

Two New Species of *Trimma* (Gobiidae) from the Western Pacific

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Abstract Two new species of *Trimma* from western Pacific coral reefs are described. *Trimma flavatrum* is characterized by the presence of cheek and opercular scales, scales in the midline of the predorsal region, no elongate dorsal fin spines, unbranched pectoral fin rays and a rather broad, shallowly concave, interorbital region with no central fleshy ridge. When alive *T. flavatrum* has red pectoral fins, yellow to reddish-orange dorsal and anal fins, and the caudal fin varies from hyaline to yellow with hyaline to white margins. Preserved specimens are dusky with densely scattered melanophores and chromatophores, the shade intensifying posteriorly to almost black in the peduncular region, and the fins are translucent, with a black basal stripe in the dorsal and anal fins. *Trimma flavatrum* have been found throughout the western Pacific, ranging longitudinally from Palawan to Samoa and latitudinally from the Nansei Islands to Fiji. *Trimma hayashii* is characterized by the absence of predorsal scales in the midline (except in some large specimens >20 mm SL, where 1 or 2 cycloid scales may be present), no opercular or cheek scales, no or only slightly elongate dorsal spines, a few branched pectoral fin rays in the middle of the fin, a moderately developed interorbital trench and no postorbital trench. When alive *T. hayashii* has pupil-diameter sized red spots on the head and nape, and 3 yellow or reddish-orange stripes on the body separated by 2 grey stripes. Uniquely among species of *Trimma* known to date, this species has a ventrally-directed, ocellated, pupil-diameter sized spot on each of the branchiostegal membranes. *Trimma hayashii* ranges longitudinally from the western tip of Java to Kosrae (Federated States of Micronesia), and latitudinally from the Nansei Islands to the Solomons.

Key words: Gobiidae, *Trimma flavatrum*, *Trimma hayashii*, New species, Pacific Ocean

Trimma contains some 85 species of small (less than 30 mm SL), often colourful gobiids, primarily associated with Indo-Pacific coral reefs. *Trimma* may be recognized by the lack of cephalic sensory canal pores, much reduced cephalic sensory papillae pattern, wide gill opening extending to below the vertical limb of the preopercle or anterior to this, lack of spicules on the outer gill rakers of the first gill arch, less than 12 dorsal and anal rays, and a fifth pelvic fin ray that is equal to or more than 40% the length of the fourth pelvic fin ray. There are 48 valid species (Table 1) of *Trimma* and approximately 40 additional species that have yet to be described. However, recent use of rebreather technology to collect fishes is uncovering a rich di-

versity of deep-dwelling (to 100 m) and undescribed species, and the total number of species in the genus can be expected to rise considerably.

Methods

Methods follow Winterbottom (2002), except pectoral and pelvic fin ray branching is described from preserved material stained with a cyanine-blue solution as outlined in Saruwatari *et al.* (1997). Values for holotype in bold where appropriate. Lengths given are standard lengths (SL), and are given in millimeters. Numbers in parentheses after the catalogue numbers for non-type material listed represent the number of specimens in that lot. Institutional codes for repository

Table 1. List of valid species of *Trimma*.

No. species	Species	Author (s)	Date
1	<i>Trimma caesiura</i>	Jordan and Seale	1906
2	<i>Trimma grammistes</i>	(Tomiyama)	1936
3	<i>Trimma macrophthalma</i>	(Tomiyama)	1936
4	<i>Trimma striaa</i>	(Herre)	1945
5	<i>Trimma okinawae</i>	(Aoyagi)	1949
6	<i>Trimma naudei</i>	Smith	1957
7	<i>Trimma unisquamis</i>	(Gosline)	1959
8	<i>Trimma corallina</i>	(Smith)	1959
9	<i>Trimma flammeum</i>	(Smith)	1959
10	<i>Trimma necopinus</i>	(Whitley)	1959
11	<i>Trimma tevegae</i>	Cohen and Davis	1969
12	<i>Trimma avidori</i>	(Goren)	1978
13	<i>Trimma mendelssohni</i>	(Goren)	1978
14	<i>Trimma taylori</i>	Lobel	1979
15	<i>Trimma flavicaudatus</i>	(Goren)	1982
16	<i>Trimma dalerocheila</i>	Winterbottom	1984
17	<i>Trimma haima</i>	Winterbottom	1984
18	<i>Trimma sheppardi</i>	Winterbottom	1984
19	<i>Trimma fraena</i>	Winterbottom	1984
20	<i>Trimma griffithsi</i>	Winterbottom	1984
21	<i>Trimma hoesei</i>	Winterbottom	1984
22	<i>Trimma winchi</i>	Winterbottom	1984
23	<i>Trimma fishelsoni</i>	Goren	1985
24	<i>Trimma emeryi</i>	Winterbottom	1985
25	<i>Trimma winterbottomi</i>	Randall and Downing	1994
26	<i>Trimma rubromaculatus</i>	Allen and Munday	1995
27	<i>Trimma filamentosus</i>	Winterbottom	1995
28	<i>Trimma barralli</i>	Winterbottom	1995
29	<i>Trimma benjamini</i>	Winterbottom	1996
30	<i>Trimma anaïma</i>	Winterbottom	2000
31	<i>Trimma bisella</i>	Winterbottom	2000
32	<i>Trimma omanensis</i>	Winterbottom	2000
33	<i>Trimma halonevum</i>	Winterbottom	2000
34	<i>Trimma stobbsi</i>	Winterbottom	2001
35	<i>Trimma woutsii</i>	Winterbottom	2002
36	<i>Trimma milta</i>	Winterbottom	2002
37	<i>Trimma volcana</i>	Winterbottom	2003a
38	<i>Trimma annosum</i>	Winterbottom	2003b
39	<i>Trimma lantana</i>	Winterbottom and Villa	2003
40	<i>Trimma cana</i>	Winterbottom	2004
41	<i>Trimma sostra</i>	Winterbottom	2004
42	<i>Trimma squamicana</i>	Winterbottom	2004
43	<i>Trimma agrea</i>	Winterbottom and Chen	2004
44	<i>Trimma fangi</i>	Winterbottom and Chen	2004
45	<i>Trimma marinae</i>	Winterbottom	2005a
46	<i>Trimma nasa</i>	Winterbottom	2005a
47	<i>Trimma anthrenum</i>	Winterbottom	2006
48	<i>Trimma preclarum</i>	Winterbottom	2006

