

New records of a triplefin, *Enneapterygius leucopunctatus*, from southern Japan (Perciformes: Tripterygiidae)

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Abstract *Enneapterygius leucopunctatus* Shen, 1994 (Tripterygiidae), known only from Taiwan, is recorded for the first time from Yaku-shima Island, Kagoshima Prefecture, and Tosa Bay, Kochi Prefecture, southern Japan. Seventeen Japanese specimens (25.2–36.1 mm in standard length) were identified as *E. leucopunctatus* based on the following combination of characters: second dorsal-fin spines 12–13; third dorsal-fin soft rays 9–11; anal-fin soft rays 17–19; mandibular pore formula mostly 4+1+4; pored and notched lateral-line scales 15–18+16–19; simple dermal flap of anterior nostril; 2 white oblique bands on shoulder girdle; 8 dark saddle markings and 5–6 small ring-like white markings on lateral body; inconspicuous sexual dichromatism.

Key words: Tripterygiidae, *Enneapterygius leucopunctatus*, Yaku-shima Island, Tosa Bay, Japan.

Introduction

The blennioid family Tripterygiidae is composed of 32 genera and 164 species, inhabiting coral reefs and rocky substratum in tropical to cold seas (Fricke, 2009). The genus *Enneapterygius* Rüppell, 1835, the largest group in the family, is diagnosed by having a discontinuous lateral line with 6–22 pored scales anteriorly and 13–27 notched scales posteriorly; the following combination of fin rays—dorsal: III, IX–XVI, 7–12; anal: I, 15–22; pelvic: I, 2; and a body with ctenoid scales except for naked head, operculum, abdomen, and pectoral-fin base (the last two areas covered with cycloid scales in some species) (Fricke, 1997; Holleman, 2005; Chiang and Chen, 2008). In the western and central Pacific, 46 species of the genus are known (Meguro and Motomura, 2010). Of 4 species described by Shen (1994), Chiang and Chen (2008) regarded *E. rubicauda* Shen, 1994 as a junior synonym of *E. flavoccipitis* Shen, 1994, and *E. hsiojenae* Shen, 1994 and *E. leucopunctatus* Shen, 1994 as valid species, not junior synonyms of *E. vexillarius* Fowler, 1946 as asserted

by Fricke (1997). Around Japan, 15 species have been recorded (e.g., Shimojyo and Hayashi, 2000; Hayashi, 2002; Yoshigou and Yoshino, 2002; Shibukawa et al., 2004; Motomura et al., 2005).

During surveys of fish faunas along the coasts of Tosa Bay and Yaku-shima Island, many specimens of *Enneapterygius* were collected from rocky shores and tide-pools to 4 m depth. Some of these were identified as *E. leucopunctatus* based on counts of the fin rays and lateral-line scales, the mandibular pore pattern, and distinctive markings and coloration. Herein, we report this species from Japan for the first time.

Materials and methods

The specimens examined are deposited in the following institutions: Academy of Natural Sciences, Philadelphia, USA (ANSP); Laboratory of Marine Biology, Kochi University, Japan (BSKU); and Kagoshima University Museum, Japan (KAUM). Counts and measurements follow Hubbs and Lagler (1958). Measurements were made to the nearest 0.1 mm with dividers

