First specimen-based record of *Epinephelus quoyanus* (Perciformes: Serranidae) from Okinawa Prefecture, Japan

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Abstract. A single specimen of *Epinephelus quoyanus* (Valenciennes, 1830), collected from the Kerama Islands, represents the first specimen-based record from the Ryukyu Islands, thereby confirming the distribution of the species in that region. At 312.3 mm standard length, the specimen, described in detail, is the largest

Key words: groupers, distribution, fish fauna, new record, taxonomy, morphology

Introduction

recorded for the species.

The serranid fish genus *Epinephelus* Bloch, 1793 is currently represented in Japanese waters by 43 species (Senou, 2013, Fujiwara *et al.*, 2015). Among these, *Epinephelus quoyanus* (Valenciennes, 1830) has been reliably reported from Izu-oshima island, Wakayama and Kochi prefectures, and Yaku-shima island, although its distribution in waters off the Ryukyu Islands has been uncertain (Senou, 2013). A single specimen, recently collected from the Kerama Islands, represents the first confirmed record of the species from the Ryukyu Islands.

Materials and Methods

Methods for counts and proportional measurements followed Randall & Heemstra (1991) are shown in Table 1. Standard length is abbreviated as SL. All measurements were made with digital calipers to the nearest 0.1 mm. Institutional codes used in this study are as follows: Kyoto University Museum, Kyoto (FAKU); the Kagoshima University Museum (KAUM); Kanagawa Prefectural Museum of Natural History, Odawara (KPM); Kochi Senior High School, Kochi (KSHS; currently transferred to National Museum of Nature and Science, Tsukuba); and Okinawa Churashima Foundation, Motobu (OCF).

Epinephelus quoyanus (Valenciennes, 1830) Standard Japanese name: Moyo-hata (Fig. 1; Table 1)

Material examined. OCF-P 3218, 312.3 mm SL, southeastern Mae-shima island, Kerama Islands, Ryukyu Islands, Japan, 25 m depth, spear, 25 Dec. 2015, S. Kato.

Description. Body oblong, rather compressed, greatest depth at origin of 2nd dorsal-fin spine,

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Fig. 1. Fresh specimen of *Epinephelus quoyanus* (OCF-P 3218, 312.3 mm SL, Mae-shima island, Kerama Islands, Okinawa Prefecture, Japan).

Table 1. Counts and measurements of	Epinephelus quoyanus	from the Ryukyu Islands.
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	Mae-shima island, Kerama Islands, Japan OCF-P 3218		Mae-shima island, Kerama Islands, Japan OCF-P 3218
Standard length (thousandths)	312.3	Measurements (% of SL)	
Counts		Pre-pelvic-fin length	36.9
Dorsal-fin spines	11	Dorsal-fin base	61.9
Dorsal-fin rays	17	1st dorsal-fin spine length	5.5
Anal-fin spines	3	2nd dorsal-fin spine length	10.3
Anal-fin rays	8	3rd dorsal-fin spine length	13.1
Pectoral-fin rays	16	4th dorsal-fin spine length	13.7
Pelvic-fin spines	1	5th dorsal-fin spine length	12.7
Pelvic-fin rays	5	6th dorsal-fin spine length	12.0
Principal caudal-fin rays	8 + 7	7th dorsal-fin spine length	12.1
Pored lateral line scales	50	8th dorsal-fin spine length	11.2
Scale rows in longitudinal series	80	9th dorsal-fin spine length	10.1
Gill rakers	5 + 13	10th dorsal-fin spine length	9.8
Measurements (% of SL)		11th dorsal-fin spine length	10.0
Body depth	34.7	1st dorsal-fin ray length	13.4
Body width	20.0	Longest dorsal-fin ray length	16.7
Head length	38.9	Anal-fin base	19.0
Snout length	8.4	1st anal-fin spine length	4.9
Orbit diameter	6.5	2nd anal-fin spine length	9.8
Interorbital width	6.7	3rd anal-fin spine length	10.0
Suborbital depth	3.2	1st anal-fin ray length	13.6
Upper-jaw length	16.9	Longest anal-fin ray length	17.6
Caudal-peduncle depth	12.0	Caudal-fin length	26.7
Caudal-peduncle length	17.6	Pectoral-fin length	29.3
Pre-dorsal-fin length	32.5	Pelvic-fin length	22.1
Pre-anal-fin length	67.2	Pelvic-fin spine length	10.5