ries of material examined follow Leviton *et al.* (1985) with an additional abbreviation: Biological Laboratory, Imperial Household (BLIH).

***Trimma flavatrum* sp. nov.**

(New Japanese name: Hime-aogi-haze)

(New English name: Wasp pygmy goby)

(Figs. 1–6)

Trimma sp. 10: Senou *et al.*, 2004: 114 (Okinawa Islands, Miyako Island, Ishigaki Island, Iriomote Island).



Fig. 1. *Trimma flavatrum*, fresh specimen, 18.1 mm SL male paratype, Amami-oshima Island, Nishikomi Cave, YCM-P39240. Photo by K. Hagiwara



Fig. 2. *Trimma flavatrum*, stock specimen, 23.0 mm SL male holotype, Amami-oshima Island, Nishikomi Cave, YCM-P42599. Photo by K. Hagiwara

Holotype. YCM-P42599, 23.0 mm SL male, Japan, Nansei Islands, Amami-oshima Island, Nishikomi Cave, 28°13'54"N; 129°10'35"E, 8 m, K. Hagiwara, 14 Sep. 2005.

Paratypes. 21 specimens. **Japan (Nansei Islands):** YCM-P34476 (20.6 SL), Amami-oshima Island, Nishikomi Cave, 8 m, Sagami-bay Marine Biological-research Club (SMBC), 31 Aug. 1994. YCM-P36357, (17.3), Kakeroma-jima Island, reef edge in front of Saneku village, 28°11'00"N, 129°11'36"E, 25 m, SMBC, 23 Aug. 1995. YCM-P39240, (18.1), Amami-oshima Island, Nishikomi Cave, 8 m, K. Hagiwara and T. Itoh, 5 Nov. 1999. YCM-P41475, (19.0), Kakeroma Island, reef edge in front of Adachi village, 28°08'37"N, 129°11'48"E, 10 m, SMBC, 2 Sep. 2000. NSMT-P61915, (16.3), Ishigaki-jima Island, Urazoko Bay, 24°27'31"N, 124°14'00"E, 15 m, K. Matsuura, 22 Aug. 1996. BLIH 20010029, (16.9), Ishigaki-jima Island, Yonehara reef, 24°27'36"N, 124°11'16"E, 8 m, Y. Ikeda, K. Sugiyama and K. Hagiwara, 2 July 2001. BLIH 20030044, (21.4), Amami-oshima Island, Nishikomi, 28°13'54"N, 129°10'35"E, T. Yonezawa, 9 Apr. 2003. **Caroline Islands:** ROM 74801, 3

(14.0–15.0), Philippine Sea, Short Drop-off SE of Koror Island, SW corner of Augulpelu Reef, 07°16'28.7"N, 134°31'32.1"E, 13.7–25.9 m, R. Winterbottom, B. Hubley, D. Winterbottom and A. Bauman, 21 May 2004. ROM 74802, 4 (6.7–15.8), Philippine Sea, Short Drop-off SE of Koror Island, SW corner of Augulpelu Reef, 07°16'54.3"N, 134°31'38.7"E, 15.2–26.5 m, R. Winterbottom, W. Holleman, B. Hubley and D. Winterbottom, 28 May 2004. ROM 74926, 3 (14.0–17.1), Philippine Sea, off SE corner of Koror Island, along Short Drop-off, Augulpelu Reef, SW corner, 07°16'26.9"N, 134°31'29.3"E, R. Winterbottom, B. Hubley, A. Bauman and S. Kiefer, 20 May 2004. **Papua New Guinea:** ROM 73442, (12.7), Greater Kimbe Bay, New Britain, 05°53'S, 150°10'E, M Beger, 12 Oct. 2002. ROM 60747, (16.4), Bismark Sea, 5°09'S, 145°50'E, G. Allen, 1 Jan. 1993 **Indonesia:** ROM 64646, (16.6), Sulawesi, Manado, 1°38'N, 124°46'E, 16 m, J. Randall and M. Severans, 29 Oct. 1991. BPBM 36559, 2 (18.8–20.1), Banda Sea, Penyus Islands, Maisel Island, 14 m, J. L. Earle, 23 Oct. 1990.

