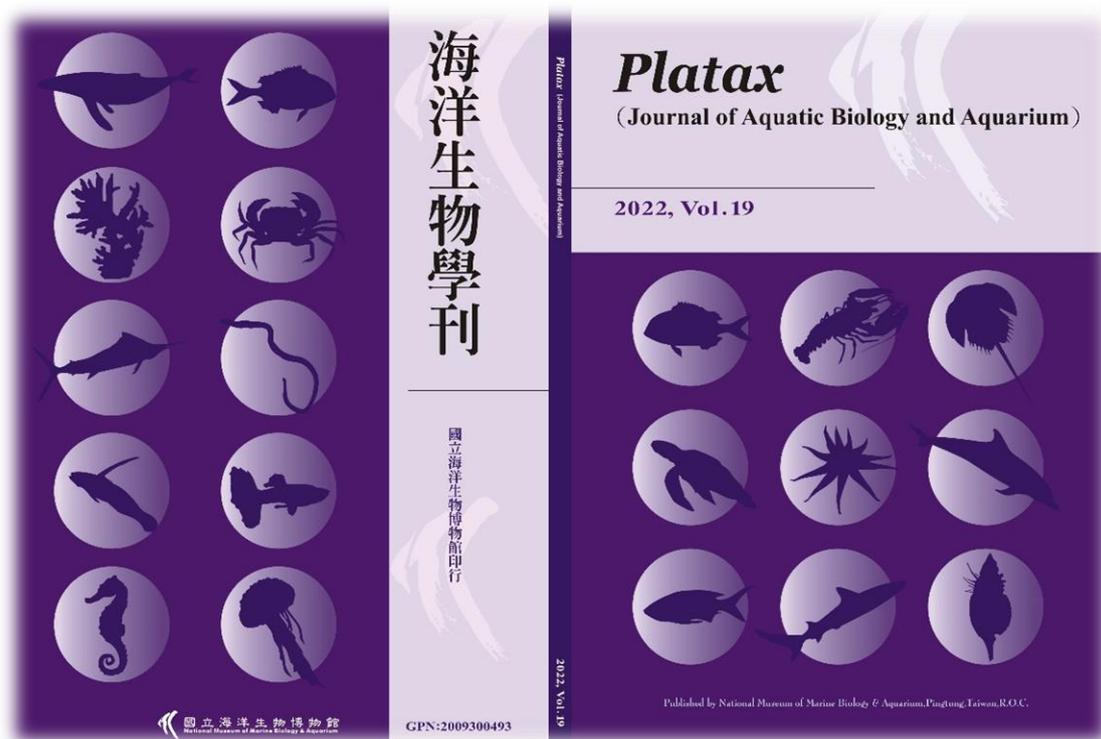


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## New record of a rare grenadier *Kuronezumia macronema* (Gadiformes: Macrouridae) off Dongsha Atoll

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### Abstract

A specimen of *Kuronezumia macronema* (Smith & Radcliffe, 1912) was discovered from off Dongsha Atoll. Formerly known only from type specimens from the Philippines, this specimen represents the first record of this species in the region. A detailed description, as well as a comparison with its congeners, are provided herein.

**Key words:** Gadiformes, grenadier, ichthyology, *Kuronezumia*, marine biodiversity

### Introduction

The family Macrouridae Bonaparte, 1831, commonly known as grenadiers or rattails, is one of the most dominant demersal fishes that can be found in a wide variety of habitats, from coastal waters to the continental shelf region; members of this family have been found in the hadal zone, with a depth range of 78–7,433 m (Iwamoto et al., 2015; Nakayama, 2020). The Macrouridae is the most specious family of the order Gadiformes, with at

least 370 valid species spanning 27 genera; new species are routinely uncovered (Nakayama, 2020). Although found globally, the majority of grenadiers reside in tropical and subtropical waters (Iwamoto et al., 2015; Nakayama, 2020). In Taiwan and adjacent waters, the diversity of grenadiers is well studied (e.g., Chiou et al., 2004; Iwamoto et al., 2009, 2015). More recently, Nakayama (2020) provided an excellent taxonomic review of the grenadiers of Japan and surrounding



**Fig. 1.** Fresh specimen of *Kuronezumia macronema*, EBFS 00162, 45.7 mm HL, 208+mm TL, off Dongsha Atoll, South China Sea, ca. 500 m in depth. Scale bar=5 cm.