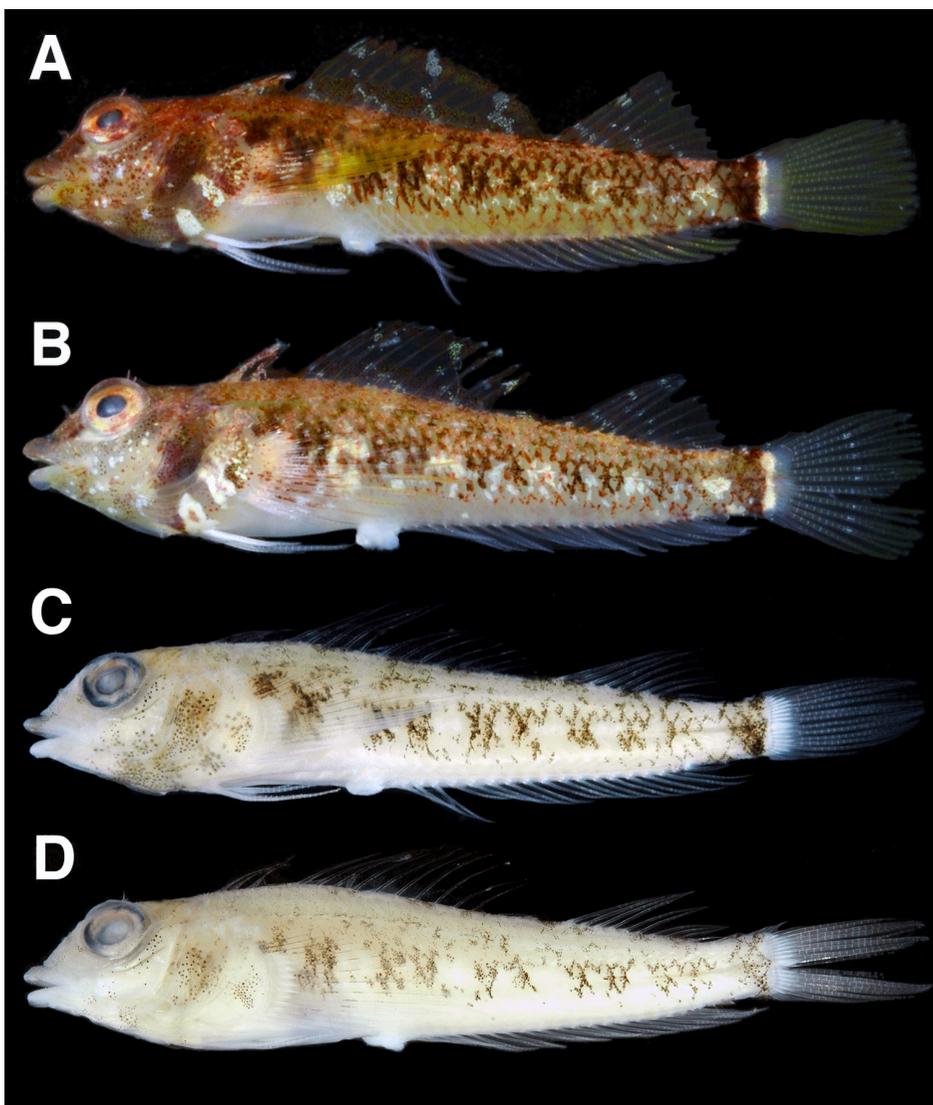


Fig. 1. *Enneapterygius leucopunctatus* from Yaku-shima Island, Kagoshima Prefecture (A, C: KAUM-I. 21838, male, 25.3 mm SL; B, D: KAUM-I. 21837, female, 26.4 mm SL). Fresh (A, B) and preserved (C, D) conditions.

and digital calipers under a binocular microscope. Terminology of the head lateral-line canals and mandibular pore formula follow Fricke (1997). Standard length and head length are abbreviated as SL and HL respectively. Fin rays and vertebrae were counted from radiographs. Observation of dentition, cephalic sensory tubes and pores, scales, and genital papillae were made using cyanine solution. To determine the sex, the gonads of each specimen were observed by partial dissection on the right side of the abdomen.

Enneapterygius leucopunctatus Shen, 1994
[New Japanese name: Hakuten-hebigimpo]
(Figs. 1, 2; Table 1)

Enneapterygius sp. 3: Shen, 1993: 491, 777, pls. 166-1, 166-2.

Enneapterygius leucopunctatus Shen, 1994: 12, fig. 8 (type locality: Taiwan); Chiang and Chen, 2008: 196, fig. 4i.

Enneapterygius vexillarius (not of Fowler, 1946): Fricke, 1997: 355 (in part); Randall and Lim, 2000: 632 (list; in part).