Non-type material. 116 specimens. **Australia (Great Barrier Reef):** AMS I.19472-089 (1); AMS I.20757-067



Fig. 3. *Trimma flavatrum*, live, Amami-oshima Island, Nishikomi Cave, 8 m. Photo by K. Hagiwara

(1); AMS I.20775-056 (1); AMS I.20779-142 (1); AMS I.22580-025 (1); **Rowley Shoals:** WAM P.28024-33 (1). **Caroline Islands:** USNM 223193 (3); USNM 223195 (3); USNM 298765 (3); BPBM 31421 (4). **Indonesia:** NSMT-P71254 (3); USNM 210240 (3); USNM 244186 (8). **Fiji:** ROM 46001 (2); ROM 46002 (2); USNM 236756 (8). **Japan (Nansei Islands):** YCM-P34470 (1); YCM-P36317 (3); YCM-P41476 (1); YCM-P41475 (5); NSMT-P61946 (7); NSMT-P64899 (2); NSMT-P65034 (2); BLIH 20010413 (1); BLIH 20010019 (1). **Marshall Islands:** BPBM 12181 (1). **Papua New Guinea:** USNM 244098 (1). **Philippines:** ROM 52976 (2); ROM 52977 (1); ROM 52978 (1); USNM 243918 (28); USNM 243919 (8); USNM 264524 (1); USNM 295300 (1); YCM-P40675 (1); YCM-P40691 (1). **Samoa:** AMS I.21998-002 (2).

Diagnosis. *Trimma flavatrum* is characterized by the presence of scales in the predorsal midline and on the cheek and opercle; no elongate dorsal spines; a broad and somewhat concave interorbital region with a bony interorbital equal to about half or more of the width of the pupil with no raised, longitudinal, fleshy ridge in the midline; no postorbital trench; fifth pelvic fin ray usually unbranched (may be branched once sequentially); and, in preserved specimens, a dusky body with densely scattered melanophores and chromatophores, the shade intensifying posteriorly to almost black in the peduncular region.

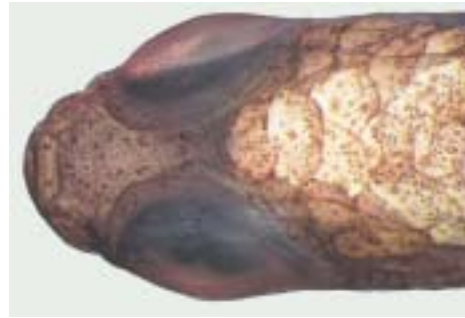


Fig. 4. *Trimma flavatrum*, composite dorsal view of head of cyanine-blue stained 15.8 mm SL male paratype, Augulpelu Reef, Palau, ROM 74802. Photo and imagine enhancement by R. Winterbottom

When alive or freshly collected, the body is yellow to dirty yellow-orange with scattered melanophores intensifying to a blackish or dark brown caudal peduncle, the median fins are reddish-orange to yellow with a dark basal stripe, except for the caudal fin, which varies from almost translucent to yellow with whitish margins (Figs. 1, 3).

Description. The description is based on the holotype and a variable number of additional specimens. Dorsal fins VI-I, 7–8 (mean=7.9, n=11), second spine longest and reaching the interspace between the dorsal fins when adpressed, all dorsal rays branched; anal fin I, 7–8 (mean=7.9, n=11), all rays branched; pectoral fin 13–15 (mean=14.1, n=11), rays unbranched, reaching posteriorly to a vertical line with the anterior few elements of the anal fin; pelvic fin I, 5, no frenum or basal membrane, first 4 rays with 1 sequential branch, fifth ray unbranched or with 1 sequential branch and 40–60% the length of the fourth, fourth ray reaching posteriorly to a vertical line with the first to third element of the anal fin; caudal fin with 11 branched rays, 8 dorsal and 7–8 ventral segmented rays, with 5–7 dorsal (6 in holotype) and 4–6 ventral unsegmented rays visible externally. Lateral scales 22–26 (mean=23.5, n=15), anterior transverse scales 7–9 (mean=8.2, n=15), posterior transverse scales 6–8, (7 in holotype, mean=7.4, n=15); predorsal scales 7–8 (mean=7.8, n=6), scales on

breast cycloid, 2 rows of cycloid scales on pectoral base, with posterior row of 2–3 scales, the dorsalmost scale very large and occupying about 80% of the height of the fin base, scales on the head extending into the interorbital region to about level with the posterior third of the pupil, 2–4 cycloid (3 in holotype) scales on cheek, 2–3 rows of cycloid scales (up to 7 scales) on opercle (Fig. 5).

