

# First Records of the Two-tone Goatfish, *Upeneus guttatus*, from Japan, and Comparisons with *U. japonicus* (Perciformes: Mullidae)

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*Upeneus guttatus* (Day, 1868) (Perciformes: Mullidae) is recorded from Japan for the first time on the basis of 21 specimens (57.8–139.5 mm standard length) collected from Kagoshima Prefecture, southern Japan. These specimens also represent the first records of *U. guttatus* from East Asia and the northernmost records in the western Pacific Ocean; this species has not previously been recorded north of the Philippines. The Japanese specimens of *U. guttatus*, described herein in detail, and 14 specimens from the Indo–West Pacific are compared with 33 specimens of *U. japonicus* (Houttuyn, 1782).

**Key Words:** Teleostei, Actinopterygii, *Upeneus japonicus*, Kagoshima, distribution.

## Introduction

*Upeneus* Cuvier, 1829 (Perciformes: Mullidae) was recently reviewed by Uiblein and Heemstra (2010), who recognized 26 valid species in the genus, including their four new species from the western Indian Ocean. Subsequently, Uiblein and Heemstra (2011a,b) described *U. randalli* and *U. seychellensis* as new species from the Persian Gulf and Seychelles Bank respectively. Uiblein and Heemstra (2010) defined four major species groups within *Upeneus* using a combination of the numbers of dorsal-fin spines, gill rakers and pectoral-fin rays, and caudal-fin coloration.

*Upeneus guttatus* (Day, 1868), widespread Indo–West Pacific species, was included in the *Upeneus japonicus* species group, which is characterized by having seven dorsal-fin spines (Uiblein and Heemstra 2010, 2011b). In the northwestern Pacific Ocean, *U. guttatus* had been recorded only from the Philippines until an ichthyological survey of southern Japan yielded 21 specimens from the East China Sea and Pacific Ocean sides of Kagoshima Prefecture at depths of less than 40 m. These specimens are described herein as the first records of *U. guttatus* from Japan and the northernmost records of this species in the western Pacific Ocean. Detailed comparisons of *U. guttatus* with a co-occurring species, *U. japonicus* (Houttuyn, 1782), are also made.

## Material and Methods

Counts and measurements generally follow Randall and

Kulbicki (2006) and Uiblein and Heemstra (2010). Standard length is abbreviated as SL. Osteological characters were examined from radiographs taken from six specimens of *Upeneus guttatus*. The formula for the configuration of the anterior neural spines and anterior dorsal fin pterygiophores follows Ahlstrom *et al.* (1976). The presence of a swimbladder was confirmed by dissection of the abdomen on the right side. The ‘Description’ section below is based on Japanese specimens of *U. guttatus*.

Specimens examined in this study have been deposited in the Australian Museum, Sydney (AMS); Bishop Museum, Honolulu (BPBM); Fisheries Research Laboratory, Mie University, Shima (FRLM); Kagoshima University Museum, Kagoshima (KAUM); Muséum National d’Histoire Naturelle, Paris (MNHN); National Museum of Nature and Science, Tsukuba (NSMT); Seikai National Fisheries Research Institute, Nagasaki (SNFR); Museum of Zoology, University of Michigan, Ann Arbor (UMMZ); and Museum Support Center, Smithsonian Institution National Museum of Natural History, Suitland (USNM).

Full counts and measurements of the following 23 specimens (74.7–139.0 mm SL) of *Upeneus japonicus* were taken: **Japan**—KAUM–I. 388, 95.8 mm SL, 19 Apr. 2006, KAUM–I. 7015, 110.7 mm SL, 9 June 2007, KAUM–I. 9847, 104.8 mm SL, 7 May 2008, east of Sakinoyama, Kataura, Kasasa, Minami-satsuma, Kagoshima, 31°25′44″N, 130°11′49″E, set net, 27 m, M. Itou; KAUM–I. 3128, 139.0 mm SL, off Kouzaki-yama, Kataura, Kasasa, Minami-satsuma, Kagoshima, 31°26′00″N, 130°10′05″E, set net, 36 m, Y. Masuda, 20 Apr. 2007; KAUM–I. 9212, 90.9 mm SL, 9 Apr. 2009, KAUM–I. 13819, 90.6 mm SL, 28 Jan. 2009,