Materials examined. 17 specimens. Tosa Bay, Kochi (15 specimens): BSKU 55655, female, 35.6 mm SL, Shirano-hana, Tosa City, 4 Sept. 2001; BSKU 56266, female, 33.7 mm SL, Shirano-hana, Yokonami Peninsula, Tosa City, 2 Nov. 2001; BSKU 58044, female, 34.6 mm SL, Shirano-hana, Yokonami Peninsula, Tosa City, 23 May 2002; BSKU 65433, female, 28.9 mm SL, Karyougo, Nahari Town, 17 July 2003; BSKU 69833, female, 34.2 mm SL, Shioya Beach, Tei, Konan City, 9 Apr. 2004; BSKU 72857, female, 29.7 mm SL, Shirano-hana, Tosa City, 18 Sept. 2004; BSKU 73022, female, 28.8 mm SL, Ijiri, Tosa City, 5 June 2004; BSKU 73108, female, 26.2 mm SL, BSKU 73109, female, 26.6 mm SL, Shioya Beach, Tei, Konan City, 19 May 2004; BSKU 73162, female, 29.2 mm SL, BSKU 73163, female, 36.1 mm SL, Gyoudo-misaki, Muroto City, 26 May 2004; BSKU 73296, female, 30.1 mm SL, BSKU 73307, male, 27.4 mm SL, BSKU

Table1. Counts and measurements of *Enneapterygius leucopunctatus* from Japan and Taiwan. Mode of counts and mean of proportions in parentheses.

Locality	This study		Shen (1994)	Chiang and Chen (2008)
	Yaku-shima Island <i>n</i> = 2	Tosa Bay <i>n</i> = 15	Taiwan <i>n</i> = 9 (incl. 3 types)	Taiwan <i>n</i> = 6
SL (mm)	25.2–26.4	26.2–36.1	26.6–34.8	23.7–29.1
Second dorsal-fin rays	XIII	XII–XIII	XIII–XIV (XIII)	XIII
Third dorsal-fin rays	10	9–11(10)	9–10	9–11
Anal-fin soft rays	18–19	17–19 (18)	18–20	18
Pectoral-fin rays	3+6+7	3–5+3–7+6–7 (3+6+7)	2–5+5–8+6–8 (3+6+7)	–
Principal caudal-fin rays	ii+9–10+ii	ii+9+ii	–	–
Pored latera-line scales	15–17	16–18 (18)	17–19 (18)	17–18
Notched lateral-line scales	19	16–18 (17)	17–19	17
Transverse scale rows	2.5–3.5+1+6.5	2.5–3+1+5.5–6.5 (2.5+1+5.5)	–	–
Madibular pore formula	4+1+4	4–5+1+4–6 (4+1+4)	4+1+4	4+1+4
In SL				
Head length	3.2–3.3	3.1–3.6 (3.3)	3.2–3.4	—
Body depth	4.5–4.6	4.2–5.0 (4.6)	4.6–5.0	—
Predorsal length	3.8–3.9	3.7–4.1 (3.8)	3.8–4.0	—
Dorsal-fin base	1.5	1.4–1.5 (1.5)	1.5–1.6	—
Anal-fin base	2.3	2.2–2.5 (2.4)	2.5–2.6	—
Caudal-peduncle length	8.4–8.8	7.5–8.7 (7.9)	8.1–8.5	—
In HL				
Snout length	3.0–3.3	2.9–3.6 (3.2)	3.5–3.8	—
Orbit diameter	3.3	2.8–3.6 (3.1)	3.2–3.6	—
Postorbital length	1.8–2.0	2.0–2.5 (2.2)	2.1–2.2	—
Upper-jaw length	2.8–2.9	2.4–2.8 (2.6)	2.7–3.1	—
In % of SL				
Head length	30.7–31.1	27.7–31.9 (30.4)	—	27.3–31.0 (29.1)
Body depth	21.7–22.1	20.2–23.7 (21.8)	—	20.6–22.4 (21.3)
Body width	18.3–21.3	14.7–20.2 (17.9)	—	20.4–21.6 (20.8)
Predorsal length	25.8–26.2	24.2–27.2 (26.3)	—	24.9–28.0 (26.4)
Dorsal-fin base	67.1–68.1	65.6–69.7 (67.4)	—	—
Anal-fin base	43.0–44.4	40.6–43.8 (42.5)	—	37.2–45.3 (41.4)
Caudal-peduncle length	11.3–11.9	11.4–13.4 (12.7)	—	8.9–12.8 (10.1)
Caudal-peduncle depth	7.5–8.4	7.7–10.1 (9.2)	—	8.7–10.3 (9.4)
1st spine length of 1st dorsal fin	10.6–11.1	8.1–12.9 (11.2)	—	8.7–10.9 (9.8)
1st spine length of 2nd dorsal fin	16.2–16.7	13.8–17.7 (15.8)	—	13.1–15.5 (14.2)
1st ray length of 3rd dorsal fin	17.6–18.0	14.6–20.2 (17.5)	—	—
Pectoral-fin length	31.6–34.5	28.6–34.9 (32.7)	—	28.8–32.8 (30.8)
2nd ray length of pelvic fin	22.7–25.0	18.3–24.8 (22.2)	—	22.2–25.4 (23.7)
Anal-fin spine length	6.9–7.3	5.7–8.5 (7.1)	—	—
1st ray length of anal fin	10.8–12.5	8.8–14.8 (10.6)	—	—
Caudal-fin length	23.4–25.8	20.6–26.2 (24.3)	—	—
In % of HL				
Snout length	30.3–33.8	27.0–34.7 (31.1)	—	25.4–33.2
Orbit diameter	29.9–30.3	28.1–36.2 (32.8)	—	29.5–34.7
Postorbital length	51.2–54.3	39.8–51.1 (46.5)	—	—
Upper-jaw length	34.3–36.0	35.3–41.3 (38.3)	—	34.4–38.2