Gill opening to below mid-pupil. Upper jaw with outermost and innermost rows of widely spaced, enlarged, curved canines with a few irregular rows of small conical teeth between them. Lower jaw with an outer row of enlarged, widely spaced, curved canines across the front of the jaw to the bend of the dentary, a middle row of small closely spaced conical teeth, and an inner row of widely spaced, somewhat enlarged canines. Tongue rounded. Gill rakers on first arch 3–4+11–13=15–17 (holotype not counted, mean =15.5, n=8). Nasal apparatus a slightly raised sac, confined to the anterior half of the snout, anterior nasal opening a tube, posterior nasal opening a pore with a raised rim (Fig. 5). Positions of sensory papillae are shown by Figure 6.

Head length 27.0–33.0% (28.6% in holotype, mean 30.2%, n=11) SL, body depth 23.6–24.6% (mean 24.5%, n=11), body width 13.3–16.3% (mean 15.3%, n=10). Snout length 15.7–23.8% (mean 18.8%, n=11) of head length, orbit diameter 36.8–51.1% (38.8% in holotype, mean 42.3%, n=11), upper jaw length 30.7–42.9% (35.7% in holotype, mean 36.8%, n=11). Bony interorbital 1/4–1/3 pupil width, with a interorbital trench and no postorbital trench (Fig. 5). Vertebrae 10+16=26, first and second caudal vertebra with the hemal arch expanded for a length equal to 2/3 length of hemal spine, the swim bladder extends into this space.

Color pattern (from slides of freshly collected specimens from the Nansei Islands, Philippines, and Palau, Fig. 1). A dark yellow to yellowish-brown body, heavily sprinkled with melanophores, without any conspicuous color patterns. The body color darkens gradually posteriorly and the caudal peduncle is dark brown to black. The



Fig. 5. *Trimma flavatrum*, composite left lateral view snout of cyanine-blue stained 14.0 mm SL female paratype, Augulpelu Reef, Palau, ROM 74926. Photo and image enhancement by R. Winterbottom

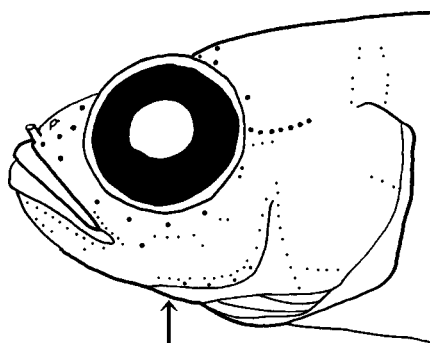


Fig. 6. *Trimma flavatrum*, diagrammatic figure of sensory papillae. Drawn by K. Hagiwara

median fins, except the caudal fin, are yellow to orange with a half-pupil width, dark or black basal stripe formed by melanophores with scattered iridocytes; the tips of these fins are hyaline. The caudal fin may be translucent with some melanophores and chromatophores on the central base, or with a white margin to the upper and lower unbranched fin rays, sometimes confluent with a white bar across the bases of the branched fin rays, and, in some cases, the middle portion of the fin yellow. The pectoral fins have a reddish wash, the pelvic spine is red with the rest of the fin yellow to orange. The iris is yellow to gold, and usually heavily invested with melanophores.

Color in alcohol. The body color is as for fresh specimens, except that all traces of yellow, orange and red have disappeared, with a straw-

yellow background and a heavy sprinkling of melanophores, which gradually become more concentrated posteriorly on the caudal peduncle. Scales margins are not outlined with melanophores. The dorsal and anal fins are translucent with a basal stripe of melanophores. NSMT-P71254 which collected in Ambon Island (Indonesia) has melanophores on near the tips of the dorsal and anal fins. Melanophores are absent in the pectoral and pelvic fins. The caudal fin is translucent with melanophores on the base. All observed specimens have a black iris (Figs. 2, 5).

Affinities. *Trimma flavatrum* sp. nov. is very similar to juveniles of *Trimma tevegae* Cohen and Davis, 1969 when preserved in alcohol. The 2 share many characteristics including the number of dorsal, anal and pectoral fin rays (D 8–9, A 8–9, P_{113–15} vs. D 7–8, A 7–8, P₁ 13–15 for *T. flavatrum*), a few cycloid scales on the cheek and opercle, and an almost black caudal peduncle. *Trimma tevegae* may have an elongated second dorsal spine (vs. never elongated), and has 9 to 12 predorsal scales (vs. 7–8), a longitudinal, median, rounded, fleshy ridge in the center of the interorbital region, and a bony interorbital width about as wide as the pupil diameter [see Winter-

bottom (2005b); vs. no ridge and bony interorbital half to two-thirds pupil width]; extent of hemal arch of first caudal vertebra equal to the length of the hemal spine (vs. two-thirds neural spine), a broad, diffuse stripe of chromatophores on the dorsum, with the scales outlined with melanophores creating a diamond-like pattern (vs. stripe and scale outlines absent) and a relatively distinctly demarkated black caudal spot (vs. a gradual darkening over the posterior half of the body) (comparison with YCM materials). *Trimma milta* Winterbottom, 2002 and *Trimma annosum* Winterbottom, 2003 are similar to *T. flavatrum* in having an interorbital trench, a poorly developed postorbital trench, no elongate dorsal spines and in the number of predorsal, lateral and transverse scales. *T. milta* and *T. annosum* have a pelvic fin basal membrane (vs. absent), more than 17 pectoral fin rays (vs. less than 15 rays). Neither of these species possesses any dark pigmentation on the caudal peduncle.

