

## Two New Species of the Gobiid Fish Genus *Trimma* (Perciformes: Gobioidae) from Southern Japan

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**Abstract** Two new species of the gobiid fish genus *Trimma*, *T. kudo* and *T. yanoi* are described based on specimens from southern Japan. *Trimma kudo* is distinguished from all congeneric species by the following combination of characters: no scales on predorsal midline; no elongate spines of first dorsal fin; fifth pelvic-fin ray unbranched, 50–70% of fourth ray in length; basal membrane between innermost pelvic-fin rays 10–17% of length of fifth ray; a shallow or deep interorbital trough, no postorbital trough; nape with a slightly developed longitudinal ridge in the midline; 22–23 longitudinal scales; ground color of head and body bright yellow, iris vivid yellow with 3 deep purple oblique lines margined in pink when fresh. *Trimma yanoi* is distinguished from all congeneric species by the following combination of characters: no scales on predorsal midline; no elongate spines of first dorsal fin; fifth pelvic-fin ray branched, 60–64% of fourth ray in length; basal membrane between innermost pelvic-fin rays 61–64% of length of fifth ray; no interorbital or postorbital trough; 24–26 longitudinal scales, 16–16.5 anterior transverse scales, and 15.5–16 posterior transverse scales; scales of body gradually increasing in size posteriorly, scales on lateral midline are largest; ground color of head and body semi translucent deep red, a dark grayish brown broken stripe on upper part of opercle when fresh.

**Key words:** *Trimma*, two new species, Gobiidae, southern Japan.

*Trimma* is an Indo-Pacific gobiid fish genus, comprising cryptic, tiny (less than 40 mm SL), colorful, tropical species found on coral and rocky reefs at depths shallower than 80 m. According to Winterbottom (1995), and Hagiwara and Winterbottom (2007), *Trimma* can 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, fewer than 12 dorsal- and anal-fin rays, and a fifth pelvic-fin ray that is equal to or more than 40% the length of the fourth pelvic-fin ray.

*Trimma* (type species *T. caesiura*) was established by Jordan and Seale (1906). The genus may contain about 85 species; 57 species are currently recognized as valid (see Hagiwara and Winterbottom, 2007; Suzuki and Senou, 2007;

Winterbottom and Southcott, 2007; Winterbottom and Zur, 2007), while the others are still unnamed.

In Japan, 11 valid species and 16 unnamed species of *Trimma* were reported prior to 2006 (Suzuki and Senou, 2007). Afterwards, *Trimma* sp. 4 and *Trimma* sp. 10 sensu Suzuki and Shibukawa (2004) were described as *T. hayashii* and *T. flavatrum* respectively by Hagiwara and Winterbottom (2007). *Trimma* sp. 11 and *Trimma* sp. 14 sensu Suzuki and Shibukawa (2004) were described as *T. yanagitai* and *T. nomurai* respectively by Suzuki and Senou (2007). *Trimma* sp. 1 and *Trimma* sp. 8 sensu Suzuki and Shibukawa (2004) were identified as *T. milta* Winterbottom and *T. benjamini* Winterbottom respectively by Suzuki *et al.* (2007a, 2007b)

In this paper, we describe *Trimma* sp. 8 and *Trimma* sp. 12 of Suzuki and Shibukawa (2004)

as new species under the names of *T. yanoi* and *T. kudoi*, respectively.

### Materials and Methods

Institutional abbreviations follow Leviton *et al.* (1985), except for BLIH (Biological Laboratory, Imperial Household, Japan) and KPM (Kanagawa Prefectural Museum, Japan).

Methods of counting and measurements follow Suzuki and Senou (2007). Although fin spines in gobiid fishes are often called rays, “rays” of second dorsal and anal fins refer to segmented rays in this paper. Pectoral- and pelvic-fin ray branching, number and distribution of scales, cephalic sensory system and trough/trench around orbit are described from preserved material stained with a cyanine blue solution. The notation of pattern of interdigitation of the dorsal fin proximal pterygiophores between the neural spines (P-V) follows Akihito (1984). Vertebrae are counted from radiographs. Information about tooth morphology and gill-raker counts was obtained from a paratype stained with alizarin red. Description of the color when fresh was based on color slides of the holotype of each species. Color descriptions when alive were based on the underwater photographs in the Image Database of Fishes in the Kanagawa Prefectural Museum of Natural History (KPM-NR) and/or Suzuki and Shibukawa (2004). The name of a color follows the recommendations of the Japan Color Research Institute (1995). Proportional measurements are provided in Table 1.