1 km southwest of Kawajiri Fishing Port, Kaimon-kawajiri, Ibusuki, Kagoshima, 31°10'N, 130°32'E, set net, 40 m, G. Ogihara and T. Yoshida; KAUM-I. 5947, 82.6 mm SL, 8 Aug. 2007, KAUM-I. 7440, 80.5 mm SL, 10 Dec. 2007, off Chiringa-jima island, Ibusuki, Kagoshima Bay, 31°16'38"N, 130°40'18"E, set net, 25 m, Orita Fishery; KAUM-I. 331, 83.4 mm SL, Uchinoura Bay, Kimotsuki, Kagoshima, 31°17'N, 131°05'E, set net, 40 m, M. Yamada, 6 Apr. 2006; KAUM-I. 792, 94.0 mm SL, 1 km north of Izashiki Port, Sata, Minami-osumi, Kagoshima, 31°05'N, 130°41'E, set net, 30–40 m, M. Chikuchishin, 25 Sep. 2006; KAUM-I. 9614, 89.8 mm SL, Meitsu, Nango, Miyazaki, 31°32'44"N, 131°22'53"E, H. Motomura, 26 Apr. 2008; KAUM-I. 12623, 107.6 mm SL, off Urato, Mimase, Kochi, 33°29'N, 133°34'E, trawl, 100–200 m, G. Ogihara and M. Meguro, 9 Mar. 2008; NSMT-P 45177, neotype of *Mullus japonicus*, 96.5 mm SL, off Futo Harbor, east of Izu Peninsula, Shizuoka, 15 m, K. Okamoto *et al.*, 12 Mar. 1993. **China** — SNFR 12061, 5, 109.0–128.5 mm SL, Yellow Sea, 9 Feb. 1997. **Taiwan** — KAUM-I. 39239, 74.7 mm SL, off Kaohsiung, trawl, H. Ho and M. Matsunuma, 3 July 2011; KAUM-I. 39614, 115.5 mm SL, KAUM-I. 39615, 123.4 mm SL, KAUM-I. 39616, 119.3 mm SL, KAUM-I. 39617, 110.9 mm SL, off Keelung, M. Meguro and M. Matsunuma, 13 July 2011.

Selected counts (*i.e.*, gill rakers) and measurements (*i.e.*, barbel and pectoral-fin lengths) of the following 10 specimens (96.0–137.3 mm SL) of *U. japonicus* from Japan were taken for comparative purposes: KAUM-I. 21033, 115.1 mm SL, off Kouzaki-yama, Kataura, Kasasa, Minami-satsuma, Kagoshima, 31°26'00"N, 130°10'05"E, set net, 36 m, M. Itou, 17 Apr. 2009; KAUM-I. 18956, 103.7 mm SL, 1 km southwest of Kawajiri Fishing Port, Kaimon-kawajiri, Ibusuki, Kagoshima, 31°10'N, 130°32'E, set net, 40 m, G. Ogihara and T. Yoshida, 15 Apr. 2009; KAUM-I. 21228, 114.4 mm SL, off Chiringa-jima island, Ibusuki, Kagoshima Bay, 31°16'38"N, 130°40'18"E, set net, 25 m, Orita Fishery, 8 July 2009; KAUM-I. 30949, 137.3 mm SL, KAUM-I. 30956, 127.4 mm SL, Shibushi Bay, Shibushi, Kagoshima, 31°38'N, 131°14'E, trawl, 70–100 m, G. Ogihara, M. Yamashita, and Y. Ohashi, 8 July 2010; UMMZ 14279, 5, 96.0–128.3 mm SL, market in Kobe, Hyogo, Japan, 1922.

***Upeneus guttatus* (Day, 1868)**

[New standard Japanese name: Akane-himeji]

(Figs 1A, B, 2, 3; Tables 1–2)

*Upeneoides guttatus* Day, 1868: 938 [type locality: Madras (currently Chennai), India].

*Upeneus bensasi* (not of Temminck and Schlegel 1843): Day 1875: 121, pl. 30, fig. 5 (Madras, India); Lachner 1954: 509 (in part; Philippines).

*Upeneus crosnieri* Fourmanoir and Guézé, 1967: 52, fig. 1/c (type locality: Mitsio, Pracel Bank, Madagascar).

*Upeneus* sp. 1: Gloerfelt-Tarp and Kailola 1984: 215, lowermost right fig. (southwestern Indonesia).

*Upeneus guttatus*: Randall and Kulbicki 2006: 301, figs 3–4 (Indo-West Pacific); Uiblein and Heemstra 2010: 42, pls 1C, 3C (Indian Ocean); Uiblein and Heemstra 2011b:

647, figs 1B, 2–3 (Indian Ocean).