Habitat. *Trimma flavatrum* forms small schools which are sometimes mixed with *T. tevegae*. The fishes hover in caves, recesses or under the overhangs of coral reefs in the western Pacific. When hovering, the ventral side faces the

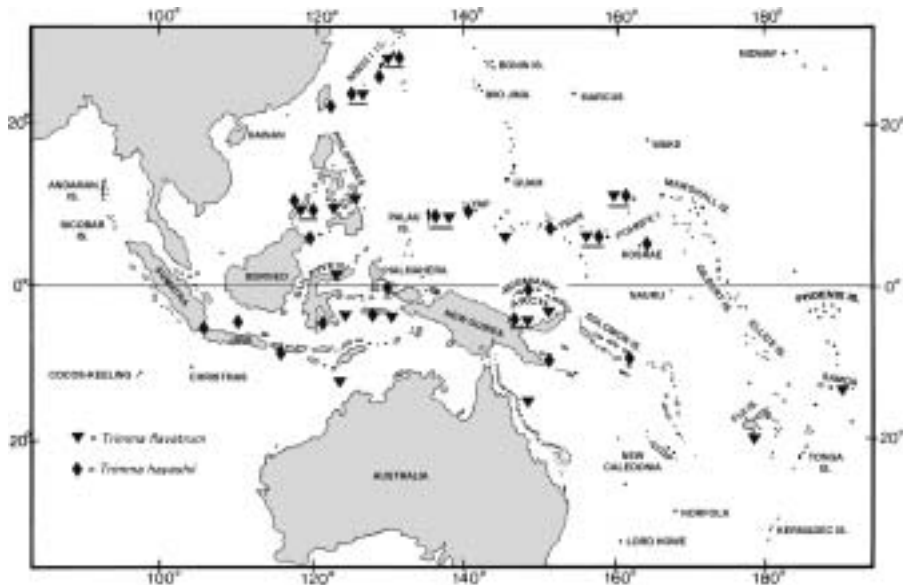


Fig. 7. Distribution map for *Trimma flavatrum* (inverted triangles) and *T. hayashii* (diamonds). Symbols underlined together indicate co-occurrence at that locality.

nearest substrate surface (e.g. the wall or roof of a cave) as occurs in *T. tevegae*. However, *T. flavatrum* tends to be found more towards the back of the caves and recesses. When feeding, *T. tevegae* tends to adopt a head-up, often vertical, posture in the water column (Cohen and Davis, 1969; Hagiwara, personal observation).

Distribution. *Trimma flavatrum* has been collected at Japan, the Philippines, Palau, Micronesia, Indonesia, Papua New Guinea, the Great Barrier Reef and Rowley Shoals in Australia, Fiji and Samoa (Fig. 7).

Etymology. From the Latin 'flavus', meaning yellow, and 'atrum', black, in allusion to the unusual yellow and black coloration of the new species.

***Trimma hayashii* sp. nov.**

(New Japanese name: Eri-hoshi-beni-haze)

(New English name: Four-eye pygmy goby)

(Figs. 7–13)

Trimma sp. No.076: Hayashi and Shiratori, 2003: 45, middle left figure (Amami-oshima Island).

Trimma sp. 4: Senou *et al.*, 2004: 114 (Miyako Island, Iriomote Island).

Holotype. ROM79838 (ex-YCM-P26315), 22.2 mm SL male, Kakeroma Island, Chino-ura, 28°09'42"N, 129°17'39"E, 10–20 m, SMBC, 28 Aug., 1991.

Paratypes. 135 specimens. **Japan (Nansei Islands):** YCM-P26316 (19.8 SL) as for holotype. YCM-P 28274, 5 (20.3–23.4), Amami-oshima Island, Atetsu Bay, 28°13'00"N, 129°17'40"E, 5–17 m, SMBC, 28 Aug. 1992. YCM-P 29500, (25.8), Amami-oshima Island, Fuka-ura, 28°12'29"N, 129°17'14"E, 5–15 m, SMBC, 3 Sep. 1993. YCM-P 42313 (18.3), Amami-oshima Island, Atetsu Bay, 8 m, K. Hagiwara and T. Itoh, 6 Nov. 1999. YCM-P 41238 (19.6), Amami-oshima Island, Atetsu Bay, 5–17 m, SMBC, 30 Aug. 2000. YCM-P 42551 (23.8,



Fig. 8. *Trimma hayashii*, fresh specimen, 22.2 mm SL female holotype, Kakeroma Island, Chino-ura, ROM79838. Photo by M. Hayashi