#### *Trimma kudoi* sp. nov.

(New Japanese name: Nagashime-benihaze)

(Figs. 1–4)

*Trimma* sp. 12: Suzuki and Shibukawa, 2004: 115 (underwater photograph, Kinkou Bay, Kagoshima Prefecture, Japan, 38 m depth, photo by K. Yano).

**Holotype.** KPM-NI 4255, male, 19.0 mm SL, Akino-hama, Izu-ohshima Island, Izu Islands, Japan, 36 m depth, H. Senou, T. Kudo and K. Imai, 24 Nov. 1997.

**Paratypes.** Six paratypes (20.0–25.1 mm SL): BLIH

19960266, 19960276 and 19960277, 3 specimens, 21.8–25.1 mm SL, Kinkou Bay, Kagoshima Prefecture, Japan, S. Dewa, 19 Apr. 1996; NSMT-P 73056 (ex KPM-NI 17932), 22.5 mm SL, Kinkou Bay, Kagoshima Prefecture, Japan, 27 m depth, S. Dewa and M. Matsuoka, 8 July 2005, stained; KPM-NI 17933 and 17934, 20.0–21.0 mm SL, 40–45 m depth, 14 June 2005, not stained, other data same as NSMT-P 73056.

**Photograph Records from Image Database of Fishes.** KPM-NR 28592, Tanabe Bay, Wakayama Prefecture, Japan, 36 m depth, 1 May 1999; KPM-NR 61735, IOP, Izu Peninsula, Shizuoka Prefecture, 25 m depth, 17 June 2001; KPM-NR 61736, 4 Aug. 2001, other data same as KPM-NR 61735; KPM-NR 66328, Tsutomezaki, Kashiwa-jima Island, Kochi Prefecture, Shikoku, Japan, 46 m depth, 26 Sep. 2001; KPM-NR 80590, Seragaki Beach Okinawa-jima Island, the Ryukyu Islands, Japan, 50 m depth, 21 July 2002; KPM-NR 80758 and 80759, 33 m depth, 30 Aug. 2002 other data same as KPM-NR 66328.

**Diagnosis.** *Trimma kudoi* differs from the other described species of the genus in the following combination of characters; no scales on predorsal midline; no elongate spines of first dorsal fin; fifth pelvic-fin ray unbranched, 50–70% of fourth ray in length; basal membrane between innermost pelvic-fin rays 10–17% of length of fifth ray; a shallow or deep interorbital trough, no postorbital trough; nape with a slightly developed longitudinal ridge in the midline; 22–23 longitu-

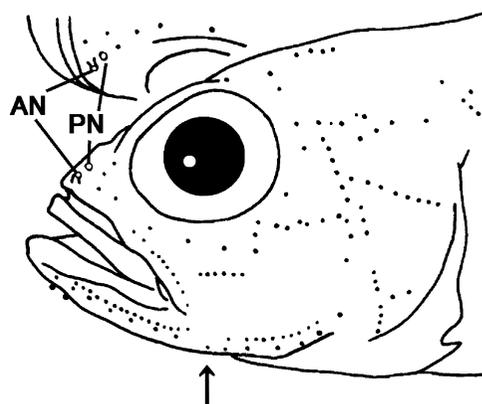


Fig. 1. The cephalic sensory system of *Trimma kudoi*, KPM-NI 4255, holotype. Anterior part of dorsal (left top) and lateral views of head. Dots represent the sensory papillae. AN and PN indicate anterior and posterior nares, respectively. Arrow shows position where gill membrane is attached to isthmus.



Fig. 2. *Trimma kudoii*, fresh specimen, KPM-NI 4255, male, holotype, 19.0 mm SL, Akinohama, Izu-ohshima Island, Izu Islands, Japan, Photo by H. Senou.

dinal scales; ground color of head and body bright yellow, iris vivid yellow with 3 deep purple oblique lines margined by pink when fresh.

**Description.** In the following description, data for the holotype are given first, followed by the data for 6 paratypes in parentheses when different.