73308, female, 30.2 mm SL, BSKU 73309, female, 29.4 mm SL, Kiragawa Town, Muroto City, 22 Apr. 2004.

Yaku-shima Island, Kagoshima: KAUM-I. 21837, female, 26.4 mm SL, KAUM-I. 21838, male, 25.2 mm SL, 30°16'03"N, 130°24'48"E, Kurio, west of Kamazeno-hana, hand-net, 0–4 m depth, coll. by KAUM fish team, 30 July 2009.

Diagnosis. A species of *Enneapterygius* with the following combination of characters: second dorsal-fin spines 12–13 (rarely 14); anal-fin soft rays 17–19 (rarely 20); pored lateral-line scales 16–19; notched lateral-line scales 17–19; 1–6 rows of small cycloid scales on boundary between abdomen and sides; simple, unbranched dermal flap of anterior nostril; simple dermal flap on orbit; 1 teeth row on prevomer; mandibular pore formula usually 4+1+4 (4–5+1+4–6); body pale reddish brown in male, pale yellowish brown in female; 2 oblique white markings on shoulder girdle, upper one anterior to pectoral-fin base and lower one above pelvic-fin base; 8 dark saddle markings on body; 1 row of 5–6 small, ring-like white markings laterally on body; 1 blackish band with posterior white margin on caudal peduncle.

Description. Counts and measurements are shown in Table 1. Body moderately elongate and compressed posteriorly. Head moderate in size, its length about 3.3 in SL. Snout moderate in length, dorsal contour somewhat gently sloping. Maxilla reaching posteriorly to vertical lines between anterior rims of eye and pupil. Anterior nostril forming short tube with an unbranched dermal flap. Supraorbital cirrus slender, unbranched. Occipital branch of supratemporal canal complex, dividing into two large branches (united in some specimens) and some sub-branches with pores laterally and distally (Fig. 2).

First dorsal fin much lower than second. All dorsal- and anal-fin soft rays simple. Pectoral fin with uppermost rays simple, middle rays branched, and lowermost rays simple. Posterior end of pectoral fin below tenth to thirteenth spines of second dorsal fin. Caudal fin relatively long with 13 principal rays: upper and lowermost 2 rays simple, other rays branched. Conical teeth on both jaws, much enlarged in outer row, sparse in inner row. Prevomer and palatines toothed, single

row in the former. Gill-rakers on first arch 1+5–6.

Body covered with ctenoid scales except for head, pectoral-fin base, and ventral side of abdominal region from isthmus to anus. Lateral line discontinuous, composed of anterior pored scale row and posterior notched scale row, with one scale row between them. Anterior lateral line extending posteriorly to vertical line at twelfth or thirteenth spine of second dorsal fin. Posterior lateral-line origin below last pored scale, extending posteriorly to caudal-fin base. Longitudinal scale rows below first pored lateral line 30–36. 1–6 small cycloid scale rows located between naked area of abdomen and ctenoid scale rows on lateral body. Vertebrae 9–10+24–26.

