

Fishes of Yaku-shima island : a world heritage island in the Osumi group, Kagoshima prefecture, southern Japan

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ファイル (説明)	photos p249-261 p65-248 p27-64 p17-26 p9-16 p1-8 contents editors preface title page, colophon cover
URL	http://hdl.handle.net/10232/18133

First records of a triplefin (Tripterygiidae), *Enneapterygius hemimelas*, from Japan

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Abstract Four male specimens (19.4–21.8 mm standard length) of *Enneapterygius hemimelas* (Kner and Steindachner, 1867) (Tripterygiidae) were collected from Yaku-shima Island, Kagoshima Prefecture, Kyushu, Japan. Because previous Japanese records of *E. hemimelas* were based on mis-identifications of *E. bahasa* or *E. flavoccipitis*, and the northernmost record of *E. hemimelas* was Taiwan, the Yaku-shima Island specimens examined in this study represent the first records of *E. hemimelas* from Japan and the northernmost record for the species.

Key words: Tripterygiidae, *Enneapterygius hemimelas*, distribution, Yaku-shima Island, Japan.

Introduction

The triplefin genus *Enneapterygius* Rüppell, 1835 (Perciformes: Tripterygiidae) in the western and central Pacific Ocean was reviewed by Fricke (1997), then Fricke (2009) recognized 42 valid species in the region. In addition, *E. sheni* and *E. shaoi* were described by Chiang and Chen (2008) as new species from Taiwan. Three species originally described by Shen (1994), *E. erythrosomus*, *E. hsiojenae*, and *E. leucopunctatus*, were synonymized by Fricke (1997) with *E. rubicauda* Shen, 1994, *E. vexillarius* Fowler, 1946, and *E. vexillarius* respectively. However, Chiang and Chen (2008) redescribed *E. erythrosomus*, *E. hsiojenae*, and *E. leucopunctatus* as valid species. Furthermore, although Fricke (1997) regarded *E. rubicauda* as a valid species, Chiang and Chen (2008) considered it a junior synonym of *E. flavoccipitis* Shen, 1994. Thus, a total of 46 species has currently been recognized as valid members of *Enneapterygius* in the western and central Pacific Ocean.

Enneapterygius, the most speciose genus among the Tripterygiidae, has been defined by a discontinuous lateral line with an anterior series of 6–22 pored scales and a posterior series of 13–27 notched scales, a first dorsal fin with 3 spines,

an anal fin with 1 spine, a pelvic fin with 1 spine and 2 soft rays, and the head, opercle, pectoral-fin base and abdomen naked (Fricke, 1997). However, synapomorphies for the genus have not been defined, and further investigation at the generic level is therefore necessary (Motomura et al., 2005).

Enneapterygius hemimelas was originally described by Kner and Steindachner (1867) as *Tripterygium hemimelas* from the Samoa Islands, and Fricke (1994) designated a male specimen (USNM 220068, 20.6 mm SL, Fagasa Bay, Tutuila Island, American Samoa) as the neotype for the species. *Enneapterygius hemimelas* is currently known from Taiwan, the Philippines, and Indonesia east to Samoa (Fricke, 2009). Previous Japanese records of *E. hemimelas* were, in fact, mis-identifications of *E. bahasa* Fricke, 1997 or *E. flavoccipitis* (see Remarks).

During ichthyofaunal surveys of Yaku-shima Island, Kagoshima Prefecture, Kyushu, Japan (Motomura et al., 2010), four male specimens of *E. hemimelas* were collected from the southern coast of the island. These specimens are described herein as the first records of *E. hemimelas* from Japan and the northernmost record for the species.



Fig. 1. *Enneapterygius hemimelas* from Yaku-shima Island, Kagoshima Prefecture, Japan (KAUM-I. 11353, male, 19.5 mm SL). **A** and **B** indicate fresh and preserved specimens respectively.

