

First Record of the Midwater Grenadier, *Odontomacrus murrayi* (Actinopterygii: Gadiformes: Macrouridae), from the Northwestern Pacific off Japan

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A single specimen of the midwater grenadier *Odontomacrus murrayi* Norman, 1939 was collected from off the Pacific coast of Miyagi Prefecture, Tohoku region, northern Japan, at a depth of 168–204 m (bottom depth 2641 m). It represents the first record of *O. murrayi* from Japanese waters and the northernmost record of this species in the Pacific. Previous records of *O. murrayi* are summarized and collection data for these records suggest that the species is generally confined to the mesopelagic layer of the open ocean. New Japanese names “Kurobouzudara-zoku” and “Kurobouzudara” are proposed for *Odontomacrus* and *O. murrayi* respectively.

Key Words: Deep-sea fish, range extension, midwater, Miyagi Prefecture, northern Japan.

Introduction

The grenadier genus *Odontomacrus* Norman, 1939 is represented only by its type species, *Odontomacrus murrayi* Norman, 1939, which is widely distributed in the Atlantic and the Indo-West Pacific Oceans. This genus is highly distinctive within the family Macrouridae in having the combination of large, fang-like teeth arranged in one distinct row in each jaw, a short lateral line ending at about the level of the second dorsal-fin origin, the anus situated well before the anal-fin origin, a small light organ between the pelvic-fin bases, and no chin barbel. *Odontomacrus murrayi* is also one of the few grenadiers that is primarily confined to the midwater of the open ocean instead of the deep demersal habitat (Marshall 1964, 1965, 1973; Iwamoto 1990; Iwamoto and Graham 2001).

During a cruise in 2009 of the R/V *Kaiyo-maru No. 7* of Nippon Kaiyo Co., Ltd., a single specimen of *O. murrayi* was captured from the northwestern Pacific off Miyagi Prefecture, Tohoku region, northern Honshu, Japan. It represents the first record of *O. murrayi* from Japan and the northernmost record of the species in the Pacific. We provide herein a full description of the Japanese specimen, with comments on the vertical distribution of this species.

Materials and Methods

Methods for counts and measurements follow Iwamoto (1970) and Iwamoto and Sazonov (1988). Head and total lengths are expressed as HL and TL, respectively. Fine structure of the body scales was examined by means of scanning

electron microscopy (SEM) at the Center for Advanced Marine Core Research, Kochi University. Methods for SEM preparation follow Roberts (1993). Institutional codes follow Fricke and Eschmeyer (2015). The specimen examined here is deposited in the Laboratory of Marine Biology, Faculty of Science, Kochi University (BSKU).

Odontomacrus Norman, 1939

[New Japanese name: Kurobouzudara-zoku]

Odontomacrus Norman, 1939: 49 (type species: *Odontomacrus murrayi* Norman, 1939, by original designation).

Phalacromacrus Maul and Koefoed, 1950: 971 (type species: *Phalacromacrus pantherinus* Maul and Koefoed, 1950, by original designation).

Diagnosis. [Modified from Marshall (1973) and Iwamoto and Graham (2001)]. Anus midway between pelvic-fin bases and anal-fin origin, preceded by small dermal window of light organ. Second spinous ray of first dorsal fin smooth along its leading edge. Body deep, well compressed laterally. Snout broadly rounded, barely protruding beyond upper jaw. Mouth large, terminal; posterior end of premaxilla extending beyond vertical drawn through hind rim of orbit. Chin barbel absent. Teeth large, fang-like, arranged in one distinct row in both jaws. Lateral line short, ending at about level of second dorsal-fin origin. Cephalic sensory pores large, prominent. Swim bladder reduced. Pelvic-fin rays 8–11. Branchiostegal rays six. Color uniformly blackish.

Odontomacrus murrayi Norman, 1939

[English names: Largefang Whiptail, Pelagic Whiptail, Roundhead Grenadier]

[New Japanese name: Kurobouzudara]

(Figs 1–2)

Odontomacrus murrayi Norman, 1939: 49 [original description; type locality: south of Arabian Sea, western Indian Ocean, 01°39'06"S, 61°13'48"E–02°07'30"S, 61°21'22"E, 0–2500 m (bottom depth 4622 m), *John Murray* station 131D].

Phalacromacrus pantherinus Maul and Koefoed, 1950: 972 [original description; type locality: Mid-Atlantic Ridge, North Atlantic, 34°59'N, 33°01'W, 2600 m wire out (bottom depth 2615–2865 m), *Michael Sars* station 53].

