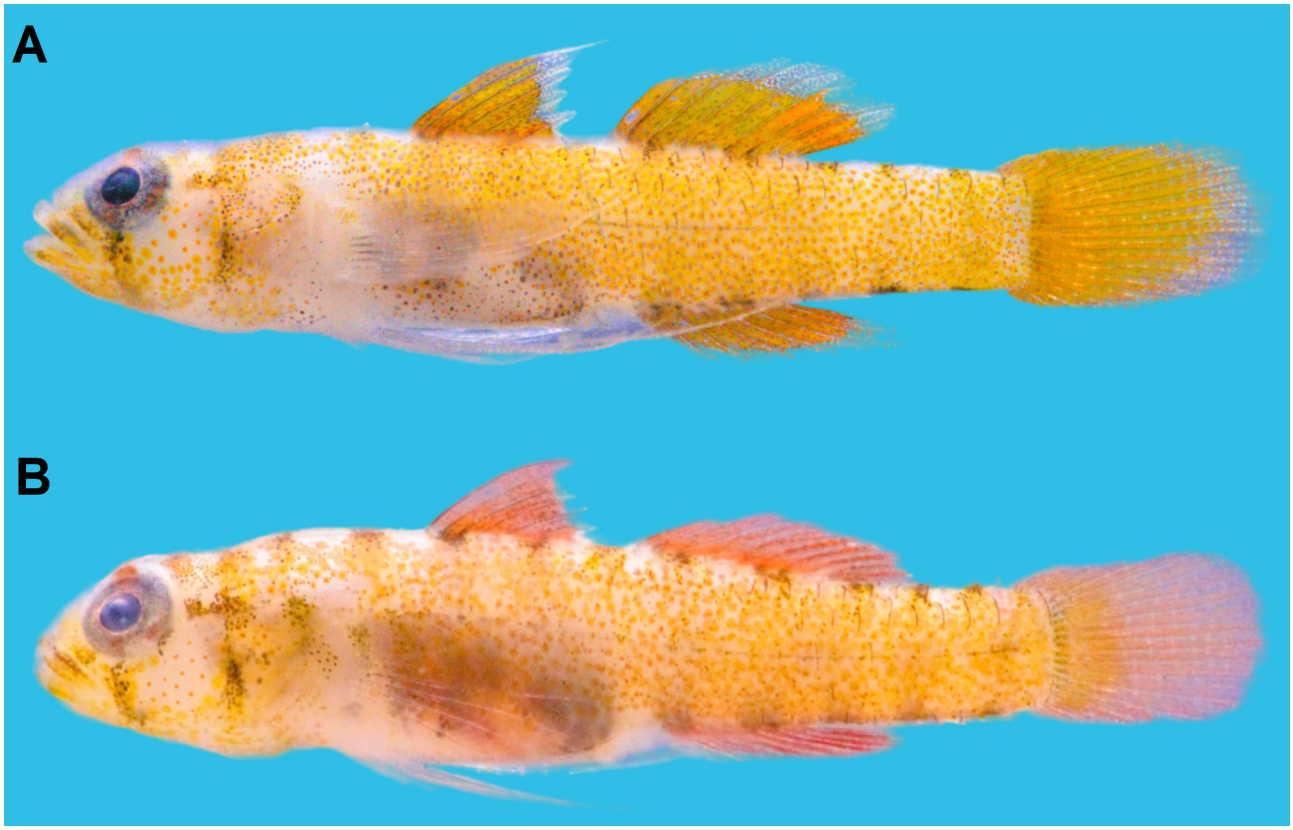


**FIGURE 1.** Fresh specimens of *Trimmatom novempunctatus* **sp. nov.**: (a). male, holotype, NTOUP-2022-01-136, 13.6 mm SL, Wanlintong, Hengchun Township, Pingtung County, Taiwan; (b). female, paratype, NTOUP-2022-01-137, 13.7 mm SL, same locality as holotype.

NTOUP-2022-01-138, 5 (12.2–13.7 mm SL), Wanlintong, Hengchun Township, Pingtung County, Taiwan, depth 5–6 m, coll. T. Harefa *et al.*, 21 January 2022. ASIZP0081795, 2 (12.0–12.2 mm SL), Shanhai, Hengchun Township, Pingtung County, Taiwan, depth 6–7 m, coll. T. Harefa *et al*., 24 January 2022.

NTOUP-2022-11-158, 3 (8.9–9.7 mm SL), Jihue, Chenggong Township, Taitung County, Taiwan, depth 5–6 m, coll. T. Harefa and D.Y. Hong, 17 November 2022. NTOUP-2023-01-098, 1 (12.2 mm SL), Jihue, Chenggong Township, Taitung County, Taiwan, depth 5–6 m, coll. T. Harefa *et al*., 12 January 2023.

**Diagnosis**

*Trimmatom novempunctatus* **sp. nov.** can be well distinguished from congeners by the following unique combination of features: D1 VI; D2 8–10; A 8–9; P 13–14; LR 23; TR 5. Second spine of D1 longest and often elongate, reaching between origin and fourth ray of D2, when depressed; P rays all unbranched; first to third rays of V branched once, fourth and fifth rays unbranched and fourth ray elongated posteriorly (reaching beyond the base of last anal fin ray), fifth ray 6–10% as long as fourth ray. Distinctive coloration: dorsum with nine dark spots in medial row extending from first dorsal fin to upper procurrent caudal fin, and five dense dark spots on ventral side of the body, between anal fin origin and end of caudal peduncle.