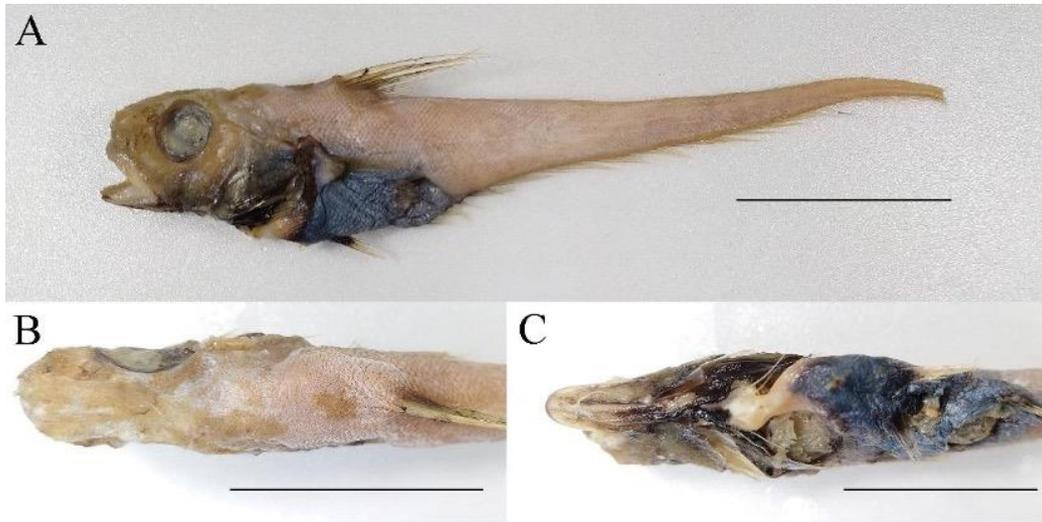
areas (including Taiwan), and at least 60 species were noted in Taiwan.

During a visit to Chingbing fishing port in Keelung, Taiwan in the fall of 2021, one grenadier was found in the bycatch of a bottom trawler operating off Dongsha Atoll, South China Sea (SCS). The specimen was identified as *Kuronezumia macronema* (Smith & Radcliffe in Radcliffe, 1912) after close examination. Formerly known only from type specimens from the Philippines, this specimen represents a new record in the area, and a detailed description has been presented herein.

### Materials and methods

The specimen was fixed in 10%

formalin and subsequently preserved in 70% ethanol. Methods for measurements, meristic counts, and morphological terminologies follow Nakayama (2020). A small incision was made to the skin fold under the opercle to aid in gill raker counting. Measurements were taken by digital calipers and recorded to the nearest 0.1 mm. Total length (TL), head length (HL), and postrostral length (PRL) were calculated for proportional measurements unless otherwise noted. Data from Shcherbachev et al. (1992) and Nakayama (2020) were used for comparison. The specimen was deposited in the Department of Environmental Biology and Fisheries Science, National Taiwan Ocean University (EBFS).



**Fig. 2.** Preserved specimen of *Kuronezumia macronema*, EBFS 00162, 45.7 mm HL, 208+mm TL, off Dongsha Atoll, South China Sea, ca. 500 m. (A) lateral, (B) dorsal, and (C) ventral views of the head. Scale bars=5 cm.

## Results

Family Macrouridae

*Kuronezumia macronema* (Smith & Radcliffe in Radcliffe, 1912)