Materials and methods

Counts and measurements follow Hubbs and Lagler (1947), Fricke (1994, 1997) and Motomura et al. (2005), with the mandibular-pore formula following Fricke (1997). Measurements were made to the nearest 0.1 mm with needle-point calipers under a dissecting microscope. Standard length is abbreviated as SL. Specimens of *E. hemimelas* examined in this study are deposited at the Kagoshima University Museum, Kagoshima, Japan (KAUM) and the Museum Support Center, Smithsonian Institution National Museum of Natural History, Suitland, USA (USNM).

Enneapterygius hemimelas (Kner and Steindachner, 1867)
[English name: Halfblack Triplefin]
[New Japanese name: Akegoromo-hebigimpo]
(Figs. 1–3; Table 1)

Tripterygium hemimelas Kner and Steindachner, 1867: 371 (type locality: Fagasa Bay, Tutuila Island, American Samoa, based on neotype).

Material examined. All specimens from Yaku-shima Island, Kagoshima, Japan: KAUM-I. 11353, male, 19.5 mm SL, east of Kamazeno-hana, Kurio, 30°16'03"N, 130°24'47"E, 0–3 m depth, hand net, coll. by KAUM fish team, 12 Aug. 2009; KAUM-I. 11354, male, 19.4 mm SL, same data as KAUM-I. 11353; KAUM-I. 11355, male, 21.5 mm SL, same data as KAUM-I. 11353; KAUM-I. 21659, male, 21.8 mm, south of Kamazeno-hana, Kurio, 30°15'57"N, 130°24'57"E, 0–2 m depth, hand net, coll. by G. Ogihara et al., 27 July 2009.

Diagnosis. A species of *Enneapterygius* with the following combination of characters: 12–14 second dorsal-fin spines; 15–18 + 17–19 lateral-line scales; 35 or 36 longitudinal scales rows; 1 symphyseal mandibular pore; mandibular pores usually 4 + 1 + 4 (rarely 6 + 1 + 5); blackish area on lower head of mature males separated into two parts, one extending from end of maxilla and near posteroventral margin of orbit onto middle and lower opercular margin and pectoral-fin base, and the other a narrow band, extending from front of upper lip to anteroventral margin of orbit; in mature males, two broad, black bands below third dorsal-fin base and caudal peduncle, the two bands joined ventrally; posterior half of anal fin black in mature males; caudal fin semitransparent white or yellow; caudal-fin base white; pectoral and pelvic fins and body (except for black areas) orange in mature males.

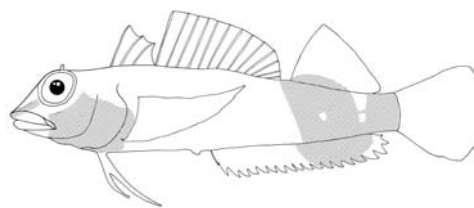


Fig. 2. Schematic depiction of melanistic male coloration of *Enneapterygius hemimelas*, based on three specimens (KAUM-I. 11353, KAUM-I. 11354, and KAUM-I. 21659) from Yaku-shima Island, Kagoshima Prefecture, Japan. Dotted areas indicate melanistic areas.

Description. Counts and measurements are given in Table 1. Cephalic sensory pore systems are illustrated in Figure 3. Body moderately elongate, slightly compressed anteriorly, progressively more compressed posteriorly; dorsal profile of snout moderately steep; anterior nostril a short

Table 1. Counts and measurements, expressed as percentages of standard length, of *Enneapterygius hemimelas*, including neotype, and non-types from Yaku-shima Island and the western Pacific.