**Description**

Morphometric measurements as shown in Table 1. Body elongated, head moderately compressed. Mouth oblique, maxilla extending posteriorly to vertical drawn through mid-pupil. Lower jaw protruding slightly beyond tip upper jaw. Anterior nasal opening with short, tapered tube reaching anteriorly to point above posterior margin of upper lip, posterior opening pore-like with low raised rim. Eyes large, positioned dorsolaterally. Narrow interorbital width with no trenches. Gill opening on each side large, extending anteroventrally to vertical drawn through posterior edge of orbit.

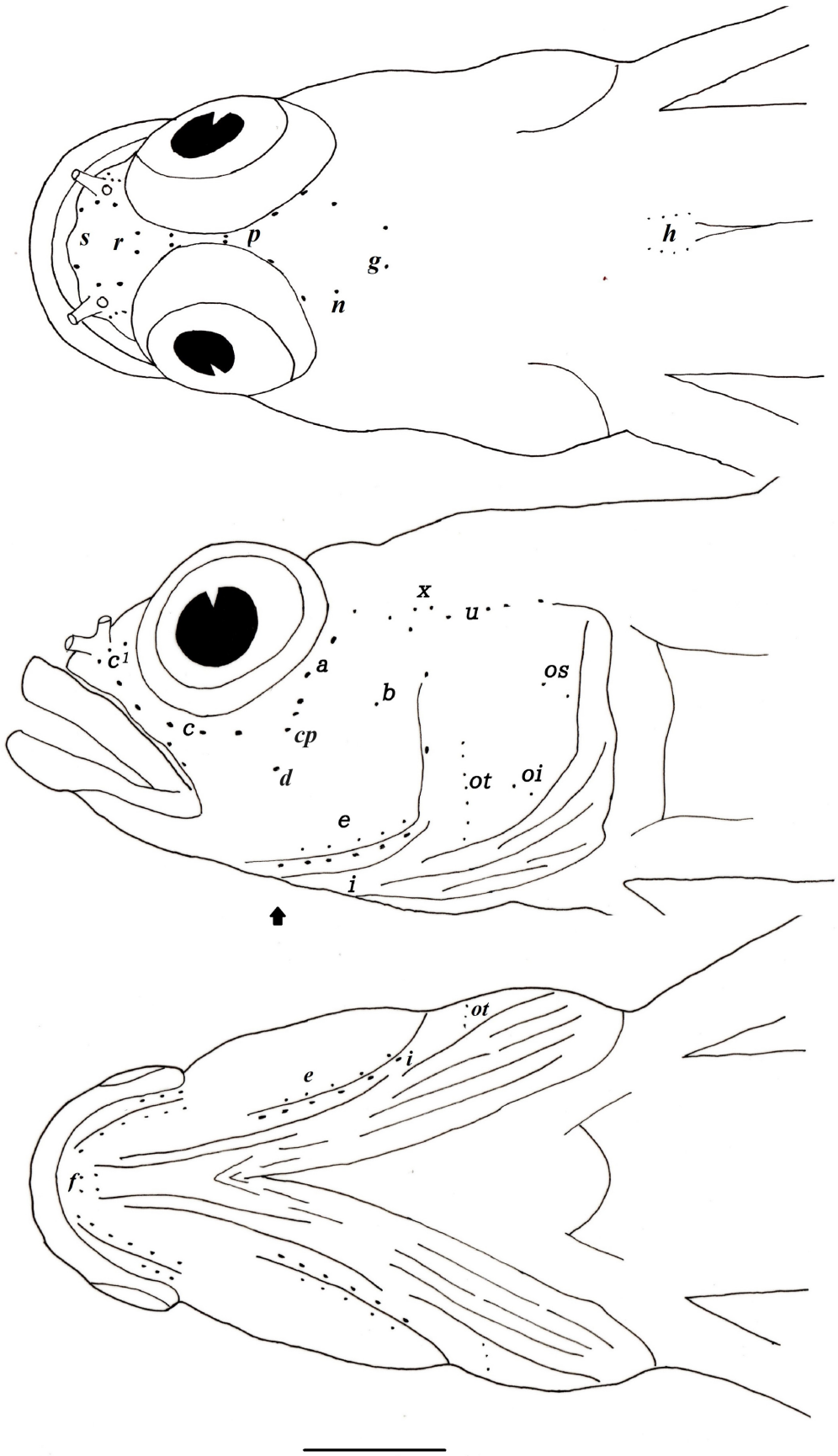


**FIGURE 2.** Head lateral-line system of *Trimmatom novempunctatus* **sp. nov.**, holotype, NTOUP-2022-01-136, 13.6 mm SL. Bar = 1 mm. The arrow indicates the position of ventral edge for the gill opening.

Fins.—Spine and ray counts: D1 VI; D2 8–10; A 8–9; P 13–14; V I/5+I/5. Second spine of D1 longest and often elongate, reaching to point between origin and fourth ray of D2 when depressed. D1 membrane not connected to origin of second dorsal-fin. D2 usually unbranched, but two examined specimens (fourth to sixth rays branched). A origin located below second ray of D2; its rays usually unbranched except fifth ray branched in one examined specimen. P rays unbranched, reaching to vertical drawn through anus. V with no frenum and with vestigial basal membrane; first to third rays each branched once, fourth ray unbranched and elongate (when undamaged reaching beyond the base last ray of anal-fin), fifth ray 6–10% as long as fourth ray.