Dorsal-fin rays VI-I, 10 (I, 9 in 1 paratype); anal-fin rays I, 9; pectoral-fin rays 17 (18 in 2 paratypes); pelvic-fin rays I, 5; segmented caudal-fin rays 9+8; branched caudal-fin rays 7+6 (7+7 in 1 paratype, 6+6 in 2 paratypes); longitudinal scales 22 (23 in 6 paratypes); anterior transverse scales 7 (7.5–9 in 6 paratypes, mode 8 and 8.5); posterior transverse scales 7 (7–7.5 in 6 paratypes, mode 7.5); predorsal scales 0; gill rakers (4+14, stained paratype only). Dorsal proximal pterygiophore formula for holotype and 3 paratypes: P-V 3/II II I I 0/9; vertebrae 10+16=26.

Third spine of first dorsal fin longest but not elongate (second and third spines longest in 1 paratype), reaching posteriorly to base of first ray of second dorsal fin when adpressed (not to second dorsal fin in 2 paratypes, to base of spine in 2 paratypes, third spine broken in 1 paratype). Pectoral-fin rays usually unbranched (middle 3 rays branched in 1 paratype, middle 12 rays

branched in 1 paratype); fin reaching posteriorly to above base of first ray of anal fin (not to anal fin in 2 paratypes). First 4 rays of pelvic fin each with a sequential branch point (1–2 sequential branch points in 2 paratypes); fifth ray unbranched and 56% (50–70% in 6, mean 59%, fourth ray broken in 1 paratype) of fourth ray in length; fourth ray longest, reaching posteriorly to base of second ray of anal fin when adressed (between anus and base of third ray in 5 paratypes, broken in 1 paratype). No pelvic fraenum. Basal connecting membrane between innermost pelvic-fin rays incomplete (10–17%, mean 14% of length of fifth ray in 6 paratypes).

Cheek and opercle without scales. Pectoral-fin base, breast and anterior belly with small cycloid scales. Remainder of body with large ctenoid scales. Scaled area on body extending anterodorsally to an oblique line between dorsal edge of pectoral base and sixth spine base of first dorsal fin. The anterodorsal part of body anterior to this oblique line covered with small cycloid scales. Nape with a slightly, median, developed longitudinal ridge from origin of the dorsal fin to above posterior margin of eye (to above posterior margin of opercle in 2 paratypes). Gill opening extending anteroventrally to below middle of pupil. Anterior naris with a short tube, posterior



Fig. 3. *Trimma kudoii*, fresh specimen, BLIH 19960276, male, paratype, 25.1 mm SL, Kinkou Bay, Kagoshima Prefecture, Japan, Photo by Y. Ikeda.

nasal opening a simple pore (with low rim in 4 paratypes). Interorbital trough shallow (deep with sloping sides, wider than deep in 5 paratypes), no postorbital trough. Bony interorbital width 19% of pupil diameter (20–28% in 6 paratypes, mean 24%). The cephalic sensory system is depicted in Figure 1.

Tooth morphology in a stained paratype: inwardly curved conical teeth in both jaws. Upper jaw with outermost row of 10 enlarged, spaced teeth followed by 5 small teeth, 4 irregular anterior inner rows of small teeth, grading to single posterior row of small teeth; anterior and outer teeth are larger than posterior. Anterior part of lower jaw with outermost row of 7 enlarged teeth, 4 irregular inner rows of small teeth, grading to 2 posterior rows of small teeth; middle part with an inner row of enlarged teeth.

*Color when fresh* (Fig. 2). Ground color of head and body bright yellow. Scale pockets with vivid yellow. Iris vivid yellow with 3 deep purple oblique lines with pink margins. The middle line interrupted by pupil. Other 2 lines indistinct, running on the dorsal and ventral margins of iris. Some diffuse pale lilac blotches on dorsal and lateral of head. Ground color of vertical fins pale yellow. Dorsal and anal fins with a light gray basal stripe and a light gray distal margin. A nar-

row bright yellow stripe across below middle of dorsal fins. Second dorsal fin with a light gray stripe above bright yellow stripe. Basal one-half of caudal fin pale yellow with some vivid yellow spots, and the rest hyaline with a light gray posterior margin. Pectoral fin hyaline with a broad pale yellow posterior margin. Pelvic fin pale yellow.

Similar color in a paratype except as follows (Fig. 3): ground color of head and body light reddish yellow. Scale pockets with dull red purple.

*Color in alcohol.* All yellow, purple and pink colors faded. Ground color of head and body yellowish white. Head with many small grayish brown dots. Scales pockets with grayish brown.