**Japanese specimens examined.** 21 specimens, 57.8–139.5 mm SL: KAUM-I. 5492, 116.7 mm SL, 24 July 2007, KAUM-I. 7819, 57.8 mm SL, 7 July 2007, KAUM-I. 9636, 84.4 mm SL, 26 Apr. 2008, KAUM-I. 9845, 100.1 mm SL, KAUM-I. 9846, 89.3 mm SL, 7 May 2008, KAUM-I. 10542, 91.3 mm SL, 29 May 2008, KAUM-I. 11885, 80.5 mm SL, KAUM-I. 11887, 88.3 mm SL, 5 June 2008, KAUM-I. 9847, 104.8 mm SL, KAUM-I. 11894, 91.5 mm SL, 10 June 2008, KAUM-I. 12842, 128.4 mm SL, 30 June 2008, KAUM-I. 12844, 107.5 mm SL, 9 June 2008, KAUM-I. 13067, 119.2 mm SL, 9 Sep. 2008, KAUM-I. 24229, 82.1 mm SL, 23 May 2009, KAUM-I. 24422, 74.4 mm SL, 22 July 2009, KAUM-I. 24423, 84.3 mm SL, 12 June 2009, KAUM-I. 30431, 135.6 mm SL, 1 June 2010, KAUM-I. 36056, 125.1 mm SL, 2 Sep. 2010, east of Sakinoyama, Kataura, Kasasa, Minami-satsuma, Kagoshima, 31°25'44"N, 130°11'49"E, set net, 27 m, M. Itou; KAUM-I. 11011, 114.1 mm SL, 28 July 2008, KAUM-I. 21032, 139.5 mm SL, 17 Apr. 2009, KAUM-I. 21035, 79.9 mm SL, 26 May 2009, off Kouzaki-yama, Kataura, Kasasa, Minami-satsuma, Kagoshima, 31°26'00"N, 130°10'05"E, set net, 36 m; KAUM-I. 6999, 61.5 mm SL, Uchinoura Bay, Kimotsuki, Kagoshima, 31°17'N, 131°05'E, 15 Feb. 2007, set net, 40 m, M. Yamada.

**Comparative material from the Indo-West Pacific.** 14 specimens, 96.3–133.9 mm SL: AMS I. 25, syntype of *Upeneoides guttatus*, 104.4 mm SL, Madras (Chennai), India, 13°01'N, 80°03'E, F. Day; BPBM 33440, 115.4 mm SL, Mafia Channel, Tanzania, bottom trawl, 10–50 m, F. Nansen, Nov. 1982; BPBM 33815, 107.3 mm SL, Chesterfield Islands, New Caledonia, R/V *Alis*, 20 Aug. 1988; BPBM 39470, 117.2 mm SL, Belep Islands, New Caledonia, trawl, 35 m, M. Kulbicki, R/V *Vauban*, 10 July 1986; FRLM 26495, 133.9 mm SL, Bitung, Sulawesi, Indonesia, S. Kimura and T. Peristiwady, 23 Oct. 2000; FRLM 29978, 96.3 mm SL, FRLM 30073, 110.8 mm SL, Phuket, Thailand, S. Kimura *et al.*, 24 Sep. 2003; MNHN 1965-17, holotype of *Upeneus crosnieri*, 127.5 mm SL, Mitsio, Pracel Bank, Madagascar, 45 m, A. Crosnier; USNM 306102, 3, 102.8–129.0 mm SL, Ras Binnah, Somalia, 11°16'18"N, 51°15'36"E, 57–59 m, G. Small, 16 Nov. 1989; USNM 395448, 3, 106.9–115.2 mm SL, off Isle Umm, Massawa, Eritrea, Red Sea, 15°09'N, 40°31'E, 35 m, L. Knapp, 19 Sep. 1971.

**Description.** Counts and measurements, expressed as percentages of SL, are given in Table 1. Frequency distributions of gill-raker counts are given in Table 2.

First dorsal-fin spine longest; all dorsal-fin soft rays branched. Anal-fin spine extremely short; first anal-fin soft ray unbranched and spinous, segmented in outer half. Mouth small, ventral and oblique; posterior margin of maxilla extending beyond a vertical through anterior margin of orbit; posterior margin of maxilla membranous and convex; upper-jaw length less than half head length. Posterior tip of depressed barbel reaching (rarely slightly extending beyond) a vertical through preopercular margin. Band of small nodular teeth in each jaw, about 2 or 3 rows of teeth at front, becoming about 6–8 rows centrally. Vomer with a few vil-