greatest width at uppermost point of pectoral-fin insertion: dorsal and ventral profiles slightly concave. dorsal profile moderate rising from snout tip to 5th dorsal-fin spine origin, thereafter lowering to posterior end of dorsal-fin base; ventral profile lowering from lower-iaw tip to origin of pelvic fin, thereafter rising to posteriormost point of anal-fin base. Caudal peduncle compressed. Pectoral fin rather long, 1.32 times in head length; uppermost point of insertion anterior to posteriormost point of opercle; lowermost point of insertion slightly anterior to pelvic-fin origin; posterior fin margin rounded, reaching to a vertical line through origin of 9th dorsal-fin spine. Anterior most point of pelvic-fin base just below 2nd dorsal-fin spine origin; posteriormost point slightly posterior to origin of 3rd dorsal-fin spine. Posterior end of depressed pelvic fin beyond a vertical line through 7th dorsal-fin spine origin, not reaching anus. Last pelvic-fin ray connected to body by membrane. Dorsal-fin base extending from slightly anterior to pelvic-fin origin to posterior to anal-fin base. Contour of spinous portion of dorsal-fin moderately notched, soft rayed portion straight. Anal-fin base extending from just below 1st dorsal-fin-ray origin to just below 12th dorsal-fin-ray origin. Caudal fin rounded. Body covered with small rough ctenoid scales. Isthmus, lips and pectoral-fin axillary region without scales. Eye and iris elliptical. Interorbital space flat. Nostrils round, paired, positioned close together and anterior to eye. Anterior nostril with dermal flap. Mouth large, posteriormost point of upper jaw well beyond a vertical line through posterior margin of eye. Anteriormost point of lower jaw anterior to that of upper jaw. Posterior edge of preopercle serrated, serration at corner enlarged. Lower edge of preopercle and posterior edge of opercle smooth. Opercle with two spines, upper spine longer than lower. Anus oval, situated anterior to anal-fin origin. Upper jaw, vomer, palatine and lower jaw with small dense conical teeth. A pair of fang-like teeth anteriorly on both jaws. Ventral edge of maxilla smooth, without step-like projection. Gill rakers long, slender. Pseudobranchial filaments present. Lateral line continuous, parallel with dorsal contour, straightening along caudal peduncle.

Color when fresh (Fig. 1): Body and dorsal and caudal fins yellowish-white with close-set reddish-brown blotches (dark brown on fins), forming yellowish-white reticulation. Two reddish-brown oblique bands on thorax. Pectoral fin reddish brown with white vermicular markings. Posterior part of pectoral fin uniformly very dark red. Pelvic fin pale yellow with dark red spots and black margin. Anal fin very pale yellow with reddish-brown blotch and black margin. Iris reddish. Pupil blueish-black.

Remarks. The specimen was identified on the basis of the following combination of characters, which closely matched the diagnostic features of *E. quoyanus* given by Randall & Heemstra (1991), Heemstra & Randall (1993, 1999), and Senou (2013): pectoral-fin length 1.32 times in head length; 17 dorsal-fin rays; serration at corner of preopercle enlarged; two reddish-brown oblique stripes running from lower part of opercular margin to origin of pelvic fin; ventral margin of maxilla smooth, without step-like projection; body covered with rough ctenoid scales; body and caudal fin with close-set reddish-brown blotches, forming yellowish-white reticulation; anal-fin margin black; pectoral fin reddish-brown with white reticulated markings on base.