*Color when alive* (Fig. 4). Similar color when fresh. Nuptial color as follows (Suzuki and Shibukawa, 2004: 115): ground color of head and body vivid orange to vivid yellow; head with pink radial bands; scale pockets with dull red to vivid yellow blotches and pink margins; dorsal and anal fins with a pale lavender basal stripe and a pale lavender distal margin; second dorsal fin with a broad pale lavender longitudinal stripe above bright yellow stripe; caudal fin with a pale lavender distal margin.

**Distribution.** Izu Peninsula of Shizuoka Prefecture, Tanabe Bay of Wakayama Prefecture,



Fig. 4. *Trimma kudoii*, live, KPM-NR 80759, Kashiwa-jima Island, Shikoku, Japan, 33 m depth, Photo by T. Uematsu.

Table 1. Measurements (% SL) for *Trimma kudoii* and *T. yanoi*. Number of specimens is in parentheses.

|                                   | <i>T. kudoii</i> |           |               | <i>T. yanoi</i> |          |
|-----------------------------------|------------------|-----------|---------------|-----------------|----------|
|                                   | Holotype         | Paratypes |               | Holotype        | Paratype |
| Sex (Sample size)                 | male             | males (2) | females (4)   | male            | female   |
| Standard length (mm)              | 19.0             | 22.5–25.1 | 20.0–22.4     | 21.8            | 21.1     |
| Head length                       | 31.1             | 26.3–28.7 | 23.9–27.7     | 30.7            | 30.8     |
| Snout to first dorsal-fin origin  | 36.8             | 32.3–33.5 | 29.1–33.5     | 37.2            | 37.9     |
| Snout to second dorsal-fin origin | 57.9             | 46.8–55.0 | 40.6–53.6     | 56.4            | 57.3     |
| Snout to anal-fin origin          | 60.0             | 50.2–57.4 | 45.4–58.0     | 58.7            | 59.2     |
| Caudal peduncle length            | 22.1             | 24.7–26.7 | 21.5–25.9     | 24.8            | 24.6     |
| Caudal peduncle depth             | 12.6             | 13.5      | 11.2–12.9     | 14.2            | 13.7     |
| Longest first dorsal spine length | 18.4             | 14.1–14.9 | 13.5–15.6 (3) | 17.2            | 16.6     |
| Eye diameter                      | 10.5             | 8.8–9.2   | 8.2–9.8       | 11.5            | 11.4     |
| Snout length                      | 5.8              | 5.6–7.2   | 4.0–5.8       | 5.0             | 5.2      |
| Upper jaw length                  | 11.6             | 9.2–10.2  | 8.0–9.2       | 12.8            | 13.3     |
| Interorbital width                | 2.1              | 0.8–1.4   | 0.9–1.3       | 2.1             | 1.9      |
| Pupil diameter                    | 5.5              | 4.2–4.8   | 4.0–5.1       | 6.0             | 5.9      |
| 4th pelvic fin ray length         | 28.9             | 31.9(1)   | 21.1–25.5     | 26.6            | 26.1     |
| 5th pelvic fin ray length         | 16.3             | 15.9–17.9 | 13.9–14.7     | 16.1            | 16.6     |
| Pelvic connecting membrane length | vestigial        | 1.7–2.6   | 1.6–2.5       | 9.9             | 10.7     |

The snout tip refers to the mid-anteriormost point of the upper lip

Kashiwa-jima Island of Kochi Prefecture, Kinkou Bay of Kagoshima Prefecture, and Okinawa Island of the Ryukyu Islands, Japan.

**Etymology.** The specific name, *kudo*, refers to Mr. Takahiro Kudo, who provided the holotype of the new species.

**Remarks.** *Trimma kudo* differs from all other congeners in having the 3 deep purple oblique lines on the eye when fresh.

*Trimma kudo* is very similar to *T. stobbsi* Winterbottom, 2001 which has no predorsal scales; 9–10, 8–9, 16–19 rays of second dorsal, anal and pectoral fins respectively; 22–24 longitudinal scales; 7–10 anterior and 7–8 posterior transverse scales; unbranched fifth pelvic-fin ray; fifth pelvic-fin ray 50–70% of fourth ray in length; no scales on cheek and opercle; scales on pectoral-fin base; no postorbital trough; nape with a slightly developed longitudinal ridge in the midline; yellowish head and body. *Trimma kudo* differs from *T. stobbsi* in having no elongate spines of first dorsal fin (vs. absent or second spine elongate in *T. stobbsi*); pectoral-fin rays unbranched or middle rays branched in 2 of 7 specimens (vs. middle rays branched); connecting membrane between innermost pelvic-fin rays present (absent); no scales on the sides of the nape (vs. present); 3 deep purple oblique lines on eye and no black spot at posterodorsal corner of opercle (vs. no oblique lines on eye and a distinct black spot, see Winterbottom, 2001).