Fig. 9. *Trimma hayashii*, stock specimen, holotype. Photo by K. Hagiwara

female), Amami-oshima Island, Atetsu Bay, 5–17 m, K. Hagiwara, 19 Oct. 2004. YCM-P42570, 4 (22.3–23.3), Kakeroma Island, Nomino-ura, 28°06'49"N, 129°17'46"E, 20 m, K. Hagiwara, 11 Oct. 2004. NSMT-P34813 (20.3), Amami-oshima Island, mouth of Atetsugawa River, 28°11'01"N, 129°17'05"E, 12 m, 12 June 1991. BLIH 19920341 (22.6), Ishigaki-jima Island, Kabira Bay, 24°26'46"N, 124°08'33"E, A. Iwata and S. Hosoya, 27 Nov. 1992. BLIH 20030039 (24.1), Amami-oshima Island, Kiyama-jima, 28°01'17"N, 129°16'27"E, T. Yonezawa, 26 Mar. 2003. Caroline Islands: ROM 74937, 5 (15.9–21.2), west coast of Babeldaob Island. off Aimelik, reef slope with corals, fine sand and silt, 07°29'20.3"N, 134°26'03"E, 9–15 m, R. Winterbottom, B. Hubley, A. Bauman and D. Winterbottom, 19 May 2004. ROM 76084, 7 (20.3–23.1), W coast of Ngeruktabel Island., rock and coral wall to sand/coral base, 07°17'11.7"N, 134°25'34.5"E, 6–14 m, R. Winterbottom, W. Holleman, B. Hubley, A. Bauman and D. Winterbottom, 26 May 2004. ROM 76085, 11 (9.0–20.5), west coast of Babeldaob Island to north of main pass, reef slope with mixed corals, sand and silt, 07°33'07.7"N, 134°29'17.9"E, 0–4.5 m, R. Winterbottom, W. Holleman, B. Hubley and D. Winterbottom, 1 June 2004. ROM 76086, 23 (15.4–22.5), E. side of Nikko Bay just W. of Kaibakku Island, coral slope to coral wall with silt/sand slope below, 07°19'19.9"N, 134°29'58.4"E, 15–26 m, R. Winterbottom, W. Holleman, B. Hubley, A. Bauman and D. Winterbottom, 4 June 2004. ROM 76404, 62 (9.0–23.1) E. side of Nikko Bay about 50 m E of ROM 76086, very steep reef slope with huge variety of hard corals, 07°19'22.8"N, 134°29'59.4"E, 9–16.7 m, R. Winterbottom, W. Holleman, B. Hubley, A. Bauman and D. Winterbottom, 4 June 2004. ROM 1773CS (ex-USNM 223158, specimens cleared and stained), 10 (13.2–17.8), Federated States of Micronesia, Pohnpei, reef just S of Nanmatol Island. (6°59'30"N, 158°15'45"E), 0–13.7 m; V.G. Springer *et al.*, 6 Sep. 1980.

Non-type material 532 specimens. **Caroline Islands:** BPBM 28235 (3), BPBM 31378 (23), CAS 56595 (3), CAS 59890 (4), CAS 59884 (1), CAS 59886 (1), CAS 59891 (3), CAS 59894 (3), CAS 59895 (2), CAS 59896 (5), CAS 59897 (1), CAS 59903 (3), CAS 59904 (1), CAS 59905 (4), CAS 59906 (8), CAS 59907 (1), CAS 59909 (10), CAS 59925 (5), CAS 59926 (4), CAS 59927 (2), CAS 59928 (10), CAS 59930 (1), CAS 59932 (7), CAS 59933 (3), CAS 59936 (1), CAS 60047 (21), CAS 60097 (10), CAS 60244 (1), CAS 60285 (1), USNM 223158 (131), USNM 233212 (78), USNM 233298 (1). **Indonesia:** BPBM 30157 (2), USNM 209982 (3), USNM 263355 (13), USNM 264580 (3), USNM 294015 (2), USNM 298750 (4), USNM 298790 (1). **Japan (Nansei Islands):** YCM-P26273 (17, as for holotype), YCM-P26442 (14), YCM-P 28012 (4), YCM-P 28438 (3),



Fig. 10. *Trimma hayashii*, live, Amami-oshima Island, Aquarium. Photo by T. Shiratori

YCM-P 28559 (11), YCM-P 29337 (16), YCM-P 29493 (2), YCM-P 29551 (3), YCM-P 29552 (2), YCM-P36054 (1), YCM-P 38267 (1), YCM-P 41189 (5), YCM-P 41496 (1), YCM-P 42485 (2) and YCM-P 42548 (5, data as for holotype). **Marshall Islands:** BPBM 29257 (4). **Papua New Guinea:** BPBM 36888 (1), CAS 65406 (8), USNM 258774 (2), USNM 263465 (4), USNM 264529 (1), USNM 264707 (3), USNM 297263 (2), WAM P.27825-065 (1), WAM P.27827-043 (4). **Philippines:** AMS I.24405-001 (4), NSMT-P72571 (3), USNM 244157 (1), USNM 263463 (11), USNM 263470 (2), USNM 263557 (5), USNM 264678 (2), USNM 264709 (1), USNM 263557 (4). **Solomon Islands:** NTM S.12711-027 (1), USNM 296031 (1).