Color when fresh (Fig. 1A, B). No melanistic coloration in male. Ground color in male: head reddish-brown dorsally, pale reddish to yellowish-brown laterally and ventrally; body pale reddish-brown, abdomen whitish, and ventral side above anal fin yellowish. Ground color in female: head and body pale reddish to yellowish-brown dorsally and laterally; cheek and ventral side of head, abdomen, and ventral side above anal-fin base whitish. A pair of brown stripes on snout between upper lip and eye. Suborbitals white. Some white spots on cheek. A large dark brown blotch on opercular region. Two oblique white bands (ring-like in some specimens) on shoulder girdle; upper blotch anterior to lowermost pectoral-fin base and lower blotch above pelvic-fin base. Dark brown blotch partly covered with upper white blotch anterior to pectoral-fin base. Pectoral-fin base white with dark blotch, with white spots anteriorly. A dark brown band dorsally on nape to middle of first dorsal-fin base. Eight saddle markings dorsally and laterally on body dark to blackish brown (each pair closely arrayed forming an M-shape laterally); dorsal interspace between saddle markings whitish to yellowish. A row of 6 white ring-like markings on lateral body, obscure in some specimens. A broad band on posterior caudal peduncle blackish to dark brown. Narrow white band on caudal-fin base. Fin spines and soft rays reddish-orange to yellow, partly whitish to translucent, forming stripes, except for white pelvic-fin rays. Fin membranes generally translucent. First dorsal-fin membrane with white, reddish-orange