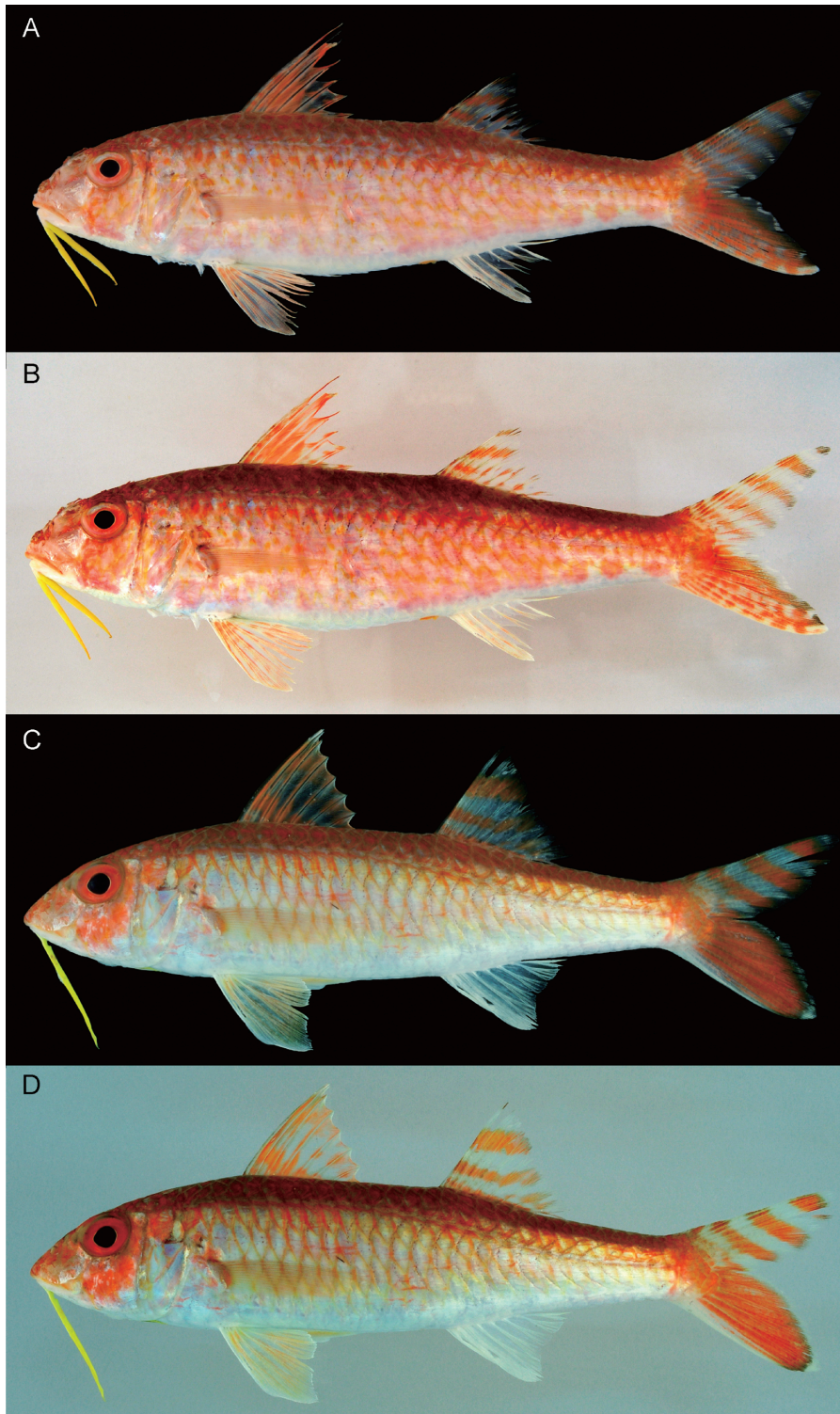


Fig. 1. Color photographs of fresh specimens of (A–B) *Upeneus guttatus* and (C–D) *U. japonicus*. A–B: KAUM–I. 11011, 114.1 mm SL, Kagoshima, Japan; C–D: KAUM–I. 9212, 90.9 mm SL, Kagoshima, Japan.

liform teeth posteriorly, no teeth anteriorly. Palatines with broad band of villiform teeth. Teeth present on ectopterygoids. Tongue fused to floor of mouth. Anterior nostril a short, vertically oval opening with dorsal edge of opening below level of ventral margin of orbit. Posterior nostril vertically oval opening, dorsal edge of opening at same height as ventral margin of pupil. Length of longest gill raker on first

gill arch subequal to that of longest gill filaments. Opercular spine at level of middle of eye, spine tip not reaching opercular margin. Scales finely ctenoid; body scales extending onto bases of second dorsal, anal, and caudal fins. First dorsal-fin origin above fourth pored lateral-line scale. Second dorsal-fin origin anterior to anal-fin origin. Pectoral fin extending beyond a vertical through last spine base of first