Scales.—LR 23; TR 5. SDP 0, no scales on mid-predorsal area, nape, cheek or opercle. Body with ctenoid scales.

**Head lateral-line system** (Fig. 2)

*Head canals and pores*. No canal pore on head.

*Sensory papillae*. Sensory papillae or free neuromasts distributed as follows, with counts and ranges shown in parentheses: Row *a* (5) long, extending from posterior to anterior of orbit; rows *b* and *d* (1–2 and 1–2, respectively); row *c* (5) situated longitudinally below infraorbital; single *cp* papillae (1); rows *e* and *i* (8–9 and 13–14, respectively) on pre-operculo-mandibular; row *f* (2 paired papillae) on rostral mandibular; rows *ot, oi* and *os* (6–7, 2 and 2, respectively) on opercular; rows *u*, *x* and *z* (4–5, 3–4 and 1–2, respectively) on nape.

**Coloration while fresh**

Head and body with yellowish-white background bearing scattered black melanophores and reddish-orange spots. Yellowish background with black melanophores also extending posteriorly from upper lip to anterior margin of eye. Cheek with vertical bar of black melanophores and yellow spots extending from below mid-pupil to beyond end of lower jaw. Mid-opercle with vertical bar of black melanophores. Two ovals composed of black melanophores and yellow spots on uppermost and middle parts of posterior side pectoral fin base. Dorsum with medial row of nine dark spots extending from origin of the first dorsal-fin to the upper procurrent caudal-fin. First dark spot located bases of D1 spines 2–3, 2$^{nd}$ at base of D1 spine 6, 3$^{rd}$ between D1 and D2, 4$^{th}$ at bases of D2 rays 2–3, 5$^{th}$ at bases of D2 rays 6–7, 6$^{th}$, 7$^{th}$, and 8$^{th}$ on anterior, middle and posterior parts of caudal peduncle, respectively, and 9$^{th}$ on upper procurrent caudal-fin. Five dark spots in medial row along ventral side of body: 1$^{st}$ at bases of A rays 2–3, 2$^{nd}$ at bases of A rays 6–7, 3$^{rd}$ to 5$^{th}$ on caudal peduncle. P and V translucent. D1, D2, A, and C fin membranes orange-yellow with whitish spots on margins.

**Coloration in preservation**

Head and body with whitish background. Light brown melanophores on body. Most obvious dark marks bars and spots on cheek, nape, mid-opercle, dorsum and ventral body. Dorsal, anal, and caudal fin with scattered melanophores.

**Etymology**

The specific name, which refers to the row of nine of dark spots on the dorsal profile of trunk from D1 fin base to C base, is an adjective derived from Latin '*novem*' (= nine) and '*punctatus*' (= spotted), with an ending masculine to match the generic name.

**Distribution**

*Trimmatom novempunctatus* **sp. nov.** was found from coast of southeastern and southern Taiwan (Fig. 8).

**Remarks**

Winterbottom (1989) described *Trimmatom macropodus* species, with a type locality from Lizard Island, Great Barrier Reef, Australia, and included a paratype from Taiwan (USNM293529). However, he also noted color differences between the Taiwanese and Australian specimens. In this study, through further collection of *Trimmatom* specimens from Taiwanese waters, coupled with morphological and genetic analyses, revealed that the current specimens belong to a distinct species, *Trimmatom novempunctatus* **sp. nov.** Consequently, it is strongly suggested that *T. macropodus* should be strict to the holotype defined from the Australian waters. The two species shares the same ray count in the dorsal, anal and pectoral fin, the same number of longitudinal scale rows, and an elongated fourth ray of the pelvic-fin. The new species differs from *T. macropodus* in having fewer transverse scale rows (5 *vs*

6), and a relatively shorter fifth ray of the pelvic-fin (6–10% as long as the fourth ray *vs* 15%). Moreover, these two species also differ considerably in their coloration in life: *T. novempunctatus* **sp. nov.**, has a vertical bar with black melanophores below the eyes and another on mid-preopercle (*vs* only below the eyes), a greater number of dark spots on dorsum, starting from the first dorsal fin to upper procurrent caudal fin (9 *vs* 6) and five dark spots along the ventral side of body (*vs* faintly visible markings).

*Trimmatom novempunctatus* **sp. nov.** is easily distinguished from *T. nanus*, *T. offucius* and *T. sagma* by the presence of body scales (*vs* scaleless). Among its scale-bearing congeners, it can be distinguished from *T. zapotes* by having fewer number of longitudinal scales rows (23 *vs* 24–25) and once-branched first to third rays of pelvic-fin (*vs* all pelvic-fin rays unbranched). It can be distinguished from three other scaled species, *T. eviotops, T. tetramaculatus* and *T. pharus*, by the elongated fourth ray of its pelvic fin, which reaches posteriorly beyond the base of last anal-fin ray (*vs* short and reaching posteriorly only to the anus or the origin of the anal-fin)

### *Trimmatom tetramaculatus* Harefa & Chen, sp. nov.

(四帶小磨鰕虎)
(Figs. 3–4)

#### *Material examined*

**Holotype.** NTOUP-2022-11-157, 1 female (12.6 mm SL), Jihue, Chenggong Township, Taitung County, Taiwan, depth 5–6 m, coll. T. Harefa and D.Y Hong, 17 November 2022.