Chinese name: 長絲黑奈氏鱈

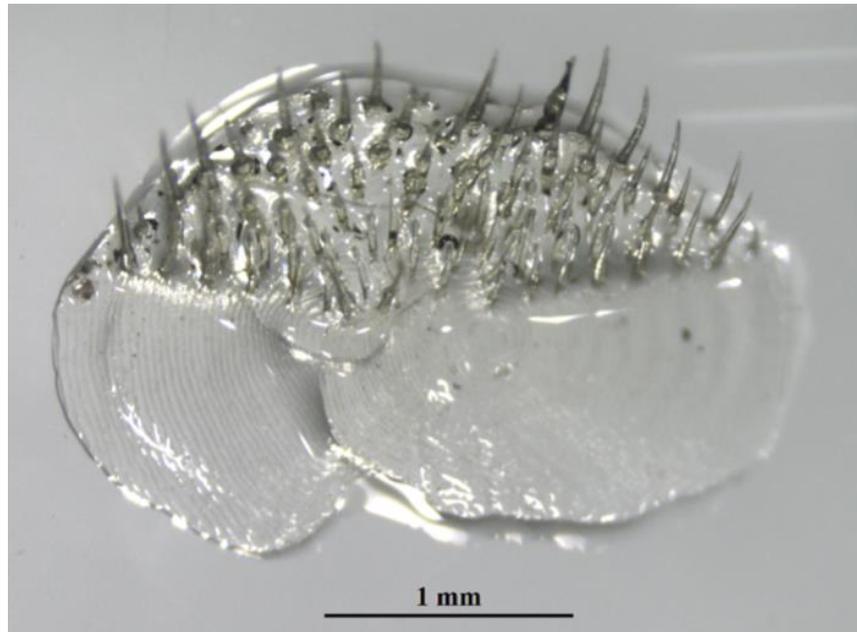
Figs. 1–3 & Table 1

**Materials examined.** EBFS 00162 (45.7 mm HL, 208+mm TL), off Dongsha Atoll, SCS (ca. 19°22'N, 116°42'E), bottom trawl, ca. 500 m, 17 September 2021.

**Description.** Measurements and meristic counts are given in Table 1. Trunk deep, laterally compressed, deepest at first dorsal-fin origin, width of pectoral fin bases 27.1% depth at first dorsal-fin origin; gradually tapering to long, strongly

compressed tail. Head moderately large, HL about 22.0% TL, 75.3% pre-anus length; supraoccipital crest rather flat. Snout short, barely protruding beyond upper jaw, length 75.8% postorbital length; ventral contour of snout nearly vertical when viewed laterally; snout high, its tip located over a horizontal line through midorbit. Orbit circular, diameter 62.2% postorbital length. Interorbital space slightly concave, its width 71.4% orbital diameter.

Mouth small, with posterior margin of upper jaw not reaching a vertical line through the midorbit (Fig. 2); upper-jaw length 93.4% postorbital length; lateral corner of mouth fairly restricted by lip



**Fig. 3.** Dorsal view of body scale from the dorsum below the interdorsal space.

folds. Suborbital region rather deep, nearly flat, without a stout bony ridge. Preopercle posterior margin straight, rounded ventrally. Anteroventral end of gill opening falling short of posterior margin of lower jaw. Outermost gill slit finely restricted by skin folds, its length subequal to orbital diameter. Gill rakers short and blunt, tubercular, with several short spines; rakers on outer side of first arch smaller than those on inner side. Branchiostegal rays 7. Barbel long and slender, length 87.4% orbital diameter. Teeth short and slender, in broad tapered bands along both jaws. Premaxillary teeth arranged in four rows, with outermost series enlarged. Mandibular band with 4–5 rows (none

especially enlarged). Posterior ends of tooth bands not reaching lateral corner of mouth in both jaws. All teeth embedded in a thick layer of gum papillae.

Anus closer to pelvic fin bases than anal-fin origin. Periproct teardrop-shaped. Light organ small, circular, and barely separated from the periproct; its anterior margin situated about a line connecting the inner pelvic fin bases. Body scales (Fig. 3) small, not deciduous, with long, somewhat erect, needle-like spinules densely distributed over exposed portion; tip of posteriormost spinules extending beyond scale margin; spinules at 45° angle relative to scale surface, giving villiform appearance to body surfaces; buttresses of