Material examined. BSKU 104866, 30.0 mm HL, 325+ mm TL, off Oshika Peninsula, Miyagi Prefecture, To-

hoku region, Japan, 37°57.99'N, 143°13.62'E–37°54.54'N, 143°15.46'E, 168–204 m (bottom depth 2641 m), mid-water trawl, R/V *Kaiyo-maru No. 7*, cruise Kyno.7-0912, station 6, collected by K. Uchikawa, T. Kamiya, and Y. Takeuchi, time: 22:16–23:57, 16 December 2009.

Diagnosis. As for genus.

Description of Japanese specimen. Counts: first dorsal-fin rays II, 9; pectoral-fin rays i8; pelvic-fin rays 8; gill rakers on first arch (outer/inner) 8–9/11, on second arch 9–10/10–11.

Following measurements given as percent of HL: snout length 34%; orbit diameter 24%; postorbital length 49%; postrostral length 72%; orbit–preopercle length 52%; sub-orbital width 23%; upper-jaw length 70%; internasal width 21%; interorbital width 32%; body depth at first dorsal-fin origin 111%, at anal-fin origin 99%; prepelvic length 103%; preanal length 136%; distance from isthmus to pelvic-fin base 31%; distance from isthmus to

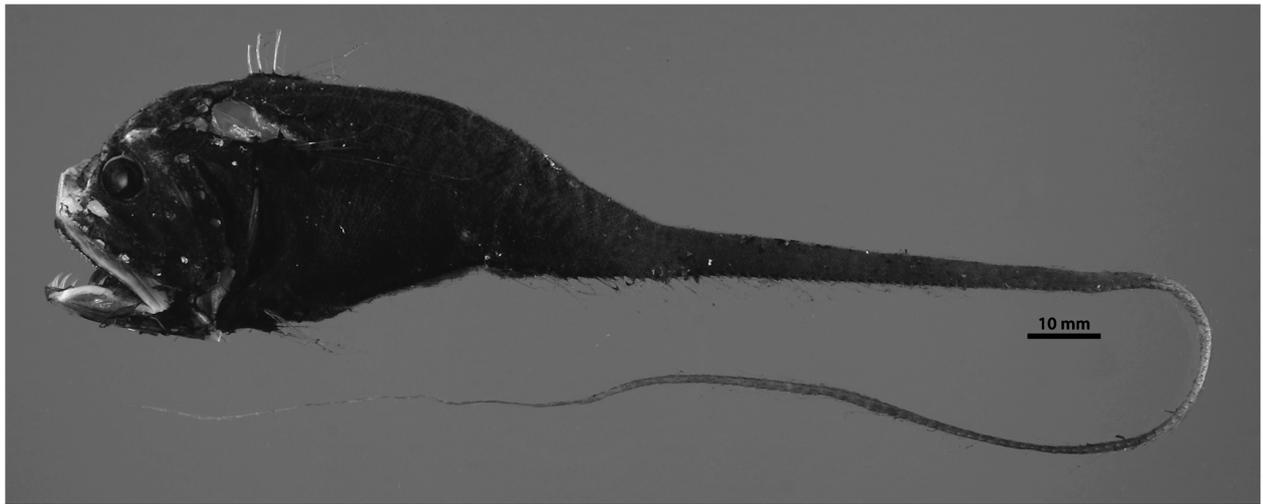


Fig. 1. *Odontomacrus murrayi*, BSKU 104866 (30.0 mm HL, 325+ mm TL), from off Oshika Peninsula, Miyagi Prefecture, Tohoku region, Japan, at a depth of 168–204 m. Fresh condition.