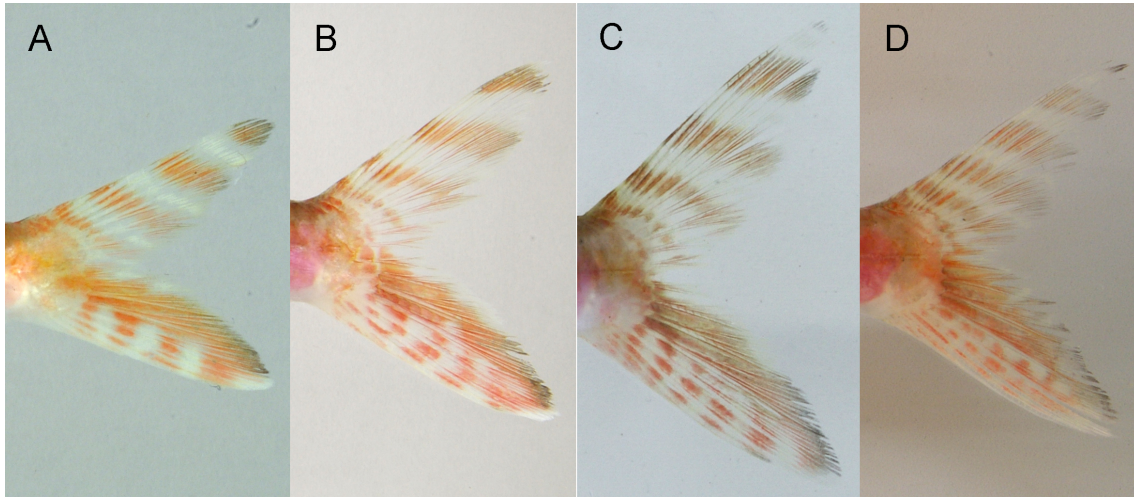


Fig. 2. Color variations of caudal fins of *Upeneus guttatus* from Kagoshima, Japan. A, KAUM-I. 7819, 57.8 mm SL; B, KAUM-I. 11885, 80.5 mm SL; C, KAUM-I. 24423, 84.3 mm SL; D, KAUM-I. 13067, 119.2 mm SL.

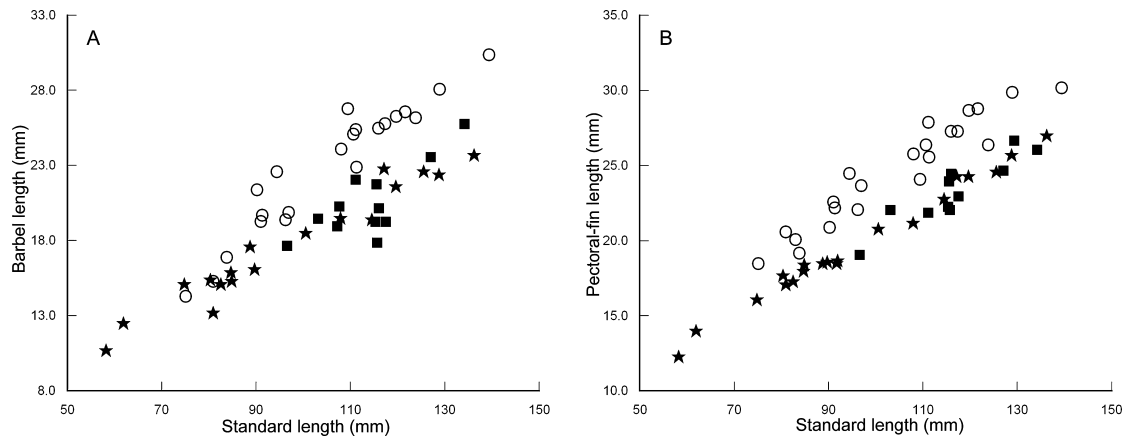


Fig. 3. Relationships of (A) barbel length and (B) pectoral-fin length to standard length in *Upeneus guttatus* (closed symbols: stars from Japan, squares from Indo–West Pacific) and *U. japonicus* (open circles).

dorsal fin. Posterior tip of depressed pelvic fin extending slightly beyond a vertical through pectoral-fin tip, but not reaching to anus. Formula for configuration of supraneural bones, anterior neural spines, and anterior dorsal pterygiophores 0/0/0+1/1+1/1/1/1/1/. Vertebrae 10+14. Upper series of procurrent caudal-fin rays 7 or 8, lower series 7; segmented caudal-fin rays 10+9; branched caudal-fin rays 7+6. Swimbladder present.