**Tab. 1.** Morphometric data and meristic counts for *Kuronezumia macronema* and *K. dara*. "-"=no data.

Species	<i>K. macronema</i>		<i>K. dara</i>	
	Type status	Type specimens	Holotype	Nontypes
Source	Present study	Shcherbachev et al. (1992)	Nakayama (2020)	Nakayama (2020)
<b>Measurements (mm)</b>				
Total length (TL)	208+	208–343 (n=3)	132+	111+–416+ (n=8)
Head length (HL)	45.7	33–51	19.6	20.1–69.8
<b>% of HL (% of PRL)</b>				
Snout length	31.9 (46.4)	27–28	27 (34)	25–29 (33–40)
Orbit diameter	26.3 (38.2)	27–30	37 (48)	26–36 (36–48)
Postorbital length	42.2 (61.3)	-	40 (52)	42–50 (56–67)
Postrostral length	68.8 (-)	-	77 (-)	73–77 (-)
Orbit-preopercle distance	33.1 (48.1)	37–40	34 (44)	33–43 (44–57)
Suborbital width	17.2 (25.3)	18	15 (20)	15–19 (20–26)
Upper jaw length	39.4 (57.2)	34–36	32 (41)	30–35 (39–47)
Length of rictus	29.9 (43.4)	-	25 (32)	23–30 (31–40)
Length of premaxillary tooth band	19.9 (28.9)	-	17 (22)	15–21 (20–28)
Preoral length	21.1 (30.7)	20	18 (24)	14–20 (19–26)
Snout width	26.3 (38.2)	-	19 (25)	18–23 (24–31)
Internasal width	18.7 (27.2)	-	16 (21)	17–20 (23–26)
Interorbital width	22.1 (32.1)	23–25	22 (29)	24–25 (32–34)
Body width over pectoral-fin bases	21.9 (31.9)	-	42 (54)	28–58 (37–77)
Pre pelvic-fin length	123 (179)	-	105 (136)	93–117 (123–161)
Pre anus-length	133 (193)	-	114 (148)	105–129 (140–178)
Pre anal-fin length	161 (234)	-	138 (179)	128–154 (171–212)
Isthmus–pelvic fin distance	40.7 (59.1)	-	36 (47)	33–42 (44–59)
Isthmus–anus distance	52.4 (76.2)	-	- (-)	42–54 (58–74)
Isthmus–anal fin distance	85.4 (124)	-	- (-)	63–82 (82–113)
Pelvic fin–anal fin distance	41.5 (60.4)	-	42 (54)	29–49 (38–65)
Anus–anal fin distance	27.8 (40.4)	-	26 (34)	17–32 (22–42)
Pelvic-fin length	43.2 (62.8)	-	- (-)	59–89 (76–118)
Pectoral-fin length	44.9 (65.2)	-	- (-)	59–68 (80–92)
Pre first dorsal-fin length	105 (152)	-	114 (148)	108–120 (144–161)
Height of first dorsal fin	109 (158)	-	- (-)	102–117 (137–156)
Length of first dorsal fin base	27.2 (39.6)	-	27 (34)	19–31 (26–41)
Interdorsal length	30.6 (44.4)	-	39 (50)	20–38 (26–52)
Length of gill slit	16.5 (38.5)	13–17	17 (22)	14–20 (19–26)
Length of posterior nostril	5.01 (7.28)	-	8 (11)	6–9 (8–11)
Barbel length	23.0 (33.4)	20–23	23 (30)	19–25 (25–34)
Pre pelvic-fin length	123 (179)	-	105 (136)	93–117 (123–161)
<b>Counts</b>				
First dorsal-fin rays	II, 9	II, 8–10	II, 10	II, 9–10
Pectoral-fin rays	i21	i16–22	i21–i22	i21–i26
Pelvic-fin rays	10	9–11	11	11–12
Outer gill rakers on first arch	6	-	8	7–9
Inner gill rakers on first arch	7	-	9	9–11
Outer gill rakers on second arch	8	10	9	8–10
Inner gill rakers on second arch	9	-	9	9–10
Longitudinal scales	38	47	53	35–48
Scales below first dorsal-fin origin	12	11–14	-	13–16
Scales below first dorsal-fin midbase	10	-	10.5	8.5–10.5
Scales below second dorsal-fin origin	13	10–12	11	10–11.5

spinules scarcely developed; reticulate structure on unexposed portion not prominent in preserved specimens. Body almost fully scaled, except for periproct, light organ, and fins, but pelvic fin scaled proximally.

Head ridges not conspicuous, nearly completely scaled; naked areas restricted to anterior nostril, upper lip, and anterior half of mandibular rami; gular and branchiostegal membranes scaled; head covered with short, stout, needle-like spinules in widely divergent rows; coarsely modified scales absent. Terminal snout scutes absent. Cephalic sensory canals without open pores. Grooved lateral line nearly complete, though slightly interrupted above pectoral-fin base.

First dorsal fin originating slightly anterior to vertical through pectoral-fin base; second spinous ray not prominently elongate; height of first dorsal fin 400% its base length; leading edge of second spinous ray with short, erect denticles. Origin of second dorsal fin well separated from first dorsal; interdorsal length 112% first dorsal-fin base length. Pelvic fin originating slightly anterior to vertical through pectoral-fin base; outermost ray significantly prolonged.