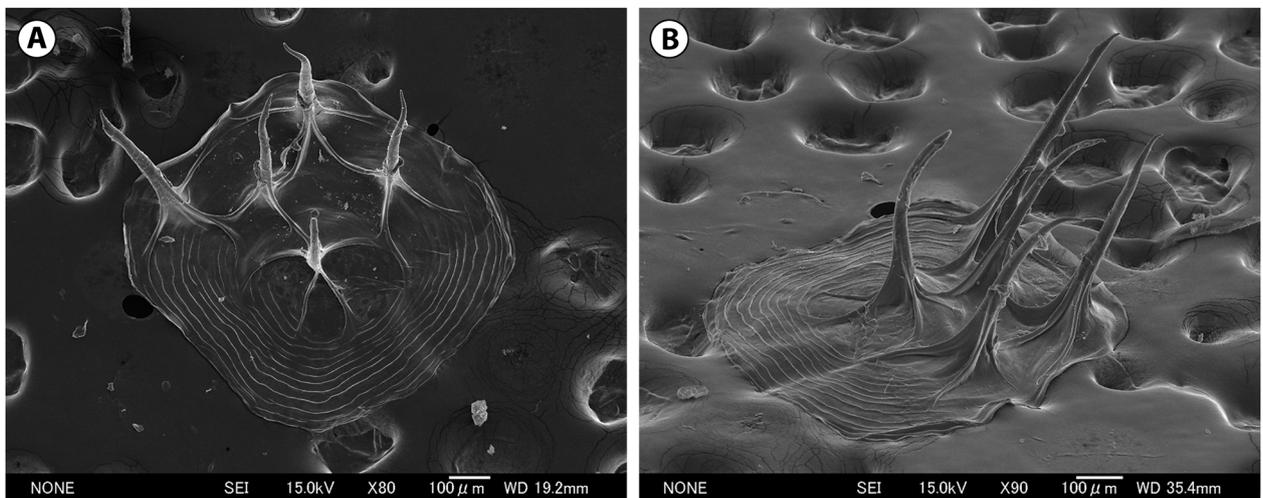


Fig. 2. Scanning electron micrographs of a body scale (from the dorsum below the interdorsal space) of *Odontomacrus murrayi*, BSKU 104866, 30.0 mm HL. A, view from above; B, oblique view.

anus 39%; distance from isthmus to anal-fin origin 60%; distance from pelvic-fin base to anal-fin origin 37%; distance from anus to anal-fin origin 25%; pelvic-fin length 44%; pectoral-fin length 84%; predorsal length 105%; height of first dorsal fin ca. 52% (tip slightly damaged); length of first dorsal-fin base 42%; interdorsal length 63%; length of gill slit 23%; length of posterior nostril 6%.

General features shown in Fig. 1. Body extremely elongate, tapering rapidly behind trunk to long, string-like tail. Trunk well compressed, width over pectoral-fin bases 27% of depth below first dorsal-fin origin. Head short, deep, HL less than 9.2% of TL; dorsal contour of predorsal region slightly humped over nape. Snout short, barely protruding beyond upper jaw. Orbit small, circular, greatest diameter 71% of snout length, 49% of postorbital length. Interorbital space moderately broad, its width 1.3 times orbit diameter. Mouth large, terminal, posterior end of upper jaw extending slightly beyond vertical drawn through hind rim of orbit; lateral corner of mouth not restricted by skin folds; height of ascending process of premaxilla 32% of upper-jaw length; lips rather thin, not papillose near teeth. Suborbital region deep, flat, lacking stout bony ridge. Preopercle large, orbit-preopercle length greater than two times orbit diameter; posterior margin of preopercle smoothly rounded; preopercle ridge poorly marked. Opercle and subopercle small, separated by wide gap where outer margin of gill cover moderately incised. Gill membranes damaged, narrowly attached to isthmus. Gill opening wide, extending from level of upper pectoral-fin base forward to vertical drawn through midorbit. Outer and innermost gill slits restricted by folds of skin attached to upper and lower ends of gill arch. Gill rakers developed as small tubercles, armed generally with two long, needle-like spines; no rakers on inner side of fourth (innermost) arch. Chin barbel absent.

Anus separated from anal-fin origin, situated about midway along pelvic-anal distance; periproct (black naked skin surrounding anus and urogenital opening) poorly developed. Dermal window of light organ small, situated on line connecting inner bases of pelvic fins.

Teeth long, immovable, prominently incurved, in one distinct row in both jaws. Premaxillary teeth distinctly smaller than those on dentary; left and right premaxillaries with 17 and 13 canines respectively. Dentary teeth modified into widely spaced enlarged fangs; four teeth on each side, anteriormost teeth smaller than those behind.

Body scales small, thin, not deciduous, covered with long, erect, needle-like spinules in quincunx arrangement (Fig. 2); buttresses of spinules greatly developed, connected with those of adjacent spinules; reticulate structure absent; body fully scaled except for fins and dermal window of light organ.

Head scales similar to those on body; no modified scales on snout and head ridges; head uniformly scaled, including mandibular rami; gular region heavily scaled; branchiostegal membranes naked.

Lateral line short, not interrupted throughout, extending from upper margin of gill opening to vertical drawn through base of fifth ray of second dorsal fin. Cephalic sen-

sory canals broad, with large, prominent open pores.

First dorsal-fin origin more-or-less above pelvic-fin base; second spinous ray of first dorsal fin smooth along leading edge; interdorsal space 1.5 times first dorsal-fin base length; second dorsal fin long-based, poorly developed throughout, its origin above base of 15th anal-fin ray. Pectoral fin long, extending slightly beyond vertical drawn through second dorsal-fin origin; its base situated below midbase of first dorsal fin, and also on horizontal drawn through upper 1/3 of body. Tip of pelvic fin extending slightly beyond anal-fin origin, when laid back. Anal fin long-based, much deeper than second dorsal fin.