	This study		Fricke (1997)	
	Yaku-shima Island, Japan (non-types) Males <i>n</i> = 4	Tutuila Island, American Samoa (neotype) Male <i>n</i> = 1	Western Pacific (neotype and non-types) Males Females <i>n</i> = 82 ¹	
Standard length (mm)	19.4–21.8	21.3	6.0–40.0	
Counts				
Second and third dorsal-fin rays	XII–XIV + 9–10	XII + 9	XI–XIV + 6–10	
Pectoral-fin rays	ii–iii + 5–6 + vi–viii	iii + 5 + vii	i–iv + 4–8 + vi–viii	
Anal-fin rays	I, 18–19	I, 18	I, 15–20	
Longitudinal scales rows	35–36	35	32–37	
Pored lateral-line scales	16–18	15–16 ²	13–20	
Notched lateral-line scales	18–19	17–18 ²	16–22	
Mandibular pore formula	4+1+4 or 6+1+5 ³	4+1+4	3–4+1–2+3–4	
Measurements				
Body depth	19.5–20.3 (19.9)	19.6	17.8–24.4	
Body width	18.5–19.3 (18.6)	17.5	11.9–17.2	
Head length	26.4–27.6 (26.9)	26.4	24.0–30.2	
Snout length	8.6–9.2 (8.9)	8.9	4.8–6.1 5.7–7.1	
Orbit diameter	9.9–11.0 (10.4)	10.0	8.2–12.7	
Interorbital width	2.4–3.0 (2.8)	2.9	2.4–4.2	
Upper-jaw length	10.9–12.0 (11.4)	11.9	9.1–12.0	
Postorbital length	11.6–13.6 (12.5)	12.3	—	
Pre 1st dorsal-fin length	26.8–28.0 (27.2)	26.5	23.8–27.6	
Pre 2nd dorsal-fin length	37.1–39.6 (37.9)	36.9	32.2–38.6	
Pre 3rd dorsal-fin length	71.8–73.6 (72.3)	70.2	63.7–71.8	
Preanal-fin length	48.8–51.4 (49.3)	47.2	47.3–55.3	
Prepectoral-fin length	31.1–32.2 (31.4)	30.9	28.0–34.9	
Prepelvic-fin length	21.9–23.0 (22.2)	21.5	20.9–25.6	
Caudal-peduncle length	9.2–11.6 (10.5)	10.5	10.1–15.3	
Caudal-peduncle depth	7.7–8.6 (8.0)	7.2	6.5–9.7	
1st spine length of 1st dorsal fin	10.4–11.0 (10.6)	10.0	7.7–12.4 5.8–7.9	
2nd spine length of 1st dorsal fin	9.3–10.2 (9.6)	9.1	6.7–11.6 8.3–9.4	
3rd spine length of 1st dorsal fin	7.2–8.8 (8.0)	7.8	4.5–9.7	
Longest spine length of 2nd dorsal fin	13.1–14.4 (13.9)	13.6	—	
Longest ray length of 3rd dorsal fin	15.3–15.7 (15.5)	15.4	13.7–20.2	
Pectoral-fin length	30.3–32.8 (31.7)	31.5	27.5–36.3	
2nd ray length of pelvic fin	21.1–24.0 (23.3)	24.9	20.2–25.2	

¹Counts were based on 82 specimens, but the number of specimens measured was not indicated by Fricke (1997). ²Counts included scales on right and left sides of the neotype. ³Only one specimen had 6 + 1 + 5. Means in parentheses.