**Coloration.** When fresh (Fig. 1), body generally brown, with abdomen darker; gular and branchiostegal membranes black; first dorsal fin black basally and

translucent distally; pelvic fins dull black proximally, pale distally; pectoral fins pale; anal fin darker anteriorly and paler posteriorly; light organ and periproct black. In preservative, nearly same coloration as when fresh, with basal portion of first dorsal fin paler, gular membrane pale, branchiostegal membranes black.

**Size.** To about 343 mm TL (holotype; Radcliffe, 1912).

**Distribution.** Northwestern Pacific Ocean, from SCS (present study) to the Philippines (Radcliffe, 1912)

**Remarks.** We identified the specimen as a species of *Kuronezumia* based on the following characteristics: seven branchiostegal rays; infraorbital and preopercular ridges separated by a distinct gap; snout very short, barely protruding beyond upper jaw; anus distinctly separated from anal-fin origin and closer to pelvic-fin bases; premaxillary teeth arranged in multiple rows; mandibular teeth arranged in wide band; chin barbel well developed; trunk finely compressed; second spinous ray of first dorsal fin serrated along its leading edge; head almost fully scaled; no modified scales on infraorbital ridge; posterior margin of upper jaw not reaching a vertical line through midorbit; posterior end of premaxillary tooth band not reaching hind margin of maxillary process; body brown, without silvery reflections; and posterior

dermal window of light organ not discernible externally (Nakayama, 2020).

According to Shcherbachev et al. (1992), the specimen is similar to *K. dara* (Gilbert & Hubbs, 1916) and *K. macronema* by the following characteristics: the absence of a large, scaly, tubercular swelling anterior to the anus; the absence of a spiny scute at the snout tip; scale rows below second dorsal-fin origin more than 10; gill rakers on inner side of the first arch fewer than 11; first dorsal-fin rays less than 11; and pectoral-fin rays less than 24. Both Shcherbachev et al. (1992) and Nakayama (2020) commented on difficulties in resolving these two species, though this likely stems from the lack of detailed descriptions of the latter. In our specimen, most of the morphometric characters and counts lie within the range of values of both species (Table 1), with the exception of snout length, upper jaw length, preoral length, snout width, and number of outer gill rakers on the first arch. Nevertheless, our specimen differs from *K. dara* in that the first dorsal fin is dark basally and pale distally, whereas the first dorsal fin of *K. dara* is uniformly black (Shcherbachev et al., 1992; Nakayama, 2020: Fig. 150); this matches the description of *K. macronema* from Shcherbachev et al. (1992). Moreover, our specimen exhibited the following: 1) scaled gular and branchial

membranes and 2) first dorsal-fin origin positioned anteriorly to a vertical line through the pectoral fin. In contrast *K. dara* is characterized by naked gular and branchial membranes, and the origin of its first dorsal fin is posterior to the vertical line through the pectoral fin. For these reasons, we identified our specimen as *K. macronema*. However, further examination of type specimens of *K. macronema* is warranted to confirm whether the mentioned characteristics are diagnostic or not.

Currently, eight species are recognized in the genus *Kuronezumia*, with four of them documented in the SCS, viz., *K. bubonis* Iwamoto, 1974, *K. dara*, *K. macronema*, and an undescribed species (*sensu* Iwamoto, 1974) (Shcherbachev et al., 1992; Iwamoto et al., 2015; Nakayama, 2020; present study). *Kuronezumia macronema* differs from *K. bubonis* and the aforementioned undescribed species by lacking a bulbous swelling anterior to the anus (vs. present) (Nakayama, 2020); from *K. endoi* Nakayama, 2020 from Japan by the absence of open pores along the cephalic sensory canals and the posterior half of mandibular rami being scaled (open pores present; scaled area on mandibular rami restricted to posterior margins); from *K. leonis* (Barnard, 1925) widespread in temperate waters in the southern hemisphere, in lacking a large

scute at the snout tip; from *K. paepkei* Shcherbachev, Sazonov & Iwamoto, 1992 from off Kenya by having higher numbers of transverse scale rows (10 vs. 7 scales below the first dorsal-fin midbase; 10–13 vs. 8 scales below the second dorsal-fin origin) and lower numbers of gill rakers on the inner side of the first arch (7 vs. 12); and from *K. pallida* Sazonov & Iwamoto, 1992 from the southeastern Indian and southeastern Pacific oceans in its possession of fewer first dorsal-fin rays (8–10 vs. 11–13) and pectoral-fin rays (i16–22 vs. i24–i27) (data of other species are adopted from Shcherbachev et al., 1992; Nakayama, 2020).

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