***Trimma yanoi* sp. nov.**

(New Japanese name: Hotei-benihaze)

(Figs. 5–7)

*Trimma* sp. 3: Suzuki and Shibukawa, 2004: 119 (underwater photograph, Iriomote-jima Island, the Ryukyu Islands, Japan, 8 m depth, photo by K. Yano).

**Holotype.** KPM-NI 5649, male, 21.8 mm SL, Sotobanare-minami, Funauki Bay, Iriomote-jima Island, the Ryukyu Islands, 10 m depth, K. Yano, 18 Nov. 1998.

**Paratype.** NSMT-P 73059 (ex KPM-NI 5650), female, 21.1 mm SL, stained, other data same as holotype.

**Diagnosis.** *Trimma yanoi* can be distinguished from all other described species of the

genus by the higher anterior and posterior transverse scale counts (16–16.5 and 15.5–16 respectively, vs. <13). In addition, the following combination of characters; no scales on predorsal midline; no elongate spines of first dorsal fin; fifth pelvic-fin ray branched, 60–64% of fourth ray in length; basal membrane between innermost pelvic-fin rays 61–64% of length of fifth ray; no interorbital or postorbital trough; 24–26 longitudinal scales; scales of body gradually increase in size posteriorly, scales on lateral midline largest; ground color of head and body semi-translucent and deep red, a dark grayish brown broken stripe on upper part of opercle when fresh.

**Description.** In the following description, the data for the holotype are given first, followed by those for the paratype in parentheses when different.

Dorsal-fin rays VI–I, 10; anal-fin rays I, 9; pectoral-fin rays 19; pelvic-fin rays I, 5; segmented caudal-fin rays 8+8 (9+8); branched caudal-fin rays 7+6 (6+5); longitudinal scales 26 (24); anterior transverse scales 16.5 (16); posterior transverse scales 15.5 (16); predorsal scales 0; P–V 3/II II I I 0/9; vertebrae 10+16=26; gill rakers (4+16).

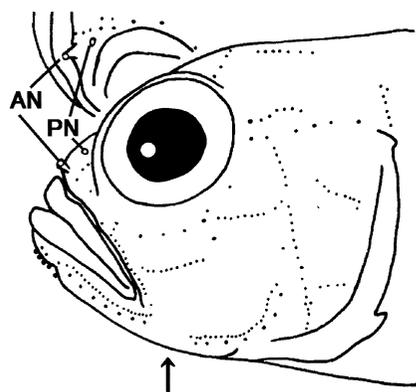


Fig. 5. The cephalic sensory system of *Trimma yanoi*, KPM-NI 5649, holotype. Anterior part of dorsal (left top) and lateral views of head. Dots represent the sensory papillae. AN and PN indicate anterior and posterior nares, respectively. Arrow shows position where gill membrane is attached to isthmus.



Fig. 6. *Trimma yanoi*, fresh specimen, KPM-NI 5649, male, holotype, 21.8 mm SL, Sotobanare-minami, Funauki Bay, Iriomote-jima Island, the Ryukyu Islands, Photo by H. Senou.

Second spine of first dorsal fin longest but not elongate, not reaching posteriorly to second dorsal fin when adpressed. Middle 14 rays of pectoral fin branched; pectoral fin reaching posteriorly to above near base of spine of anal fin (not reaching to anal fin). First 4 rays of pelvic fin with 2 sequential branch points (2–3 sequential branch points); fifth ray with 2 dichotomous branch points and 4 terminal tips, 60–64% of fourth ray in length; fourth ray longest, reaching posteriorly to base of first ray of anal fin when adpressed. No pelvic fraenum. Basal membrane between innermost pelvic-fin rays 61–64% of length of fifth ray (75%).

Cheek and opercle without scales. Pectoral-fin base with very small cycloid scales (4 rows of very small cycloid scales). Breast and anterior belly with very small cycloid scales. Remainder of body with small ctenoid scales which gradually increase in size posteriorly. Scales on lateral midline are largest. Scaled area on body extending anterodorsally to an oblique line from dorsal edge of pectoral base to origin of first dorsal fin. Gill opening extending anteroventrally to below middle of pupil. Anterior naris with a short tube, posterior nasal opening a simple pore (with low

rim). No interorbital or postorbital trough. Bony interorbital width 35% (32%) of pupil diameter. The cephalic sensory system is depicted in Figure 5.