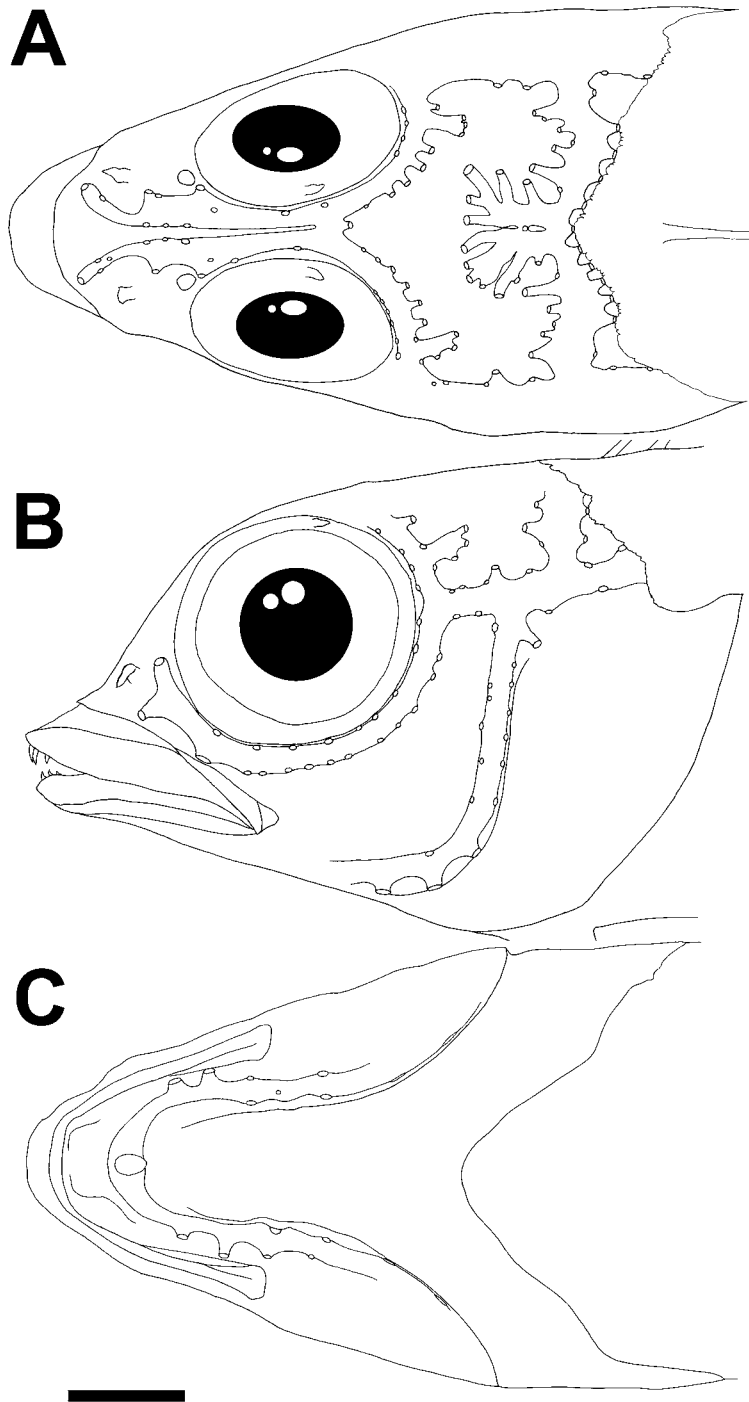


Fig. 3. Cephalic sensory pore systems of *Enneapterygius hemimelas* (KAUM-I. 11353, male, 19.5 mm SL, Yaku-shima Island, Kagoshima Prefecture, Japan). (A) Dorsal, (B) lateral, and (C) ventral views of head. Bar represents 1 mm.

membranous tube with an unbranched, thin tentacle; anterior nostril located at mid-level of eye; posterior nostril opening elliptic; eyes oriented dorsolaterally; a minute, simple tentacle on upper posterior part of eye; interorbital space very narrow, width less than pupil diameter; mouth slightly oblique; posterior margin of maxilla just short of, or extending slightly beyond, a vertical through anterior margin of pupil; uppermost anterior margin of upper jaw approximately level with lowermost margin of orbit.

Lateral line discontinuous, with an anterior series of pored scales and a posterior series of notched scales; pored scale series ending below membrane between last spine of second dorsal fin and body; notched scale series beginning below last or penultimate pored scale and ending at caudal-fin base; one vertical scale row between posteriormost pored scale and notched lateral line; body covered with ctenoid scales; size of scales above and below lateral lines subequal; head (including maxilla, interorbital space, preopercle and opercle), pectoral-fin base, pre- and inter pelvic region and abdomen naked; no scales between head and first spine of first dorsal fin; fins naked, except caudal-fin base.

First dorsal-fin origin above middle of opercle, first spine longest, third spine shortest (1.2–1.5 in first spine); distal margin of first dorsal-fin membrane notched; second dorsal-fin origin above fifth pored lateral-line scale, second to fourth spine longest (longer than first spine of first dorsal fin); third dorsal-fin origin above fifth or sixth notched lateral-line scale; first or second soft ray longest; pelvic-fin origin anterior to first dorsal-fin origin; uppermost pectoral-fin ray origin below second or third spine of first dorsal fin; pectoral fin pointed, posterior tip of longest ray below twelfth to fourteenth spine of second dorsal fin, not reaching to level of third dorsal-fin origin; anal-fin origin below sixth spine of second dorsal fin; posterior margin of caudal fin slightly rounded.