Color when fresh (based on color photographs of 19 fresh specimens): Head and body reddish dorsally, whitish pink ventrally, sometimes with faint longitudinal stripe from eye to caudal-fin base. Barbels yellow. First dorsal fin pale red anteriorly, translucent with poorly defined reddish spots posteriorly. Second dorsal fin translucent with 4 irregular red bars. Pectoral fin translucent yellow. Pelvic and anal fins translucent with indistinct reddish spots scattered on rays. Caudal-fin upper lobe with 4 or 5 red bars reaching to fin margin and indistinct red bar close to fin base (not reaching to margin). Caudal-fin lower lobe with 4–9 reddish bars or spots on ventral margin of lobe (bars and spots distinct

when young, becoming more irregular with growth); upper half of lobe uniformly reddish without spots or stripes. Posterior margin of caudal fin white, dark sub-marginally. In preserved specimens, reddish bars and spots faded and barely discernible.

**Distribution.** Widely distributed in the Indo–West Pacific, ranging from the east coast of Africa and the Red Sea east to southern Japan, the Philippines, and New Caledonia (Uiblein and Heemstra 2011; this study). The present specimens from Kagoshima represent the first records of *U. guttatus* from Japan and also from East Asian waters.

**Remarks.** *Upeneus guttatus* was originally described by Day (1868) as *Upeneoides guttatus* from Madras (currently Chennai), India. Day's description was based on multiple specimens, although he did not provide registration numbers or the number of type specimens. Three syntypes are recognized in museum collections, *i.e.*, AMS I.25, BMNH 1868.5.14.11, and BMNH 1975.9.30.19 (dry) (Eschmeyer 1998).

Uiblein and Heemstra (2010, 2011b) redescribed *U. gut-*



Table 1. Counts and measurements of specimens of *Upeneus guttatus* and *U. japonicus*, expressed as percentages of standard length with means in parentheses.

	<i>Upeneus guttatus</i>					<i>Upeneus japonicus</i>	
	Japan (Kagoshima) Non-types n=21	India Syntype of <i>U. guttatus</i> AMS I. 25	Madagascar Holotype of <i>U. cromieri</i> MNHN 1965-17	Indo-West Pacific Non-types n=12	Japan Neotype of <i>M. japonicus</i> NSMT-P 45177	East Asia Non-types n=22	
Standard length (SL, mm)	57.8–139.5	104.4	127.5	96.3–133.9	96.5	74.7–139.0	
Counts							
Dorsal-fin rays	VII, 9	VII, 8	VII, 9	VII, 9	VII, 9	VII, 9	
Pectoral-fin rays	13–14 (13)	14	14	13–15 (13)	14	13–15 (14)	
Pelvic-fin rays	1, 5	1, 5	1, 5	1, 5	1, 5	1, 5	
Anal-fin rays	1, 7	1, 7	1, 7	1, 7	1, 7	1, 7	
Pored lateral-line scales	28–29 (29)	29	30	28–29 (29)	29	29–30 (29)	
Scales above lateral line	2	2	—	2	—	2	
Scales below lateral line	5–5.5 (5.5)	5	—	5–5.5 (5)	—	5–5.5 (5.5)	
Scale rows between dorsal fins	4–5 (4)	3	—	3–4 (4)	—	3–4 (3)	
Gill rakers (upper + lower = total)	5–7 (6) + 16–18 (17) =22–24 (23)	6 + 16 = 22	7 + 18 = 25	6–7 (6) + 15–18 (17) =21–25 (24)	7 + 18 = 25	6–7 (7) + 17–20 (18) =24–27 (25) <sup>1</sup>	
Measurements (% of SL)							
Body depth	23.1–26.3 (24.7)	23.7	24.4	22.9–25.6 (24.2)	24.9	22.6–26.3 (24.5)	
Body width	13.3–15.8 (14.5)	13.3	15.4	12.4–15.6 (14.3)	13.7	14.0–17.7 (15.6)	
Head length	26.8–30.5 (28.3)	28.8	28.4	26.2–30.0 (28.1)	29.4	14.9–31.3 (28.4)	
Snout length	10.4–12.5 (11.3)	11.9	12.2	10.7–11.9 (11.4)	11.2	10.6–13.1 (11.6)	
Orbit diameter	6.7–9.1 (7.7)	6.8	6.1	6.5–8.1 (7.1)	7.4	7.2–9.5 (8.3)	
Interorbital width	7.2–8.0 (7.6)	7.7	7.2	6.8–8.4 (7.6)	7.9	7.0–8.4 (7.5)	
Upper-jaw length	10.2–11.7 (11.2)	11.9	11.2	10.7–12.2 (11.3)	10.5	10.1–11.9 (10.9)	
Cheek depth	7.9–9.2 (8.5)	8.6	9.0	8.5–9.8 (9.1)	8.6	7.8–9.6 (8.6)	
Barbel length	16.3–20.2 (18.4)	18.7	18.4	15.4–19.9 (17.9)	20.5	18.9–25.1 (22.1) <sup>1</sup>	
Caudal-peduncle depth	9.5–10.7 (10.1)	10.5	10.1	9.7–11.4 (10.4)	10.2	8.4–11.1 (10.1)	
Caudal-peduncle length	21.2–24.9 (23.0)	23.8	26.1	20.6–23.5 (22.1)	23.7	21.0–25.9 (23.7)	
Pre-first dorsal-fin length	34.9–37.3 (36.2)	36.5	35.5	34.7–36.8 (36.1)	37.1	34.7–38.8 (36.4)	
Pre-pelvic-fin length	29.2–32.7 (30.8)	32.2	32.8	28.6–32.9 (30.9)	—	60.0–66.1 (62.7)	
Pre-anal-fin length	63.7–65.7 (61.4)	61.7	65.1	63.7–68.6 (65.6)	31.3	30.7–33.2 (31.9)	
First dorsal-fin spine length	20.6–22.4 (21.4)	18.8	—	19.6–23.5 (22.1)	—	17.7–23.9 (21.2)	
Second dorsal-fin spine length	17.8–22.4 (19.8)	—	—	17.2–21.2 (19.8)	18.0	16.8–21.8 (19.4)	
Third dorsal-fin spine length	16.0–20.0 (17.5)	15.4	—	13.8–18.1 (16.5)	17.0	14.7–18.6 (16.9)	
Fourth dorsal-fin spine length	12.5–16.6 (14.2)	12.4	—	11.3–13.7 (12.6)	12.6	10.9–15.4 (13.5)	
First dorsal-fin soft ray length	7.1–9.6 (8.8)	8.7	9.1	7.4–9.9 (8.5)	—	7.3–10.4 (9.1)	
Second dorsal-fin soft ray length	14.0–16.0 (15.1)	15.0	13.9	13.5–16.0 (14.6)	—	13.6–16.3 (15.0)	