Diagnosis. *Trimma hayashii* is characterized by a little elongated or no elongated dorsal spine; the presence of a basal membrane between the pelvic fins; the absence of predorsal scales; an interorbital but no postorbital trench; absence of cheek and opercular scales; fifth pelvic fin ray branched sequentially once or twice and, uniquely among known species of *Trimma*, a bilateral, pupil-sized black spot on the branchiostegal membrane. When alive, *T. hayashii* has red spots which are a little smaller than the pupil diameter on the head and nape, the posterior half of body has 3 yellow stripes separated by 2 grey stripes, and the black spots on the branchiostegal membranes are ocellated with white or blue (Figs. 8, 10).

Description. The description is based on the holotype and up to 100 addition specimens. Dorsal fins VI-I, 8–9 (mean=8.5, n=98), second or third spine longest and variably elongate that extending posteriorly to between the base of second to fourth dorsal fin rays when adpressed, with the

third spine reaching as far as the fourth element of the second dorsal fin, all fin rays branched; anal fin I, 7–8 (mean=7.9, n=97), first ray branched or unbranched, the others branched; pectoral fin 14–17 (mean=15.8, n=96) with 2–9 (6 in holotype) branched rays in the approximate center of the fin, the longest ray reaching posteriorly to a vertical line with the first few elements of the anal fin; pelvic fin I, 5, no frenum, basal membrane 50–100% the length of the fifth ray (variation may be due to damage to this delicate structure), first 4 rays with 1 sequential branch, fifth ray unbranched or more often with 1 sequential branch and 60–90% the length of the fourth, fourth ray reaching posteriorly to a verti-



Fig. 11. *Trimma hayashii*, composite dorsal view of head of cyanine-blue stained specimen, 20.1 mm SL female paratype, Palau, ROM 76806. Photo and image enhancement by R. Winterbottom



Fig. 12. *Trimma hayashii*, composite ventral view of head of cyanine-blue stained specimen, 20.1 mm SL female paratype, Palau, ROM 76806. Photo and image enhancement by R. Winterbottom

cal line with the first to second element of the anal fin. Lateral scales 22–26 (24 in holotype, mean=23.2, n=97), anterior transverse scales 7–10 (mean=9.2, n=97), posterior transverse scales 7–8, (mean=7.7, n=97); predorsal without scales in the midline except in some large specimens (>20 mm SL, Palau), in which there may be 1 or 2 cycloid scales in the mid-region of the nape; scales on breast cycloid, 2–3 cycloid scales on pectoral base, scales on the side of the head extend anteriorly to above the vertical limb of the preopercle, cheek and opercle scaleless. Gill opening to below mid pupil. Upper jaw with an outer row of widely spaced, enlarged, curved canines followed by a few irregular rows of small conical teeth, the innermost row enlarged and directed medially. Lower jaw with an outer row of widely spaced, enlarged, curved canines extending to the bend of the dentary, 1–2 middle rows of small, closely spaced, conical teeth, and an innermost row of widely spaced, enlarged canines about half as high as the outer row and directed medially. Tongue round to roundly truncate. Gill rakers on first arch 2–5+14–18=17–22, (holotype not counted, mean=19.0, n=30). Nasal apparatus a slightly elevated sac confined to the anterior half of the snout, anterior nasal opening a tube, posterior nasal opening a pore with a raised rim. Positions of sensory papillae are showed by Figure 13.

Head length 25.9–33.3% (30.9% in holotype, mean 30.3%, n=72) of standard length, body

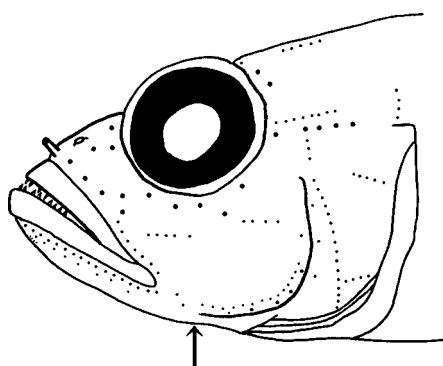


Fig. 13. *Trimma hayashii*, diagrammatic figure of sensory papillae. Drawn by K. Hagiwara

depth 20.8–27.5% (25.3% in holotype, mean 24.1%, $n=70$), body width 13.5–18.9% (15.6% in holotype, mean 15.9%, $n=72$). Snout length 18.6–30.7% (mean 24.5%, $n=68$) of head length, orbit diameter 29.5–43.3% (38.5% in holotype, mean 35.1%, $n=72$), upper jaw length 38.0–43.3% (mean 35.1%, $n=72$). Bony interorbital 1/4–1/5 pupil width, with a interorbital trench and no postorbital trench (Fig. 11). Vertebrae 10+16=26, hemal arches not expanded.