#### Diagnosis

*Trimmatom tetramaculatus* **sp. nov.** can be well distinguished from congeners by the following unique combination of features: D1 VI; D2 9; A 9; P 18; LR 23; TR 6. Second spine of D1 longest but not reaching origin of D2 when depressed; P rays unbranched; first to fourth rays of V branched once, fifth ray unbranched 12% as long as fourth. Distinctive colorations: a short, light–purplish-blue band on each side of upper opercle but not connected across nape; upper side of body with four broad, light-purplish-blue vertical bands.

#### Description

Morphometric measurements as shown in Table 1. Body elongated; head moderately compressed. Mouth oblique, maxilla extending posteriorly to vertical drawn through mid-pupil. Lower jaw protruding slightly beyond tip upper jaw. Anterior nasal with short, tapered tube reaching anteriorly to above posterior margin of upper lip, posterior opening pore-like with low raised rim. Eyes large, situated dorsolaterally. Narrow interorbital width with no trenches. Gill opening on each side large, extending anteroventrally to vertical drawn through posterior edge of orbit.

Fins.—Spine and rays counts: D1 VI; D2 9; A 9; P 18; V I/5+I/5. Second spine of D1 longest but not elongated and not reaching origin of D2, when depressed. D1 membrane not connected to origin of second dorsal fin. Both D2 and A unbranched. A origin located below second ray of D2. P rays unbranched, reaching to vertical drawn through anus. V without frenum, basal membrane vestigial; first to fourth rays each branched once, fourth ray longest and reaching anus, fifth ray 12% as long as fourth ray and unbranched

Scales.—LR 23; TR 6; SDP 0, no scales on mid-predorsal, nape, cheek or opercle. Body with ctenoid scales.

#### Head lateral-line system (Fig. 4)

*Head canals and pores*. No canal pores on head.

*Sensory papillae*. Sensory papillae or free neuromasts distributed as follows, with counts and ranges shown in parentheses: row *a* (4) long, extending from posterior to anterior of orbit; rows *b* abraded. Row *d* (3); row *c* (5) present longitudinally below infraorbital; single *cp* pappillae (1); rows *e* and *i* (21 and 12, respectively) on preoperculo-mandibular; row *f* (2 paired papillae) on rostral mandibular; rows *ot, oi* and *os* (7, 2 and 2, respectively) on opercular; rows *u, x* and *z* (4, 4 and 3, respectively) on oculoscapular.

#### Coloration while fresh

Head and body with light-purplish-blue background. Cheek with two light-orange vertical bands and scattered brown spots, space between bands with dense tiny, oval, brown spots. Opercle with orange band extending vertically

to anterior part of dorsum. Both sides of upper opercle with short light-purplish-blue band, these being discontinuous across nape. Body with four broad, orange-reddish vertical bands: 1st and 2nd band separated ventrally but joined dorsally; connected to contralateral band through bases of D1 spines 4–6; 3rd band joined ventrally to 2nd band, connected to contralateral bands through bases of D2 rays 2–5; 4th band joined to 3rd band in lower half of body, connected to contralateral band through posterior end of second dorsal fin. Four light-purplish-blue wedge-like spaces between these bands on upper half of body: 1st wedge connected to contralateral wedge at origin of D1; 2nd between D1 and D2; 3rd through D2 rays 5–9; situated on caudal peduncle, with extension onto procurrent caudal fin. Base of P orange, with two spots from brown melanophores spots on upper and lower posterior margins. D1 spine red with reddish stripe near base of fin. D2 rays red with stripe extending from 1st to 5th ray near base of fin. Other fins: A translucent with rays reddish near their bases; P and V translucent; C reddish but translucent near margin.

**Coloration in preservation**

Head and body whitish background. Check with scattered melanophores, with two brown bars. Upper opercle and anterior nape with cluster of brown melanophores. Pectoral fin with two brown blotches melanophores on upper and lower base. Body with four broad brown bands. Caudal peduncle with scattered brown melanophores. Dorsal fin translucent, anal fin and caudal fin with scattered dark brown melanophores.

**Etymology**

The specific name, which refers to the four light-purplish-blue on uppers side of body, is a compound participle derived from Greek '*tetra'* (combining form for 'four'), and Latin '*maculatus'* (= stained), with an ending masculine to match the generic name.

**Distribution**

*Trimmatom tetramaculatus* **sp. nov.** was found from reefs of Taitung, southeastern Taiwan (Fig. 8).


**FIGURE 3.** *Trimmatom tetramaculatus* **sp. nov.**, female, holotype, NTOUP-2022-11-157, 12.6 mm SL, Jihue, Chenggong Township, Taitung County, Taiwan: (a) fresh and (b) preserved one.