Eighth dorsal-fin soft ray length	6.2–7.9 (7.0)	—	6.7	6.1–7.3 (6.6)	7.5	5.8–8.1 (7.0)
Ninth dorsal-fin soft ray length	6.5–8.5 (7.3)	7.6	7.5	5.7–8.8 (7.5)	7.6	6.0–8.4 (7.3)
Anal-fin spine length	0.5–1.6 (1.1)	1.0	—	0.7–1.5 (1.0)	—	0.5–1.1 (0.9)
First anal-fin soft ray length	8.4–10.5 (9.1)	8.2	9.3	7.9–10.4 (9.0)	—	7.4–11.2 (9.5)
Second anal-fin soft ray length	12.9–15.1 (14.4)	14.0	15.0	13.3–15.7 (14.8)	—	12.9–16.3 (14.6)
Last anal-fin soft ray length	7.2–9.4 (8.2)	7.7	—	6.8–9.7 (8.0)	8.7	7.4–10.0 (8.4)
Caudal-fin length	25.4–29.8 (28.2)	—	—	23.2–30.2 (27.6)	—	22.5–30.7 (25.6)
Caudal-concavity length	14.6–18.1 (16.5)	—	—	13.9–18.1 (16.1)	—	11.7–15.1 (13.1)
Pectoral-fin length	19.6–22.6 (20.7)	18.9	18.2	19.1–21.4 (20.1)	24.5	21.3–26.0 (23.5) <sup>1</sup>
Pelvic-fin spine length	13.0–16.4 (15.0)	14.3	14.5	14.2–16.1 (14.9)	13.9	12.0–16.3 (14.1)
Longest pelvic-fin ray length	19.1–22.5 (20.3)	18.5	19.5	18.5–21.7 (20.1)	19.7	17.5–22.5 (20.0)

<sup>1</sup> Based on 32 specimens.

Table 2. Frequency distribution of gill-raker counts of *Upeneus guttatus* and *U. japonicus*.

	Upper limb					Lower limb					Total					
	5	6	7	15	16	17	18	19	20	21	22	23	24	25	26	27
<i>U. guttatus</i>	1	22 <sup>S</sup>	12	1	4 <sup>S</sup>	24	6			1	5 <sup>S</sup>	13	14	2		
<i>U. japonicus</i>		8	24 <sup>N</sup>			4	16 <sup>N</sup>	11	1				7	15 <sup>N</sup>	8	1

<sup>S</sup> Includes data for syntype of *Upeneoides guttatus*; <sup>N</sup> includes data for neotype of *Mullus japonicus*.