Color pattern (from slides of live and freshly collected specimens from Nansei Islands, Indonesia, Palau, Marshall Islands, and Taiwan, Fig. 8). Freshly collected specimens have a red to reddish orange background, with pupil-sized or slightly smaller, darker red spots on the head and nape, and 3 yellow stripes separated by grey stripes on the body. The uppermost yellow stripe begins at the origin of the second scale row below the first dorsal fin. The middle stripe follows the mid lateral septum and begins roughly below the last elements of the first dorsal fin. The ventralmost stripe begins just anterior to the anus and passes posteriorly along the ventral portion of the body. All 3 stripes extend onto the caudal fin. An intense black spot, roughly pupil diameter in size, with a white (or blue in life) ocellus is present bilaterally of the branchiostegal membranes. Melanophores are sprinkled over body, most intensely on the head. Scale pockets are diffusely outlined with melanophores, more so dorsally than ventrally. The dorsal fins have 2 orange stripes, the upper stripe at the center of fin elements is diffuse, poorly developed, and about one-third the length of fin rays in width, the lower stripe is well defined, about one third pupil-diameter in width, and situated distal to the bases of the fin elements by about the same width. A similar but more orange basal stripe is present in the anal fin which may be expanded distally over half the height of the fin, and is sometimes separated into 2 stripes. Pectoral and pelvic fins are light red or orange without pattern. The caudal fin rays may be margined with yellow and orange, and the iris is red with scatterings of melanophores and/or dark chro-

matophores.

Color in alcohol. Body straw-yellow with sprinkled chromatophores, with heavier concentrations on anterior sections of body. Scale pattern on dorsal half of body is diffusely outlined with chromatophores and melanophores. The red spots on the head and nape are pale, the ocellus of the black spot on the branchiostegals is not visible, and the spot itself is somewhat diffuse around the edges (Fig. 12). The stripes on the body are indistinct. The anal fin has a basal stripe and is darker at the distal tip, with sparse melanophores between them. The caudal fin is translucent with melanophores along some fin ray, and melanophores are sparsely present in pectoral and pelvic fins. All observed specimens have a simple black iris.

Affinities. *Trimma fangi* Winterbottom and Chen, 2004 is very similar to *T. hayashii* sp.nov., but lacks the unique (among members of the genus) dark branchiostegal spot. *Trimma bisella* Winterbottom, 2000 and *Trimma woutsii* Winterbottom, 2002 are similar to *T. hayashii* in the presence of an interorbital trench present, no postorbital trench, dorsal spines often elongated, and in the number of predorsal, lateral and transverse scales. *Trimma bisella* has no pelvic fin basal membrane (vs. present). *Trimma woutsii* has 9 anal fin rays (vs. 7–8 rays), 1–3+11–12=13–15 gill rakers of first gill arch (vs. 2–5+14–18=17–22). *Trimma preclarum* Winterbottom, 2006 also has 3 yellow stripes separated by grey stripes on the posterior half of the body, similar to those of *T. hayashii*. But *Trimma preclarum* is distinguished from *T. hayashii* by the presence of 5–9 scales in the predorsal midline, 4 yellow spots on the iris, and lack of an ocellated black spot on the branchiostegal membrane and of red spots on anterior half of body.

Habitat. *Trimma hayashii* lives under corals in embayments, which are sometimes covered by siltation. It often positions itself upside-down on the roof of the recess.

Distribution. *Trimma hayashii* has been collected at Japan, the Philippines, Palau, Micronesia, Indonesia, Papua New Guinea and the

Solomon Islands.

Etymology. *Trimma hayashii* is named for Mr. Masayoshi Hayashi. It has been referred to by Hagiwara and Hayashi (1997) as an undescribed species, and Mr. M. Hayashi provided a photograph of holotype for this paper.

Comparative materials. *Trimma tevegae* (74 specimens). **Japan (Nansei Islands):** YCM-P4473, 1 (22.1 mm SL). YCM-P4768, 1 (19.2). YCM-P6034, 3 (18.3–19.0). YCM-7534, 3 (14.7–17.1). YCM-P7564, 1 (18.2). YCM-P10227, 1 (15.4). YCM-P24653, 1 (17.9). YCM-P26391, 1 (28.3). YCM-P26436, 3 (20.0–21.1). YCM-P28135, 9 (14.9–27.2). YCM-P28318, 9 (9.9–27.4). YCM-P28603, 1 (26.5). YCM-P29044, 12 (12.5–28.3). YCM-P29153, 1 (25.1). YCM-P29308, 3 (26.0–29.1). YCM-P29434, 4 (25.2–32.0). YCM-P34048, 7 (12.0–27.8). YCM-P34059, 1 (30.3). YCM-P34369, 6 (15.5–27.5). YCM-P38336, 1 (29.3). YCM-P38463, 1 (22.0). YCM-P38502, 2 (19.5–20.7). YCM-P39049, 1 (21.1). **Malaysia:** YCM-P36862, 1 (23.1). See also material in Winterbottom (2005b).

Acknowledgments

We thank Keiichi Matsuura, Koichi Sibukawa (NSMT), Yuji Ikeda (BLIH) and members of SMBC for provided materials, Masayoshi Hayashi and Taketomo Shiratori for provided the photographs. And we would like to thank Marg Zur for data collation, and Doug Hoese for freely providing many details of the distributions of the new species. Support for fieldwork from the Members Volunteer Committee through the ROM Foundation is gratefully acknowledged. Support for the research was provided by the people of Canada through NSERC Discovery Grant A 7619 and the ROM.

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Manuscript received 8 February 2006; revised 23 October 2006; accepted 24 October 2006.

Associate editor: S. Kimura.