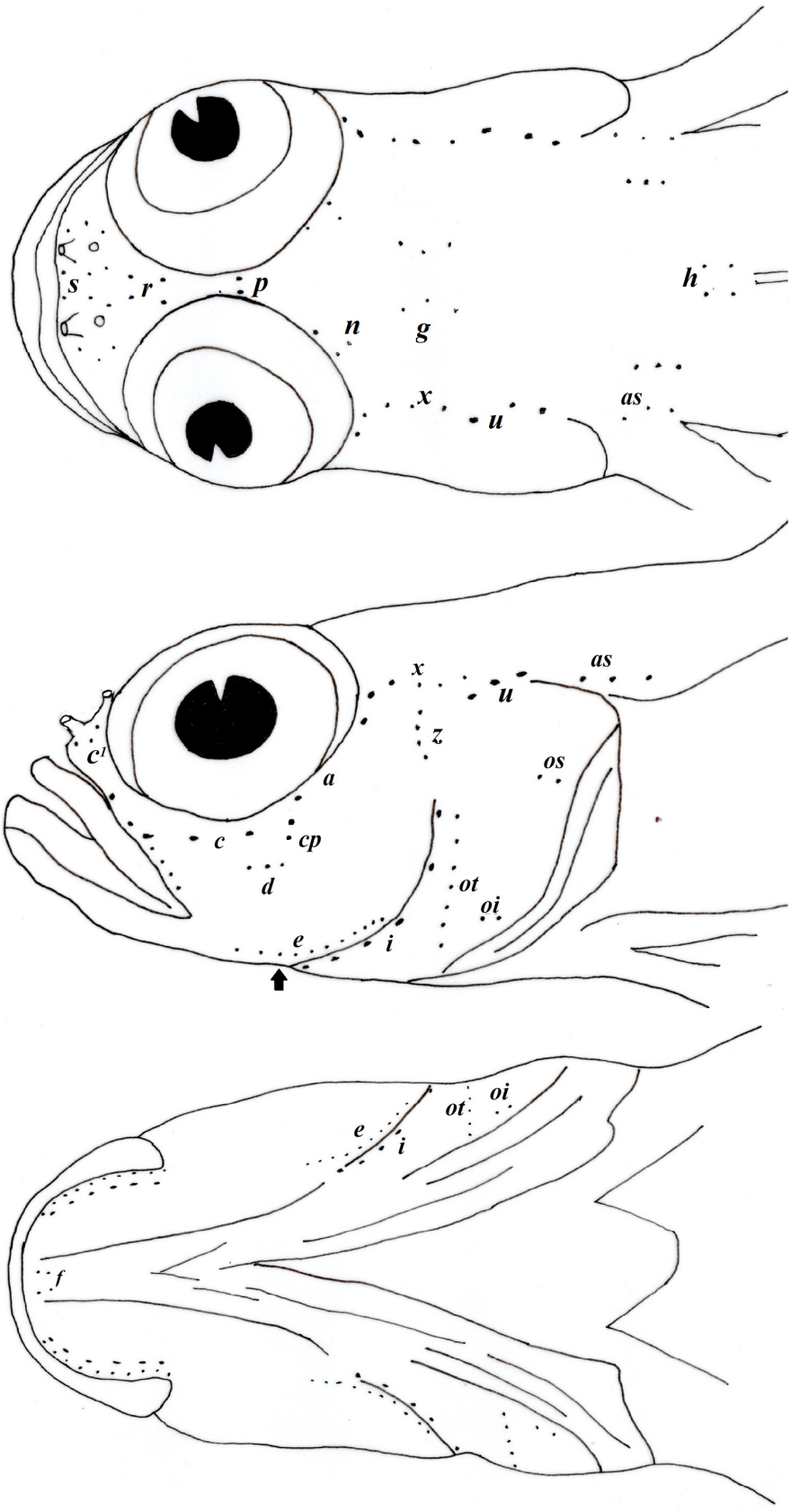


**FIGURE 4.** Head lateral-line system of *Trimmatom tetramaculatus* **sp. nov.**, holotype, NTOUP-2022-11-157, 12.6 mm SL. Bar = 1 mm. The arrow indicates the position of ventral edge for the gill opening.

**Remarks**

*Trimmatom tetramaculatus* **sp. nov.** can be distinguished immediately from *T. nanus, T. offucius* and *T. sagma* by the presence of body scales. It differs from *T. nanus* in having higher counts of pectoral-fin rays (18 *vs* 14–16). *T. offucius* differs from *T. tetramaculatus* in having higher counts of pectoral fin rays (19–22 *vs* 18) and higher counts of second dorsal-fin rays (10–12 *vs* 9). The new species also can be distinguished from *T. sagma* by having fewer rays of both second-dorsal fin (9 *vs* 11–12) and anal-fin (9 *vs* 10–12). Among its scale-bearing congeners, *T. tetramaculatus* can be distinguished from *T. zapotes* by having fewer longitudinal scale rows (23 *vs* 24–25), more rays in pectoral-fin (18 *vs* 12–13), first to fourth rays of pelvic-fin each branched once (*vs* all pelvic-fin rays unbranched), and a relatively shorter fifth ray of the pelvic-fin (<10% as long as fourth ray *vs* 12%).

It can be distinguished from *T. novempunctatus* and *T. macropodus* by its higher counts of pectoral-fin ray (18 *vs* 13–14) and the shorter fourth ray of its pelvic-fin, which reaches posteriorly only to anus (*vs* elongate, reaching posteriorly beyond the base of last anal-fin ray). *T. tetramaculatus* differs further from *T. novempunctatus* in having more transverse scale rows (6 *vs* 5), and a relatively longer fifth ray of the pelvic-fin (12% as long as fourth ray *vs* 6–10%). Finally, it differs from *T. pharus tetramaculatus* in having fewer transverse scale rows (6 *vs* 7) and a different coloration pattern (body with 4 orange-reddish vertical bands *vs* 9–10 such bands).