Color of mature males when fresh. Based on color photographs of KAUM–I. 11353 (Fig. 1A), KAUM–I. 11354, KAUM–I. 11355, and KAUM–I. 21659, all from Yaku-shima Island. Schematic depiction of melanistic male coloration is given in Figure 2. Head reddish orange with a black nar-

row band, its width less than pupil diameter, from front of upper lip to anteroventral margin of orbit, and black area extending from posterior margin of maxilla and near posteroventral margin of orbit to middle and lower opercular margin; body reddish orange with several indistinct blackish and whitish blotches mid-laterally below first and second dorsal fins, and two broad, black bands below third dorsal fin and caudal peduncle, the two bands joined ventrally; pectoral fin orange or yellow, with black base; pelvic fin yellowish orange or white; dorsal fins semitransparent with poorly defined yellow, white and blackish blotches, especially on first dorsal fin; anal fin reddish orange anteriorly, black posteriorly; caudal fin semitransparent white or yellow, white basally.

Color of preserved male specimens. Head white with a black narrow band from front of upper lip to anteroventral margin, and black area extending behind posterior margin of maxilla and posteroventral margin of orbit to middle and lower opercular margin; body white with several indistinct blackish blotches mid-laterally below first and second dorsal fins, and a broad black band from posterior end of second dorsal fin to caudal-fin base; pectoral fin semitransparent, with black base; pelvic fin white; first and second dorsal fins semitransparent; anal fin semitransparent anteriorly, black posteriorly; caudal fin semitransparent with white base.

Distribution. The species is currently known from the western Pacific, with reliable records from Yaku-shima Island (this study), Taiwan, Hainan Island, Philippines, Indonesia, Phoenix Island, American Samoa (type locality), Tonga, Marianas, Marshall Islands, and Australia (Schultz et al., 1960; Myers, 1999; Matsuura et al., 2001; Allen and Adrim, 2003; Randall, 2005; Fricke, 2009). The Yaku-shima Island specimens were collected from rocky tidepools in depths of less than 3 m. In the western Pacific, most specimens were collected from reef flats or tidepools in depths of less than 5 m (Randall, 2005).

Remarks. The *Enneapterygius hemimelas* group was defined by Fricke (1997) as having the following combination of characters: a small to medium sized body; a relatively long anterior lateral-line series, with 13–23 pore scales; a rela-

tively low first dorsal-fin ray in both sexes; caudal peduncle without black narrow vertical bars or blotches; lower half of head black in mature males; usually at least some parts of body and unpaired fins black in mature males; and 1 or 2 vertical scale rows between posteriormost pored lateral-line scale and notched lateral line. This group comprises *E. atriceps* (Jenkins, 1903), *E. bahasa*, *E. clea* Fricke, 1997, *E. hemimelas*, *E. namarrgon* Fricke, 1997, *E. nigricauda* Fricke, 1997, *E. signicauda* Fricke, 1997, and *E. similis* Fricke, 1997.

The four male specimens from Yaku-shima Island were identified as belonging to the *E. hemimelas* group in having the aforesaid characters, and characters of the specimens agreed with description of *E. hemimelas* given by Fricke (1997). However, there are some differences between morphometric data for *E. hemimelas* given by Fricke (1997) and this study (Table 1), although measurement methods are the same between the two. Fricke (1997) gave body width as 11.9–17.2% of SL [vs. 18.5–19.3% (mean 18.6%) in this study], and snout length in males 4.8–6.1% of SL [vs. 8.6–9.2% (8.9%)]. The neotype of the species (male) was examined by both of Fricke (1997) and this study, and data for the neotype are consistent with those of non-type specimens of *E. hemimelas* given by this study. So Fricke's (1997) morphometric data are most likely to be erroneous.