Coloration. Head and body uniformly dull black; lips paler, but narrowly delineated in black; oral cavity blackish, branchiostegal cavity mostly pale; gill rakers and arches dark, filaments pale. No obvious color change from fresh condition noted following preservation.

Distribution. Widespread throughout tropical and temperate waters of the Atlantic and the Indo-West Pacific Oceans. Known from midwater depths above 2500 m.

Remarks. The Japanese specimen agrees well with descriptions of *Odontomacrus murrayi* given by Iwamoto (1970) and Marshall (1973), with no significant differences in meristic and morphometric characters except for a slightly higher count of the first dorsal-fin rays (II, 9 in the Japanese specimen vs II, 6–8 in the previous studies). This difference appears too subtle to cast doubt their conspecificity, and is regarded as geographical variation.

The occurrence of *O. murrayi* in Japanese waters is not surprising, considering previous records of the species. It has been widely reported from the world's oceans, with its type locality in the south of the Arabian Sea (Norman 1939; Marshall 1964, 1973). In the Indian Ocean, *O. murrayi* is also known from off South Africa (Marshall 1973), the Mozambique Strait (Parin *et al.* 2008), Walters Shoals (Shcherbachev 1987; Parin *et al.* 1993, 2008; Iwamoto *et al.* 2004), the Seychelles (Shcherbachev 1987), and Western Australia (Fujita and Hattori 1976; Endo 1997). Previous records of this species are concentrated in the Eastern Atlantic from off Portugal southward to South Africa (Iwamoto 1970; Marshall 1973; Iwamoto and Anderson 1994; Santos *et al.* 1997; Porteiro *et al.* 1999; Allué *et al.* 2000; Trunov 2001; Sutton *et al.* 2008; Parin *et al.* 2010; Menezes *et al.* 2012; Sobrino *et al.* 2012). It has also been listed from the Sargasso Sea (Vinnichenko 1997) and the southwestern Atlantic off Brazil (Menezes and Figueiredo 2003). In the Pacific, *O. murrayi* has been reported from Australasian waters including southern Australia (Iwamoto and Graham 2001; Iwamoto and McMillan 2008), New Zealand (Paulin *et al.* 1989), and New Caledonia (Rivaton *et al.* 1990; Fricke *et al.* 2011), northward to the South China Sea (Marshall and Täning 1966; Marshall 1973), and it is now known from Japan. More investigations are required to verify whether the species occurs farther east in the Pacific.

The new Japanese names “Kurobouzudara-zoku” and “Kurobouzudara” are proposed here for *Odontomacrus* and *O. murrayi* respectively. These names are derived from a combination of the species' black color (= *kuro*) and round-

ed head (= *bouzu*), added to the Japanese name for gadi-form fishes (= *dara*); “*zoku*” means ‘genus’ as a taxonomic category.

Odontomacrus murrayi has often been referred to as a strictly bathypelagic grenadier (e.g., Marshall 1964; Iwamoto 1970; Iwamoto and Graham 2001), but according to the collection data of previous records, most specimens have been obtained above a depth of 1000 m (where bottom depths were greater than 2000 m). This might indicate that *O. murrayi* is normally distributed in the mesopelagic zone. Unfortunately, it is uncertain how regularly the species occurs at bathypelagic depths. *Odontomacrus murrayi* has been collected exclusively by open midwater trawls (see the references cited in the second paragraph of this section), and there is a possibility that all these supposedly bathypelagic specimens were actually captured at much shallower depths. However, the bathypelagic zone is not only the largest habitat on earth, but also one of the most unexplored areas of the world’s oceans (Koppelman *et al.* 2000; Snelgrove 2010). There is, in fact, a paucity of trawl hauls made in the bathypelagic zone as compared with those conducted in other deep-sea habitats. This limited sampling effort might well account for the scarcity of bathypelagic records of *O. murrayi*, and further investigation could result in more specimens of this enigmatic species from bathypelagic waters. The present Japanese specimen was captured in night at a depth of 168–204 m (bottom depth 2641 m), which represents one of the shallowest records of the species. It is uncertain whether this species makes diel vertical migrations from deeper waters.

Comparative material examined. BSKU 82273, 8 specimens, 10.3–12.6 mm HL, 119+–179+ mm TL, off North West Cape, Western Australia, eastern Indian Ocean, 20°25.3’S, 102°33.7’E, T/V *Oshoro-maru*, station OSL 9406, collected by K. Nakaya, 23 November 1994. CSIRO H1256-04, 1 specimen, 54.4 mm HL, 376+ mm TL, east of St. Patrick’s Head, Tasmania, 41°35’S, 148°41’E, 905 m, 2 April 1988.

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