*Trimmatom tetramaculatus* **sp. nov.**, is rather similar in coloration to *T. eviotops* in that both species have broad vertical bands on the upper side of body. They also both have branched first to fourth rays of pelvic-fin and unbranched fifth ray as well as identical ray counts in the anal- and pectoral-fins. However, *T. tetramaculatus* differs from *T. eviotops* in having fewer longitudinal scale rows (23 vs 26–27), fewer transverse scales rows (6 *vs* 8), fewer second dorsal-fin rays (9 *vs* 10–11). Differences in coloration include: the lack in *T. tetramaculatus* of any connection across the nape of the short light-purplish-blue bands on both sides of upper opercle (*vs* similar bands connected across the nape) and the presence of four (*vs* five) light-purplish-blue vertical band on the upper side of the body.

***Trimmatom pharus* Winterbottom, 2001**

(Figs 5–6)

***Material examined***

NTOUP-2021-12-247, 1 female (12.4 mm SL), Longdong, Gongliao District, New Taipei City, Taiwan, depth 12–15 m, coll. H.E. Li, T. Harefa and D.Y. Hong, 09 December 2021.

**Diagnosis**

*Trimmatom pharus* can be well distinguished from congeners by the following unique combination of features: D1 VI; D2 9; A 9; P 17–20; LR 22; TR 7; SDP 0. Pectoral fin rays unbranched; first to fourth rays of V branched once, fifth ray unbranched and 10–20 % as long as fourth. No scales on cheek, opercle, nape or predorsal. Coloration in life including 9–10 vertical red bands on body.

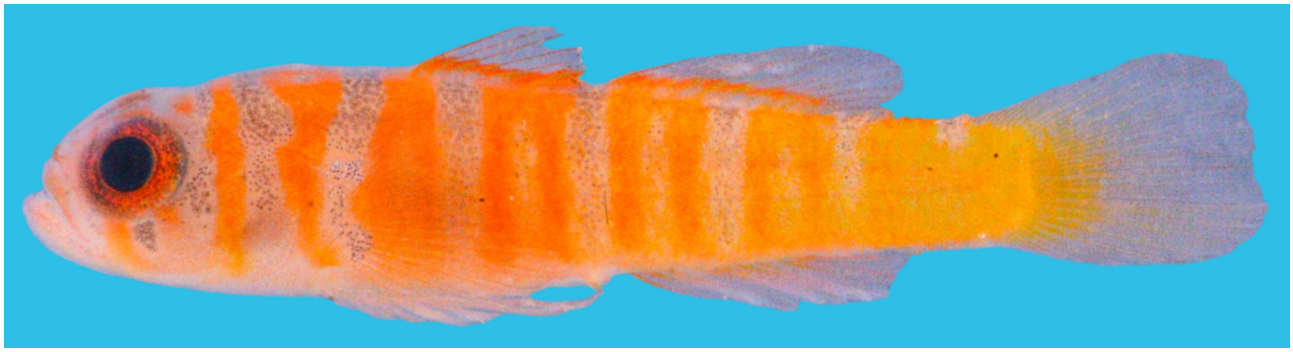

**FIGURE 5.** Fresh specimen of *Trimmatom pharus*, female, NTOUP-2021-12-247, 12.4 mm SL, Longdong, Gongliao District, New Taipei City, Taiwan.