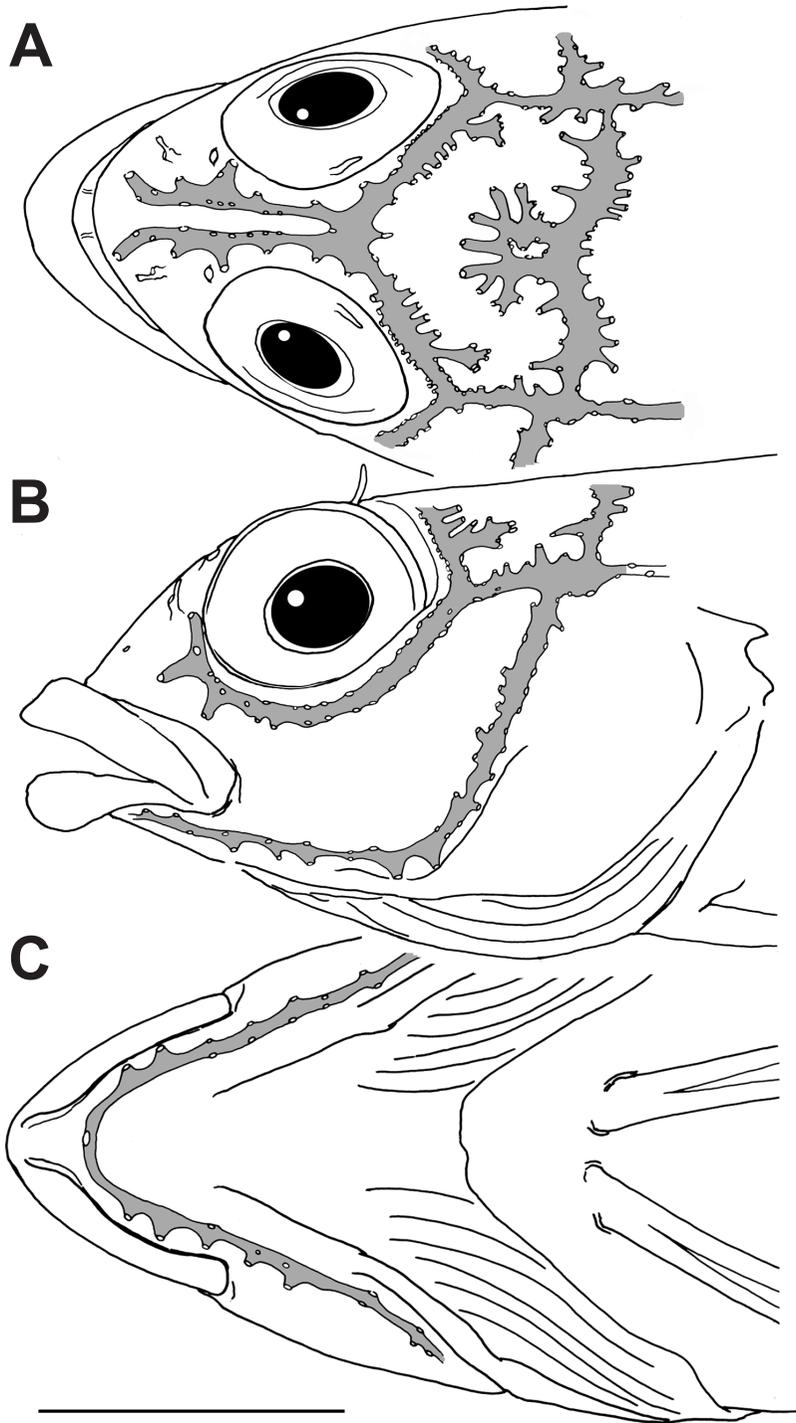


Fig. 2. Head lateral-line system of *Enneapterygius leucopunctatus* (KAUM-I. 21837, female, 8.2 mm HL, 26.4 mm SL, Yaku-shima Island, Kagoshima Prefecture). (A) dorsal view, (B) lateral view, and (C) ventral view. Scale bar indicates 3 mm. Drawn by E. Katayama.



Fig. 3. *Enneapterygius vexillarius* from Aguni-jima Island, Okinawa Prefecture, Japan (holotype, ANSP 72068, 30.1 mm SL).

and blackish pigments; second dorsal-fin membrane with two dark longitudinal bands on margin and near base, three oblique white bands generally interrupted; third dorsal-fin membrane with 3 to 4 oblique reddish-orange bands. Anal-fin rays reddish-orange basally, yellowish distally. Caudal-fin rays pale yellow in male, light grayish with a whitish transverse band on middle in female; 1 to 3 upper and lowermost rays reddish with stripes (absent or faint in some specimens). Pectoral-fin rays pale yellow in male, pale reddish-orange in female, with a large white blotch near middle of base, white spots on middle of rays, and a small red blotch on 3 to 4 uppermost rays near base; its base whitish.

Color in alcohol (Fig. 1C, D). Ground color of head and body cream to yellowish-cream. White, yellow, and reddish-orange coloration in fresh specimens fades in preservative except the transverse band on the caudal fin in female becomes translucent. Red, brown, and dark brown to blackish coloration in fresh remain as melanophores: band on upper lip and snout, two blotches on opercular and anterior to pectoral-fin base, 3 to 4 uppermost pectoral-fin rays near base, dorsal band on nape and anterior of first dorsal fin, 8 saddle markings on body, caudal peduncle band, first dorsal fin, and two longitudinal bands on second dorsal fin. In addition, melanophores present partly on underside of head with unpigmented area, isthmus, and anterior to pelvic-fin base; head pigmentation somewhat dense in male but sparse in female.

Distribution. In Japan, known from rocky shores at depths of 0–4 m in Tosa Bay, Kochi Prefecture, and Yaku-shima Island, Kagoshima Prefecture; also Taiwan (Shen, 1994; Chiang and Chen, 2008).

Remarks. In the western and central Pacific, the present specimens belong to the *E. etheostomus* species-group (Fricke, 1997) being characterized by having: a large body size (33–54 mm SL); high numbers of second dorsal-fin spines (12–16), anterior lateral-line scales (15–23) and total scale rows (32–39); parts of the anterior head and body dark in males; males with a high first dorsal fin; and posterior lateral-line series continuing 2 rows below the anterior series. This species-group includes 6 species: *E. etheostoma* (Jordan and Snyder, 1902), *E. vexillarius*, *E. miyakensis* Fricke, 1987, *E. leucopunctatus*, *E. hsiojenae*, and *E. senoui* Motomura, Harazaki and Hardy, 2005. As mentioned above, Chiang and Chen (2008) regarded *E. leucopunctatus* and *E. hsiojenae* as valid species, clearly different from *E. vexillarius* by fresh coloration, the mandibular pore pattern (4+1+4 in *E. leucopunctatus*, 3+1+3 in *E. hsiojenae* and *E. vexillarius*), and the counts of second dorsal-fin spines (14 in *E. hsiojenae*, 13 in *E. leucopunctatus*, and 16 in *E. vexillarius*). Further, their molecular analysis of 11 *Enneapterygius* species from around Taiwan indicated that *E. hsiojenae* and *E. leucopunctatus* are separated from each other (*E. hsiojenae* forms a clade with *E. elegans*), although *E. vexillarius* was not included in the analysis. We confirmed that the holotype of *E. vexillarius* (ANSP 72068) has 16 second dorsal-fin spines, 14 pored lateral-line scales, 16 notched lateral-line scales, 2+1+4 transverse scale rows, no dermal flap above eye (but probably damaged), and maxillary end slightly beyond vertical line at anterior rim of pupil (Fig. 3). In addition, Fowler (1946) noted that *E. vexillarius* showed the following markings and coloration: anal fin reddish, with 10 transverse dark bars, most distinct along base of fin; caudal fin red, with 5 irregular transverse gray bars; ventral body uniformly red.