Enneapterygius hemimelas can be separated from the remaining six species in the group by the number of symphyseal mandibular pores and mature male coloration (Fricke, 1997). *Enneapterygius hemimelas* is easily distinguished from *E. bahasa* by having a single symphyseal mandibular pore (vs. 2–8 pores in the latter; Fricke, 1997). The blackish area on the lower head of mature males of *E. hemimelas* is separated into two parts: one extending from the end of the maxilla and near the posteroventral margin of the orbit onto the middle and lower opercular margin (and onto pectoral-fin base); and the other is a narrow band, extending from the front of the upper lip to the anteroventral margin of the orbit (Fricke, 1997; Figs. 1–2). However, the blackish area on the lower head of males of all other species in

the *E. hemimelas* group is not separated (Fricke, 1997). In addition, *E. hemimelas* has a distinct color pattern on the posterior portion of the body. It is distinguished from *E. bahasa*, *E. clea*, *E. nigricauda*, *E. similis*, and *E. signicauda* by having a semitransparent whitish or yellowish caudal fin in mature males (vs. fin entirely black in the first four species, and only basal half of fin black in *E. signicauda*; Fricke, 1997). Although mature males of *E. atriceps* and *E. namarrgon* have a semitransparent caudal fin, they differ from *E. hemimelas* in lacking black markings on the anal fin (vs. posterior half of fin black in the latter; Figs. 1–2). The anal-fin coloration (black posterior half of fin) of mature male *E. hemimelas* is unique among the *E. hemimelas* group (tips of last one or two anal-fin rays in male *E. clea* being black).

Enneapterygius hemimelas was originally described by Kner and Steindachner (1867) from the Samoa Islands. Fricke (1994) regarded *E. fuligicauda* (Fowler, 1946) and *E. macrobrachium* (Fowler, 1946), both originally described from Aguni-jima Island, Japan, as junior synonyms of *E. hemimelas*. However, Fricke (1997) re-considered *E. fuligicauda* and *E. macrobrachium* to be junior synonyms of *E. philippinus* (Peter, 1869) and *E. rubicauda*, respectively, and identified Masuda et al.'s (1984) *E. hemimelas* (Japanese name: Gomafu-hebigimpo) from the Ryukyu Islands as *E. rubicauda*. Recently, Chiang and Chen (2008) synonymized *E. rubicauda* with *E. flavoccipitis*; thus, Masuda et al.'s (1984) *E. hemimelas* is identified as *E. flavoccipitis*. The Japanese name “Gomafu-hebigimpo” (for *E. hemimelas* in Masuda et al., 1984) has been applied to *E. bahasa* since Shimojyo and Hayashi (2000).

Myer (1989) included the Ryukyu Islands in the distributional range of *E. hemimelas*, but he might have simply cited Masuda et al.'s *E. hemimelas* (= *E. flavoccipitis*), and not based the record on any other information or specimens. Hayashi (2002) reported and illustrated a male and female of *E. hemimelas* from the Ryukyu Islands. However, Hayashi's (2002) *E. hemimelas* is identified here as *E. bahasa* in having three symphyseal mandibular pores and a black caudal peduncle and fin (anal fin and trunk below anterior portion of third dorsal-fin base not black).

Thus, the Yaku-shima Island specimens examined during this study represent the first record of *E. hemimelas* from Japan and the northernmost record for the species.

Comparative material examined. *Enneapterygius hemimelas*: USNM 220068, neotype of *Tripterygium hemimelas*, male, 20.6 mm SL, Fagasa Bay, Tutuila Island, American Samoa, 0–3 m depth, 7 Oct. 1975, coll. by R. Wass.

Acknowledgments

We are grateful to Y. Haraguchi, G. Ogihara, T. Yoshida and M. Yamashita (Kagoshima, Japan) for their curatorial assistance, J. Williams (USNM) for his kind hospitality during the first author's stay at USNM, and G. Yearsley (Hobart, Australia) who read the initial manuscript and offered helpful comments. This study was supported in part by a Grant-in-Aid for Scientific Research (A) (19208019) from the Japan Society for the Promotion of Science, Tokyo, Japan, and a Grant-in-Aid for Young Scientists (B) (19770067) from the Ministry of Education, Science, Sports and Culture, Japan.

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