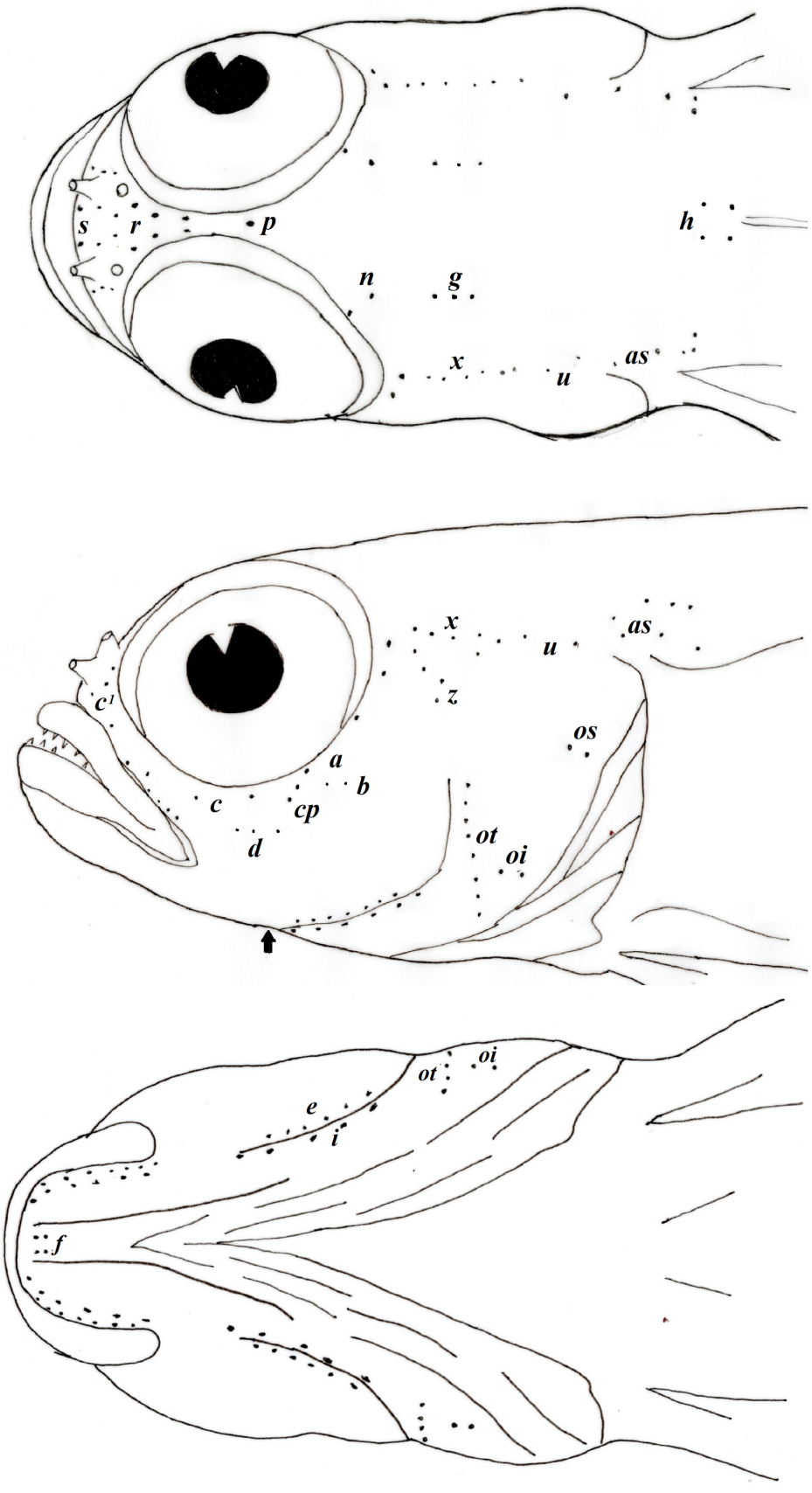


**FIGURE 6.** Head lateral-line system of *Trimmatom pharus*, NTOUP-2021-12-247, 12.4 mm SL. Bar = 1 mm. The arrow indicates the position of ventral edge for the gill opening.

**Distribution**

Besides the type locality Anonyme Island, Seychelles (Fig. 8), this species is widely distributed in the Indo-Pacific, with previous records from Amirante Islands, Chagos Archipelago, Indonesia, Timor Sea, Papua New Guinea, Solomon Island, Australia, Philippines and Japan (Winterbottom 2001; Allen & Adrim 2003; Nakae *et al*. 2018; Heemstra *et al*. 2022).

**Remarks**

The present specimen represents the first record of *T. pharus* from Taiwan. This record fills the gap in the known range of the species and suggests that it might be widely distributed on western Pacific coral reefs. Morphological measurements, meristic counts and a depiction of the head lateral-line system are presented here to augment the available information on this species.

**TABLE 1.** Morphometrics of three *Trimmatom* species found from Taiwan.

| Species | ***T. novempunctatus*** | | ***T. tetramaculatus*** | ***T. pharus*** |
|---|---|---|---|---|
| Sex | male | female | female | female |
| N | 4 | 6 | 1 | 1 |
| Standard length | 12.2–13.6 | 11.8–13.7 | 12.6 | 12.4 |
| % in SL | | | | |
| Head length | 29.1–30.8 (29.8) | 28.8–30.3 (29.4) | 29.3 | 28.3 |
| Snout to 1st dorsal origin | 37.7–40.0 (39.3) | 37.3–39.6 (38.9) | 36.3 | 38.6 |
| Snout to 2nd dorsal origin | 57.1–58.6 (57.6) | 57.6–59.2 (58.3) | 54.1 | 57.7 |
| Snout to anus | 55.3–56.5 (55.7) | 53.2–56.2 (54.7) | 53.8 | 55.1 |
| Snout to anal fin origin | 59.5–60.9 (60.2) | 58.4–61.1 (59.5) | 61.1 | 60.9 |
| Prepelvic length | 29.6–32.7 (32.0) | 29.7–31.7 (30.8) | 27.4 | 30.1 |
| Caudal peduncle length | 18.2–21.2 (19.7) | 18.3–20.2 (19.2) | 22.6 | 19.9 |
| Caudal peduncle depth | 12.0–12.1 (12.0) | 10.5–13.0 (11.9) | 10.8 | 12.7 |
| First dorsal fin base | 11.8–13.0 (12.2) | 11.3–12.9 (11.9) | 14.8 | 10.9 |
| Second dorsal fin base | 17.3–19.2 (17.8) | 17.3–20.0 (18.7) | 20.5 | 18.6 |
| Anal fin base | 14.0–15.5 (14.8) | 13.3–15.2 (14.2) | 18.3 | 24.2 |
| Caudal fin length | 23.5–25.6 (23.9) | 21.7–24.2 (22.9) | 23.1 | 14.9 |
| Pectoral fin length | 27.8–30.7 (28.5) | 26.2–30.5 (27.5) | 20.9 | 25.9 |
| Pelvic fin length | 41.2–46.6 (43.6) | 43.0–48.3 (46.4) | 29.2 | 31.7 |
| Body depth of pelvic fin origin | 18.1–19.0 (18.5) | 17.5–19.8 (18.7) | 21.0 | 21.1 |
| Body depth of anal fin origin | 14.7–15.8 (15.6) | 13.4–15.6 (14.9) | 17.8 | 18.2 |
| Body width of anal fin origin | 8.7–10.8 (9.2) | 8.7–11.3 (10.0) | 10.4 | 11.4 |
| Pelvic fin origin to anus | 23.5–25.7 (23.9) | 22.2–24.6 (23.4) | 26.1 | 19.5 |
| % in HL | | | | |
| Snout length | 16.1–18.4 (17.5) | 15.8–18.7 (17.1) | 8.4 | 7.2 |
| Eye diameter | 26.9–30.1 (29.4) | 26.6–30.9 (28.5) | 43.6 | 30.7 |
| Postorbital length | 42.0–44.7 (43.5) | 40.4–44.3 (42.3) | 42.2 | 34.8 |
| Check depth | 12.0–13.6 (13.0) | 9.9–13.7 (12.1) | 17.7 | 13.9 |
| Head width at upper gill opening | 37.4–40.7 (39.4) | 37.8–42.2 (39.7) | 49.7 | 45.7 |
| Head width in maximum | 61.6–67.6 (65.0) | 58.3–68.5 (63.4) | 72.4 | 74.3 |
| Fleshy interorbital width | 10.9–14.7 (11.6) | 8.8–12.6 (11.0) | 18.3 | 15.5 |
| Bony interorbital width | 0.5–1.1 (0.7) | 0.6–1.4 (1.0) | 3.2 | 1.6 |
| Lower jaw length | 30.8–33.1 (31.8) | 27.7–32.1 (30.2) | 32.0 | 32.4 |