Although *E. quoyanus* is most similar to *E. macrospilos* (Bleeker, 1855), both having the body and caudal fin with close-set reddish-brown blotches, forming yellowish-white reticulation, rounded caudal fin and the dorsal fin base lacking large black blotches (Heemstra & Randall, 1993, 1999; Senou, 2013), the former is characterized by the anal fin margined with black (margined with white in *E. macrospilos*), two reddish-brown oblique bands on the thorax (spots on thorax), and the body covered with rough scales (midlateral body scales smooth; Randall & Heemstra, 1991; Heemstra & Randall, 1993, 1999; Senou, 2013).

Although Randall & Heemstra (1991) and Heemstra & Randall (1993, 1999) described the numbers of upper and lower gill rakers of *E. quoyanus* as 6–8 and 14–16 respectively, those of the present specimen numbered 5 and 13 respectively. This minor difference is regarded herein as an intraspecific variation of *E. quoyanus*.

Reliable records of E. quoyanus in Japanese waters have been reported only from Wakayama and Kochi prefectures (Ikeda, 1999), Yaku-shima island (Motomura et al., 2010) and Izu-oshima island (Senou, 2013). Ikeda (1999) reported two specimens from Minabe Town, Wakayama Prefecture (FAKU 72319, 220.0 mm SL) and Kashiwa-jima island, Kochi Prefecture (KSHS 21064, 138.0 mm SL); Motomura et al. (2010) reported a single specimen (KAUM-I. 20042, 81.2 mm SL) from Yudomari, Yaku-shima island. Senou (2013) included an underwater photograph (KPM-NR 98668) of the species taken off Izu-oshima island. Although Katayama (1960) and Yoshino & Nishijima (1981) reported the species from Amami-oshima and Sesoko-jima islands respectively, their records were not based on voucher specimens or reliable photographs. Furthermore, records of E. quoyanus from Sagami Bay (Hayashi & Ito, 1974), Suruga Bay (Kuroda, 1951), Mie Prefecture (Kataoka & Tomita, 1981), the Japan Sea coast of Yamaguchi (Kawano et al., 2011a, b) and Fukuoka prefectures (Kawano et al., 2011b), and the Tokara Islands (Kamohara, 1954) were similarly unsupported by voucher specimens. Unsupported records of E. quovanus from the Ogasawara Islands in Sugiura (1970), Kurata et al. (1971) and Zama & Fujita (1977) were suggested by Randall et al. (1997) as having been based on mis-identifications of E. macrospilos. Accordingly, the present specimen from the Kerama Islands represent the first reliable record of E. quoyanus from the Ryukyu Islands.

The largest specimen of *E. quoyanus* previously recorded being 308 mm SL [collected from the southern Great Barrier Reef, Australia (Randall & Heemstra, 1991)], the present specimen (312.3 mm SL) becomes the largest record for the species.

Comparative material examined. Epinephelus macrospilos (6 specimens, 84.8-361.0 mm SL): KAUM-I. 36320, 127.7 mm SL, KAUM-I. 36322, 84.8 mm SL, off Okinoerabu-jima island, Amami Islands, Kagoshima Prefecture, Japan, collection date and collector's name unknown; KAUM-I. 51312, 158.9 mm SL, Chabana Port, Yoron-jima island, Amami Islands, Kagoshima Prefecture, Japan (27°02'09"N, 128°24'08"E), 24 Oct. 2012, line fishing, Y. Kimura; KAUM-I. 60916, 297.7 mm SL, off Yoron-jima island, Amami Islands, Kagoshima Prefecture, Japan, purchased at Yoron Fish Market, 1 May 2014, H. Motomura; KAUM-I. 66189, 361.0 mm SL, off Sunasaka Fishing Port, Tanega-shima island, Osumi Islands, Kagoshima Prefecture, Japan (30°28'N, 130°53'E), 10 m depth, line fishing (purchased at Minamitane Fish Market), 17 Sept. 2014, H. Hata and M. Takayama; KAUM-I. 71148, 139.3 mm SL, Chabana Port, Yoron-jima island, Amami Islands, Kagoshima Prefecture, Japan (27°02'57"N, 128°24'43"E), depth 1-2 m, 18 Mar. 2015, hand net, T. Yoshida.

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