Tooth morphology in a stained paratype: inwardly curved conical teeth in both jaws. Upper jaw with outermost row of 9 enlarged, spaced teeth, 3 irregular anterior inner rows of small teeth, grading to 2 posterior rows of small teeth; anterior and outer teeth of inner rows are larger than those posterior. Anterior part of lower jaw with outermost row of 6 enlarged teeth, 2 irregular inner rows, the medial row of enlarged, and the row in between of small teeth. Single very large tooth on midlateral part of upper jaw and 2 very large teeth on anterolateral part of lower jaw.

*Color when fresh* (Fig. 6). Ground color of head and body semi-translucent and deep red. Iris deep red with a diffuse broken circular black line. A dark grayish brown broken stripe on upper part of opercle. A series of dark red internal blotches along ventral column faintly visible. Ventral part of tail with 3 diffuse large deep orange blotches, as well as a deep orange broad band at posterior end of caudal peduncle. Ground



Fig. 7. *Trimma yanoi*, live, Iriomote-jima Island, the Ryukyu Islands, Japan, 8 m depth, Photo by K. Yano.

color of dorsal, pectoral and caudal fins pale red-dish gray. Dorsal fins with a bright yellowish orange basal stripe. Base of caudal fin with some large diffuse bright yellowish orange blotches. Anal fin light orange. Pelvic fin hyaline.

*Color in alcohol.* All red and orange colors faded. Ground color of head and body yellowish white. Dorsal side of head and body pale yellowish brown. Upper part of opercle with a broken dark grayish brown stripes.

Color when alive (Fig. 7: Suzuki and Shibukawa, 2004: 109). Similar color when fresh, except as follows: ground color of head and body vivid yellow red; a vivid yellow circle around pupil.

**Distribution.** Iriomote-jima Island, the Ryukyu Islands, Japan.

**Etymology.** The specific name, *yanoi*, refers to Mr. Korechika Yano, who provided the types of the new species.

**Remarks.** *Trimma yanoi* differs from all other congeners in having smaller scales on body (*i.e.*, more than 15 anterior and posterior transverse scales).

*Trimma yanoi* is very similar to *T. sheppardi* Winterbottom, 1984 in shape of body and in body depth. *Trimma yanoi* differs from *T. sheppardi* in having: 10 rays of second dorsal fin (vs. 8–9 rays in *T. sheppardi*); 16–16.5 anterior and 15.5–16 posterior transverse scales (vs. 11 and 8–9); no elongate spines of first dorsal fin (vs. second spine elongate); fifth pelvic-fin ray 60.3–63.6% of fourth ray in length (vs. 75%); basal membrane between innermost pelvic-fin rays 61–64% of length of fifth ray (vs. vestigial); bony interorbital width 32–35% of pupil diameter (vs. 50%); no transverse lines on head, and no blotches at posterodorsal corner of opercle although it does have a dark stripe when fresh (vs. 4 yellow transverse lines and a pair of longitudinally aligned black blotches when fresh, alive and preserved, see Hagiwara and Hayashi, 1992; Winterbottom, 1984).

Of the species of *Trimma* without predorsal scales, *T. yanoi* is similar to *T. woutsi* Winterbottom, 2002, which has 9–10, 9, 17–19 rays of second dorsal, anal and pectoral fins respectively; 23–24 longitudinal scales; middle pectoral-fin

rays branched; branched fifth pelvic-fin ray; fifth pelvic-fin ray 60–75% of fourth ray in length; basal membrane between innermost pelvic-fin rays about 20–75% of length of fifth ray; no scales on cheek, opercle and nape; no postorbital trough; bony interorbital width 25–33% of pupil diameter. *T. yanoi* differs from *T. woutsii* in having: 16–16.5 anterior and 15.5–16 posterior transverse scales (vs. 8–10 and 7–9 respectively in *T. woutsii*); no elongate spines of first dorsal fin (vs. second spine elongate); no interorbital trough (vs. shallow to moderate); a series of dark red internal blotches along ventral column faintly visible when fresh and alive (vs. large irregular orange to brown spots on head and body, and no series of dark red internal blotches, see Winterbottom, 2002).

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