**TABLE 2.** Frequency distributions of certain meristic counts for four nominal species of *Trimmatom* from Taiwan.

| | D2 I/ | | | | A I/ | | | | P | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Species | 8 | 9 | 10 | Av | 8 | 9 | 10 | Av | 13 | 14 | 15 | 16 | 17 | 18 | Av |
| ***T. novempunctatus* sp. nov.** | **1** | **18** | **2** | **9** | **20** | **1** | **-** | **8** | **18** | **3** | **-** | **-** | **-** | **-** | **13** |
| ***T. tetramaculatus* sp. nov.** | **-** | **9** | **-** | **9** | **-** | **1** | **-** | **9** | **-** | **-** | **-** | **-** | **-** | **1** | **18** |
| *T. nanus* | - | - | 4 | 10 | - | - | 4 | 10 | - | - | - | 4 | - | - | 16 |
| *T. pharus* | - | 1 | - | 9 | - | 1 | - | 9 | - | - | - | - | - | 1 | 18 |

*.....continued below*

**TABLE 2.** (Continued)

| | LR | | | | TR | | | | PreD | |
|---|---|---|---|---|---|---|---|---|---|---|
| Species | 0 | 22 | 23 | Av | 5 | 6 | 7 | Av | 0 | Av |
| ***T. novempunctatus* sp. nov.** | **-** | **-** | **21** | **23** | **21** | **-** | **-** | **5** | **21** | **0** |
| ***T. tetramaculatus* sp. nov.** | **-** | **-** | **1** | **23** | **-** | **1** | **-** | **6** | **1** | **0** |
| *T. nanus* | 4 | - | - | 0 | 4 | - | - | 0 | 4 | 0 |
| *T. pharus* | - | 1 | - | 22 | - | - | 1 | 7 | 1 | 0 |

## Diagnostic key to all nominal species of *Trimmatom*

1a. Body scales present . . . . . 2
1b. Body scales absent . . . . . 7
2a. All V rays unbranched . . . . . *T. zapotes*
2b. Some V rays branched . . . . . 3
3a. 1st to 3rd rays of V branched, 4th ray of V elongated, reaching posteriorly to last base of A ray . . . . . 4
3b. 1st to 4th rays of V branched, 4th ray of V not elongated, only reaching anus or origin of A. . . . . 5
4a. TR 5, dorsum from D1 fin base to C base with row of 9 dark spots . . . . . ***T. novempunctatus* sp. nov.**
4b. TR 6, dorsum from D1 fin base to C base with row of 6 dark spots . . . . . *T. macropodus*
5a. Body with 9–10 orange or reddish vertical bands, with narrow dark saddle on caudal peduncle . . . . . *T. pharus*
5b. Body with 4–8 orange or reddish vertical bands, with broad dark saddle on caudal peduncle . . . . . 6
6a. D2 10–11, LR 26–27; dorsal half of trunk with 5 or more bands . . . . . *T. eviotops*
6b. D2 9, LR 23; dorsal half of trunk with 4 bands . . . . . ***T. tetramaculatus* sp. nov.**
7a. D2 9–10, dorsum with no dark saddle . . . . . *T. nanus*
7b. D2 10–12, dorsum with dark saddles . . . . . 8
8a. P 15–19 (usually 20), D2 is crossed by two dark saddles on its base . . . . . *T. sagma*
8b. P 19–22 (usually 17–18), D2 is crossed by single dark saddles on its base . . . . . *T. offucius*

## Acknowledgments

The authors wish to thank all the lab members of R509, Institute of Marine Biology, NTOU (Taiwan), for their help during the marine fish surveys. We also thank Dr. Mark J. Grygier for kindly help with editing and proofreading of the manuscript. This research was conducted under permit No. 1101019460 from Kenting National Park, and under the project from National Academy Marine Research, Kaohsiung, Taiwan.

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## APPENDIX I. Comparative material of *Trimmatom* species.

***Trimmatom nanus* Winterbottom and Emery, 1981.**

**NTOUP-2011-07-203**, 4 specimens (7.1–8.7 mm SL), eastern outside slope of great lagoon, Dongsha Atoll (Pratas Islands), South China Sea, Taiwan. 12–15 m depth. coll. I-S. Chen et al., July 7, 2011.