*tatus* on the basis of Indian Ocean specimens and distinguished it from other members of the Indo-Pacific *U. japonicus* species group by having a reddish body without a distinct lateral stripe, 12–14 (mostly 13) pectoral-fin rays, 28–31 lateral-line scales, 23–25 gill rakers, the color pattern of the caudal-fin lower lobe, and several morphometric features. Characters of the present specimens from Kagoshima, Japan, agree with those of *U. guttatus* given by Uiblein and Heemstra (2010, 2011b), with the exception of the gill raker count (22–24, but only one specimen with 22 rakers; Table 2).

*Upeneus guttatus* is similar to a co-occurring species in Japanese waters, *U. japonicus*, in sharing the presence of teeth on the ectopterygoids (Kim and Nakaya 2002; this study) and a reddish body coloration. The two species have been confused; Day (1875) and Lachner (1954) mistakenly reported *U. guttatus* as a junior synonym of *U. bensasi* (Temminck and Schlegel, 1843) (currently regarded as a junior synonym of *U. japonicus*; see Randall *et al.* 1993). Uiblein and Heemstra (2010) mentioned that *U. guttatus* differs from *U. japonicus* in having “fewer gill rakers, shorter barbels, shorter pectoral fins, and bars present along ventral margin of lower caudal-fin lobe in fresh fish”. However, they did not give concrete values of meristics and morphometrics of *U. japonicus*. Detailed comparisons between the two species in this study show that Uiblein and Heemstra’s (2010) purported differences between the two species are accurate. *Upeneus guttatus* has 5–7 (mode 6) gill rakers on the upper limb, 15–18 (17) rakers on the lower limb, and 21–25 (24) rakers in total whereas *U. japonicus* has 6 or 7 (7), 17–20 (18), and 24–27 (25), respectively (Table 2). Barbels of *U. guttatus* tend to be shorter [15.4–20.2% of SL (mean 18.2%)] than those of *U. japonicus* [18.9–25.1% (22.1%)] (Table 1; Fig. 3A). While the posterior tips of the depressed barbels of *U. japonicus* extend well beyond a vertical through the preopercular margin, those of *U. guttatus* usually just reach the margin. Pectoral-fin length of *U. guttatus* [18.2–22.6% of SL (mean 20.4%)] is also shorter than that of *U. japonicus* [21.3–26.0% (23.5%)] (Table 1; Fig. 3B).

Coloration of the lower caudal-fin lobe of *U. guttatus* differs from that of *U. japonicus* when the fish are fresh. The ventral half of the lower lobe of *U. guttatus* is whitish with irregular red bars and/or poorly defined spots (bars and spots distinct when young, becoming more irregular with growth; Fig. 2), and the upper half of the lobe is dark red without any markings (Figs. 1A, B, 2A–D). The ventral and posterior margins of the lower lobe of *U. japonicus* are white without red bars or spots and the remaining part of the lobe is uniformly red with a narrow black margin posteroventrally (Figs. 1C, D).

Although Uiblein and Heemstra (2011b) showed geographic variation in morphology and color patterns of *U. guttatus* within the Indian Ocean, detailed population data for this species in the western Pacific Ocean are unavailable and cannot therefore be compared with data from the Japanese population. All the Japanese specimens examined in this study had yellow barbels, whereas specimens from the Indian Ocean had white (2 specimens) and yellow (13

specimens) barbels (Uiblein and Heemstra 2011b). Examination of color photographs of 19 specimens taken when fresh shows that the upper caudal-fin lobe of Japanese *U. guttatus* has 4 or 5 red bars reaching to the fin margin and an indistinct red bar close to the fin base (not reaching to the margin) (Figs. 1A, B, 2). In contrast, the upper lobe of *U. guttatus* from the Gulf of Suez has 3 and 1 bars respectively, and in fish from the Indian Ocean it has 4 and 1 bars respectively (Uiblein and Heemstra 2011b). The number of reddish bars on the ventral margin of the caudal-fin lower lobe in Japanese *U. guttatus* is 4–9 whereas that of conspecifics from the Seychelles Bank is 2–5, and 5–8 in fish from the Gulf of Suez and Chennai (Uiblein and Heemstra 2011b). There is some possibility that the Japanese specimens of *U. guttatus* represent a separate species or a distinct geographic population of *U. guttatus*; further research on specimens from the western Pacific is required.

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