The present specimens are easily separable from *E. etheostoma* and *E. miyakensis* by the shape of the anterior nostril's dermal flap (unbranched vs. 2–3 branches in other two species), the number of transverse scale rows above anterior lateral line (2.5–3 vs. 5–6), overall markings and coloration, and nuptial coloration in male (inconspicuous vs. melanistic: Senou, 2009), from *E. senoui* by the counts of second dorsal-

fin spines (12–13 vs. 14–15), pored lateral-line scales (15–18 vs. 20–21), overall markings and coloration, and nuptial coloration (vs. melanistic in male and yellow anal fin in female: Motomura et al., 2005), from *E. vexillarius* and *E. hsiojenae* by the mandibular pore pattern (usually 4+1+4 vs. 3+1+3) and overall markings and coloration (Fowler, 1946; Shen, 1994; Chiang and Chen, 2008). Further, our specimens clearly differ from *E. vexillarius* by the count of second dorsal-fin spines (12–13 vs. 16) and pored lateral-line scales (15–18 vs. 14).

Our specimens conform to *E. leucopunctatus* in having 12–13 second dorsal-fin spines (13 in 15 specimens), 9–11 third dorsal-fin rays (9 or 10 in 15 specimens), 17–19 anal-fin soft rays (18 in 12 specimens), usually 3+6+7 pectoral-fin rays, 15–19 pored lateral-line scales, 16–19 notched lateral-line scales, and usually a 4+1+4 mandibular pore pattern (Table 1; Fig. 2). In addition, 2 white bands on the shoulder girdle, 6 ring-like markings and 8 dark brown saddle-like markings on the body, a dark band on the caudal peduncle, other white and blackish stripes on fin membranes, and inconspicuous dichromatism agree well with the color photographs of *E. leucopunctatus* by Shen (1994). We tentatively regard some differences of counts and proportions among the specimens from Taiwan (Shen, 1994; Chiang and Chen, 2008), Yaku-shima Island and Tosa Bay as variation within the species. Although the range of snout length in Japanese specimens is different from that in the original description (2.9–3.6 in HL vs. 3.5–3.8), the photographs of two paratypes and the present materials suggest that the snout proportions do not significantly differ from each other (Fig. 1; Shen, 1994: fig. 8). Further, the range in Japanese specimens is almost identical with that in Chiang and Chen (2008) (27.0–34.7 % HL vs. 25.4–33.2) (Table 1). The wide range of some proportional characters, however, may suggest that the materials include more than one species.

Enneapterygius leucopunctatus has been previously recorded only from Taiwan: Wen-tz-keng (type locality, east of Keelung, in northern Taiwan), Chenggong (central east coast) and Feng-chui-sha (southern Taiwan) at depths of 2–12 m

(Shen, 1994; Chiang and Chen, 2008). Hence, the present specimens represent the first records from outside Taiwan. Although the species' known range is extended to Yaku-shima Island and Tosa Bay, southern Japan, its occurrence around the Ryukyu Islands and Amami-ohshima Islands is still unknown. If this gap between Taiwan and Yaku-shima Island is confirmed by further investigation, the distributional pattern of *E. leucopunctatus* may support a hypothesis of the Kuroshio Current acting as a barrier related to the endemism of the fish fauna around the Ryukyu Islands as proposed by Senou et al. (2006).

The new Japanese name of *E. leucopunctatus*, “Hakuten-hebigimpo”, meaning “white spotted triplefin”, is based on the male specimen of KAUM-I. 21838 collected from Yaku-shima Island, Kagoshima.

Comparative material examined. *Enneapterygius vexillarius*: ANSP 72068, holotype, 30.1 mm SL, 39.0 mm in total length, Aguni-jima Island, Okinawa Islands, 27 July 1945.

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